UNIQUITOUS CARTOGRAPHY:
CASUAL POWER IN DIGITAL MAPS

"UNIQUITOUS" EN "CASUAL": OVER MACHT IN DIGITALE KAARTEN

(met een samenvatting in het Nederlands)

Proefschrift ter verkrijging van de graad van doctor aan de Universiteit Utrecht op gezag van de rector magnificus, prof.dr. G.J. van der Zwaan, ingevolge het besluit van het college voor promoties in het openbaar te verdedigen op vrijdag 9 december 2016 des middags te 2.30 uur

door

ALEX GEKKER

geboren op 19 April 1985 te Kharkiv, Sovjet Unie

Promotor: Prof.dr. J. F. F. Raessens

Copromotor : Dr. S. Lammes

The research carried for this dissertation has received funding from the European Research Council under the European Community's Seventh Framework Programme (FP7/2007-2013) / ERC Grant agreement n° 283464 "Charting the Digital"

Acknowledgements

This thesis as made possible by several people, both metaphorically and in a very literal sense. First and foremost, I owe an enormous debt of gratitude to Sybille Lammes. I have known Sybille for almost six years now, first as a lecturer in my Masters programme, then as my MA thesis supervisor, who encouraged me to further my academic endeavours, and finally as an applicant – and then a member – of 'Charting the Digital' research project for which she was the principal investigator. But beyond merely providing the administrative and academic space for my enquiries, Sybille has become a mentor and a friend, always willing to support and assist when needed. In an environment where PhD candidates tell supervisor horror-stories in hushed voices, I feel incredibly lucky to have worked with Sybille. The same can be said of Chris Perkins, whose kindness, patience and an incredible wealth of knowledge were similarly instrumental in the writing of this dissertation. This is especially true regarding my introduction to the fascinating and previously unknown world of geography and cartography. Joost Raessens was the promotor who knew when to take a hands-on approach and when to give me the space needed, and his overview of the process was central during several key moments. Finally, though technically not supervisors, Sam Hind and Clancy Wilmott – my partners in crime for the PhD trajectory in the project – have become crucial in my intellectual development, and very good friends on top of that.

Not least of importance was the support I received at home. My wife Neta had to put up with the usual academic ramblings, late-night edit sessions, conferences and writing retreats disappearances and more. Towards the end of my writing this tension was exacerbated by the arrival of our firstborn daughter Alma. And yet, Neta always provided the unconditional love and support that I came to rely on. If my academic environment provided the compass and maps for this journey into the unknown, Neta and Alma were always the safe harbour to which I return to be revitalised. I love them both dearly.

My parent, my grandparents and my brother have always been a great inspiration to me. Many of the things that are implicitly imbued in this dissertation came from them, and the household in which I grew up: The intellectual curiosity that led me to this path. The sense of humour that allowed me to deal with the uncertainty of a dissertation-life. The pursuit of knowledge as an ideal. The belief in oneself. A respect for fellow people and the value of comradery. And of course, the pleasure of a good verbal fight – this last one became more instrumental in my academic career than initially anticipated.

Many people stood up during these years who helped me shape, refine, rethink and rewrite the arguments that made it into this dissertation. Others provided me with the intellectual stimulation to venture outside of my comport zone. In no particular order I would like to especially thank Sarah Dellmann, Dafna Rupin, René Glass, Mirko Tobias Schäfer, Imar de Vries, Stefan Werning, Michiel de Lange, Nanna Verhoeff, Frak Kessler, Teresa De la Hera, Michiel Kamp, Jasper van Vught, Ingrid Hoofd, Stephanie de Smalle, Sjors Martens, Eliane Fankhauser, Bob van de Velde, Björn 't Hart, Naomi Bueno de Mesquita, Kalina Dancheva, Jana Wendler, Pablo Abend, Jirka Panek and all the members of RMeS PhD council, past and present.

Special thanks to Noam Lemelshtrich Latar who saw the potential in me and allowed me the grant that launched my academic endeavours, Grisha Asmolov who was instrumental in this event and in further intellectual development and to Marianne van den Boomen, who is unfortunately no longer with us but nonetheless was my first MA teacher and inflicted me with the love for the craft. Thanks to the European Union and its Research Council who made this incredible project possible and allowed me to spend four years of my love doing innovative yet critical research. Thanks to everybody who offered a hand or a smile along the way. Thanks and apologies to all those who I forgot to thank - the next drink is on me.

Table of Content

List of figures

Introduction

This thesis is concerned with the making of the digital map in contemporary computational culture and, specifically, its role as a guiding sign-thing, manufactured and designed by complex networks of various actors and aiming to provide such actors' vision for how the world is. By doing so, they present a certain argument on the nature and relations of various object in the world, reflected by the map. Such argumentation has influence on the spatial perceptions of everyday map users, especially those without training or a background in mapping. Contemporary techno-media environments enable a certain affinity between us and our generative, sensor-infused, location-aware devices. The digital map is an increasingly interesting construct, a hybrid object that is rapidly populating our satnav devices, computers, phones, our shopping (Yelp), play (Foursquare), public transport (CityMapper), civic engagement (FixMyStreet.com) and dating (Happn). Every such map is a complex assemblage of disparate things: information from GPS satellites, transmission technologies (often involving broadband networks), skills involved in making and reading maps, third-party APIs and so forth. In the examples that I study, the map is utilised and designed to present citizens with nuanced governmental geo-data in one case and serves as a backdrop for spatial dispatch operations in the other. These maps are not blank slates; they are meticulous historiographies of designers (in the broad sense of the word) who continuously conceptualise map users and the living worlds these users inhabit. These worlds are reactive and reflective, fuelled by contemporary software's abilities to track and be tracked, adapt and update. This naturalized state of digital maps allows them to become powerful tools for those wishing to exert power on their end-users, and they require unique epistemological tools with which to explore.

While the stable ontology of the paper map has already been continuously questioned by critical cartographers (Harley 1988a; Crampton 2001; Wood and Fels 2008), its digital successors have become even more enmeshed in the fluidity of production and consumption practices more akin to other contemporary mass self-communication media (Castells 2006). In simpler terms, such maps are reminiscent of informational modes more closely associated with the disciplines of media studies and science and technology studies than with more traditional inquiries into maps and mapping. This thesis aims to fill this knowledge gap, particularly by calling attention to the personalization and customisation qualities of digital maps and the way those aspects change user interaction. I contrast the established term of 'ubiquitous cartography' (Gartner, Bennett and Morita 2007) with my suggestion for a 'uniquitous cartography', highlighting the fact that while widespread and

commonplace, the digital maps in question employ a variety of tracking methods in their design, aiming to captivate and engross each user in a personalised way. Furthermore, I employ the notion of casual power to elucidate the nature of such design practices and the resulting power relations between designers, maps and users.

The seminal work of Harley (1988a, 1989) into Foucauldian notions of power-knowledge – as exercised on historical maps – has already become a staple of modern critical cartography. As a historical geographer, he was mindful of the technical limitations of paper maps, and warned that we must be aware 'not only of the geographical limits to knowledge, but also of the technological constraints to representation, and of the silences in the historical record owning to the destruction of evidence' (Harley 1988b, 57). Maps are not made in a vacuum, but are part of a complex web of decisions regarding form and content. Harvey's introduction to such notions as 'silence' as opposed to 'lacunae' or 'error' challenged the dominant perspective of neutral, scientifically-objective mapping as ushered in by the famed cartographer Arthur H. Robinson who, while leading a US military mapping division during the Second World War, introduced user-testing and laboratory sensibilities into the field (Crampton and Krygier 2005). For Harley and his followers, the map is never simply *done*, but created *by someone*, who brings certain discursive claims while rooted in a specific sociopolitical context, affecting the final form of the map, what it includes and what does not.

Geographers Kitchin, Gleeson and Dodge (2013) refer to the above stage of thinking about maps as the *descriptive* stage, where the map was either considered a *true* representation (for Robinson) or a *social construction* (for Harley), which nonetheless is able to uncover some truths about the worlds it aims to portray, if one is careful enough to peel away the ideological mask it is veiled in (from a constructivist point of view). Kitchin, Gleeson and Dodge contrast this with the later work of such critical cartographers as Wood and Fels (2008), who reject the inherent truth of maps-as-construction and instead see them as delivering series of propositions. For them, the map is not *descriptive* but *prescriptive*, forming the world it aimed to portray as much as representing it. Yet, Wood and Fels still believe in the ontological stability of the map in its 'finality' and argue that such prescriptive power arises from the ideology loaded into the map's immutable surface. Kitchin and his colleagues identify themselves as subscribing to an even more radical view. They position their own work as a logical conclusion of the aforementioned process of map destabilization through various critical prisms, until the map loses its stable ontology and morphs into a processual and emergent object. Such an approach takes into account not only the conditions of map production and what was imbued in it, or how such prescribed ideologies affect realities on the ground. Rather,

> ….such a reconsideration necessitates a radical shift, as the conceptual bases of cartography move from being concerned with the 'rules' of map design, and techniques of cartographic production, and/or documenting and deconstructing the underlying ideologies and agendas of maps, to a processural perspective concerned with how mappings and cartographic design, technique and ideology emerge time and again through a plethora of practices framed within a complex discursive and material context, and the diverse, unfolding work of mappings in the world (Kitchin, Gleeson and Dodge 2013, 2).

This approach looks at *mappings* rather than simply *maps*. Mappings are contingent and emergent, contextually relational and depending on the map-reader as much as its creators. Processual views of mapping take into account such things as the navigational aims of doing something *through* a map (Brown and Laurier 2005; November, Camacho-Hübner and Latour 2010); maps as spaces and performances (Del Casino and Hanna 2006); maps as ontogenetic, or constantly co-created by the act of their use (Kitchin and Dodge 2007); maps as playful, both in nature and as revealed through use (Perkins 2009b); and maps as game-boards (Lammes 2011). Looking at maps in such ways often involves unpacking the complex sociotechnical infrastructure on which they are built and utilises manifold multi-disciplinary methodologies and theoretical frameworks. This is what I do with my case studies, aiming to understand their role in manifesting various mappings, and – through them – the specific conditions for popular digital cartography today.

The resurgence of popular, consumer-oriented mapping through web, digital and neo-cartography (Perkins and Dodge 2008; Farman 2010; Bittner, Glasze and Turk 2013; Haklay 2013; Della Dora 2012) – each term with its own unique contextual and ideological bias – requires us to subscribe to the processual ontology and resulting epistemology or epistemologies. Digital maps, be they navigation apps on your phone or as part of an apartment hunting process conducted on your laptop, are not ontologically stable, immutable objects. They cannot be conceptualised as static and self-contained. The premise of digital cartography is its ability to visually adapt itself to the changing requirements of the end-user, often through implementation of clever algorithms that learn and anticipate such user's actions (Knoller and Ben Arie 2014). Thus, for me, the digital map is positioned at the apex of several complementary trends that proliferate in contemporary digital economies: the colonization of the quotidian by the digital through increased autonomy of algorithms in human decision-making; the spread of interfaces as active and suggestive meaning makers; and the ongoing ludification of culture, often exhibited in design drawing on casual and fun

engagement with media, and often through practices of gameful design. And while one of the main points of the processual approach's non-fixed ontology is to detract from the fixation on the map-makers' agency, I would argue that such agency, while definitely not dominant or fixed, still strongly shapes the chains of association in which the map participates.

While I agree that contextual use of maps opens up a manifold of possibilities for them to be read, understood and acted upon in a certain way, more often than not, the developers and designers of such maps have very active roles in shaping such possibilities– by promoting and obstructing them. This has to do, first, with the fact that digital economies promote an endless feedback cycle – the map is never completely 'free' from its creator's intervention, but rather exists in permanent 'semi-finished' state of beta versions, patches and data analytics of user behaviour. Second, by including contemporary design practices and methodologies from Human-Computer Interaction studies, map-makers gear their creation from the get-go to certain audiences and attempt to imbue it with specific uses and values through affordances. Third, digital maps no longer stand by themselves, as their analogue cousins often did, but occupy a peculiar spot as hybrids, living on multi-functional platforms and competing with other (unrelated) media – from movies to news to games – for users' attention. It is under these conditions that I wish to examine the map-making processes of the organisations I study,

Research Question

My main research question is therefore as follows:

What are the *processes* through which *user interfaces* that enable *digital cartography practices* are *assembled and inscribed*; and what are the *power relations* underscoring those assemblages and inscriptions?

Unpacking this question leads to a series of cascading follow-ups:

1. RQ 1: How can the *processes* of map-making be described, traced and captured through my case studies?
2. RQ 2: What is the digital maps' *user interface*? How can it, and in particular the processes that call interfaces into being, be theorised, specifically in relation to paper maps' user interfaces?
3. RQ 3: What are the specificities *of digital cartography maker practices*? How do they relate to traditional cartographic practices and how to digital media production practices?
4. RQ 4: How does the process of inscription allow for the configuration of future map users?
5. RQ 5: What forms of *power* does such inscription enable in digital maps?

This last sub-question presents a concept upon which many of my theoretical underpinnings are based. The notion of *casual power* is central to my work and requires careful unravelling both as a basis for further theorizing and for operationalising the ethnographic work which I deploy to test my hypotheses. The purpose of this introduction is to broadly sketch the work for the reader, and I go further into the methodological implications in chapter 3, so for now let us focus on why this concept needs to be introduced early on.

While addressing map-maker practices, one cannot ignore the role of quotidian software interventions in human actions today, particularly while operating a digital device. My claim is that such interventions become increasingly powerful when map designers learn to extrapolate and anticipate user actions from tracking and move to pre-emptively counter resistance through the maps' interface. This occurs especially when

> [n]ew forms of invisible interface/ubiquitous computing/enchanted objects […] use context to present users with predictive media and information in real time. The aim, we might say, is to replace forethought by reconfiguring/replacing human 'secondary memory' and thinking with computation. That is, the crucial half-second of pre-conscious decision-forming processes whereby we literally 'make up our own minds' is today subject to the unregulated and aggressive targeting of the programming industry (Berry 2014, 211).

Casual power is thus my extrapolation of the design practices and proscribed affordances of devices aiming to intervene at these decision-making moments. The term comes from Juul's analysis of casual games (Juul 2010) and refers to such elements as ease-of-use, visceral feedback to miniscule actions and the affordance to be accessed often, but in small increments. And while Berry talks mostly of automated algorithmic helpers such as Google Now or Apple's Siri, my definition goes beyond. For me, digital maps, like the Google Map on a smartphone or a satnav screen in a car, represent precisely this type of attempt to automatize and algorithmize human thought processes within the scope of daily interaction.

Such algorithms, are part of what Knoller and Ben Arie (2014) refer to, after Vertegaal, as the Attentive User Interface (AUI). They are predominantly found in personal platforms and devices, from mobile phones to Netflix's selection screen, aiming at discerning the behavioural patterns of a particular individual and adjusting themselves accordingly. The idea of casual power incorporates such continuous optimisation of the interface through active and passive user data, in order to better

anticipate choices and suggest those with the most relevance to the user. Mapping software occupies a special place in such assemblages, due to the dual propositions of enhanced entanglement between the interface and the content compared to other types of interfaces and the unique position of the map's interface as a supposed digital membrane between two physical entities: the user and the 'world'. Casually suggesting certain choices on a regular basis, the map's interface effectively learns to hide the less optimal ones, presenting the illusion of broad choice from a limited selection of pre-defined ones (Sandvig 2014). To paraphrase, the interface of a digital map in daily conduct is a sign-thing (Lammes 2011) that is created with certain intents (which can be circumvented or ignored): affording users to perform specific tasks in the physical world, while minimizing their cognitive load. As I will show next, current regimes under which these sign-things are produced call our special attention to the ways designers are building such maps for the 'perfect' user – the consumer, the navigator, the voter – and through processes of inscription (limiting and allowing the actions available on the map) aim at 'configuring' (Woolgar 1990; Grint and Woolgar 1997) this user. Such configuration, occurring in a climate of attention scarcity and information overload, can affect the ways users experience the physical world beyond the boundaries of the map.

To understand it, I spent time with two organisations that manufacture such maps for their users. One is Mapi, a governmental mapping and GIS organisation making a transition into the world of web-cartography, opening their databases to the general public and for the first time considering the specificities of map-making for broader audiences, beyond their previous scope of professional cartographers. The other, Nowforce, is a small private company specialising in manufacturing web and mobile-centred systems for first responders. Their new version prioritises the map above previous concentrations on tabular data, and their desire is to become a platform that allows entities of various kinds to conduct diverse spatial activities. My aim here is to explicate how the actions of individuals and the structure of these organisations contribute to the manufacturing of aforementioned mapping inscriptions and assemblages and the implied mapped lived worlds that manifest through them.

Like most everyday technologies, the digital map relies on its ability to be black-boxed from external scrutiny, as 'the more science and technology succeed, the more opaque and obscure they become' (Latour 1999, 304). Unlike other technologies, digital mapping positions itself as a first stage in a complex move as a *double referent, twice removed from the world*. The (paper) interface of the map has always been a stand-in for the physical and social features it represented. It was a convenient stand-in, easily mistaken for the signified, framed by images of

techno-objectivity, from which Alfred Korybski famously warns us in his semiotic maxim 'the map is not the territory' (1933). A digital map complicates this move by being displayed on a screen which is itself built on computational metaphors fostered by computer scientists, HCI researchers and designers alike (Bolter and Gromala 2005; Drucker 2011; Van den Boomen 2014). Thus, the digital map is at the same time *a reference to* a 'real' space which interests the user, and *a referent of* the screen that constructs it as an achievable action within the framework of current regimes (Hayles 2005; Galloway 2012; Berry 2014).

Often, the two fissures of this translation process, which are screen- and map-related, are treated in discord differently by their respective disciplines. While critical cartography (often aided by and borrowing from science and technology studies) focuses on the divide between the map and the world it aims to represent/construct (since the map creates territory as much as it depicts it), media studies often looks into the ways analogue objects gain or lose in their translation to digital domains. My work aims to reconcile these two translations, providing a detailed account of how maps are made specifically within and for the digital ecologies (Jung et al. 2008), and how their creators should be regarded as media disseminators as much as map-makers, and vice versa (figure 0.1).

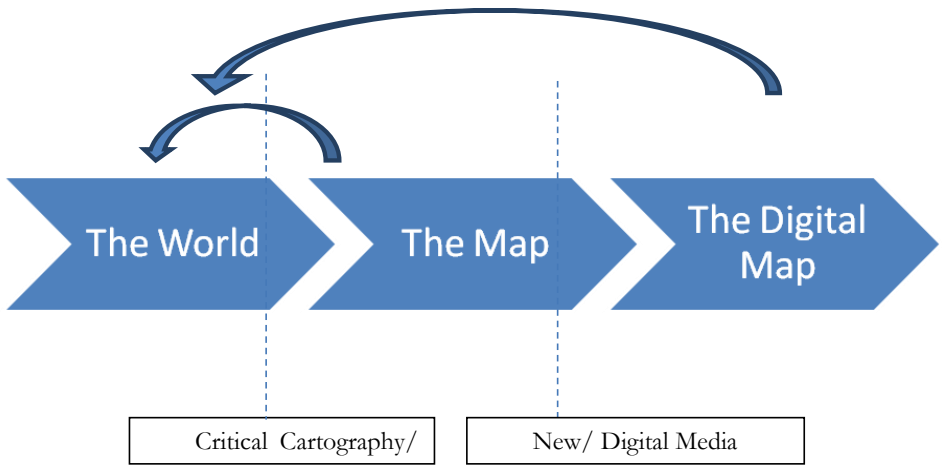


Figure 0.1: The Digital Map as a Double Referent

Here, I present the dual translation work done by the theoretical construct of 'the digital map', and the scholarly disciplines that approach it. The arrows represent the processual notion of translating the world into first paper and then graphical formats, while simultaneously referencing and influencing each other. Paper maps have accrued a certain number of conventions to communicate with the map readers. Critical cartography scholars work to unpack those communicative processes and challenge the seemingly unassuming relations between what is shown on the map and what is done in the world (Crampton and Krygier 2005). New media studies often examine in similar terms the changes that occur when habitual practices are supplemented, or changed, through digitalisation and the encroachment of computing (Bolter and Grusin 2000; Kerssens 2016). While simplistic at first glance, the figure and the divide it represents is a necessary justification for positioning my work in the respective academic fields. By bringing together *the mapped* along with *the digital*, I wish to point at digital maps' unique position within the conglomerate of digital things and their interfaces. As such, the map is better suited to act as a 'sleeper agent' within users' habituality, enmeshing itself as smoothly as possible in practices as diverse as information retrieval, navigation, real estate search, emergency response, conducting the management of police and warfare operations etc. What is it about the unassuming nature of maps that renders them so trustworthy? If we accept that the power of maps is manifested exactly in this naturalization and habitualisation, then inscription in the digital maps' interface must follow previous popular conceptions of maps, especially since 'no other image has enjoyed such prestige of neutrality and objectivity.… The most oppressive and dangerous of all cultural artefacts may be the ones so naturalized and presumably commonsensical as to avoid critique' (Craib 2000, 8). I will claim that it is this naturalized form of the map that allows it to casually embed itself into digital work-nets of humans, things and territory and thus warrants special methodologies for exploring the power structures surrounding it.

Structure of This Thesis

The manuscript is divided into seven additional chapters. The following chapter serves as a systematic literature review, bringing together key texts from geography and media studies. It aims to provide an overview of the different disciplinary backgrounds for understanding digital maps and introduce the processual mapping framework that will guide the rest of this thesis. It explains the notion of processual mapping, reflects on the use of cognitive theories in relation to modern

mapping assemblages and as part of their construction, and offers the term *uniquitous cartography* to account for digital mapping ability being omnipresent yet customisable.

Chapter 2 lays the groundwork for the methodological approaches to be found throughout the remaining chapters. It presents a unified conceptual framework of *casual power*, a compound theoretical prism that takes into account designer intent, user interpretation and mediatized environments in which maps are deployed. Specifically, based on research into critical interface reading, design and designer ethnographies, data studies and play studies, I explain how designers attempt to exert power on users. I break this type of power down into three components: digital maps' position as part of the attention economy, gamification of the map and quantification of the map.

Bringing together various theoretical prisms in this extensive literature review allows me to address the first two sub-questions, pertaining to the description and capturing of mapping and mapping interfaces processes. Following it, my third chapter presents itself as an in-depth methodological argument. In it, I discuss the justifications for my case studies – a local mapping government agency and emergency services start-up. I detail the methods I employed to contact them, what data I collected and explore the software tools I used to for it. Accordingly, the chapter is structured into four parts. In the traditions of ethnographic writing, the parts correspond to the relevant temporal stages of my project and present methodical considerations beyond methods, namely research dilemmas and debates around my own positionality as researcher in the field.

Chapter 4 marks the start of the second part of my dissertation, in which my two case studies are analysed. My empirical chapters are not arranged according to case studies, but rather they sketch a process of maps' becoming, compared across both cases: gathering the data for the map, visualising it and engaging user-experience specialists for final interface tweaking. Following ANT principles, these stages were selected by me and do not represent any fixed formal breakdown of what 'digital map-making' should consist of. Rather, they are epistemological tools that allow examination of the relevant concepts. Each chapter is built on multi-layered data from both case studies. Explanations about the intricacies of each stage are taken from observations, interviews and secondary sources such as trade journals or specialist websites when necessary. The chapter positions underlying data structure, and the APIs that connect them demonstrate how map-making has become a radically different procedure. Through a priori demarcation of what can and cannot be recorded, as well as structural, financial and practical limitations of the organisations involved that face fierce competition on multiple fronts, maps are tailored to specific uses. The design process of this

interface manifests as a double-sided membrane through which the user both enacts and is enacted upon.

Following, chapter 5 further unpacks the inscription process of such an interface and the role of the user in this process. Map-makers choose visualisations with a certain anticipation of the user's ability to unravel the conversion from data to visuals, through agreed signs. The organisations I study attempt to anticipate how users will interpret the various arrangements of elements of the visual interface surrounding the map. They do this in an effort to carefully present a calibrated world to their users. The map interfaces are designed with an exploratory approach in mind, mimicking the best-practices of other web and mobile interfaces. By doing so, Nowforce and Mapi aim to engage a spectrum of user skills and requests, and attempt to solve cartography's traditional dilemma of showing too much or too little. I conclude by analysing the visual methods that they deploy to solve this issue in digital interfaces: making them uniform and recognisable, yet customisable enough to engage and captivate the user.

Chapter 6 is the last empirical chapter, and it describes a stage in the map's inscription that I did not anticipate when embarking on the research: the outsourcing of certain design aspects to external companies, mostly those specialising in what they call *User Experience* (UX) *Design*. These external entities do not come from the world of maps, and instead position themselves as interface specialists – able to make any product on any platform better simply by virtue of understanding the cognitive and affective states of users who engage these products. After the data has been collected and prepared in its proper form to be read from the database and integrated through various APIs, and after certain digital visualisation methodologies were implemented to translate this data into a user interface accessible to the non-professional user, an external expert was invited in both my cases to suggest modifications to the way the map was presented, in order to make it better – at least according to the experts. This change touches upon both the visual and deeper algorithmic level of the map, creating a situation in which the map-makers cede their authority over the map.

In the conclusion to this dissertation I answer my research questions through the conceptual frame of casual power that explains how power manifest in the map configuration process alongside uniquitous mapping that highlights the specific condition of my cases' maps. I claim that maps today are made through the combination of user surveillance and experiential design and clarify how such design requires a balance between familiar forms alongside space for personalisation. In the final pages of this dissertation, I discuss the ramifications of attention, playfulness and quantification for the world of maps, and suggest further avenues for research.

1. Ontologies and Agencies of Digital Maps

'[I]ntentionality is not a quality ascribed uniformly to all types of animate agent. Amongst humans, for example, we are sometimes less likely to grant this quality to the very young, or to the old or to the mentally ill. There also appears to be a hierarchy of animate non-humans who (which?) more or less deserve attributions of cognitive states (Dogs can be said to be looking happy, but gerbils?)'.

Steve Woolgar, 'Reconfiguring the User' (1991:62)

This chapter serves as a systematic literature review, bringing together key texts from geography and media studies. Those fields are rarely brought together but need to be combined for the purpose of understanding digital maps. Thus, my first stage of intervention is pinpointing how relevant ideas from those different disciplines can supplement each other and elucidate the compound nature of my research objects. This review underpins central arguments in the research: that digital maps are today made differently than before, that such difference accounts to the way users are imagined through their production process, and that casual power is a productive prism through which to explore it.

The end goal is to provide an overview of the different disciplinary backgrounds for understanding the digital maps under scrutiny and introduce the processual mapping framework that will guide the rest of this thesis. To understand contemporary mapping platforms, there is a need for a more comprehensive theoretical toolset than those of traditional geography/cartography only, because modern maps are also *digital media objects*[1] that are being manufactured, and tuned, alongside and in concurrence with other digital objects, which 'differ from physical objects and other cultural records (e.g. art objects, paper-based files) of non-digital constitution along a number of dimensions' (Kallinikos, Aaltonen and Marton 2010, 2). I begin with the introduction of processual views of mapping which emerged from studies of the history of cartography and then critical cartography. Then, I move to discussing a specific instance that encompasses both map-making and map-research, the concept of cognitive mapping, how cognitive mapping fits into the processual view, and how cognitive-mapping methods can inform further study of mapping production. Lastly, I offer

[1] Objects in the sense of composite, ontologically relational objects (Harman 2010), not as in the Hegelian object/subject dialectic.

geography and media theory perspectives on digital maps as interface objects and discuss the power of map-makers to provide spatiotemporal affordances for their users.

1.1. Defining processual mapping through Actor-Network Theory (ANT)

This chapter outlines mapping as a processual practice. Reconstituting maps (first paper, then digital) from static objects into performative processes allows me to focus on the role of map designers in the subsequent production of space for their imagined end-users. A processual view of mapping highlights how user interfaces are inscribed with meaning, in the hopes of later influencing users' understanding of the world around them, and how these practices are based on designers' conceptualisation of users' end goals and imagined qualities (Woolgar 1990; Grint and Woolgar 1997). I chose to begin this chapter concerning itself with maps and mapping with a quotation from Woolgar's now-classic science and technology studies (STS) paper about a software company's user-trial phase; this selection, though it might seem surprising, is not. This work showed how the introduction of technological innovation happens over time in a congruent manner, where users and makers have intertwined roles and agencies. In such a process, makers attempt to weave certain actions into the device, while users often appropriate but also circumvent them. One key theme which will be repeated throughout this chapter (and the entire dissertation) is how contemporary maps, in the ways they are assembled and presented to end users, should be understood within modern computerized media-scapes and media ecologies. A recurrent claim will be made that digital maps must be read through the prism of software and hardware, without losing sight of their unique abilities to frame space and place. Maps will be shown to be constructed in complex chains of productions. Moreover, they will be defined as mutable and permeable objects rooted in surrounding technologies and design. Woolgar, through detailing a process of a prolonged and embedded study as part of a new computer's development team, aims to solidify the notion of ICT systems as having agency. Such agency is not metaphorical, but is instead ascribed to the computer through the process of mutual interplay between (a) the developers' and designers' expectations regarding what their machine is intended to do, (b) the users' expectations of the same issue and (c) a long process of mutual configuration that arises through ongoing usability trials and adjustments within the development space.

1.1.1. Agency of maps as technologies

Woolgar's case-study of the computer addresses the larger problem of how technological objects exhibit agency, specifically by drawing attention to chains of delegated authority created by the people who make them. The decisions taken to include a certain switch as part of the hardware, thereby influencing future user interactions, and so the switch becomes a kind of a 'gatekeeper' for those users. Essentially, the switch manifests a complex interface membrane where the desires of those who made it and their visions conflict and coalesce with users' minds and bodies engaged with the tasks for which it was intended. Woolgar sees intentionality and agency as transferable properties which pass through networks of humans and tools until they congeal in certain actors (which can be inanimate objects as well). This position is common in material semiotics, and particularly, in the work of Bruno Latour, who advocates examining the chains of associations of production, design, use and misuse that temporarily crystallize, allowing for its unpacking, or in his famous maxim: 'technology is society made durable' (Latour 1991, 103). Ontological philosophers who have taken such a view as a point of departure suggest that technological artefacts (or *objects*) operate on the same level as human actors, and what they do is imbued with inherited plans for actions from their designers and the materials that comprise them (Harman 2009; Harman 2010; Bryant 2010). Such an approach rejects a deterministic approach of technologies overpowering their users by their mere nature (technological determinism) as much as it rejects fully open ontological states where any type of device can be re-appropriated in any conceivable way (social constructivism). Rather, we ought to examine the emergent agency of each techno-object as an assemblage of its material properties, the design characteristics woven by its makers, the particular codes developed around its deployment and use, the resistances and acceptances of its (potential) user base, and other actants.

Recognising such agency within the multi-layered relationship between humans and devices requires a creative vocabulary. The most condensed expression of such agency is how our machines seem to be 'stubborn', 'infuriating' or 'annoying', as exampled by the soon-to-be discussed case of Apple's map fiasco (section 1.2.). This notion of transferable and interoperable agency (from the designer to the device) also calls attention to the chains of production and the institutional logics that hide behind a stubborn machine, or the reasons for its particular 'temper'. More often than not, we fail to recognize the complexities of advanced mechanisms that hide their appearance behind design metaphors and instead expect them to operate in a straightforward manner like a coffeemaker (Van den Boomen 2014). This is often referred as the blackboxing of technology, in a metaphor that

alludes to technical devices appearing as mere input/output prompts to the user. The user interfaces of maps on our various devices that help us navigate, shop or otherwise make sense of the physical world around us are no different. They, also, depend upon cascading rules of what is allowed and what is not, imprinted by socio-technical networks of hardware, software and people. What complicates things even further is digital maps' embeddedness in the various digital platforms that they populate, from operating systems to car dashboards to app stores. This makes it challenging to accurately describe and analyse the map-makers' intentions within the context of a single map as a unit-of-analysis, as it is exceedingly difficult to draw a line between what constitutes a part of the map and what does not. In the next section, I will highlight how certain sociographic techniques from Actor-Network Theory can help with such uncertainty.

1.1.2. Understanding maps in a flux: ANT approaches involving inscription and de-inscription

In her research on technology transfer process for developing countries, Madeleine Akrich (1992) notes the difficulties facing those dealing with studying *technologies* in the science and technology studies field. Unlike researching localized knowledge productions of scientific enquiry, the technical aspects are more often spread across a multitude of heterogonous locals, coming together in compound practices, tools, legislations etc. A car's warning sound that will not stop until the driver puts on a seatbelt is as much a result of regulatory imagining of the 'proper way' to use the technology as it is the result of the platform's technical limitations (Latour 1992). However, 'the process of describing everything about a car in such terms would be a mammoth task. Furthermore, the end product might well be banal. The automobile is so much a part of the world in which we live that its sociography (a description of all the links making it up) would no doubt look like a collection of commonplaces' (Akrich 1992, 206). The following is concerned with this very issue and focuses on adapting a nuanced perspective of digital mapping without making the process cumbersome or banal.

According to Akrich, '[t]he methodological problem is that if we want to describe the elementary mechanisms of adjustment, we have to find circumstances in which the inside and the outside of objects are not well matched. We need to find disagreement, negotiation, and the potential for breakdown.' (Akrich 1992, 207). For her, such fuzziness is located in the ongoing conflict between a design's intended uses and the results in the field, as shaped by the local conditions, which is an important observation for this thesis that focuses on the site-specific issues when making maps for certain users. Using semiotics, she describes how certain conditions are *scripted* into the very thing

being constructed, by limiting and excluding potential actors from the future network while allowing others. In her case-study, a photoelectric element was designed with a certain rigidness to try and account for multiple rough conditions in which it might be deployed. For instance, a nonstandard connection was chosen to prevent tampering by users or even local electricians unfamiliar with direct current (as opposed to alternating one). In practice, it made the users overly-dependent on the local contractor for the device, who would come to perform maintenance only twice a year. In this regard, '[t]he lighting kit (and behind it the designers) worked by a process of elimination. It would tolerate only a docile user and excluded other actors such as technicians or businesspeople who might normally have been expected to contribute to the creation of a technico-economic network' (Akrich 1992, 211).

In the methodological framework mentioned above, the researcher seeks the point of contention between the (in)scripted uses and the de-scripted uses, following – in a linear process – design meetings, concept testing and subsequent user reactions. In Woolgar's usability-testing case-study, the methodology is more complicated, taking into account the configurative process of iterative design that co-constructs the technological artefact. In both cases, the researcher must account for a fuzzy boundary between the thing-in-the-making and the thing-being-used and chronicle the points of contention through ethno-methodological frameworks of participatory observations, interviews, images, videos and the like.

The main issue with such a methodology today, and in relation to popular digital cartography in particular, is that this fuzzy boundary becomes even fuzzier. Due to the compressed nature of modern digital landscapes and the pervasiveness of adaptive interfaces, personalization and data-driven business models (which will be examined further in the next chapter), it becomes increasingly harder to differentiate between what an object is, when it is brought into being or where the boundary lies between being made and being used. Fixity is antithetical to the world of software which is 'the world of permanent change – the world that is now defined not by heavy industrial machines that change infrequently, but by software that is always in flux' (Manovich 2013, 2).

The dividing line between the maker and the user is hard to see here. The notion that while '[o]nce technical objects are stabilized, they become instruments of knowledge' (Akrich 1992, 221) allows us to methodologically focus on moments of crystallization in order to make meaningful observations, it becomes an issue when such stabilization never occurs. A navigation glitch in a map mash-up – popular hybrid interfaces built on top of Google Maps – can be traced through Google's

dominance of the mapping API ecosystem[2] and its rules about data collection and sharing, as much as the developer in question's own decisions. In turn, Google's algorithms can be perceived as influenced by a variety of secondary inscription processes, including – but not limited to – the level of open-data standards practiced by a local municipality or the number of users employing Google products while driving in the area (in turn, as determined by local culture, regulation, socioeconomic status etc.). And then, one needs to account for the emerging feedback loops, as organizations change and update their maps' software based on ongoing data collection from users and developers alike.

In such state of flux, there is a principal requirement to assume that older distinctions become less relevant. This is not because some idyllic view of newer media as inherently different or exceptional compared to older ones (Stevenson 2013), but because the digital nature of modern maps and the political economy of their employment requires ongoing blackboxing of surveyed users to compete in high-speed attention and experience economy.

My solution to this flux is to look closely at *how users are manifested in the designer intent* rather than the specific places of translation. In the ANT framework, inscriptions are followed by *subscriptions* by anticipated actants (map users in our case), or – in the case of tensions and disagreements – de-inscriptions, where actants utilise anti-programs to undermine and rewrite the inscription in the technical object. The most relevant concept, however, is that of a *re-inscription* which is a processual imagining focusing on 'the redistribution of all the other variables in order for a setting to cope with the contradictory demands of many anti-programs; it usually means a complication – a folding – or a sophistication of the setting' (Akrich and Latour 1992, 262). It is worth remembering that 'ANT does not presuppose that order, or perhaps better continuity, is a reflection of some reality "out there", but instead that it is the consequence (a construction) of a (temporary) stabilization of a particular set of forces that can be conceptualised as a *network*' (Loon 2007, 114, emphasis in original). Thus, I treat the intent to make a map as a constant process of re-inscription, pushing against the users' resistance to becoming *dividuals*[3] (Deleuze 1992) through the application of casual power. For example, in their analysis of Palestine Crisis Map, geographers Bittner, Glasze and Turk showcase how the interface of

[2] Google's Application Programming Language (API) provides external developers the ability to use some of Google Maps' features, such as route calculation, when building their own maps on top of them.
See https://developers.google.com/maps/documentation/javascript/directions for elaboration.

[3] Deleuze suggests that unlike previous types of disciplinary societies, where duality was held between the individual and their place in the mass, in digitalised societies of control one becomes an entry in a database – a *dividual* instead of an individual. Thus, individuality is not lost on the whole, but becomes a controlling element through what we might call today big-data approaches to tracing movement, behaviours and the like.

a web 2.0 digital map is always a congealed and quasi-stable moment of punctualization, a distributed network momentarily becoming a perceived whole (Latour 1996). In their example, a US-based map maker was approached by another US organization to create a map for a specific purpose and ended up changing the interface – and with it the user base – stemming from her re-aligned political convictions. They specify that focusing on this particular instance of translation altered their understanding of the map and warn that 'the rhizomatic nature of actor networks prohibits a single epistemological scope and the choice of method rather depends on the respective parts of the networks and the evidence available' (Bittner, Glasze and Turk 2013, 943). My focus is on the manufacturing of such maps, and so the next chapter examines the changes in scholarly thought on what it means to make and use maps.

1.2. Processual views on mapping: Historical views and recent developments

My work mainly concerns the late, modern stage of cartography, beginning with the Second World War and following the introduction of GIS and web cartography, pinpointing the role of contemporary, non-professional user-centred cartographic practices. To be clear, the scope of this work prevents me from going in-depth into historical mapping, which also would be superfluous regarding the aim of this book. Fully incorporating the historical backdrop and social, cultural and cognitive linkages between humans and maps would require an enormous and expansive project, as is indeed the case with the *History of Cartography* volumes, which have been continually published over the last twenty years.[4] This section (1.2) will outline a brief history of cartographic thought (1.2.1), highlighting how my contemporary view of maps incorporates or challenges some of the traditional views in cartography (1.2.2). The subsequent section (1.3) will build on those theories to discuss the cognitive aspect of mapping and their consequences for this study.

1.2.1. Maps as representations, social constructions and propositions: A historiography

This section traces the progression of geographic scholarship in regards to maps, their ontological status and the claims they make on the world. In doing so, it highlights the transition of approaching maps as static and fixed to viewing them as transformative (transductive) objects, a view

[4] A project initiated by the late J. B. Harley and David Woodward and currently edited by a team of scholars, it aims to encompass the entire history of humanity's cartographic practices (non-Western cultures included). Volume 6, chronologically the latest, was published in 2015. An estimated publication date is yet to be announced for Volumes 4 & 5. For more information on the project and to download finished volumes directly and for free, visit http://www.geography.wisc.edu/histcart/#Project

that is far more suitable for my methodology of researching maps as chains of production and co-construction. The section traces the state of maps' ontological stability – from a static and fixed object, to a contested reading and then to an unstable emergent construct. The argument I wish to make here is that while digitalisation and other developments that I unpack later change the nature of popular and scholarly understanding of what 'a map' is, this meaning has been in itself continuously challenged in modern history.

It is common in scholarly work to give a brief historical overview of the object of study. In this case, such contextualising will show that the maps that we have on our screens today are the product of modern trends that prioritise a form of geometrical-calculative sense-making. While perceived as natural by the broader public, they are not necessarily aligned historically with what mapping began. However, there is a general disagreement among scholars of what actually constitutes maps, and thus ostensibly regarding the pinpointing of its origins. More often than not, cartography is thought to be rooted in the Classic period, or slightly earlier – within the contexts of Mesopotamian or Egyptian civilizations (Smith 1987). Early researchers into prehistoric mapping, for example, were quick to conflate archaeological findings of ancient civilizations with widely documented anthropological accounts of 'primitive' cultures, ignoring the findings that prehistoric maps may have been 'produced in a religious context, that matters of belief governed their execution, and that their function would have been abstract and symbolic rather than exclusively practical wayfinding and recording' (Smith 1987, 48). Calling such artefacts 'maps' and drawing linear continuity to the term used today is thus misguided.

Harley (1987) similarly warns against using the present to interpret the past. He points out how religious iconography, storytelling and artistic depictions are often mashed together by researchers to incorporate contemporary notions of accuracy and path-finding. He notes how for a long time, cartographers and those interested in the history of cartography purported a teleological view of maps, wherein better mathematical and technological tools would necessary produce 'better' and 'more accurate' maps to determine real-world elements such as distance and direction. Imposing such criteria, rooted strongly in modernist-empiricist perceptions, on all (historical) maps, is very limiting. In a move that is popularly considered to have greatly contributed to the emergence of modern critical cartography (Edney 2005), Harley argued in a series of works that maps can be deconstructed following Foucauldian notions of power-knowledge, to unravel the biases of mapmakers (Harley 1987, 1988a, 1989). According to him:

> [a]t the very time maps were being transformed by mathematical techniques, they were also being appropriated as an intellectual weapon of the state system. If their study had become, by the end of the sixteenth century, the 'science of princes', it was because maps were by then recognized as a visual language communicating proprietorial or territorial rights in both practical and symbolic senses. In cartographic terms, however, the exercise of such power could be negative and restrictive. The map image itself was becoming increasingly subject to concealment, censorship, sometimes to abstraction or falsification (Harley 1988b, 59).

Denis Wood goes as far as to suggest that 'there were no maps before 1500' (Wood 2010, 22). By that, he means that attributing the agency of what we today call 'maps' to pre-15th century (or pre-12th in the case of China) artefacts is pointless, as the contemporary map carries within it the cumulative power of exploration, colonialism and the emerging nation-states, able to *make* a place as much as *describe* it. This claim might be exaggerated to a point, leaning more on the rhetoric than the historical. For instance, it relies on the assertion that very few maps can be found from the Hellenistic period, despite Ptolemy's detailed instruction on making such maps. This assertion is problematic due to the fact that 'the breaking up and dispersal of once organic atlases or the disappearance of cartographic items into inaccessible private collections accentuate the problem of document survival' (Harley 1987, 6). However, Wood's major point remains relevant: he argues that maps should be critically approached as *propositions and assertions*, both on the right to map territory as in the specific claims. Those claims are rooted in the nation-state's desire to expand territory or affirm existing borders. Cartographic practice as we know it comes primarily from the jargon-heavy institutional academic processes of professional consolidation, closing the field to non-academic practitioners and delineating cartography from fields like architecture, communications or design that all took part during the mid-20th century (Wood 2003). Arguing against the previous work of the likes of Harley, for Wood, the map can never be 'cleansed' of the ideological overlay of secrets and ambiguities.

So while Harley sought to read historical maps *despite* such omissions and exaggerations and Wood claimed that maps exist as such *because* of them and the precarious historical relations between maps and territory, they both subscribe to what recent critical geographers call the 'ontologically stable' nature of the map (Dodge, Kitchin and Perkins 2009a; Kitchin, Gleeson and Dodge 2013). In this view, the map is an a priori object, crafted with certain intent and then left to be read – or

deciphered – by varied audiences (figure 1.1). In contrast, Kitchin, Gleeson and Dodge offer a post-representational view that prioritises the emergent and mutable nature of mapping.

Robinson (1952)	*Harley (1989)*	*Wood and Fels (2008)*	*Kitchin and Dodge (2007)*
Maps as truth	Maps as social constructions	Maps as propositions	Mappings
Representation (descriptive)	Representation (descriptive)	Inscription (prescriptive)	Practices (relationally prescriptive)
Essentialist	Constructed	Constructed	Emergent
Map ontologically secure (fully formed/immutable)	Map ontologically secure (fully formed/immutable)	Map ontologically secure (fully formed/immutable; meaning mutable)	Mapping ontologically insecure (emergent and mutable)
Inherent, objective truth; non-ideological	Inherent truth; ideological mask that can be removed by deconstruction	Map ideologically loaded	Ideology emergent and relational to context

Figure 1.1: The key characteristics of different ontologies of cartography – reproduced from Kitchin, Gleeson and Dodge 2013

1.2.2. Post representational views of mapping

Here lies the major difference between how 'traditional' critical cartography viewed maps and how I examine them in this dissertation, especially with regard to their manufacture and practices in contemporary digital media-scapes (Appadurai 1996). Kitchin et al. (2013) follow earlier work (Kitchin and Dodge 2007; Perkins 2008; Dodge, Kitchin, and Perkins 2009; Kitchin and Dodge 2011) in which they explore the complicated relationship between maps, the spaces being mapped and the spaces created by mapping. According to their emergent, or *ontogenetic* view of maps, one should examine maps as *mappings*: processual and ever-changing. To understand such emergence, they utilise Simondon's (1992) notion of *transduction* exemplified by his metaphor of growing crystals: each molecular layer is based and shaped on the previous one. 'In other words, the crystal grows through individuations, that cite previous individuations, to transduce elements into a crystal' (Kitchin and Dodge 2007, 341). Building on the earlier works of map theoreticians such as Jeremy Crampton (2001, 2002, 2003) and John Pickles (1994, 2004), they return the map to the living world, as something that affects people and places connected to it, just as much as they affect it. Moving beyond both Harley's and Wood's views, Kitchin and Dodge state that maps

> are of-the-moment, beckoned into being through practices; they are always mapping. From this perspective maps are fleeting, contingent, relational and context-dependent, emerging through transductive processes to solve relational problems. This theoretical turn has led us to suggest that cartography is processual, not representational, in nature. Rather than

> cartography being narrowly understood as the scientific pursuit of how best to represent the spaces of the world (focused on issues such as form and accuracy), cartography becomes understood as the pursuit of representational solutions (not necessarily pictorial) to solve relational, spatial problems. In so doing, cartography shifts from being ontical in status, wherein the ontological assumptions about how the world can be known and measured are implicitly secure, to an ontological project that questions more fully the work maps do in the world (Kitchin and Dodge 2007, 343).

This *processual view of mapping* is the defining point of departure for the rest of this thesis. The case of the Apple corporation launching its own mapping software in September 2012 will illustrate and substantiate the proposition that such a view matters.

Many reactions were (strongly) negative to the switch Apple made in their then-new mobile operation system, which was centred on the replacement of Google Maps with their own mapping software developed in cooperation with several existing cartographic and satnav companies. Users tried the new app for a while and then often stopped using it, according to an anonymized data analysis undertaken by a mobile analytics company (Tofel 2012). Some of the issues motivating this were related to unclear/mistaken data as expected from a new mapping database, such as the duplication of the (amusingly disputed) Senkaku/Diaoyu islands (Geens 2012).

Apple CEO Tim Cook apologized for the mishap, recommending some alternative mapping and navigation applications while the issues were being ironed out (Tozzi 2012). Over time, the executive thought to be responsible for launching the map was dismissed (Lessin 2012). Even though later claims have been made that Google Maps – Apple's main competitor in the online mapping business – has lost approximately 23 million mobile users in the USA (Arthur 2013), the main point of interest in this story is not the actual loss or gain of users by tech giants, but how the map in question went beyond being merely a static (ontologically secure) image of the world. The event underscored the breaking of routine use of maps and the foregrounding of (failed) processes that facilitate such routines. Businesses were listed in improper locations, navigation instructions sent users the wrong way, new neighbourhoods emerged, historical roads came alive while newer paths disappeared, and users were invited to drive onto railway tracks or airport runways (Cohan 2012; Johnson 2012; Rundle 2012). At that point in time, Google Maps had habitualized for mobile users actions such as locating oneself on the map or finding nearby places of interest whilst performing (motorized) navigation. Introducing Apple Maps thus led to the breaking of the map, black-boxed

behind the user interface, and to subsequent destabilization of users' daily lives, which had come to be reliant on and shaped by mapping platforms. Complaints framed and reported by popular social media sources exposed Apple's map as an active thing, guiding people about their business and producing myriads of daily micro-realities, some funny, some tragic. The map in this case was never merely an objective representation of the world, nor was it 'just tainted' with an ideological veil (as for Harley), nor did it impose a single and unifying asserted reality (as for Wood). It produced the world(s) for individual users, in contextual, faceted and fluid ways.

This highly visible example unintentionally foregrounds the main principles of a processual view of mapping, predominantly its situational and contingent characteristic. When discussing processual views of mapping, many authors tend to exemplify their argument with paper maps. The rhetoric involved is clear: if one can show that even the most seemingly stable maps are contingent, then the proof is valid for other (digital) kinds as well. The argument usually goes along the following lines: consider a family on a daytrip using a tourist map in a foreign city. Representational theories will divide the situation into two parts: the map-maker and the map-reader. Map-makers created this map, and it can be deconstructed accordingly; the family is not even necessary for the analysis in this view of the case. One can examine what the map-maker wanted to present of this city's history (landmarks, choice of fonts), social structure (which areas/neighbourhoods are visible) or transportation (Are there visible public transport stops? Is the map scaled for walking or driving?). In a similar manner, the family can be analysed without knowing much about the map-maker. What are each family member's skill and experience with map reading? Who holds it? Who takes the lead in navigation? How easily can each member interpret the symbology? Navigate effectively? A processual view, on the other hand, requires us to examine the map as a key actor in a series of translations that connect the map-maker to a map-reader, without discounting one or the other. Now consider again the Apple map example. Unlike the tourist-map case, it is very difficult to treat as representational mapping. There is no singular version, there are no fixed users, and the whole thing makes very little sense outside a broader technological framework that also includes such actors as Google or smartphones. Unlike the paper examples, contemporary digital cartography forces us adopt the processual view. This is what November, Cumancho, Hübner and Latour (2010) refer to as a 'navigational' view of the map. They use the metaphor of complex marine navigation that is reliant on correlating the sea chart with external conditions in order to illuminate the way maps work in the world. Such a mode of enquiry is especially prudent when considering the haptic entanglement

of the digital user with the (mostly mobile) digital map, leading to the 'double-tap mode' (Hind and Lammes 2015). In this mode,

> not only is the networked process that leads to digital mapping images far more dependent on fast, and multi-directional calculations, these processes are also far more foregrounded. Being invited to give input that leads to the mapping images (e.g. velocity, movement, entering a postcode, traffic warnings), users have more of a chance to participate in the chains of productions that lead to the mapping image they engage with (ibid., 8).

In light of this focus on digital mapping as processual, it is both timely and thematically appropriate to go beyond cartography's past fascination with separating 'makers' from 'users'. Outside the scholarship however, there are also pragmatic and industry-driven reasons for a more unified and processual approach. The 'human' in Human-Computer Interaction studies (HCI) has become a staple of what media critic David Berry (2014) calls the computational industries. Well beyond the academic world, companies progressively rely on processes of streamlined user-testing and 'user-experience' (UX) design to make their software products appealing. This will be discussed in details in chapter 6, but for now this adds an additional argument for adopting the processual view. To reiterate: we can productively examine mapping as Kitchin and Dodge position it – ontogenetic, task-oriented flows – both because of contemporary scholarship *and* the fact that the industries that make (digital) maps and that are at the foci of this dissertation unknowingly subscribe to similar views.

After Kitchin and Dodge (2007), I argue against the a priori divide between map-making and map-using, unifying both practices into a contextual chain that shapes worlds, as in the case of a population map created for a certain goal which might then be used to enact policy. In this, they follow the recommendation to abandon binary thinking in relation to cartography and treat maps as 'both representations and practices simultaneously' (Del Casino and Hanna 2006, 36). My own research investigates the extent to which such recommendations might already be well in line with processes that occur in places where maps are made. As I discuss over the next chapters, witnessing the work within mapping organizations shows how those making maps often focus on the people who will end up using them, rather than the maps themselves, and implement different methods to try and 'get into the heads' of their future users. Often, these inquiries are funnelled back into the design process, creating an endless loop of iteration and cross-pollination between the makers, users and emerging mapping worlds. Nowhere does this become clearer than in the frequent mentioning

of cognitive maps, often presented as tools to design, control and evaluate the production of mapped media and their affordances.

1.3. Cognitive mapping

This section and the following sub-sections bring together cognitive theories from the field of mapping and beyond. The aim is twofold: first, to provide an academic vocabulary through synthesis of recent developments that explore maps from the point of view of the individual's thinking processes when engaged with the map; and second, to do so in order to understand the overlap between this vocabulary and the design-oriented vocabulary of map-making organisations. They are in the midst of a transformation in which, by subscribing to internet-promoted conventions of usability and design experience, they adapt the language of cognitive science to optimise and enhance their mapping interfaces.

1.3.1. On the need for cognitive theories in studying map-making

Providing a comprehensive account of digital mapping demands moving beyond geography and cartography. After all, as I stated before, maps today are also software constructs co-inhabiting digital platforms with other types of software. This section expands on maps from other fields of social sciences and humanities while focusing on the notions of affordances and ecological psychology. Grounded in the study of perception, such notions highlight the possibility of designing certain environmental cues into the interfaces of objects or devices in order to facilitate certain preferred modes of interaction for the user. In the social sciences in particular, there is a great deal of interest in incorporating concepts from cognitive sciences, especially when conducting empirical research (Flyvbjerg 2001). This is the appeal of understanding complex systems of human behaviour as corresponding to and controlled to some extent by internal psychological machinery. The empiricist's ideal is to find such mechanisms which are common to all humans and can be discerned, quantified and probed. The example of cognitive maps and their use in geography and cartography, discussed in the next section, is one such trend.

While processual views of cartography often oppose the use of cognitive theory, I disagree somewhat. The opposition stems from the perceived inability of cognitive science, in its often rigid empiricist setting, to account for the social and contextual aspects of mapping. Researcher of maps' narratives Sebastien Caquard (2014) rightly claims that adapting the processual view can be seen as

merely shifting traditional boundary lines in cartographic enquiry, effectively disqualifying any cognitive study that strips away the social and contextual aspects of map use. However, he concludes that

> by enabling the combination of critical positioning with empiricist practices, post representational cartography offers opportunities to revisit and alleviate some of these tensions, as well as to envision our mental, emotional and embodied relationships with maps and with places through maps. These relationships are made of a complex mix of measurements and perceptions, facts and stories, memories and fantasies. A stronger integration of the diversity of concepts and practices associated with maps and mapping, drawing on a range of disciplines from both the sciences and the humanities, might strengthen our understanding of these relationships (Caquard 2014, 8).

Such an approach is also exemplified in MacEachren's work on merging the cognitive and semiotic in map analysis and design (MacEachren 1995) which I follow in my work. To clarify, this dissertation is not rooted in any cognitive empirical research. However, following up on Caquard's recommendations, ideas from cognitive science, in particular from James and Eleanor Gibson's 'ecological' theories of perception (J. J. Gibson 1977, 1986; E. J. Gibson and Pick 2003) – and the concept of 'affordances' – are vital to my research. Moreover, those concepts have become a mainstay in both media and cartography research. They are also often used by designers when talking about the *desired* use of their maps and thus are crucial to understanding the intricacies of such design processes. Over the course of the dissertation, I use the works of the Gibsons, supplemented by my understanding of advances in the field of cognition, especially as related to information processing and task automatization (see Kahneman 2011). The aspects with most relevance to map research lie in the fact that human beings are reluctant to use limited higher-order cognitive and processing capabilities when cognitive shortcuts – in the form of heuristics – are available. When taking decisions, we often assume that this is done through a process of rational deliberation, while in fact, our intuitive and very embodied 'circuitry' does the job most of the time. Of particular interest in my work is the manifestation of heuristics around quantification and the way numerical information is processed by the individual on the map's user interface. Digital maps are at the same time the product of quantification, relying on digitalisation of previously analogue data while exhibiting, alongside other digital objects, an abundance of numbers as part of the way they communicate with their users. And while I will go into this aspect of mapping in depth in the next chapter, it is

worthwhile to briefly examine the relevant theories before proceeding with the way these, and similar, theories are used through the concept of cognitive mapping. Two behavioural economic theories that look into unconscious processes are especially relevant when dealing with quantification: cognitive ease theory and intensity matching.

Economics Nobel Prize winner Daniel Kahneman differentiates between two (hypothetical) agents that operate within human consciousness: system 1 and system 2 (Kahneman 2003). In broad terms, system 1 is responsible for day-to-day operations, from regulating body temperature to setting a convenient walking speed to performing rudimentary calculations (like counting the number of trees one sees). This system is constantly 'running in the background' and requires no particular effort to operate. System 2, on the other hand, is responsible for complex tasks. Those can range from maintaining a high level of physical exertion (or even walking at an unusual pace) to solving a difficult maths equation or focusing on one particular voice in a noisy setting. System 2 is dormant and often called into action when system 1 encounters a task it cannot perform. It also very energy-consuming and requires expending the body's reserves. This is not a metaphorical statement, but a physiological one – experimental settings have shown that when a high attention level is required, individuals exhibit physical responses such as a higher heart rate and dilated pupils. System 2 requires more cognitive effort, and much of the effort involved comes from the need to maintain attention while the mind wishes to switch to the more energy-efficient system 1. Thus in Kahneman's framework, '[f]low neatly separates the two forms of effort: concentration on the task and deliberate control of attention. Riding a motorcycle at 150 miles per hour and playing a competitive game of chess are certainly very effortful. In a state of flow however, maintaining focused attention on these activities requires no exertion of self-control, thereby freeing resources to be directed at the task at hand' (Kahneman 2011, 41). Here, he references flow theory, introduced by Csikszentmihalyi (1990) as the term for actions performed at the peak of a practitioner's interest and ability when entering a high-challenge, high-skill state of mind in which the work surges and failure seems impossible. Csikszentmihalyi explored the concept in relation to his previous work on mechanisms of concentration and information attainment, suggesting that when above-average levels of challenge engage above-average levels of participants' skills, a person might enter into a 'flow' state. Nakamura and Csikszentmihalyi (2001) summarize that in a state of flow, the individual experiences extreme concentration on the task at hand along with the merging of action and awareness, a loss of self-reflexivity, a heightened sense of control, distortion of time perceptions and a sense that performing the task is a reward in itself. This concept explains how even complicated user interfaces, utilised

under pressure, can still be enjoyable. Orienteering comes to mind as a map-rooted example: in this competitive sport, participants tax mind and body alike while identifying their location and navigating in unfamiliar terrain faster than the competition.

This mode can be further explained by the concept of cognitive fluency. Experimental psychology has shown a correlation between cognitive ease, memory and the mood of the person involved. Factors like readability, clear presentation, the recipient being in a good mood and even a message presented in rhymed form all contribute to it being remembered more easily (Jacoby et al. 1989; Whittlesea, Jacoby and Girard 1990; Jacoby 1991). The benefits of such techniques have been widely adopted in the design field, where consistent styles, grids and colours are continuously implemented for the users' benefit (Forlizzi and Battarbee 2004). Moreover, cognitive ease or reducing the strain on thinking (in other words, not activating system 2) has the property of evoking a sense of truthfulness regardless of the information's accuracy. One simple example of this process demonstrates how market stocks with pronounceable abbreviations have been shown to perform better than stocks that lack vowels or are otherwise difficult to pronounce (Alter and Oppenheimer 2006). Repetition is the key aspect of this, as long demonstrated by marketing and communication research (Lazarsfeld, Berelson and Gaudet 1944; Lazarsfeld and Merton 1948): on average, the mind has trouble distinguishing trustworthy from false information after recurrent encounters, as the sense of cognitive ease of recognizing something can be interpreted as 'truth' (figure 1.2).

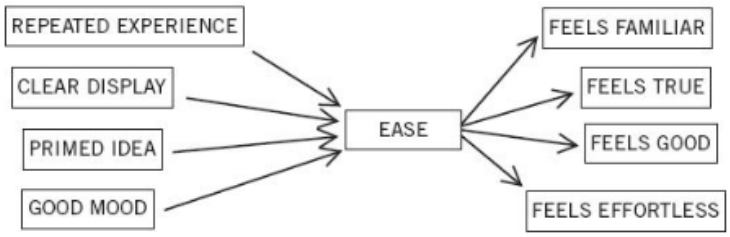


Figure 1.2: Cognitive ease. Source: Kahneman 2011, 60

Moreover, as shown in a series of experiments by psychologist Robert Zajonc, there is a causal relationship between cognitive fluency and affect. Repeated exposure to a message – even if it consists of random symbols – has a positive effect on subjects' moods (Zajonc 1968; 1980; Bornstein 1989). Zajonc offered an evolutionary explanation for this, which is rooted in an organism's ability to quickly distinguish between safe and unsafe objects and social situation. The

orienteering example above might provide the participant with satisfaction merely through successfully mastering the act of map-reading, regardless of the results in the field. From a processual point of view, it is also important to note how this brings forth different mapping worlds in different contexts: a map designed to be detailed and complex might be pleasurable to a professional orienteer in a stressful situation while annoying to a casual map user in the midst of a stroll. To those using a map on a screen, such experiences are complicated by the automatization process that removes much of the cognitive load associated with map-reading, while anchoring the information processing in the quantifiable nature of the digital media. Understanding it requires evoking another attribute of human perception, specifically the unique approach to numbers as exhibited by the property of *intensity matching*.

Acting through a map often involves examining numerical information – whether in units of time or space. But such data is a trace of 'cartographic illusions' (Ingold 2000), obscuring the complex spatiotemporal relationship between humans, place and space. As maps are made to perform more calculative functions for their readers, this affects not only the visible aerial distance on the map, but also the concrete turn-by-turn directions that create the actual lived distance created by traffic lights and obstructed sidewalks.

The propensity of humans to measure is supplemented by their ability to compare those measurements across different, often unrelated scales and is known as *intensity matching*. Kanhenman notes that most people from a similar cultural background agree on matching such attributes as the intensity of a colour to the severity of a crime (murder is a deeper shade of red than theft) or the height of a person to the remarkableness of a child's achievement (being able to read at the age of four can be symbolized by a tall person, but not as tall as someone who can read at 18 months). This also links to the *availability heuristic* (Tversky and Kahneman 1973), which allows substitution of a question related to frequency or quantity with an easier one. Thus, if the question that I need to answer is how long it takes to get from A to B on two different routes, the answer I might end up with is 'which of the two numbers presented to me by Google Maps is lower?' Maps – and digital maps especially – can be inscribed with affordances that prompt such readings.

Affordances in decision-taking will be the core of the next chapter, which discusses the concept of casual power and the way designers try to extrapolate users' actions with their maps. While not central to the mapping overview, they are nonetheless important for understanding modern thinking about mapping, especially amongst professionals. Therefore, the following section will stress the

difference between a cognitive and an actual map, and how – following Caquard's recommendations – the concept fits into researching digital mapping production.

1.3.2. Cognitive maps as design tools

The notion of a cognitive map is a pervasive idea for scientists and designers and is rooted at the heart of the mapping processes. It can help us begin to understand the power enmeshed in mapping production, especially when used by map-makers themselves. A cognitive map is a method by which an individual acquires and stores spatial and navigational cues in order to position herself in the world. Originally introduced by cognitive psychology pioneer Edward Tolman (1948), the concept has since gained much traction in fields as diverse as psychology, geography, education, neuroscience and more (Dodge, Kitchin and Perkins 2011b). When a map is (being) created, it is more than a flat inscription for transferring knowledge in the form of an immutable mobile, more than an image copied from a local drawing in the sand and the ship's logs to be carried back home.[5] It is an *interface* and a negotiation field between two cognitive maps, the one offered by the designers and the other incorporated by the reader. Between them occurs a process of translation in which a group of people attempts to present to another group not just how the world *is*, but what you can (and should) *do with it*.

One way to understand the discrepancy between a physical manifestation of a map vis-à-vis a cognitive map is looking into the research done on navigation and wayfinding, particularly as maps are a long-established tool for orienteering (Lobben 2007). Geographers and mobility HCI specialists Barry Brown and Eric Laurier (2005) have shown that while cognitive maps do have a place in the processing of wayfinding, the materiality of the map itself is also important. They deploy video ethnography to capture two cases – a businesswoman navigating her way via a London tube map and

[5] Here, I reference the oft-cited example of Bruno Latour's use of French explorer La Pérouse's encounter with the natives of Sakhalin. Latour describes how a map of the region was drawn in the sand by the locals and copied to a paper version by the Europeans, much to the surprise of the former. He positions the map in such a way as a flat techno-inscription, an immutable mobile that can be carried from place to place without being changed, reifying knowledge structures about the world to other practitioners of the Western scientific establishment (the 'centre of calculation'). For Latour, the map stands as an independent actor facilitating such knowledge exchange. Though outside the scope of this dissertation, there exists a fascinating challenge to Latour's account presented by geographer and historian of science Michael Bravo (1999), based on La Perouse's actual journal and ethnographic exploration of the Sakhalin area and the Amur people. Bravo argues against Latour's metropolitan-centric reading in favour of the field encounter. For him, the episode is part of the process of 'ethnonavigation', wherein the collective performative processes of the native multi-ethnic trader cultures encounter a traveller aiming to find his way. La Pérouse's main concern was with orienting and locating himself in a continuous traversal of territory. This argument goes quite well with my own conceptualisation of processual mapping, in placing the 'blame' for the map on both parties (the local and the traveller), each with their own contextualized goals.

a group of friends on a car daytrip – and use it to emphasize how discussions, disagreement, (re)negotiation, finger pointing and map crumpling are as much part of bringing the world into being as any mental constructions that precede them. Lamenting the focus on the preferred laboratory setting for exploring the cognitive aspects of navigation, they 'see cognition as something which can be studied as a publicly available activity, without using notions such as "mental representations" or "cognitive ability" ' (Brown and Laurier 2005, 7). They further note how the inherent ambiguity of the map allows for individuals and groups to construct descriptions of future routes and then enact them (or fail to do so). In the case of the daytrippers especially, the social aspect often trumps the 'map-as-description' form, leaving it more of a playground – or battleground – on which the participants' desires and demands are negotiated. Here, temporality, conspicuously absent from the map's design (Lammes and Perkins, 2017), rears its head as the trip sites begin to be categorized, not only by location but also by order of visit. This is the distinction that anthropologist Tim Ingold (2000) makes between human and animal movement. According to him, humans weave *narratives* in their process of wayfaring – performative, repetitive and based on embodied sensorial feedback rather than rigid mental maps. Navigation of familiar ground is rooted in narrativistic reenactment of previous journeys, and therefore – as in the case of the daytrippers above – 'when navigating in a strange country by means of a topographic map, the relation between one's position on the ground and one's location in space, as defined by particular map coordinates, is strictly synchronic, and divorced from any narrative context' (Ingold 2000, 237). Each participant's cognitive map becomes more complex and multi-dimensional than can be imagined in laboratory setting.

When I talk about designers mediating the world to everyday users, problems of scale emerge. More often than not, people who make maps attempt to replicate in (semi-)laboratory settings the type of conditions they expect their users to encounter when modelling the types of cognitive maps these users will deploy. Narratives and social negotiations are hard to reproduce in this case. Research has shown that there is a substantial difference between cognitive maps created during actual movement in lived spaces versus cognitive maps that arise during interaction with a map of the same space (Burnett and Lee 2005). Creation of such maps is heavily reliant on multiple factors which must be taken into account when designing geo-spatial interfaces (Fabrikant and Lobben 2009) such as ingrained sense of direction (Lobben 2007), whether the user performs additional tasks during navigation, and whether the user is able to transcend egocentric frames of references (i.e. left-right, with respect to the body) and achieve allocentric frames, relating oneself to external objects and cardinal directions (Wen, Ishikawa and Sato 2013). Utilising a computer-aided navigation system

creates a third way of experiencing and negotiating space, positioned somewhat between egocentricity and allocentricity. Digital maps employ different methods of bringing the user closer to the physical reality they aim to describe: they utilise cognitive shortcuts such as automatization, personalization and reduction of processing load. For instance, voice-aided car navigation has adverse effects on the long-term construction of cognitive maps due to factors such as a simpler and shorter decision-making process, lowered attention level, reduced time dedicated to studying the map and lower stress (Burnett and Lee 2005). Yet, as Brown and Laurier remind us in a study which focuses on GPS-aided car navigation (Brown and Laurier 2012), the messiness of real life is never as straightforward as a lab setting (Burnett and Lee's study made use of students driving in a virtual space). As it turns out, drivers and passengers argue amongst themselves and with the satnav. Destination and routes are misinterpreted, the satnav does not display the relevant information due to database or sensor problems, and there is a mismatch between the strictly legal driving actions as interpreted by the machine compared to the mutable and relativist application of road laws by humans. The space we experience is simply not the Euclidian space of the code (cf. Lefebvre 1992; Elden 2007).

1.3.3. Cognitive concepts in map design

In the two previous sub-sections, I presented the processual (post-representational) view of mapping utilised throughout this work, introduced conflicting ways in which the model of cognitive mapping makes claims about the world and showed how the two models can strengthen each other. Ostensibly, while it is ill-advised to reduce user-map interaction to decontextualized in vitro laboratory settings, we must recognize that *such reductions are often the way map-making practitioners carry out their work*. This final section on cognitive mapping presents the main ideas from design and cartographic theory that allow me to begin outlining how *media* theories are helpful for understanding decisions made throughout the design processes which influence users. This section examines map-makers' attempts to deal with the shifting technological platforms by focusing on quantifiable and reproducible usability and user-experience methods, specifically when consumer-oriented maps are designed with a degree of assistive interface.

Digital maps with assistive directional output are becoming widespread in multiple domains. By this, I mean interfaces that go beyond static representation and instead offer automated localized advice and guidance through the map when approaching the physical space. Researching such developments presents certain methodological issues. In fact, through my own interaction with map-

makers, I have witnessed a large number of attempts to come up with viable ways to study automated navigation in the field. The most striking feature of digital maps is perhaps their resistance to some traditional HCI methodologies of user evaluation, such as pointer/eye tracking and A/B testing, especially when implemented on mobile devices. The movement to smaller displays, the inclusion of continuous vector animations as a necessary component of the interface and the disappearance of legends and menus into touch interfaces have all made traditional evaluation methods somewhat obsolete, requiring the development of new and combined evaluation methods (Fabrikant et al. 2008; Çöltekin et al. 2009; Fabrikant 2013). In traditional HCI methodologies, information hierarchies are transformed into menus and buttons and testers measure the minimal steps (clicks) or the time required to complete a desired task. New generations of maps with their overlay functionality and the requirement to work on multiple devices and screens pose a challenge for such methods.

Contemporary computational media culture relies on the practice of making multiple layouts of user interface and then examining – either in a laboratory or via unknowing users – the potency of small changes to the product. Maps have been at the pinnacle of user-testing ever since Robinson introduced usability criteria into his map lab, shifting the focus of design from the cartographer to the user (Crampton and Krygier 2005). Clear guidelines for style, colours, iconography and the like have become a must in the toolset of contemporary cartographers. Edward Tufte, a prominent figure in information visualization design, has written extensively on maps' abilities to clearly communicate meaning when utilising precise techniques (Tufte 1990, 1997). Yet, while digital maps continue to enhance the tradition of user-centred design (cf. Krygier and Wood 2005), the difficulty of evaluating maps which are embedded in surrounding software platforms is enormous. This is not to say that previously maps were sterile or removed from messy habitualities in which they were operated, but today many more maps are very much part of the media-scape (touchscreens, keyboards, mobile data plans). This is why many of the concerns regarding usability and human factors in modern map development arise *before* the actual product is developed, through the use of such methods as personas or heuristics.

As Woolgar showed in the 1990s, the ways technology is evolving are dependent not only on how the developers of this technology *want it to behave*, but also on the ways such developers *envision their users' wants and needs*. Kuparinen, Silvennoinen and Isomaki (2013) attempt to solve mobile

mapping's usability-testing issues by building on the notion of heuristics in design sciences[6]. Heuristics are conceptual shortcuts that allow designers to evaluate their digital artefacts without extensive user testing. This is contingent on employing the knowledge of one or several experts to assess the usability and friendliness of a user-centred system (Nielsen and Molich 1990; Nielsen 1994). Unlike user testing, heuristics allow designers to evaluate the product in short timeframes and without utilising external expertise, often relying on in-house talent. This makes them particularly suitable for rapid-prototype-development processes typical of the modern software industry. Heuristic evaluation might include diverse categories that require the interface to be consistent, or for the user to be able to easily recover from mistakes. The example of the 'Control+Z' keyboard shortcut illustrates how a design schema might be tested: this shortcut allows the undoing of previous action on many Windows-based systems, often word processors, and is similar to the 'back' arrow. A designer of a new program might then evaluate a beta version of a mapping software running on a Windows operating system, checking whether the Ctrl+Z shortcut does anything for the user (recovery from mistakes) as it does on other programs (external consistency) and whether this shortcut works the same on all screens of the program (internal consistency).

A complimentary methodology often involves 'virtual' users in the form of design personas (Pruitt and Adlin 2010). This means that the designer compiles a list of attributes into personas representing different usage scenarios (i.e. 'a middle-aged mother of three interested in locating the nearest clothing store'). The different scenarios are then presented for each persona, sometimes with numerical attributes corresponding to the perceived (or collected through previous research) importance of each factor within the system (Hosono et al. 2009). The resulting conclusions change the characteristics of the system, highlighting certain options and hiding others. The real end-users will never know what was in their respective persona description or how it prevented them from seeing this or that function of the system-in-construction. As in many other technological fields, decisions are often made in light of presumed familiarity with the user's needs, rather than the actual requirements.

By utilising such HCI methodologies as heuristics and personas, designers aim to understand the broader societal processes surrounding map reading as disconnected from the map itself and tap into them. They imagine their users as distinct case studies, impose on them social categories and

[6] Here, we must differentiate a heuristic as appears in psychology, which I mentioned previously to heuristics evaluation in relation to design. The first relates to cognitive shortcuts employed by the human mind, the second to usability and user-experience checks conducted by an expert (without users involved) based on established knowledge of such shortcuts.

traits and 'lead' them through scenarios that are fuelled by the designers' own beliefs (and hopes) regarding their future product. As I claimed above, the processual conceptualisation of the map requires us to see mapping as ontogenetic and transductive. Those who make maps are building future visions of usage into the design process, shaping the possible interactions to be taken within their maps and nudging users into certain patterns of use and misuse, if not directly controlling them. Nowhere is it clearer than in the case of the specifics of designing *digital* maps.

1.4. Towards uniquitous cartography: Digital maps as interfaces with affordances.

At this point, I would like to briefly return to the research sub-questions 3 & 4 posted in the introduction. Namely, how do we conceptualise the specificities of *digital* cartographies and how do we theorize the resulting assemblages of envisioned user personas wrapped in design heuristics and underscored by changing technological platforms?

In this dissertation, I focus on a certain subset of digital mapping. In order to delineate my objects of study, I focused on maps that can be understood simultaneously as cartographic and media objects. Such are the maps found in the foci of myriad daily digital users, without being registered as special or specialised. To profoundly understand what kind of maps fit my cases, I operationalise them through three tropes: cartographic, layered and popular. This definition follows the established difficulty of defining maps, even in their pre-digital and pre-ubiquitous phase (Vasiliev et al. 1990).

Vasiliev and colleagues show that the meaning of a map varies from person to person, based on their background and geographic knowledge. Using meta-analysis of textbooks, encyclopaedias and dictionaries, they define a map as 'a representation of the Earth's geographic surface' (Vasiliev et al. 1990, 120). They use this definition to examine maps' linguistic origins in several languages, as well as deploying an exploratory experimental study in which participants ranked various elements of 'map-ness'. Their conclusions affirm the suggested definition and tie 'map-ness' to horizontal representation at a certain scale. They emphasize how such definition is also applicable to (then) new developments and can include 'air photos, satellite images, CRT screens with map-like images on them, and digital files of coordinate data' (ibid., 122). Taking into account contemporary developments, this definition still remains broad enough to include, for instance, the use of locative apps on a phone while excluding other types of horizontal (flat) inscriptions found on screens. An information visualization, even if located against a backdrop of Earth's contours, is not a

cartographic map. Nor is a mind map or a word cloud. A cartographic map begins with a proposition of an activity. Building on the processual understanding of mapping and November et. al.'s (2010) *navigational* meaning of mapping, such a map is intended as a call for action: to explore, navigate or imagine. A cartographic map is meant to convey location through traditional display forms (lines, contours, colour pallets) but transcluded onto a computational device, and thus enjoying various technological advantages which include but are not limited to GPS positioning, high-resolution displays and internet data transmission (Dodge, Kitchin and Perkins 2011d).

These technologies allow for a *layered* map. Layering is a defining characteristic of the digital. It alludes to both the superimposed nature of data and software structures as well as emerging hybrid relations with physical entities that such structures mediate (Manovich 2006; Parikka 2010; Galloway 2012; Verhoeff 2012; Manovich 2013). For me, this is a crucial factor when discussing digital mapping, as it transfixes the logic of software, data and code, together with the political economy of their production, onto what was previously an analogue field (Dalton 2015). Displaying and comparing different data types on the same base map, opening and closing various symbols, clicking or tapping on a map object in order to access additional information about it are all examples of layered digital-map interactions. Moreover, layering always assumes a type of interactivity not present in a paper map: the user is called on to actively shape and select her[7] map (within the boundaries defined by the system's designer). Thus, the famous Facebook connections map that used graph theory to chart the link strength between various Facebook users based on their self-reported geographic location is not a digital map, even if the result (after several corrections) resembles an incomplete map of the world (figure 1.3). A static image featuring the contours of the world, even if produced by digital means, does not fit in my definition of a 'digital map' – it is a diagram or a visualization. The form in which it is given – a closed image file – prevents anyone from using it for anything other than static viewing. The lack of zoom or panning options places it in the image category rather the map category for the purposes of this dissertation.

[7] I will use female pronouns when discussing hypothetical situations or abstract users. If there are two such characters, the second will be referred to as male for the sake of reading flow and clarity.

Figure 1.3: The Facebook links map forms the contours of familiar continents but is greatly lacking in places Facebook was not (yet) popular, such as Russia and China. Source: https://www.facebook.com/notes/facebook-engineering/visualizing-friendships/469716398919

Lastly, my scope includes only popular digital maps built and deployed for non-professional audiences. This is perhaps the most controversial of my definition's components. Yet, it is necessary if we want to define contemporary digital cartography in relation to other practices, such as professional GIS work or – at the other end of the spectrum – uploading geotagged images to social-networking sites like Facebook or Instagram (Evans 2015). Popular digital mapping is made for broad audiences, it positions the map as a medium for reaching user's goals, and it often includes GPS-enabled locative capabilities (or other IP- or WIFI-based locative functionality when used on non-mobile devices). In their own attempt to define the specificities of digital mapping, Dodge, Kitchin and Perkins warn that

> [t]here are clear signs that cartography will be seen as simply one of many available 'on demand' web services. As the digital map display becomes more flexible and accessible, it is also, in some respects, granted a less reified status than the analogue paper map of the past. Maps are increasingly treated as transitory information resources, created in the moment, and discarded immediately after use (Dodge, Kitchin and Perkins 2011d, 119).

As my empirical work shows in the coming chapters, this flexibility and accessibility is mainly the case now in popular digital cartography, where professional map-makers' craft and pride is being

substituted by a (commercial) need to compete with a variety of other web-enabled services. This excludes from my analysis such tools as professional GIS software and the highly-specialized communities that use them, although of course those are also undergoing significant shifts (Kwan 2002, 2012; D. B. Richardson et al. 2013). Overall, digital mapping is part of ongoing trends of digitalisation that proliferate more and more in everyday life (Gartner, Bennett and Morita 2007; Della Dora 2012). Therefore, when unpacking digital mapping, the *digital*, with its quirks, idiosyncrasies and complicated relations to spatiality (de Souza e Silva 2006; Farman 2012), should not be ignored.

In his doctoral dissertation, military historian William Rankin (2011) traces the development of the Global Positioning System (GPS) and other geographic technologies in the latter half of the 20th century. He argues that over the course of the century, technologies of accuracy, measurement and automation have transformed cartography from something concerning itself with representing space to a discipline aiming at *producing* it as a utility, not unlike water or electricity. As the mathematics of the grid-based Universal Mercator Translator (UTM) system allowed far more accurate calculation of each point on the globe and the introduction of GPS allowed for acquiring and managing locations under this system, 'space [was made] legible by installing a full-scale, three-dimensional system of coordinates, essentially replacing the original terrain with an abstract electronic landscape' (Rankin 2011, 3). This makes for a very different sort of mapping effort. Previous spatial knowledge (or 'geo-epistemology', according to Rankin) required maps to be interfaces of indirect enquiry, passive in their acquisition of location by limiting the affordances to operating outside of the delimitated world of the map. The new geo-epistemology posits the map as a permeable membrane, drastically reducing the cognitive resources required to access the world beyond (through?) the map and shortening the translation process between image and action. Positioning mapping as 'a mass technology that operates as a kind of scientific instrument' (ibid., 21), Rankin concludes that '[m]apping thus presents an opportunity to ask how every day technological systems are theory-laden. In a general sense, this means analyzing how different forms of mapping have influenced the ways that individuals understand, interact with, and help construct geographic space' (ibid., 24). In the case of digital maps that I examine in this dissertation, this geographic space is one of availability and affordances, enabled by the minuscule distance between image and action.

What separates this historic framework from similar theories that attempt to pinpoint changes in the triadic relations of navigation, maps and space is its ontological correspondence with post-representational mapping. According to Rankin, the shift that occurred with the introduction of

modern technologies renders mapping applications senseless in themselves, without accounting their roles as service interfaces for extracting and making use of space. For me, this particular difference is best elaborated by the (admittedly, somewhat tired) visual metaphor of stepping through the looking-glass, particularly with the different way this metaphor plays out in Lewis Carroll's work versus the Wachowski siblings' now classical *The Matrix*, which heavily borrowed iconology from Alice in Wonderland and its adaptations. In the first instance, Alice is tapping on the glass (Carroll 2008), imagining that she has passed through it, before being transported to a world that – at least initially – is not unlike her own. Neo, the protagonist of the Matrix films (Wachowski and Wachowski 1999), touches the mirror once, becomes engulfed in the strange silvery substance on the mirror's surface, which subdues and chokes him, before being forcefully thrown into a radically new space.

The difference between the two is not in the surface details – both are interfaces (both are mirrors) due to their propensity for first visualizing and then transferring the user (protagonist) into a nearby, yet bounded world. My argument here, and throughout the thesis, is that within digital mapping interfaces designers have far greater controls over how to engage and motivate users. Like the mirror in the Matrix, the digital interface actively 'sucks' the user in, learns about her and exerts an intentional effort to keep her within the system. Designers can effectively hide certain parts of the interface, revealing only portions of it, by precise construction of users implemented through heuristic testing and user schemas in the design stages of the technical development. The specifics of precisely how this is achieved will be dealt with in later chapters. The remainder of this one will be dedicated to fleshing out the particularities of the digital map from dual disciplinary perspectives – geography and media studies – in order to better understand the power relations between designers and users. I begin with a summary of what contemporary geography scholars have to say about the rapid shift to a predominantly digital and ubiquitous cartography. Through this summary, I intend to highlight the distributed nature of significant parts of such cartography, as well as the unique position that Google products have in it. The second part will look into broader (and new) media theory to summarize the specificities of the 'digital' in maps and the platforms on which they are displayed, focusing on the notion of mediatization as a meta-theory explaining user interfaces and their importance in defining the interaction between content and users.

1.4.1. Contemporary geographic theories on digital mapping.

As computers became widespread and the Internet grew from a specialised military-scientific network into the popular medium it became (Castells 2001), geographers, cartographers, information

visualisations specialists and GIS people (and the various intersections of thereof) began exploring the various ways mapping interfaces can be used access - but also explore – geospatial data (MacEachren 1994; 1995; 1998). Notions of design and usability began to influence the discourse around such interfaces, especially in relation to facilitating collaborations between various fields and opening up spatial data to non-professionals (MacEachren and Kraak 2001; Kraak 2003; 2006; Cartwright et al. 2001). What started as a scientific community research agenda significantly grew in scope with the rapid introduction of consumer grade geo-spatial visualisation software and the spread of mobile devices that further enabled it.

In a special 2007 issue of 'Cartography and Geographic Information Science', guest editors Georg Gartner, David A. Bennett and Takashi Morita offered the term 'ubiquitous cartography' (Gartner, Bennett and Morita 2007) as a general term for concurrent changes. To them, the main attribute of the technological and societal revolution of modern mapping is the sheer availability of specific maps tied to location-based services for growing groups of users. They pinpoint three main vectors that have allowed for this: advances in telecommunication infrastructure – mostly in the form of different bands of wireless networks; the opening of GPS and similar systems to broad commercial applications; and the distribution of mobile computing devices. Like many other contemporary innovations, Gartner et al. view ubiquitous mapping primarily as a consequence of technological improvement in relevant fields, making their article primarily a listing of technical challenges that need to be overcome, such as smaller screen sizes, computational challenges involved in real-time navigation and addressing the privacy concerns of the users of location-based services (LBS) through proper protocols. They acknowledge the manifold possibilities of ubiquitous cartography since '[a]t a high level of abstraction ubiquitous mapping applications are, therefore, computer applications that deliver information that is dependent on the location of the device and user, but beyond this generality, it is hard to find a consensus on the scope or definition of this new technology' (Gartner, Bennett and Morita 2007, 255).

The tone of the special issue is optimistic and the authors concern themselves primarily with how to explore certain (technical) aspects of new wireless and satellite networks in mapping, rather than the ontological and epistemological change that such cartography's claims might incur when removed from the once-contained professional practice and into the media-scapes of smartphones and wide use. I recognize Gartner et al.'s focus on increased access to contextual maps in relevant situations and its broader societal applications. Following this, my argument incorporates Wood's (2003) 'cartography is dead' proposition to offer a view of ubiquitous cartography that opens it up to

broader, previously excluded publics, continuing the notion of 'popular' in the definition that opened this section. Such notions are built on recent developments in the assemblage of technologies that facilitate the incorporation of remote viewing into big data, 'opening' the world for seemingly endless scrutiny (Parks 2005; 2009). The opening of GIS to wider audiences created a growing demand for cartographic interfaces with LBS integration (Zickuhr 2013). This, in turn, has resulted in the flocking of people without prior cartographic experience but with the necessary skills for devising and designing technological solutions into the scene. The availability of application-programming interfaces (APIs) and mash-ups such as those provided by Google simplify the process of creating a map, stripping it from the massive investment in surveying and building of your own geo-databases. The resulting processes are then dominated by a very user-centric approach, where those who make the maps try to envision the choices and selections which will be made by users in order to make certain cartographic claims through their maps' interfaces (Dalton 2015). To understand it, we must trace the origins of such interfaces by looking into the history of Google Earth (GE) and Google Maps (GM).

For many, the prototypical 'ubiquitous map' today is Google Maps. Whether from a desktop, a mobile phone or as a printed page in a hotel brochure, it is an easy, free (or cheap) and accessible way for various parties to display cartographic information. Its hegemony has, however, an additional aspect on top of the ever-available map of everything envisioned by Gartner et al. As I will show in Chapter 4, the influence of this software in the work-spaces and work practices of modern designers is thoroughly felt, as the subjects of my case studies build upon, compare and compete with various Google products. GM is the benchmark for other maps in terms of function, symbology, speed and technological infrastructure.[8]

GE and later GM facilitated a core transition in the *notion of what a map is* through the introduction of a superior interface combining satellite imagery, smooth scrolling and zooming, addresses, business search and much more (see Ćmielová and Pánek 2016). Mobility scholar Jason Farman (2010) ties together the increased uses of aerial and spatial imagery with the popularity of GE, the free GIS platform that was first launched in 2005. Craig Dalton (2012) tells an expansive history of Google's acquisition of the company behind GE and the way it has integrated locative data into its own core business of search and advertising revenue. After acquiring the proprietary software – then named Earth Viewer – from Keyhole, Inc., Google has opened the program to a wide variety

[8] Not always as a positive example, though, as Google Maps is sometimes criticized in terms of aesthetics and functionality, often by those with cartography background (cf. Hurst and Clough 2013).

of non-professionals at no cost. Comprised of multi-layered tiles combining aerial and satellite photography, the program consisted of a 3D virtual globe, based on technology developed for video games, complete with zooming functionality and later integration of a map and 3D building models. As Farman (2010) points out, the initial zoomed-out view of the globe is reminiscent of the way astronauts first saw Earth from the moon, in the iconic 'earthrise' photo of Apollo 8's crew (figures 1.4 & 1.5). Such images underscore the seemingly innocuous nature of maps. Previously rooted in authorial hand-drawn practice and shifting to mechanical reproduction, maps have become detached from personal responsibility, thus masking the presence of an author with a purpose (Harley 2001). GE, like other maps to follow, also bestows a 'god-like' view on its users, enabling them to move from a cosmic perspective to satellite imagery with a resolution occasionally as high as 15 centimetres. It also allows users to be 'lost' in the map, seamlessly switching between Apollonian rationality and Dionysian excess (Kingsbury and Jones 2009). This accentuates the 'neutral' effect of GE and later GM (Parks 2009), because

> [w]hile photographs are often associated with a photographer (the 'witness' snapping the shutter in a specific moment in time), satellite and aerial photographs used in programs like Google Earth are more commonly associated with the machinery that produces them than the person or organization capturing or compiling them. This association between machine and product distances maps like Google Earth from a sense of subjectivity and instead emphasizes the objective nature of photographic representations of Earth. The result, as Sontag (1977: 154) argues, is that the 'photograph is not only an image (as a painting is an image), an interpretation of the real; it is also a trace, something directly stenciled off the real, like a footprint or a death mask (Farman 2010, 875).

Figure 1.4: 'Earthrise', taken during Apollo 8, the first manned lunar mission, in 1968. Source: NASA

Figure 1.5: The opening screen of Google Earth, screenshot by the author from January, 2015.

To go back to Woolgar, this is also an instance of concealing the designer's agency, which maintains itself by masking decisions taken on behalf of the user (for example 'she will see her own physical location as the centre of the virtual globe at stat-up'). This has far-reaching political consequences in digital environments. As Dalton (2012; 2015) points out, Google is interested in maintaining such ambiguity, coupled with a sense of familiarity and ownership over *your* own content, in order to facilitate large user numbers and subsequently gain revenues and cut costs from advertisements and data analysis. Many of the original unintended by-products of GE, such as the ability to create personal maps or mash-ups (overlaying Google's geodata with your own), have found their way into the mainstream of GM today. GE began as a free service for an enthusiast community but had to maintain its appeal of usefulness, fun and applicability, integrating its functionality into those of other products in the Google ecosystem, until it was perfected and made mandatory for *all users*.

Continuously erasing its own footprint in their map, and making it 'everybody's' or 'yours' instead, can be conceived as a tactic for an organization that wishes to present geographic knowledge as naturalistically as possible. This is what cultural cartographer Veronica della Dora names 'telescopic vision, which is the presentation of cartographic information along the illusion of a "naturalistic" scalar continuum (a seemingly uninterrupted movement from a local to a global scale)' (Della Dora 2012, 2). Such a strategy combines two different mapping traditions: *geography*, which concerns itself with the representation of the entire Earth employing a mathematical-geometric framework, and *chorography*, which aims to represent a particular region and its inhabitants (often exhibited in the form of drawings of beasts and men on ancient maps). Both have a 'rhetoric of truth' (ibid., 6), one through an appeal to scientific empirical claims (Shapin and Schaffer 1989), the other through evocation of rich, life-like images of far-away places and people. The way GE merged those two has shaped future versions of Google geo-products and, following the popularity of GM, the design consideration of other digital mapping platforms. The reliance on user-submitted layers, the cross-platform approach, the use of XML-based syntax, familiar to web developers, to describe geographical information – all those are commonplace today and began with GE. Google has been since continuously moving to dissolve the difference between professional and popular cartography, unifying them in accessible and layered maps that have become the staple of other LBS services (Dalton 2015). Finally, while integrating simple features of GE into GM, Google made its advanced GIS-like GE Pro a free download in January 2015 (Marquardt 2015).

1.4.2. Personalized interfaces, user tracking and designer agency

A minor component that was introduced into GE as an afterthought has come to dominate other maps – the personalization aspect. The ability to save My Places originated in the introduction of 'mash-ups' of several maps together. Created first as a transgression of the GE terms of use by Paul Rademacher, creator of housingmaps.com,[9] mash-ups mixed traditional GIS data forms with dynamic lists of non-cartographic information, from rent prices to crime activity. Google has embraced these mash-ups (even hiring Rademacher after his project became a success) and quickly followed with introduction of My Places (My Maps prior to 2013). This lowered the skill bar for creating mash-ups by allowing everyday users to mark routes and sites as markers on personalized Google maps which could then be shared, collaborated on and saved (Dalton 2012). This function has since become a mainstay of the redesigned New Google Maps, albeit with a twist. Creating and saving personal maps is normally no longer possible, but it is mandatory when using the map while logged into one's Google account (which is necessary for using the map as an app on a mobile device). In such a case, Google remembers your use patterns and generates a personalized map automatically.

The software behind the map utilises the user's personal search and movement history to draw personalized maps (Morozov 2013; Badger 2013) for the purpose of generating 'a billion maps, one for each user', as stated by Jonah Jones, lead designer of GM (Olanoff 2015). While some view it as a positive return to the inherent multiplicity of maps and mapping (Mirani 2013), in line with the processual view advocated throughout the chapter, the fact remains that integrating this design strategy into GM (and derivative products) leaves users in a constant state of cartographic flux, where choices are made behind the black-boxed user interface, arguably discouraging questioning of the map's secretive logic (i.e. advertising placements). Della Dora and Farman both highlight this degree of user interactivity and the ability to create your own mash-ups and layouts as a key aspect of GE and GM. Here, they subscribe – perhaps unintentionally – to the prevalent paradigms of web 2.0, which equate participation and customisation with emancipatory practices (Jarrett 2008; Schäfer 2011). This contested view has come under scrutiny from geographers (Perkins and Dodge 2008), political philosophers (Dean 2003) and policy researchers (Chadwick 2008; Coleman 2011) alike. Participation and personalization are not equivalent to democratization, especially in the case of a commercial company, as '[t]argeted individualization is part of Google's pursuit of making everyone

[9] Which presented popular electronic notice board Craigslist.com housing ads on top of a Google Earth mash-up.

a Google user, even people who don't know that they "need" its services. Google's ad-based strategy allows it to attract and retain loyal users through a popular and familiar experience, consumption' (Dalton 2012, 179). In other words, when exploring assemblages of contemporary digital maps, the researcher must be aware of the way commercial integration has made mapping into a service that competes with other services for the users' attention and must build a proper theoretical and methodological framework to accommodate it.

If GM represents the current culmination of Gartner et al.'s ubiquitous cartography, a better term would perhaps be 'uniquitous cartography', as on top of being widespread and accessible, new forms of cartographic knowledge also tend to be highly customisable and geared towards unique depictions tailored for individual users. However, not all users benefit (or suffer?) from user customisation equally, and social engagement which drives bursts of participation will not necessary lead to sustained involvement in mapping efforts (Perkins and Dodge 2008). Participatory GIS proponent Muki Haklay cautions against equating all kinds of contribution offered by GE and GM. Repurposing a commercial GPS receiver (or, today, a smartphone) in order to engage in a game of Geo-Caching[10] is quite far removed from acquiring the novice computer literacy skills to engage in the creation of mash-ups and APIs and very different from becoming part of the small tech elite engaging in 'deep technical hacking' (Haklay 2013, 65), which is able to modify complex computer system into forms that challenge its original intent and open new political and social spaces of possibilities. The majority of users do not aspire to code. While this does not mean they users lack agency completely (cf. Hind and Lammes 2015) – after all, maps are transductive and contextual – it does ascertain that those who make the platforms possess a very different understanding of the ways maps work in the real world. The ramifications for exploring map-making practices are serious. When discussing digital cartography and the people making it according to the processual view, we must be careful not to equate the power relations between those who make and those who use, even when the latter are supposedly brought into the design process from the start.

Going back to Gartner et al.'s concept of ubiquitous cartography, they list three main points of technological change that brought about the need for the term: advances in telecommunication, improvement of LBS and the proliferation of new mobile devices. This last point merits some elaboration. When writing the special issue's introductory article, the authors exemplified it as 'PDAs [personal digital assistants] that support mobile input and output devices, "thin" client-side

[10] Geo-Caching (https://www.geocaching.com/play) is a global treasure-hunt game where participants leave objects for others to find in a geocoded form.

cartographic displays, and access to "thicker" server-side spatial analytic and cartographic software' (Gartner, Bennett and Morita 2007, 247). Published in October of 2007, the authors could not include any consideration of the first Apple iPhone, launched only four months beforehand (Wikipedia 2015). This launch harbingered the upcoming avalanche of smaller, faster and more diverse devices that – unlike the PDAs in the example above – became commonplace in the following decade. There is a tremendous distinction between the PDAs of old with their distinct usefulness to a subsection of privileged elites and the smart devices of today that are being marketed and sold as a broad range consumer devices (Falaki et al. 2010). This has ramifications for the understanding of ubiquitous cartography from Gartner et al.'s original text, compared to how the term would be employed today. Such difference is also paramount in the design of HCI studies of users engaged with digital mapping, and correspondingly, in methodologies for researching those who design and employ such studies. While previous research often focused on specific modes of engagement with maps during dedicated sessions on bounded devices, smartphones, with their multi-functionality, connectedness to other devices and embeddedness in daily lives, require researchers to think about mapping and navigation as a subset of other activities performed on and with the phone. In my case studies, the presence of smartphones and similar mobile devices in the considerations of the designers is a crucial component to analyse. Making popular maps today assumes the availability of mapping on the go and at the touch of a finger, even when the map in question is not purely mobile in nature. Responsive design (which alters the look of the map depending on the size of the screen) is a major challenge to those who design and deploy mapping assemblage in a continuously fractured consumption space of various devices and platforms.

Unlike today, early research into navigation using digital maps conducted in the field (to account for contextual cues[11]) often took the form of dedicated sessions in which researchers provided participants external devices with pre-loaded and configured maps alongside a set of tasks to be completed and evaluated. Interesting methodological examples can be found in the work of Corné van Elzakker and colleagues. In the early days of mobile map research, his team equipped a group of foreign students with a navigation-dedicated GPS device and a head-mounted camera and set them to conduct navigational tasks in a small town they were unfamiliar with (Van Elzakker, Delikostidis and van Oosterom 2008). Aimed at examining scalability and generalization issues (before GM made

[11] I specifically mention field-based research since it is the evaluation method which is the most in line with the processual view of mapping, as it simulates as closely as possible the conditions that real users face in real circumstances. This method was also found empirically to locate the most usability errors compared to laboratory settings, although simulating usage in virtual environments proves almost as effective (Delikostidis et al. 2014).

continuous pan-and-zoom, 'slippy' interfaces commonplace), they used a combination of video recording and think-aloud and post-observational interviews to understand the ways interface issues framed user's interpretation of space through the map. In follow-up research, this group equipped students with a more advanced type of PDA running navigation software and GM and set them in a comparative navigational task-scape in Amsterdam (Delikostidis and Van Elzakker 2009). Both studies were careful to simulate 'average' street conditions as closely as possible, attempting to extrapolate from the experiment to actual life navigation. The researchers made sure that the participants' time and effort was dedicated *only* to the maps in front of them and the tasks they were meant to facilitate. In fact, 'highly disturbing instances (demonstrations, national celebrations, road work and the like) in the test area had to be avoided. These posed a threat to […] safety but they could also negatively influence the task execution and the proper application of the research methodology.…' (Delikostidis and Van Elzakker 2009, 155). Here, we can see that even though the researchers attempted to perform field-based rather than laboratory experimentation, the focus on navigation alone and the deliberate avoidance of 'disturbing instances' removes the reality of situated navigation, rendering the world lab-like.

The whole process is encapsulated in the resulting dissertation of Iolanis Delikostidis on usability in pedestrian navigation systems, where he elaborates the issues around designing a working prototype based on such experiments (Delikostidis 2011). His work shows how the process of design required conceptual (user scenarios) and actual (field) usability testing centred on the image of a task-oriented singular user engaged in a single session of continuous navigation, this following traditional methodology from HCI, design and usability studies. However, focusing on directed navigation alone removes much of the messiness inherent to the real world, rendering field trial into something quite similar to a laboratory-setting experiment.

Compare this to the recent work from the Stockholm Mobile Life Research Centre led by Barry Brown (one of the co-authors, with Eric Laurier, of the map-reading video ethnographies mentioned in section 1.3.2) on the everyday realities of phone use (Brown, McGregor and McMillan 2014). Brown and his colleagues tracked 15 users by capturing the video of their iPhone screens and surrounding audio at random intervals. This allowed them to study map use (among other things) in situ, as part of the natural rhythms of participants' lives. In order to do so, they asked the study participants to annotate and upload the randomly selected videos from their phones, following interpretive coding of selected videos by the three researchers. The team was particularly interested in the social interaction surrounding the personal instances, as captured by the audio recordings from

the environment. Several years after Van Elzakker's group, the Stockholm researchers have attempted to create a multi-layered picture documenting instances of communication, navigation, information retrieval and many more, often intertwined and enmeshed in a way that resists singling out. Specifically, '[t]he purpose here [was] to remain anti-reductionist and avoid coding for patterns, as this leads to an analysis of the general not the specific, and loses the nature of the phenomena being investigated' (Brown, McGregor and McMillan 2014, 224). This approach to mapping and navigation, as practices situated within broader media-scapes of digital devices, is much more in line with the processual understanding of mapping. Nonetheless, it does not exclude empirical and user-focused methods. In my own work, I follow similar views, positioning the map-makers in my case studies not as rigid controllers of their intended user's destinies but as participants in an emergent and transductive process which coalesces users and makers alike.

This brings me back to the opening questions of section 1.4.: what is unique to *the digital* in digital mapping? How can it be conceptualised and what is the theoretical framework needed to study it and the people who make it? Some of the answers were provided above by both cultural geographers and mapping HCI experts: contemporary digital mapping is ubiquitous, adapting to users' needs through tailored personalization; it is reliant on sharing and participation (although that does not automatically equate to democratizing and free engagement); it is entangled with the meteoric rise of GE and – later – GM as the prime form of mass digital mapping. I suggest the name *uniquitous cartography* for its ability to represent the world granularly while maintaining a singular experiential envelope through an accessible and adaptable interface; it is rooted in traditions of quantitative and qualitative HCI research performed by industry and academia of the cognitive structures behind discernible user interactions and the attempts to modify and streamline such structures for increased efficiency. As the last cited research shows, the shortcomings of such HCI perspectives, which were always reductionist to an extent, have become glaring in the age of increasing smartphone usage in the Western world (DeGusta 2012; IDC 2014). Considering that GM leads as the most popular app on such devices (Hinka 2013) makes it harder than ever to focus on the singular instances of map users. For that, I argue that we must look into the complex media ecologies surrounding map use and understand that those who make maps today are compelled to fit them into hybrid task-scapes while competing with other digital products within the attention economy. It requires explaining digital maps as an instance of contemporary new digital media. To do so, I use framework combining critical media reading, specifically the notion of mediatization with Actor-Network Theory (ANT), a distinct ontological-epistemological framework which allows

for exploring both human and non-human actors. The remainder of this chapter is devoted to bringing the processual view of uniquitous cartography to its logical conclusion: positioning it within the multitude of other activities that make up the digital landscape before moving to ANT in the next chapter.

1.4.3. Mediatization as a meta-process: what can media theory say about digital mapping?

To explain what I mean by the multitude of activities, let me begin with a personal anecdote. Some time ago, I needed to pick up my car from being repaired, then drive it to a meeting. While doing so, I performed cartographic actions through my phone in four distinct ways.

Being late and depending on public transport, I rushed out of the house and onto the train. I then located the final meeting place on GM by its address. I checked the time it would take me to get there with my car using the GM 'directions' tab with the car-navigation options. I decided to also check the public-transport option, switching – with one fluid finger tap – the display on the 'directions' tab from the car icon to the train icon. GM routing, I previously noticed, prioritises train connections over local busses and thus miscalculates switching times. To double check, I launched the app 9292, a trusted local provider of contextual public-transit data that takes into account disruptions and delays. So far, these two (or three, if you count car vs. public transport) modes of engaging with the physical spaces around me through a mediated display took me a few moments, while on the move in the train. Discovering, relieved, that the car was indeed working again, I chose the car option as the fastest and set out for my destination. As GM was already set to the desired location, I – with little thought – switched it to the turn-by-turn navigation mode by pressing the little blue triangle on the bottom of the screen. Placing the phone on the designated holder on my car's windshield, I then proceeded to my destination and with but a single glitch (the phone was on silent mode so I missed the first highway exit), reached it in the projected time. Having concluded my business, I wanted to return home. While being vaguely aware of where I was, I preferred to not get lost again, and so the phone was pulled out again. This time however, I used another application – Waze (purchased by Google and slowly integrated into Google's larger geo-spatial systems) – to do so. Waze had my home address saved, thus requiring far fewer actions to set me in motion. It also had 'social' and 'gamified' functions, which allowed gaining points by unlocking customisable avatar icons by means of various driving-related acts. So, even after getting onto a familiar highway, I didn't switch off the – easily reachable – app, being interested in further accumulation of this virtual currency.

There are several components that make this account poignant from a media-studies point of view. First is the expansion of the mediated and mobile nature of the navigational experience, once limited *only* to non-digital road atlases and the bothering of passing strangers. Second, and more to the point, those mediated actions were habitual. Media scholarship, linking to qualitative and quantitative traditions of transmitting human experience of social sciences and the humanities, has been always invested in the Foucauldian notions of unveiling the things that 'just are'. James W. Carey's (1989) communication as culture approach is one prominent example, in which he paraphrases McLuhan to assert that like fish unaware of water, various forms of communication lead participants into complex socialization processes that end shaping the ways society is made. While certainly not the communication type that Carey had in mind at the time of writing, there exists a continuum of social practices corresponding to the way I communicate (textually and visually) with distant servers through my screen, and the way such communication resembles multitudes of similar acts with both human (texting, social networking, telephoning?) and non-human (accessing the web, searching, translating) actors.[12]

This habituality is of interest principally when noting that while all the actions I took involved digital maps, they were nevertheless *different* digital maps. They are different not only as initiated and shown by different phone applications (or one's specific screen), but also in terms of different contextualized engagement; the same map communicates different types of information depending on my need, internal decision-taking process and external circumstances (car's mechanical state, traffic). In fact, the description above moves beyond the immediate realm of mapping by opening up enquiries into relations between users and screens in the traditions of communication research (Silverstone 1999; Bolter and Grusin 2000), screen theories (Manovich 2002; Verhoeff 2012) and software studies (Galloway 2004; 2006; Bogost 2007; Berry 2014). It opens up for consideration not only the immediate use of the map, but also the combined quotidian practices of operating devices and interacting with others that make such uses possible, in the spirit of Brown et al.'s (2014) mixed-method mobile research. In this dissertation, I look at mapping as a communicative process through the prism of *mediatization* theory.

Mediatization is 'a term that seeks to capture the shifting inter-relationship between change, on the one hand, and sociocultural media-communicative change, on the other' (Hepp 2013, 31). In

[12] The distinction is, as always, artificially simplistic. Sending a text to a human requires a variety of technological transmissions, while the database that I query for my navigational route was built and maintained by human engineers who might examine the data traffic I generate and so on. Moreover, as Brown et al.'s (ibid.) research shows, the actions are also often entangled with other human participants from the user's immediate physical environment.

other words, it is a broad theory aiming to reconcile the ongoing shifts in the communicative actions of individuals and publics – especially in relation to habitual actions such as listening to the radio or talking on a mobile phone – with larger processes of technological change in media production and distribution. It is a *meta-process*, a term coined by sociologist and mathematician Friedrich Krotz (2007), one which occurs and changes parallel to and with other meta-processes such as globalization, or migration. It informs knowledge construction, identities, social relations and organizational structures. The European Communication Research and Education Association's (ECREA) temporal working group on mediatization tries to define it as follows:

> …media are not given but are objectivations of human agency. Therefore, mediatization research does not investigate a certain 'medium as a message', but tries to reflect the characteristics of various media in their relevance for communicative action and consequently for our social and cultural construction of reality (ECREA 2012).

Media culture and communication theorist Andreas Hepp goes back to Krotz's conceptualisation of the meta-process, yet suggests infusing it with elements of ANT to present technological endeavours as 'coagulated actions' (Hepp 2011, 13) of human and non-human actants. He argues that media are not a transparent instance of communications but an institutionalized sociocultural process, consisting of the coagulated actions of media institutions, governmental actors and the technologies that allow them, along the relevant idiosyncratic ways they are used (by viewers, participants, etc.) in each case. This conceptualisation of mediatization is built not on specific media logic, or even logics, but on 'the moulding forces of the media' (Hepp 2011, 14). This is an inherently processual view which concerns itself with ongoing changes and does not subscribe to any particular linear explanation of how specific types of media cultures arise. Specifically, culture in this context is understood as *translocal,* where '[t]ranslocal concepts [of culture] are outwardly orientated and exogenous, focusing on hybridity, translation and continuing identification' (Hepp 2013, 72). It assumes that such culture – in my case, the developing Western culture of using digital maps on a computer screen or a mobile phone – is reliant on not only the technological changes, but also broader cultural transformation and the way technological artefacts relay or supplement such changes. The moulding forces of the media thus create a backdrop, a constantly shifting setting of transmittable symbolic interactions. Going back to section 1.3.2, it is crucial to note how the work done in academic and industry map labs is a form of such mediatization, exerting – in Hepp's terms

– a certain pressure on the way habitualized actions of users may form in relation to this technological change.

In other words, the media assemblages of mapping production should be read as moulding power structures attempting to generate a certain 'normality' in how users read and use maps on screens. In traditional media research, we would try to analyse such structures in terms of content production, gatekeeping, framing and salience of messages (Bennett and Iyengar 2008). However, recalling Berry's computational industries and the colonization of the pre-cognitive, we must also be wary of the meticulous design work that goes into user interfaces (UIs) of such maps. Such interfaces are simultaneously tasked with providing the users with operationalised direction of how to access spaces through maps while occluding the selections and influences that it exerts on the user (Bolter and Gromala 2005), which is often rooted in military technologies of visibility and control (Kim 2015).

1.4.4. Media theory approach to interfaces and their users

This is what media critic Alexander R. Galloway calls the problem of unrepresentability. His concept is crucial because it suggests a way to tackle future methodological issues underpinning theorizing of *all digital maps,* in the form of *a specific* digital map. Galloway offers two irreconcilable claims: first, that aesthetics of data, which he equates with the notion of the digital media and the interface, is in essence non-existent. Data ("that which is given") has no visual form. It transitions from arbitrary data to contextual information through the process of being in-formized, or put into a form. Thus, data exists only in an abstract mathematical value, and 'data have no necessary information' (Galloway 2012, 83). Galloway's second claim is diametrically opposed: that data (thus the digital artefacts built upon it) has a totalizing singular form which subordinates all others. To illustrate this point, he looks into practices of data visualization, specifically in relation to depicting networks. He notes that while the particular network's visualizations vary, from those depicting the internet's structure through mappings of the human brain, they share striking aesthetic similarities. By translating from a mathematical (data) to a semiotic (visualization) form, Galloway argues that each instance of data visualization is first and foremost a *visualization of its own rules of translation*. In a world dominated by certain types of machines that produce such visualizations, each piece looks similar, with neatly organized spherical clusters and a prioritisation of form over function.

The point, Galloway continues, is to resist attempts to reconcile the two claims, but keep them dialectical in order to understand the mediating work done by user interfaces. This dichotomy

between new media's claims reveals the true nature of interface mediation: either failure through inability to conceive forms arising from the (data) essence, or a totalizing success through unification of all things algorithmic in a singular form. Thus 'algorithmic interfaces – even as they flaunt their own highly precise, virtuosic levels of detail – prove that something is happening behind and beyond the visible. In other words, there are some things that are unrepresentable' (Galloway 2012, 86). Then how does such unrepresentability manifest in the case of the mapped interface? As mentioned in the introduction to this thesis, the traditional form of the map already performs a similar type of obfuscation, even before the introduction of the digital and the algorithmic. A map on a digital device then, is unrepresentable both of due to its nature as a map, and of because of its nature as a screen object. Considering the proliferation of maps on everyday devices, we arrive at another point of contention: the interface and the user, located in the physical body of the user.

In his book about mobile media interfaces, Jason Farman offers 'a "sensory-inscribed" understanding of the body that is not only conceived out of a sensory engagement across material and digital landscapes, but also incorporates sociocultural inscriptions of the body in these emerging spaces' (Farman 2012, 415). For him, this understanding is embedded in the material and tactile foundation of the software devices with which we interact. The phenomenological tension between experiencing a place, while simultaneously experiencing it when mediated by a mobile screen, is what highlights the process of producing lived spaces through interfaces. Galloway takes this centrality of the interface even further than Farman when he suggests that the entirety of digital (new-media) culture today should be conceptualised in terms of interfaces. Modern computational landscape allows for open-source and propriety software to flourish, hybridise and multiply. Building such software with aesthetic qualities of 'transparent' interface design means that the interface is never simply a singular object, but an Interface Effect. Computerized media is the medium of possibility, of being. Interfaces are the in-between membranes which entice users with promises of access yet hide the specificities of *what they do*. New media interfaces are never simply a remediation of the information behind them due to their unique nature, since

> [a] computer might remediate text and image. But what about a computer crash? What is being remediated at the moment? It can't be text or image anymore, for they are not subjects to crashes of this variety. So is a computer crash an example of no-media? (Galloway 2012, 21).

Following this line of thought, what is the interface of a map? For a paper map, it seems relatively straightforward, as the cartographic information is being inscribed once on a surface and then read by distinct users. Such a view is however problematic when taking into account the aforementioned research from critical cartography and cognitive mapping. Brown and Laurier look into the way people interact with (paper) maps on a daily basis and show that 'reading' a map rarely occurs in its own right. People *use* maps for wayfinding and '[t]he question for map readers is seldom "what is the world like?", but more "what can I do?" ' (Brown and Laurier 2005, 30). This follows November et al.'s (2010) call for the navigational understanding of maps, as opposed to the mimetic. A map is an assemblage that allows a user to carry out an action. Again, from a processual point of view, examining a map from the context of what it shows or represents is misleading, as it is a *gateway towards*, not a *drawing of*. And when examined in such a way, the interface of each map – paper and digital alike – becomes a field of possibility, incepted in the cartographer's envisioning of the end-users' capacities and goals, going through the material properties and affordances inscribed on the map (size, scale, foldability etc.) and the users' particular state in each iteration of the map. Considering digital maps in their 'native environments', then, presents an even more complex task.

To keep up with mediatization theory, we must consider what kind of moulding forces might be mapped by media exerts. Unlike traditional broadcast or print media, mapped media communicates a specific kind of spatial data. It affects a user's perceptions of distance and time through the implementation of technological metaphors. New media and geography scholar James Ash (2012; 2015) develops the concept of technicity as found in the works of Heidegger, Simondon and Stiegler, making an explicit link between technological things, spatiality and embodiment. Building on the non-representational theory (Thrift 2008) and geographers' novel understanding of the relation between software and emerging spatiality (Kitchin and Dodge 2011), he offers a post-phenomenological view of technicity as the ability of technological objects to alter and adjust the sensorial apparatus of the human body, leading to a consideration of *phenomenality* as

> a process through which the spatiotemporal limits of sense are organised. In other words, phenomenality encompasses how the past, present, and future appear as specific modes of potential and how these modes are actively fixed for human perception as a kind of spatiotemporal envelope through a variety of body – technology assemblages (Ash 2012, 188).

Ash carried out observations and interviews with amateur and professional competitive players of the arcade fighting game *Street Fighter IV*, showcasing how a de-construction of the game mechanics and graphics into a series of interlocked frames allows player to develop new kinds of proprioception vis-à-vis the controller and attain higher level of mastery by developing a gradual understanding of time durations usually inconceivable in daily life (between $1/6^{th}$ and $1/60^{th}$ of a second). He offers the notion of interface envelopes which are 'localised foldings of spacetime that work to shape human capacities to sense space and time for the explicit purpose of creating economic value for the designers and creators of these interfaces' (Ash 2015, 11). The significance of such findings for the queries at hand is the ability to reconceptualise a digital map from an object with which the individual *interacts* into an object *enabling* a habitual spatial perception. This prism allows conceiving the designer as a creator of spatiotemporal affordances for the user to accept or contest. In turn, this allows one to embrace the different ways in which embodied experiences are mediated through the map, avoiding dualities of producers/consumers and recognising the complex meaning-making occurring at the individual level, thereby accepting and resisting the envelopes of digital interfaces.

For Galloway (2012, 9), '[t]oday all media are a question of synecdoche (scaling a part for the whole), not indexicality (pointing from here to there)'. For me, the map's interface is a shining example of such synecdoche. Cartographic, layered and popular, digital maps are created by people aiming to flesh out (economically rationalised) physical experience through digital spatial mediation. Having the users present from the initial inception – whether in the form of focus-group testing or through User Interface/Experience (UI/UX) design methods (personas, imagined users etc.) – user interfaces embody such synecdoche and allow us to understand mapping assemblages through them. Flaunting the paradox of unrepresentability, as an object that attempts to unify multiple forms of 'real' world knowledge structures under the aura of objectivity, the interface of each digital map is like and yet not like all other map interfaces. The particularities of each case hide design strategies, imagined users, material constraints, and eventual success and failure of products. Creators are involving users – real and abstract – in elaborate design processes, aiming to minimize cognitive load and make maps as easy, legible and 'true' as possible. This is the application of *casual power* which will be detailed in the next chapter.

2. Casual Power of Digital Maps

'Since Lefebvre's death in 1991, user experiences with computer games and SatNav devices have made that "space peculiar to information science" very much a part of everyday life. Information technologies no longer operate purely as technocratic domination. Even if they inherit the research legacies of the military, the state and capital, these devices have been domesticated as user-friendly commodities, objects of desire and information utilities. They offer the interactive pleasures of knowledge and mastery'

Chris Chesher, 'Navigating Sociotechnical Assemblages' (2012:318).

This chapter presents a unified framework of *casual power*, a compound theoretical prism that takes into account designer intent, user interpretation and mediatized environments in which maps are deployed. I claim that designers attempt to exert power on users in a specific way, through the interfaces of maps, and unpack how the particularities of such power should be analysed. Such power is contingent on inscribing affordances into the user interfaces of maps and map-like devices. It manifests in the ways mapping interfaces are deployed to anticipate and captivate user attention, thus potentially influencing their conduct in the physical world. I term it *casual* because of the way it slips through the screens in tangent with the conception of the way map technology today is enmeshed with and along quotidian practices.

In chapter 1, I reviewed the history of (digital) cartography and the scholarship surrounding it. I established the specificities of digital mapping, as anchored both in contemporary developments of mapping software as well as in the changes taking place in web and mobile media. I have made the claim that modern cartography, by implementation of cognitivist approaches and advanced user-experience design methods, aims at nullifying the critical consideration of maps, by making them seamlessly fit into the routines of the user. Here, I would like to expand and support this claim by looking at the changing power relations that arise between designers, maps and users in my case-studies. I define casual power through tracing design choices and the resulting user interfaces, while being mindful of the unique conditions in which these maps are deployed. Such power structures are somewhat different in the contexts of paper maps and digital devices, and so this chapter brings together various necessary fields to explore diversity. There are several components that need clarifying.

First and foremost, I understand maps to be designed with certain affordances, grounded in the cognitive ecology framework and adopted by HCI. Of equal importance is the fact that the map-makers themselves are also aware of the notion of affordances, and actively work on continuously adapting and expanding the user interface of their products. Their interests are often predominantly commercial (Perkins 2009a) and as such the framework of casual power examines map-makers' goals in relation to the propagation of commercial appeal to their user base, which is often measured in terms of performance metrics, predominantly the number of users and/or length of use.

Second, such affordances are not scripture, but rather scripts or proscriptions: 'what the device allows or forbids of actors – humans and nonhuman – that it anticipates' (Akrich and Latour 1992, 261). This is what Nagy and Neff (2015) refer to as *imagined affordance* to emphasize the agency of the users. It can be followed or circumvented, but nonetheless leaves traces of its intended usability within the chains of actors in its wake. The above understanding of affordances has certain consequences for both the power exerted and for studying it. The map-makers anticipate the limit of their power and supplement the inscription of the user interface by other means, such as by using economic incentives within the product's pricing structure to attract new customers. This process is cyclical and parallel: information from the (un)finished map is presented to the user, who in turn provides usage data that changes the map-makers' ideas on the nature of use. For my analysis, I seek to identify the points of designer's anticipated resistance and the actions they take to circumvent it.

Third, a casual power approach takes into account that both makers and users operate in broader media-scapes that are networked and accelerated and thus open to less permanent and emergent 'expressions' of power. Technology and media coalesce across borders and cultures, at higher speeds than ever before (Appadurai 1996; 2001; Virilio and Bratton 2006). And so, the power emanating from maps' user interfaces should be understood in relation to design and use practices of other digital artefacts. I have focused on these processes in greater detail in chapter 1, but to reiterate, I subscribe to a particular ontology of the map as processual and focus on the emergent 'mapping' process. At the same time, I evoke cognitive theories of mapping and navigation both as attempts to draw broader outlines of such emergent instances and as a methodological tool to access and examine map-making practitioners who design their maps with such cognitive approaches in mind. Mediatization meta-theory suggests that *mediation* through an electronic medium creates certain moulding forces that shape habitualised user communication and interaction (Hepp 2013), not only because of the changes in the associated technical institutions, but also in relation to other sociocultural changes. In this case, space is being mediated through new types of *digital* maps, and the

associated communicative actions of interacting with others (human and non-human alike) to describe, traverse or challenge space is shifting accordingly. Those prepositions form the background for re-evaluating the power relation for such mediation of space.

Here I wish to offer three lenses through which such power should be examined. Those are not mutually exclusive components of my theory, as they bleed into and rely on each other. Instead, those three segments continue the multidisciplinary perspective of chapter 1 to highlight the necessary expansion of research vocabulary when dealing with digital maps as compound digital objects. I begin with looking at digital maps' participation as an actor within the attention economy, which will be discussed in the next section; gameful design of mapping interfaces, which I detail in section 2.2. and the underlying quantification of the map, to be unpacked in section 2.3. The last part of the chapter (2.4.) summarises the resulting theoretical prism of casual power while focusing on the term *casual*, its origins and the derived methodological considerations as a prelude for chapter 3.

2.1. Digital maps in the attention economy

The first component of understanding casual power lies in the two distinct ways that digital maps appeal to user attention. First, through distraction: the map draws one away from the world and to the screen. While many other digital devices thrive on such redirection of attention, maps do so differently by tacitly suggesting their own image as a substitution for the world unobserved. Yet while until very recently maps 'competed' only with the physical world they aimed to substitute for the attention of the viewer, they now compete with other digital objects (screens, apps, streams, timelines) with which they cohabitate on digital platforms, also. Even more, maps take part in a computational regime maintained by high-tech companies through heuristics-based algorithms that predict user behaviours (Berry 2014). Such regimes produce constant demand for user attention through active notifications and customised dashboards. In such configurations, 'thinking itself can be outsourced through cognitive technical devices which will supply the means to understand and process the raw information given by a new politics of access' (Berry 2014, 181). The colonisation of the pre-cognitive by the computational is a necessary component in explaining the first lens of casual power. In this section (2.1) I will outline how the corresponding notions of thought and attention should be taken into account when analysing my case-studies. I begin with the traditional critique of the way maps manifest their power on users' perceptions of the world before moving on to the specificities of the digital.

It has long been observed that maps tend to compress space and time, turning the potential into an actual. It is what Ingold refers to as the 'cartographic illusion' (Ingold 2000, 234), whereby focusing on the end product of a map-making project (the produced inscription), the user of the map (map-reader, often engaged in wayfinding) confuses her surrounding landscapes with 'space'. One aspect of such an illusion

> [l]ies in the assumption that the structure of the world, and so also that of the map which purports to represent it, is fixed without regard to the movement of its inhabitants. Like a theatrical stage from which all the actors have mysteriously disappeared, the world – as it is represented in the map – appears deserted, devoid of life. No-one is there; nothing is going on (ibid.).

My argument here is that in digital mapping, the cartographic illusion is even stronger. A digital map presents a more complex illusion: it animates the fixity of the map, populating it with images of people and objects that resemble actual actors in their mutability. It captivates the user's attention by manufacturing a momentary freeze that transfixes such actors through the screen on which they are displayed. With a click of a mouse or a tap of the finger (Hind and Lammes 2015), one can select a different mode of viewing or interacting with the map. Depending on the specific user interface, such modes include switching between cartographic and satellite views, but also morph into more specialised displays as afforded by the designers' intent or the technological limitations (Google Street View and CityMapper's walking routes between different stops are good examples of such displays). The user is thus encouraged to believe that the digital map is in some ways *truer* to the world than the paper variant, because it amends the inertness of its predecessor and allows (the illusion of) control over what aspects of the world can be witnessed through the map (Kingsbury and Jones 2009).

The affordances of digital maps are also aimed to a greater extent at creating such an illusion. The ways such a map structures the world are augmented by dual implementation of numerical forms that define it. On the one hand, it is *digital*, thus able to appropriate digital formats, from images to text to databases (Manovich 2002). This means that various forms of digital content can be integrated into the map, as Google Maps does with its use of uploaded user photographs or Booking.com does with its use of user reviews and hotel publicity materials. On the other hand, such a map is *quantifiable* in its ability to turn the underlying numerical structures into forms easily processed by its users. Distances, minutes and review ratings all simplify our engagement with the

world, making it more legible and requiring far less mental arithmetic. To borrow from Ingold's theatrical metaphor above, the numerical structure is analogous to the *kuroku* – the black-clad stagehands of traditional Japanese theatre: we are supposed *to consciously not pay attention to it*, while the work it does makes the changing scenery appear real. It is the map-makers' goal to maintain and promote such qualities of the digital map's interface in order to immerse the audience in the experience, and they do so by highlighting certain aspects of the design while occluding others.

Maps cohabitate with myriad other types of digital artefacts on competing and complementary digital platforms. They are constructed with a certain goal in mind: to be used and to be useful. While at first those goals seem tautological, they are not. A map has to be useful in order to be used. It has to be clear, quick to load, provide relevant information, be pleasing to the eye etc. Those are not new ideas but rather a direct development of the notions that historically have made maps into such effective information carriers (Krygier and Wood 2005). However, in the pre-digital age, maps did not have to compete with non-maps to the same extent: a material separation of media limited the chances for interruption. During a wayfaring exercise, navigators would only have in their hands the tools for navigation – a book lying on the desk alongside the map does not ping with pop-ups demanding attention.

As Dalton (2015) notes, new kind of map-makers are now emerging without a background in traditional cartography, building digital maps and map-like services in order to supplement existing software products. The map becomes another aspect of the combined computational and media industry. It is no longer compartmentalized into specific intended uses (the road atlas is pulled out in the car), but rather exists parallel to other maps, map-like interfaces and non-map interfaces. The new amateur map-makers that Dalton describes are not brought into the fold of self-imposed cartographic traditions of truth or accuracy. Instead, they are more often immersed in the prevalent sociotechnical codes of conduct of 'playful fun and profit seeking' (Dalton 2015, 1029), using existing web cartography resources (primarily Google's Map API) for pursuing projects in the hopes of eventual monetization. The 'fun' aspect of it is as much of a factor as 'profit': amateurs are encouraged to perform unpaid 'playbour' (Kücklich 2005) involving the things they love, where the chances of individual gratification are slim and the main benefactor is the tools or platform provider. It continues the tradition of extracting value from unpaid labour online, by framing such labour as fun or turning it into a leisure activity (Terranova 2000; Scholz 2008). Ensuing software regimes are thus characterised by the *experience of* maps rather than merely the *use* of them, in order to draw users in. Product developers and designers are making maps in certain ways while being told overtly that

both creating and using software should be experiential. They translate their own preconceptions about how the user should be engaging with their product into a set of interface decisions that attempt to make their maps fit seamlessly and casually into their users' routines.

Under the catch-all offer of fun, makers are encouraged to work for free to capture the attention of users in a competing *experience economy,* as coined by authors and frequent *Harvard Business Review* contributors Pine and Gilmore (1998). The term, which was later turned into a book with the same name (Pine and Gilmore 2011), presented an argument concurrent with the then-peaking dot-com bubble: that consumers seek experiences of products that provide more than rational value. From a more critical perspective, this leads to what philosopher Bernard Stiegler (2010) calls the *attention economy*, where the computational industries are cultivating methods to capture the attention of (often young) audiences in order to maximise their future financial worth. Corporations are interested in training large swaths of audiences to pay attention in specific ways that can be later turned into profits, either by viewing, ads or otherwise. Stiegler refers to this as *neuro power* and claims that the method of such a move is the gradual destruction of individuals' abilities to apply critical and reflexive attention to the world around them; instead,

> [a] case could certainly be made here in favor of some motors of attention dispensing with the consciousness of vigilant cognitive tasks in favor of that of profound attention, which are basically search engines as attention automatization. And why not, in fact, develop some kind of computer-assisted attention, if attention is always assisted in some way? Why not? (Stiegler 2010, 102)

New-media cultural critic Tiziana Terranova (2012) suggests that such a move is tied to the human brain's ability to change and adapt over time – its neuroplasticity. By tapping into the shifting cognitive skills of its audiences, web companies – those producing digital maps included – attempt to reconfigure user habits in order to domesticate and habitualise beneficial ones and eradicate those that do not contribute to the economical conception of attention. Such a conception usually translates the amorphous concept into measurable and quantifiable metrics: clicks, page views, likes and shares can be counted, packaged and sold to advertisers or otherwise give value to the platform owner. This leads to a paradoxical state where

> [w]ithin current discussions of the economic implications of shifts in technologies of attention, the latter is seen not only as 'scarce' because limited, but also as increasingly

> 'degraded'. In a strange reversal of early information theory's take on entropy, attention here becomes the scarce quantity which is 'consumed' by that which is abundant, that is, information. In the recent wave of publishing around the idea of a 'crisis of attention' (which parallels and supplements discussions of attention economy), it is common to find the notion of a 'degradation of attention' provoked by digital technologies and its [sic] economic effects (Terranova 2012, 4).

Moreover,

> [t]he economic/informational plastic brain is thus caught in a double bind: on the one hand, in order to participate in the attention economy, it must enter a technological assemblage of attention; on the other hand, becoming part of this assemblage implies a dramatic cognitive loss that is translated into a subjectivity more adept at carrying out routine tasks but less capable of reasoning, reflecting and intimacy (ibid, 6)

Writing from their respective points of view of academia and the television and advertising industries, Jenkins, Ford and Green (2013) suggest that what succeeds in the attention economy is *spreadable media.* This term aims to unify the sociotechnical conditions that allow content to be distributed freely and contrast it to such terms (mainly from marketing discourse) as 'stickiness' or 'virality'. The latter two, they claim, attribute more coercive power than is attributed to content producers and deny the agency of the audience and the technology. They give the example of the Susan Boyle phenomenon. Boyle, a contender on *Britain's Got Talent* television show who fell outside of the age group and appearance standards for such shows, gave an outstanding performance during the show's auditions. That launched her into internet fandom, attracting millions of views for the video and financial success for a subsequent album. Jenkins et al. point out that while the content has spread quickly on the web, this happened in spite and not because the owners of the content, as the video was uploaded and re-uploaded by global users and the episode was not available for purchase outside the UK. They attribute the success to the sharing and embedding affordances of YouTube as a video platform and the cultural practices of TV show fandom, which is eager to edit, upload and re-upload material. Nonetheless, over time, they managed to spin Boyle's performance into significant monetary gains. Such spreadability is therefore the content producers' response to the attention economy. The term encapsulates the desire to create something easily sharable, distributed and unanchored. From the point of view of casual power, we can say that spreadable media has the

affordances to be replicated and reproduced, often without much reflexivity. The integration of various sharing and embedding options across and between social-media platforms is a good example of this. In mapping, we can trace a similar process in the way major providers (and Google chief amongst them) have made their cartographic content increasingly easy to integrate into other formats, through API integration and simple sharing options for non-technical users.

What results is 'a new socio-economic landscape, one in which flexibility, play, creativity, and immaterial labor – call it ludic capitalism – have taken over the old concepts of discipline, hierarchy, bureaucracy, and muscle' (Galloway 2012, 27). Since attention is valuable, yet degradable, the companies that aim at capturing it are simultaneously aiming to reduce the cognitive loads of their users while maintaining conditions in which this use is pleasant. It is by no means an easy task: continually fractured and accelerating, the media landscape is demanding more and more of user's attention and informational overload becomes the background noise through which various signals attempt to break. Casual power is about such a balancing act. On the one hand, the map-makers I study attempt to make their maps readable and easy to understand. They strip away what they deem unnecessary details, simplify the user interface and overall predominantly rely on the feature-poor 'blandscapes' (Kent 2009) that excel at being the base for additional layers of information but lack as cartographic displays. On the other hand, such designs put them at a disadvantage when differentiating their products from those of their competitors (in the broad sense of the word). This leads them to try and make the map unique enough to evoke unique experiences when using it.

All this is done through various digital interfaces. After all, as predicted by Pine and Gilmore, '[e]xperiences have always been at the heart of the entertainment business – a fact that Walt Disney and the company he founded have creatively exploited. But today the concept of selling an entertainment experience is taking root in businesses far removed from theatres and amusement parks. New technologies, in particular, encourage whole new genres of experience, such as interactive games, Internet chat rooms and multi-player games, motion-based simulators, and virtual reality' (Pine and Gilmore 1998, 99). Of this list, Ash (2015) suggests that video games are the ultimate interfaces for the capturing and focusing of attention by doing so routinely and seamlessly. Such observation is vital for advancing my claims on the role playfulness has in understanding casual power, because since the time of Pine and Gilmore's original text attention has been increasingly focused inside digital platforms. Ash cites his own familiarity with the field as a game tester (Ash 2010) in the way meticulous tweaking during the game's development cycle strives to reduce a gamer's non-active moments to the necessary minimum. The focus of this theory is in how design

allows affecting spatiotemporal perception of the human user through the interface, controlling for user attention and the resulting sensory input to benefit the goals of the interface creators. And while maps are not video games, as I will discuss in the next section there are certain connecting threads between the two types of interfaces that can be productive for the analysis ahead.

How can we analyse such sensibilities in the design processes of maps? I claim that we must examine the ways designers of maps are attempting to manifest certain lived worlds for their users by making the interaction with those worlds *easy, experiential and gameful.* Certain affordances are inscribed into the map that aim to maximise the time period of engagement with it by turning it into a type of a ludic interface (Fuchs 2012) which morphs the process of interacting with the map into a playful activity in itself. An exercise of using a public-transport app on a smartphone, such as the highly stylised Citymapper, becomes a competition: choosing the best route option between the ones presented to you while adapting to the demanding shifts in big-city traffic is quite reminiscent of the ubiquitous quest markers on the mini-maps of popular open-world games, where the act of movement towards a particular HUD marker is often framed as an exciting journey of discovery. But this is also a competition against competing navigational apps, or against the user's social-media feed: the map aims to engage and entertain while remaining functional. Harkening back to Dalton's 'fun and profit' developers (2015), following various actors through the ANT methodology allows us to examine the fuzzy boundaries of such maps' crystallization in light of changes on labour markets, distribution and marketing strategies, hardware and software evolution etc. In the example of Citymapper above, it is a framework that enables us to ask questions about exactly how the start-app ecosystem, urbanization and the proliferation of smartphones have led to a creation of an A-to-Z map aiming to serve the largest, most technologically-advanced urban zones in the world. Moreover, using attention as an organising lens, we can evaluate this map not only in terms of functionality but in terms of the gamefulness embedded in its design, also. In the next section (2.2), I will detail how we can operationalise such gamefulness for the task at hand before moving to quantification as the unique conditions that allow for both the utilisation of attention and the embedding of playfulness.

2.2.Playfulness and gamefulness

The second side of the casual power prism lies in extrapolating the logic of ludic capitalism and adopting a certain way of looking at the intertwining of play and *gamefulness* in computerised systems. Understanding the way maps capture the attention of their audience calls for examining the notion of

playfulness and the ramifications for playing on and with the map's interface. This approach focuses on a specific type of play, one that can be found in contemporary digital games and their player community. According to proponents of this approach, digital games generate meaning through an emergent interaction between the rules codified by the designers and the ensuing action of the players. Moreover, such rule-bound meaning-making – proceduralism – is seen as a new form of rhetorical argumentation, different from other traditional forms of persuasion as text or images (Bogost 2006; 2007; 2011). All the while, others criticize it for being overly simplistic and deterministic, failing to recognise the unique personal properties that may change the meaning embedded in the rules by virtue of a resistant reading recognised in such cultural-studies traditions as the Birmingham School (Sicart 2011). However, both proponents and critics of the concept tend to draw parallels between rule-bound meaning-making in computer games to broader computer-infused modes of living where software and algorithms have growingly dominant roles in structuring daily interactions with various societal institutions. In his breakdown of the different ways various aspects of gamefulness are discussed in contemporary discourse, designer and media scholar Sebastian Deterding calls this approach 'the rhetoric of systems' (Deterding 2015). Building on Kitchin and Dodge's (2011) work on co-constructing spaces through software, he claims that 'today's code/space is the basic technological precondition for deploying algorithmic game(like) systems beyond the confines of a single gaming device and software... Several authors have in fact argued that computers and games show such deep structural similarities that computerization equals gamification' (Deterding 2015, 33).

This rhetoric supports some of the claims I make here about casual power. By virtue of computerisation (or digitalisation) of the map, it becomes more than a paper map transported onto a screen. The quantitative changes in speed, volume of available information and the ability to recognise the user's goal result in a qualitative change pertaining to the final form of such map. By tracing specific manifestations of the mediatization (meta-)process, I aim to show how the moulding forces of various entangled industries (spatial data, social-networking sites, user-experience design etc.) come together in the making of digital mapping interfaces in a way that borrows from design associated with video games to capture attention. Thus, the continuously-growing entanglement of additional spheres of life with specific media logics leads to the hybridisation of communicative and cultural practices in the production of maps. However, I take a nuanced view of the rhetoric of systems as applied to maps. While rules may indeed be weaved into a system, cementing control in previously-unknown ways (Galloway 2004), these rules are then interpreted by user interfaces. As we

have established before, this process is not straightforward, and instead presents a form of a coagulated action where the intents and desires of the map-makers crystallise in relation to accepted design practices and are presented to the multifaceted user. In order to do justice to those caveats, I wish to first unpack and then supplement the rhetoric of systems with 'the rhetoric of playfulness' (Deterding 2015, 47–48) and specifically Miguel Sicart's notions of play as a mode of being through objects. I will use this approach to describe some of the ways play and in particular gameful elements are weaved into map-design practices

2.2.1. Playfulness as interaction

According to the rhetoric of system, the *user* or perhaps even the *player* (rather than reader or viewer, for instance) is the main subject of the computational industries. The digital maps' boundary fuzziness discussed above means that the processual becoming of a map today is guided far more by the way it interacts with code and other types of computerised flux states. This is not to suggest that paper maps will become irrelevant (Hurst and Clough 2013), as 'old media are not being displaced. Rather, their functions and status are shifted by the introduction of new technologies' (Jenkins 2006, 14). No, the focus here is that the principal moulding force of the media which affect our current cultural landscape is that of the ICTs and, embedded within it, the game. Joost Raessens' (2006) claims that games and other digital technologies facilitate playful goals and identities, leading to 'ludification of culture'. Raessens suggests that modern Western cultures will become more accepting of notions of play outside traditional escapist or leisure domains. Play is appropriated as a metaphor for a political process, utilised to foster suspense in game shows and movies or to conduct war through drone interfaces inspired by video-game consoles and their controllers (Raessens 2012).

Modern scholarship often sees video games as the most bound expression of play in code and software. Katie Salen and Eric Zimmerman (2004) note that as digital technologies, computers and video games develop, a new definition sneaks into the field: that of *games as systems* (Crawford 1982). Consequently, Salen and Zimmerman suggest that a game is 'a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome' (p. 80). This transition marks the move from general play into computerised gamefulness: in such systems, play has to be bounded and encoded into the confines of the system, losing some of its free form but gaining recognisable and transferable traits across various digital domains.

Jesper Juul, attempting to extract a unified definition of the relation between games and play, sums up prominent and canonical definitions, and identifies several key aspects that are common to

them: a delineated game space, participants (players) and agreed terms of engagement. His synthesized classification attempts to combine them: '[a] game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome, and the consequences of the activity are optional and negotiable' (Juul 2003, 35). Play disappears from such a definition and games become rigid, rule-based structures. This view, of the game designer as enactor of rules, has found a large following, especially through the notion of procedural rhetoric (Bogost 2006, 2007, 2011), which assumes that a different type of persuasion occurs in the possibility space a designer leaves for players. Such a view echoes the notion of stickiness discounted by Jenkins, Ford and Green: a coercive element of new media, giving much power to the designer to persuade and influence. It follows a similar thread to the critical scholarship on representational mapping, where meaning was fixed, but often hidden, within the map.

However, subscribing to the processual logic and rejecting ontological fixity, I refuse such totality. The maps that I studied have a clear affinity to other computerised rule-based systems and, as I will show next, adopt certain design particularities that can be understood as borrowing mechanics or aesthetics for games and appealing to users' experiences. Such rule systems are manifested in interface affordances which can be accepted or rejected, and thus should be read as *arguments* put forth by the map-makers rather than commands. My approach in examining casual power is different: I look into the way designers might make maps experiential by turning them into specific modes of engaging with space, in a way that prioritises the actions performed through the map rather than the anticipated results of such actions.

To do so, I look into the work of play philosopher and designer Miguel Sicart (2014), who offers a dissenting view on play and gamefulness, breaking away from formalist definitions. He attempts to re-introduce the concept beyond rule-bound game systems (Sicart 2011) while still keeping it as a viable operational term for the purposes of analysis. Play is a mode of human activity, a mode of being in the world and with the world. Play is not bound to any particular object and does not emerge from games with fixed rule systems. Sicart's point of departure, in fact, is not games but *toys,* citing the wonder and creativity they evoke in children and adults alike. For him, play is appropriative and autotelic. By that, he means that play transforms intended activities into others not related to the player's original goal

This conceptualisation is built upon several components. Sicart's play is *contextual,* often dependent on environmental cues embedded (and I would say inscribed) in the objects or

environments facilitating play. A video-game console controller is a cue for play, but so is a soccer ball or a carnival mask. This means that play is also *carnivalesque*, in the tradition of Bakhtin (1968), who identified the need for controlled breaks of chaos in order to maintain order over time. Play is also *appropriative*. It is a mode of being that borrows from other modes, as well as taking over existing spaces and social occurrences. An office is designed for non-play, a space focused on productivity, but can nonetheless support various forms of play, superseding and sometimes even supplementing work (Mainemelis and Ronson 2006). Play is therefore *disruptive*, as when it appropriates, it often changes and alters whatever is appropriated, for better or worse. Certain types of behaviour of sports fans at stadiums are not considered acceptable in most other situations, nor do they have anything to do with the rules of the game being played. Play is *autotelic*, pursuing a purpose disconnected from other activities. This purpose is not fixed and the negotiation of the purpose of play constitutes an integral part of such activity. Consequently, play is *creative,* requiring players to negotiate rules, appropriating contexts and skilfully disrupting life around them. And finally, play is *personal*: while often generally conceived as a group activity, the player is immersed within her own morals, ethics and memories. Play is defined against our own goals, victories and defeats. Overall, '[p]lay is being in the world, through objects, towards others. We play not to entertain ourselves or to learn or to be alienated: we play to be, and play gives us, through its characteristics, the possibility of being' (Sicart 2014, 18).

This definition, and specifically the evocation of objects as conduits of play, brings to the fore an important distinction for discussing mapping interfaces: between play and playfulness. While often conflated, the two are quite different, since

> play is an activity, while playfulness is an attitude. An activity is a finite and coherent set of actions performed for certain purposes, while an attitude is a stance toward an activity – a psychological, physical, and emotional perspective we take on activities, people, and objects.
>
> In this sense, playfulness is projecting some of the characteristics of play into nonplay activities. It is an attempt to engage with the world in the mode of being of play but not playing (Sicart 2014, 22).

This distinction will be useful when analysing gameful design of interfaces, in mapping and beyond. Games are the medium of play, but according to the cited play as system rhetoric, components of elements associated with games are now to be found in the broader media-scapes.

An object can be imbued with gameful design to be playful, i.e. embedded with properties that bring about playfulness. This does not mean that this object was created for play or designed with play in mind. Playfulness is an attitude that fully takes on play's attribute of appropriation, as it is reliant on one's ability to see beyond the mundane, useful, accepted uses of objects and spaces, rejecting fixity and *reambiguating* the world. It disrupts existing contexts and injects play into non-play places. In our case, into digital maps.

2.2.2. Digitalisation as enabling gamefulness in maps

Chris Perkins (2009b) was the first to suggest introducing play into research focused on mapping assemblages. Following cartographers' fixation on usability and efficiency achieved through scientific means, which is devoid of the cultural components of mapping and its contextual specifics for users (Perkins 2008), he argues for re-examining the disruptive role of digital mapping when facilitating

> the possibilities of [users] putting themselves on their own map, destabilizing the taken-for-granted representational neutrality of the image; new kinds of maps are being made; more people are making maps; more things are being mapped; and mapping is taking place in more contexts than ever before (Perkins 2009b, 168).

Video games in particular, which as we have established are particularly potent interfaces for the capturing of attention, have drastically changed the relation between play and maps. Exploring the similarities and differences between those two types of spatial interfaces, as well as the production contexts in which they are made and the tool they are made with, will help understand some of the intricacies of my methodology in the next chapter. Beyond the fact that there exist an entire genre of games that appropriate or subvert the colonial fantasies of map domination (Lammes 2010; Mukherjee 2015), the more recent colonisation of the quotidian by both types of media allows us to re-examine previously incompatible concepts. Media scholar Chris Chesher (2012) equates navigation in third-person computer games with navigation utilising a GPS satnav device, pointing out how both systems re-structure Lefebvrian notions of social space. He lists three distinct ways in which those sociotechnical spaces are similarly structured: first, by displacing ad hoc navigational practices with concrete instructions, the system entrenches the rigid procedural logic and rhetoric of structured play; then, both systems similarly re-make the spaces around them into a subject-oriented consumption space where desires are gratified almost immediately by automatically aligning the

personal point-of-view with that of the mapped world; finally, by presenting a complex overlay on top of the mapped view (which I referred to as *map layering* in the previous chapter), both systems enhance the previous two points. He concludes by asserting the transferability of analysis from a particular navigational assemblage to many gaming ones, a point underscored by the congruence of patents and histories of navigation and gaming companies such as the use of gaming-graphics technology for the first digital globes (Dalton 2012). Recent experimental work has similarly shown that participants' navigational habits in physical spaces correlate with their in-game behaviour, proving the transferability of digital and physical navigational perceptions (Lange et al. 2015).

Thus, play is not foreign to maps and the coming together of various map-enhanced navigational regimes in games and other screen-based media emphasizes this fact. Re-examining Perkins' suggestions through my prism of casual power, a counterargument can be made that while playfulness opens up some possibilities, it closes others, in line with the principles of appropriation and personalization of play advocated by Sicart. Specifically, once multiple new actors have access to map-making, and while traditional map-makers are required to compete with newcomers and other distracting screens, the role of play in mapping can become more insidious than in paper cartography. If play is a mode of being in the world through the map, and mapping is conceived as an emergent and processual practice, play can be subverted in order to facilitate certain ways of being in the world that benefit the map-maker rather than the map-user. This is done by occluding and enhancing certain elements of the map's digital user interface. Sybille Lammes notes that 'mapping interfaces are Latourian quasi-things inscribed with programs of actions' (Lammes 2009) and shows that in the case of many location-based games, the distinction between map and game board essentially disappears (Lammes 2011). Therefore, we can accentuate regard gameful design as a distinct possibility within the digital map.

One interesting way to examine this is through the research done on video games and game development, particularly by following Ash (2010, 2012, 2015) in recognising games' interface as an experiential spatiotemporal effect rather than one of informatics. As games ethnographer Casey O'Donnell (2012) points out, the game industry is often conflated with the software industry, but this is a misguided notion. Game developers build software intended for artists and designers to create interactive experiences for gamers. Game interfaces are renowned for guiding those experiences for users, immersing them in processual engagement.

Making games is different than engaging in more traditional forms of software production (O'Donnell 2012) and stands in even starker opposition to GIS-based map-making. To simplify, we

can say that the point of traditional software design is to create code-based tools for users to utilise on a digital platform. The purpose and form of such software may vary greatly, from creating spreadsheets to running and monitoring a nuclear reactor. Yet, the design process[13] itself is aimed predominantly at providing the user with accurate tools to modify output of calculable processes via continuous input.[14] We must also differentiate between the process of writing software and the processes of *utilising* the end product of such software by others, since '[j]ust as Microsoft Word can be used to construct a novel, poem or short story, no one would be so quick to label writing and book production "just software" ' (O'Donnell 2012, 24). In similar ways, digital maps are made with certain technical codes, but their production process is imbued with greater meanings, drawing on traditions of mediating and interpreting spaces for users.

Games also include software only to the extent that it is utilised to create the authoring tools with which game designers craft the experiential process for the player, a fact made clear when various editing tools are constantly released alongside the games they were used to create in order to extend those games' shelf-lives (Kücklich 2005). Games and their designers were also one of the first media to utilise animated maps, which have become available only recently for practical purposes, but have been available since the early days of the gaming medium in such classics as the *Rogue* and the *Ultima* series The graphics company Keyhole,purchased by Google and eventually became Google Earth and the prototype for Google Maps, was originallya video game company which developed created their virtual globe technology from within the gaming industry (Dalton 2012).[15] Above all, as opposed to software (and I say the paper map),

> [v]ideo games […] continually retrain the player and make no assumption about consistency. Players can be moulded to perform the actions of a game. Indeed, players often expect

[13] A term I use here broadly to include the initial specification, various versions of software and the potential usability considerations (Latour 2008).

[14] This is my working definition. While looking into the matter, the definitions I kept coming to were overtly structuralist, with little to no regard paid to the users involved: (1) "the entire set of programs, procedures, and related documentation associated with a system and especially a computer system; *specifically* : computer programs" (Merriam-Webster online dictionary 2016); (2) "**Computer software**, or simply **software**, also known as computer programs, is the non-tangible component of computers." (Wikipedia 2016). I understand that from an ontological point of view, software doesn't really **need** users to exist (traffic lights are run by software). Yet, from my theoretical perspective, the software I'm interested in always has some user in mind, even if it's the city traffic technician required to change the frequency of green lights at a junction on some rare occasion.

[15] It is therefore not surprising that one of the co-founders of Keyhole and a long-time Google employee John Hanke is the founder of Niantic, the company responsible for the recent success of Pokémon Go augmented game (Mac 2016)

> learning curves and even enjoy the challenge of meeting a new game's mechanics and game systems as part of what makes playing 'fun' (O'Donnell 2012, 27).

Here again, I return to the 'balancing act' of casual power: the inscription of affordances that make a digital object feel familiar and evoke constant use while fitting it within the media-scape. O'Donnell offers a solution to such a predicament: turning the learning and retraining process into something that is compelling in itself. He notes how video-game designers excel at introducing new elements into the user interface, game mechanics and progression systems of video games, turning the process of failure into an integral and fun part of experiencing the game (Juul 2013). This learning-as-fun, or the introduction of intrinsic motivation to the learning process, has long been hailed as the main potential of games and gameful things in more 'serious' domains such as education, healthcare and the corporate world (Abt 2002; Michael and Chen 2005; McGonigal 2011).[16] This is my argument for the second component of the casual-power analysis. By virtue of software (read digitalisation), map-making has become more open than ever before, allowing for changes in the deployment of mapping assemblages beyond and parallel to the initial inscription. This affords the introduction of gameful elements into the maps' interfaces that evoke a sense of playfulness (Sicart 2014) as a mode of experiencing autotelic engagement disconnected from the broader goals of both the map-maker and the map-user. In other words, the digital makes it easier to design for the attention economy in a way that evokes 'getting lost in the map' for users. Again, I wish to stress that this is not a necessary effect, and that it would be a generalization to assert some linear process of design-inscription-reaction. However, as I will show in my empirical chapters, attention is harnessed in a way not dissimilar to how Ash's (2015) video-game interface envelopes affect user's spatiotemporal perception. Particularly in my genealogy of user experience (UX) and the institutions that arose to accommodate this concept, I will refer to this idea through the discussion of changing the functioning of a map by accounting for user preferences.

One element in particular makes such design more likely. The innate quantifiability of the digital (map) brings the map closer to other digital artefacts and the modes of experiencing them. In particular, the way such quantifiability resonates with similar modes of calculated interaction on other

[16] There is a great scholarly and industry debate across various disciplines on whether such effects can be taken outside of games and if so to what extent. Criticism is often raised against those who take the most shallow and addictive elements of gameplay in order to compel users. The scope of this debate is well beyond the confines of this chapter, and I suggest the edited volume by Fuchs, Ruffino, Fizek and Schrape (2014) for further reading. However, whether one agrees or disagrees with the ethics of the move, there is a seeming consensus about the potential of such effects to affect behaviour outside of games (Deterding 2015).

digital platforms relates to the specific sociotechnical and economic conditions of contemporary media-scapes. The next section focuses on such conditions and unpacks quantification as the final component of casual power.

2.3.Quantification

Maps are permeated with varied forms of quantification, such as scoring (e.g. places in Google Maps), route calculations and constant (re-)evaluations of speed, directions and ETAs.

At the centre of my argument regarding the relation between quantification, gamefulness and maps lays the assertion that through the use of numerical displays, maps compress time and space for their audiences. By building these components into the maps' user interfaces, designers take advantage of the cognitive heuristics of the human mind, reducing reflexivity and accepting the map as more truthful. To comprehend casual power in relation to quantification, I wish to evoke the notion of the 'machine zone' (Schüll 2014). This concept stands for mechanical engagement with an opaque interface, designed in a way to isolate the user and engross her in the immediate actions that she performs, rather than the consequences of such actions. I use the concept to help to explore the designing of playfulness into a system when this alters the system's original meaning. Specifically, I trace the link between surveillance and quantification, as the two rely and fuel each other.

2.3.1. Lost in the machine zone: gambling and beyond

Anthropologist Natasha Schüll spent a decade interviewing machine gamblers, designers and gambling industry executives. Her primary finding is about the way this industry is concerned with getting people 'into the zone'. Done through black-boxing the numbers behind gambling by way of digital technologies, this 'zone' is defined as a psychological state of repeated interaction with the digital gambling machines where the users, no longer interested in winning or losing, are engrossed in the actions themselves and the feedback loops they generate. In this state, playing to win is irrelevant, but rather the aim is, according to one gambler, 'to keep playing – to stay in that machine zone where nothing else matters' (Schüll 2014, 2). Using Sicart's dichotomy, I argue that this attempt at 'zoning' the user is the application of gameful design to gambling spaces and objects, detaching it from the 'official' goal of gambling – winning money – and putting it into an autotelic, appropriative state that draws on the action (being) more than the result. I will then argue that tracing similar acts

of 'zoning' through social media and finally mapping can aid an understanding of gamefulness as an applied perspective on experience-centred design.

Certain types of gambling have often been examined from a cultural and anthropological perspective. In the seminal works of Goffman (1961) and Geertz (1972), gambling is indicative of high-risk play, unpacking and transposing social interactions between the players involved. The gambler exhibits liminal traits, re-affirming personal status or resisting society's confining authority. As Schüll notes, the slot machine is given little consideration in such works. Lacking the human interaction component, it is at best explained as a crutch for those (yet) unable – or unwilling – to participate in 'real' gambling, at casino tables or in cock-fighting rings. To Schüll however,

> [a] zone in which **time, space, and social identity are suspended in the mechanical rhythm of a repeating process** may seem an unpromising object for cultural analysis. Yet such a zone, I argue, can offer a window onto the kinds of contingencies and anxieties that riddle contemporary American life, and the kinds of technological encounters that individuals are likely to employ in the management of these contingencies and anxieties (Schüll 2014, 13; emphasis mine).

The repetitive aspect is crucial for understanding casual power. Just like the gambling machines, the maps I explore are built to be operated routinely, internalising the requirements of working with a numerical user interface. The introduction of digital technologies has created a unique conjuncture of highly traceable and manipulable users, whether they be gamblers or map-users. Digitalisation hides components that were previously visible and discernible behind an occluding rectangle of glass. Here, the machine is manufacturing a sense of wonder and enchantment through increased use of calculations to undermine uncertainty (Schüll 2014). In the case of gambling machines, the mechanical reels were gradually replaced with electronic and later digital components that created a disconnect between the game as experienced by the player and the actual outcomes, which were pre-calculated in an exact manner. After tracing trade materials and interviewing designers, Schüll concludes that by obfuscating the actual game mechanics, while giving players the illusion of control by including nostalgic aesthetic elements into the design, the gambling industry aims at maintaining this aura of enchantment. The magic of the machine is intrinsically tied to the way human perception works, as '[t]here is a mismatch […] between human capacities to process and respond to information and those of the digital technology. This mismatch, one could further suggest, reflects

the larger asymmetry between designers and players, technologies of disenchantment and states of enchantment' (Schüll 2014, 85).

The machine zone is then a state of contrived contingency (Malaby 2007), manufactured by 'enchanting' the technological process through repetition and the creation of a disjunction between how the end user perceives the game and its actual mechanics. In other words, this is an aspect of the principle of unrepresentability that Galloway brings forth in his interface-effect argument, only from a designer's perspective. Unlike the preconceptions of what a gambling state is, the resulting mood for the constantly-tracked and measured user is that of a nullified certainty. Gamblers report that they remain calm and engrossed in the action they are performing. In a similar way, mapping interfaces often work to evoke a similar 'machine-zone-like' state in their users. This substitutes telic, traditional use of maps for the sake of encountering the world they represent, with a free form of engaging with the map *for the sake of the map*. For example, using the Waze app that was mentioned earlier might coerce users into collecting points while driving, even without registering what the points are for or whether this action contributes to the overall goals of navigation (figure 2.1).

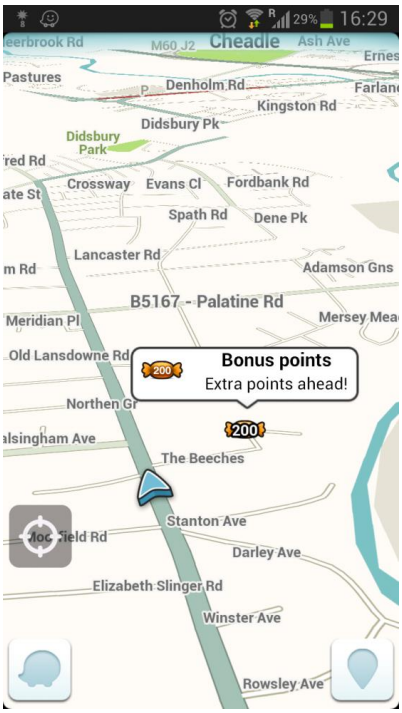


Figure 2.1: Bonus points appear on the map when no route has been selected. The only way to collect them is to 'drive over them' in the physical space; screenshot by the author.

When reading interviews of gambling-machine designers, it becomes clear that such a state has implications beyond the gambling industry. Struggling between sticking to the claim of addiction (or 'problem gambling') as something inherent to the individual, most designers nonetheless admit that there are ways to foster addictive behaviours – or perhaps, more accusatively, addictive loops[17] – at the point of contact between users and devices, the user interface. Schüll emphasizes that this is

[17] Compare with Stefan Werning's (2007) discussion of video games as programmed objects where he draws parallels between the psychological notion of 'behavioural loop' and programming's loops and recursions techniques.

achieved by implementing a massive tracking apparatus in the casinos. However, unlike the traditional Foucauldian surveillance of hidden cameras and guards on the casino floor, digitalisation of gambling permitted the type of surveillance that Deleuze characterised as inherent to societies of control: one where the institutional gaze is internalised while the individual is turned into a 'dividual' (Deleuze 1992, 6) to be sampled, tagged, analysed and tracked. Introduction of personalization to casino machines is reminiscent of the ongoing personalization of Google's location services that I described in the previous chapter: both aim at reducing cognitive stress and generating a 'frictionless' experience for the user – built for maximising calculable interactions like clicks or shares over a period of time. After all, as Terranova points out,

> [t]he abstract quality of attention and at the same time the fact that the 'attentional assemblages' of digital media enable automated forms of measurement (as in 'clicks', downloads', 'likes', 'views', 'followers', and 'sharings' of digital objects) open it up to marketization and financialization (from the floating value of Internet companies to the accumulation of celebrity capital by means of a number of followers on Twitter to the changing value of 'clicks' as calculated by Google's software AdSense and AdWords. (Terranova 2012, 3).

Such quantification and commodification of attention is also an example of what social-media researcher Christian Sandvig calls 'corrupt personalization' – where the users agree to personalization services for the benefit of improving their digital lives, and instead receive results based on collected data but geared towards the commercial interest of others, ensuring a skewed experience (Sandvig 2014). Both mapping and gambling digitalisation processes offer benefits that are presented as consumer perks while relying on the private information disclosed by users who opt in to (or, commonly, fail to opt out of) the same services. The reinforced-reward loops of the casino floors were not as efficient before the introduction of electronic user accounts, radio-frequency identification (RFID) cards that allow machines to recognise gamblers, and adaptive user interfaces that take into account the individual skill and speed of a use that began with the advent of digital technologies a decade ago (Schüll 2005). Similarly, Google Maps and the products built on it could not have provided effortless geo-locative searches without the user agreeing to her previous searches being stored and analysed, her phone tracked (Farman 2010).

While far from claiming that the two technological settings are similar, the induction of users into an attempted machine zone is nonetheless symptomatic of the larger design processes that I

observe as part of my own work. Such is the attempt to engage the map reader in a totalising use experience, divorced from the initial goal of the action and instead becoming appropriative and autotelic, 'getting lost' in the interface.

The focus on creating a user experience that is totalising and non-reflexive is not new (Norman 2002). What is new is the digital media-scape that allows for such design (a) to be constantly optimized via the implementation of tracking technologies and (b) to strongly rely on quantifiable elements of the GUI to foster continuous feedback loops. It is the induction of playfulness into objects, making them open-ended and attractive to users due to their experiential offer rather than the function they serve. In fact, my initial interest in the machine zone came from an editorial piece by a journalist and visiting history-of-technology scholar at Berkeley University, Alexis Madrigal, who had pointed out that the term and snippets of interviews with gamblers talking about it had an eerie similarity to his own experience with using social media, in particular to the more monotonous actions associated with it, such as picture browsing or timeline scrolling. He notes that

> [t]hinking about the machine zone and the coercive loops that initiate it has great explanatory power. It explains the 'lost time' feeling I've had on various social networks, and that I've heard other people talk about. It explains how the more Facebook has tuned its services, the more people seem to dislike the experiences they have, even as they don't abandon them. It helps explain why people keep going back to services that suck them in, even when they say they don't want to (Madrigal 2013, n.p.).

Such an affect can be explained in terms of cognitive fluency (see section 1.3.1), or receiving repeated stimuli in a situation framed as one of uncertainty. In gambling machines, this is achieved by making a disconnect between visible mechanisms of gambling, as in the case of the mechanical reels that are no longer used and the actual interface that allows development of gambling 'skills' of precision and consistency, maximising the time-on-device for the machine makers while maintaining a sense of pleasant familiarity for the user. Ultimately, much of the experience interwoven into the design of digital maps can also be understood in terms of cognitive fluency and the machine zone, as the map allows the user to substitute complex thought processes and cognitive unease with repeated interaction with their physical reality through a pleasant mantle of the familiar. To make the messy physical world familiar and enhance the cartographic illusion, maps make use of quantified user elements.

2.3.2. Understanding the machine zone through quantification and gameful design

Although it does not posit a distinct link between quantification as a mode of 'truth' and the specificities of social media, this is what Madrigal's analysis of the machine zone in relation to Facebook means. Social media quantifies basic human relations to the world, allowing one to constantly re-assess her position vis-à-vis subjective reality by answering a series of easier questions (How many friends? How many likes?), all the while experiencing a (misleading) sense of familiarity through mastery of a user interface designed to foster a disconnect between the ease of an action and its meaning. Artist and critic Benjamin Grosser, inventor of the Facebook Demetricator browser add-on that deletes all quantity-related mentions from the popular platform, notes on such constant self-assessment:

> [o]ur need for personal worth is highly dependent on these social interactions, as both relatedness and esteem are necessarily measured in relation to others. If this essential human need can only be fulfilled within the confines of capitalism, then it stands to reason that we are subject to a deeply ingrained desire for ***more***: a state of being where more exchange, more value, or more trade equals more personal worth. In other words, our evolutionarily developed desire for worth is an intrinsic need, which translates, through the 'pervasive atmosphere' of capitalist realism, into a desire for more (Grosser 2014, n.p.).

Grosser's argument is built on the propagation of neo-liberal managerial culture, and specifically the audit, as an evaluation method rooted in observable metrics that exceeded its original role in the financial industry and moved into domains such as higher education and public service. David Beer (2015a) suggests that measurements have a profound effect on those being measured. Using examples from professional sports, he underscores how individuals internalise the external measurements applied to them and adjust their behaviour accordingly. Beyond the realm of athletes, he connects such productive measurement to the encroachment of sensor-infused devices and the data networks that link them. To him '[w]e are, as Will Davies has put it in his recent book, *The Happiness Industry*, "living in the lab". Even our emotions can be measured for tracking and manipulation. This "lab" is not just measuring our exercise and activities but also our emotions, well-being, health and even our sexual and reproductive properties' (Beer 2015b, n.p.). Facebook builds upon this culture of measurement in two ways: as a driving mode, and as a data infrastructure. First, by constantly displaying metrics to the user, it aims at commodifying the social interaction into a

manageable structure while playing on individuals' anxieties of missing out or losing. The numbers – most often notifications of new events – go up whether the user pays attention to them or not, maintaining constant pressure to check what is new in the feed. But the moment a user checks (i.e. clicks on the icon which displays the number), the count is gone and the user must obtain additional notifications by creating interaction opportunities, by engaging with others through Facebook who are be prompted if they comment or message back. Additionally, based on a list data structure, Facebook's database in itself is geared towards keeping score and assigning numerical structure; thus, '[o]n occasion, this may lead the Facebook interface programmer to include a metric simply because they can' (Grosser 2014, n.p.).

As can be seen from the discussion of the machine zone as a quantitative engagement mode, my argument regarding the casual power of maps combines concerns over social-media design intended to habituate behavioural automatism (Madrigal), via modes of commodifying quantification (Grosser) in order to create an autotelic mode of being (Sicart), through the introduction of gameful elements into the interface design (Deterding). Both social media and digital mapping are the offspring of increasingly shortening attention cycles and unique characteristics of digital objects (see section 1.3.3). Both are often presented as utilities that allow one to extend existing characteristics of human interaction or spatial perception through improved means (in a quite McLuhanistic [1995] way). Numbers play similar function in the two as they propagate a sense of the immediate, the calculable and the objective.

While not as saturated with metrics as the Facebook user interface (figure 2.2), Google Maps nonetheless has a very number-heavy presence. Numbers appear independently of the user's inclinations. Selecting any point on the digital map will provide few suggestions on the possible ways to interact with it in the physical world, whether by offering quantified (time and distance) ways to reach it (figure 2.3) or by ranking it compared to other locations in the area, based on user input, and one's personal preferences as distilled from previous use patterns (figure 2.4).

Figure 2.2: Metrics location on Facebook User Interface, reproduced from Grosser 2015.

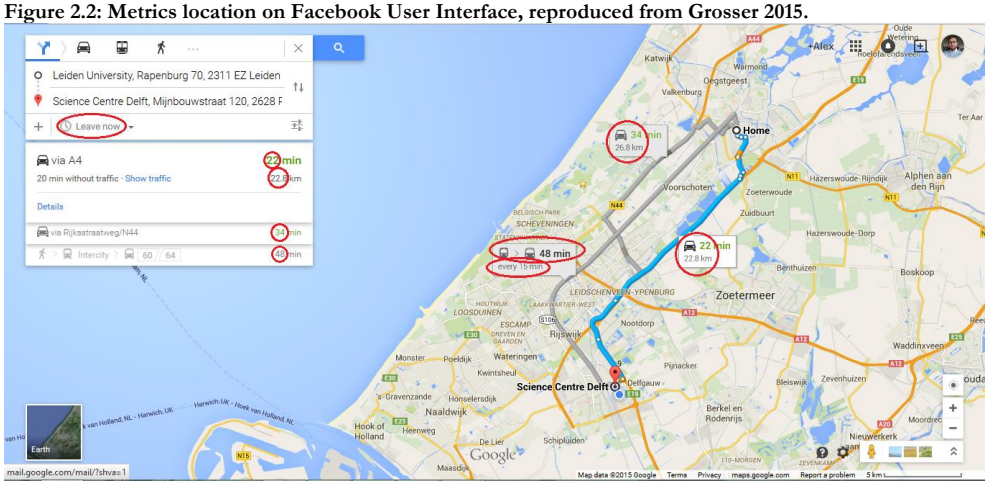


Figure 2.3: Google Maps metrics when navigating; screenshot by the author.

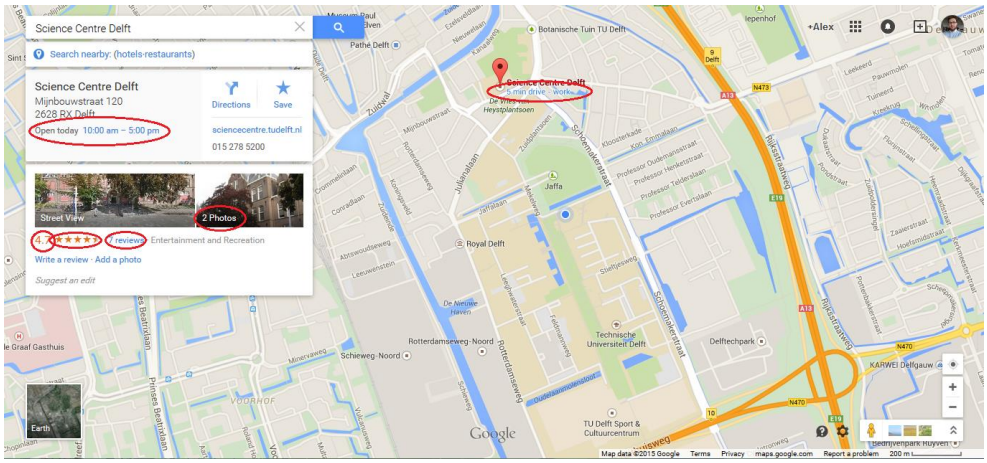


Figure 2.4: Google Maps metrics when examining a POI; screenshot by the author.

Finally, Ned Rossiter (2015) notes how the reliance on numbers changes an organisation's logic not only for the software product's interface in question but also on the level of managing and structuring human resources within it. While conducting research on global logistics systems of enterprise-resources planning (ERP) giant SAP, he highlighted that media and software studies have paid little attention to those types of software despite the fact that they are omnipresent; with SAP in particular having a near monopoly on controlling the internal processes of major modern organisations. Rossiter uses an ANT breakdown of such software's proliferation to comparatively analyse neo-liberalization processes that co-occur in the financial world and global academia:

> [i]ndeed, I would go so far as to suggest that the correspondence between the academy and the corporate world may best be understood not from the traffic in managerial culture and labor practices across institutional settings, though there is no doubt such movements are key at the level of what Ross terms institutional 'coevolution'. One sees such coevolution not only in the management discourse that dominates institutional life, but also the mobility of labor between corporate and university settings along with the numerous examples of collaborative research projects between industry and academia. Rather than posit a constitutive force between discourse, subjects and institutions, I would instead propose that attention to enterprise software systems may help explain the emulation of conduct between otherwise diverse institutional forms and organizational cultures (Rossiter 2015, 137).

Moreover, through ethnographic research of both types of organisation, he focuses his comparison on practices of gameful design (which he refers to as gamification) employed by them. Gamification, through the frame of ERP software, is the ability to simultaneously engage employees in otherwise boring repetitive tasks while extracting large quantities of constant voluntary data on these same employees. Citing executives from both corporate and university worlds who praise gameplay's ability to extract value from otherwise wasteful processes, Rossiter evokes the notion of playbour that I discussed above (Kücklich 2005) to explain the attempted coupling of play and work to form a monitored cycle that is constantly optimized and monitored from above. Here, we can link user tracking, quantification and mechanical rhythms of work into a unified framework.

In other words, gamification is the glue that ties those highly divergent organisations, and ERP software, which is marketed to 'enhance' and 'salvage' lost internal value within those organisations, is the conduit for such practices. 'Gamification' here is the imposition of the machine zone on employees, through practices of quantified self-worth, that artificially simulates truthfulness with efficiency metrics and offers both employees and employers a false sense of calm. Here, playfulness is subverted, stripped of its free-form elements and turned into Schüll's casino floor – engineered to maximise time-on-device, designed for reduced reflexivity and automatization of certain processes at the expense of others. Casual power in maps is of a similar nature. We can look at the quantified elements of the map as they enhance the gameful design propensities aimed at capturing and maintaining user attention. Similar to the link that Rossiter finds between academia and logistics in their deployment of gameful quantitative software for control, and following Deterding's encapsulation of gameful design within the rhetoric of systems, I look at the way experiential design is influencing the production processes of digital maps.

2.4.Conclusion: A genealogy of casual power

In this chapter, I have suggested casual power as a term for understanding how playfulness-within-objects changes the nature of the power relations between designers and users in digital environments. Furthermore, I have defined it through the analysis of designed affordances in the digital maps' user interfaces within the context of contemporary media-scapes. I defined casual power through the amalgamation of the way digital maps capture attention, the gameful elements within the interface of the map and the quantification of various digital platforms which the maps populate (and their effect on user perceptions of worth). First, digital maps are operating in the

attention economy, built with the goal of capturing users' attention and competing with other digital devices. Second, they do this in regimes of ludic capitalism, where interfaces are built with gameful affordances and thus imbued with fun properties for economic value. Third, this occurs as quantification, in itself built on user surveillance, attempts to neutralise user's self-reflexivity by creating mechanical rhythms of use. In this last section, I dwell on the origins of the term and its ramifications for the study ahead.

The 'casual' in casual power is borrowed from *casual games*, a type of video game that has become popular in recent years and is characterised by easy and enticing mechanics, short play sessions and appeal to mass audiences (Juul 2010). Such games have a tendency to suppress other types of activities, often through users' smartphones, as they are played between and instead of less desired tasks: on public transport, during class or at a boring meeting. Those types of games have recently captured the attention of the public, academics and business alike, with titles such as *Farmville* (Zynga 2009), *Angry Birds* (Rovio 2010), *Candy Crush Saga* (King 2012) and *Clash of Clans* (Supercell 2012) enjoying critical and financial success. According to Juul, one of the main aspects of such games is 'juiciness' (Juul 2010, 30). While the term is difficult to define precisely, he sees this as the visceral component of the experience, the way a continuous feedback loop rewards even the most miniscule of the player's actions. I find this concept to be at the core of the casual power concept. The reward-within-itself and the drive for continuous prompting through the interruption of daily routines is a mode of communication adopted by a growing number of digital artefacts, including maps. The loss of reflexivity on the part of the player is often due to the evocation of the most basic urges, through carefully constructed 'Skinner boxes' issuing random rewards to keep the players clicking or tapping (Lewis, Wardrip-Fruin and Whitehead 2012).

Similarly, casual power can be traced in designs intended to invoke (a form of) playfulness and to overwrite something else. It can be positive, as when stairs to the underground are modified to resemble piano keys in order to encourage people to be physically active (Rolighetsteorin 2009). Yet, it is often also a problematic technique which aims to deceive the user, or at least distract her from being self-reflexive about the actual activities she is undertaking within a system. A tension always exists between functional and predictable design and design intended to invoke playfulness (Zagal, Björk and Lewis 2013). In the concluding section of this chapter, I argue that casual power is symptomatic of a bigger digital trend, where developers are expected to build interlocking platforms rather than unitary products (Helmond 2015). Moreover, similarly to Rossiter's methodology, where '[t]he infant world of play-made-computational increasingly intersects with ERP systems within

institutional settings seeking to extract greater value from data generated by their workforces' (Rossiter 2015, 148), I wish to emphasize again that it is not my intention to claim that maps are made like games, or that direct influence can be found between the two. Rather, following the lens of casual power outlined above, I claim that by adapting to the attention economy, maps, like many other digital artefacts, adopt gameful design components, along with resulting points of similarity, such as the reliance on data or the primacy of experiential over functional interface design.

A major component of this shift is temporal, the so-called move from a product- to a service-based model (Jacob and Ulaga 2008). Unlike the former, companies in the latter are expected to continuously monitor and update their offerings to compete with completion. This results, among other things, in a move to an alternative pricing model, often involving free basic products and then profit generation through either advertising, gathering of data on users, offering paid premium services ('freemium') or a combination of the above. The introduction of Google Earth and Google Maps into the world of popular cartography has triggered such trends, and their influence is felt within the case-studies I present later in this dissertation. During the transition from a product to a service model, retention is key. As more users remain within the scope of your system for a longer time, one gains more data-driven insights into their behavioural patterns, allowing you to customise your service on the fly, making it more appealing to users and enhancing the loop. Juho Hamari (2011) arrives at conclusions similar to my own when he examines free-to-play games through the prism of behavioural economics.

Like Rossiter, and with a less optimistic view than Sicart, I see playfulness, overlaid onto various forms of artificial gameful design, as a tool for additional value extraction. Therefore, casual power is a way to examine the design process of a digital map while looking for some key characteristics that – like in games – attempt to quantify user experience, lock them into repetitive patterns and hide – frequently behind the veneer of enjoyment and fun – the ongoing data extraction that occurs. The modern digital map is only good for the non-professional user when it is better than a paper map, which is still often perceived as more reliable and trustworthy (Hurst and Clough 2013). Yet, one thing that benefits digital maps is being part of an ongoing trend of *ludic interfaces* that 'demonstrate how playfulness is about to intrude systems, devices and relationships that were once governed by determinism, control, and straightforward teleological thinking' (Fuchs 2012, 1). The preferred route for digital maps to achieve this primacy seems to be by black-boxing the intricacies of space and place from the same users that employ their services. This is further achieved by subversively collecting data from the actual process of use to make the black-boxing even more hermetic. Just like

in similar tracking that often occurs in casual video games, '[o]n the part of the player, the intimate surveillance required by metrics may be unproblematic in a single game space, but when linked to one's social network, real identity, and real-life activities, the potential for the exploitation of these surveillant functions increases' (Whitson 2011, n.p.). The models that casual (mainly free-to-play) games pioneered with the emergence of social-networking sites like Facebook and Twitter and the rise of smartphones are proving very useful for other types of digital objects. This should not come as a surprise, since, as game designer and academic Eric Zimmerman expressed to Jesper Juul in an interview,

> [a]s digital technologies and networks of information, the Internet, computers, mobile technologies, more and more pervade our lives, [and] the ways in which we socialize and flirt and communicate and learn and work and do our taxes and engage with our government and manage our finances, and many, many other important aspects of our lives, the more I think our culture becomes primed for play and particularly, games as the dominant form of leisure (Juul 2010, 215).

Games today are run like services, requiring ongoing acquisition and retention of players as customers. As maps undergo a process of digitalisation, they too move into the realm of a continuous service structure. Similar to how the world of gambling machines got rid of its mechanical origins in favour of digital chips, thus obfuscating gambling as an activity-with-a-goal and promoting gambling as an interface-enabled autotelic activity, digital maps reinforce the cartographic illusion by making the user mistake the interface for the world that is being represented. Therefore, when examining their processes of production, it is prudent to look into how the structures involved attempt to draw their users in, what world they aim to show to them through the quantified user interface, where the conscious (and unconscious) decisions that end up shaping the user-making process lie (Woolgar 1991), and more. To do so, I utilise the conceptual framework of Actor-Network Theory to examine several mapping interfaces as processes of inscription and de-scription. In the next chapter, I will go into the specific methods utilised during this study in detail, explaining the ways I selected my case-studies, and gathered and analysed my data before moving on to the results.

3. **Methodology**

'Before thinking about the kinds of detailed relationships between ideas, literature and methods which have to be outlined in research proposals, we argue, it's important to have cast a preliminary research net, initiated access to appropriate people and places and thought through the role of language, power relations and ethics.'

Mike Crang and Ian Cook, 'Doing Ethnographies' (2007,17)

This chapter details the methodology used in the collection and analysis of data for this dissertation. It is both informed by and follows the established notions of contemporary mapping as a processual emergent practice (chapter 1) that can be analysed by examining mapping interfaces' casual power (chapter 2). In short, the main focus of my methodology is participatory (auto-)ethnography and interface critique. I carried out embedded research at two map-producing organisations while working alongside and interviewing the various people engaged in the process. This resulted in troves of interview transcripts, personal notes and schematic illustrations aiming to visualize the process of map production. I digitalised and analysed the material, looking for common themes and patterns that connected the two while referring back to existing literature on both media production and map production. Particularly of interest for me were references made to examples and practices coming from outside the realm of traditional cartographic practice, as it allowed me to focus on the unique prism of embedded playfulness as a novel proposition in the world of cartography.

In order to do so, I raise several research traditions, building on multidisciplinary enquiry informed by cartography, media production and play. Accordingly, the chapter is structured into four parts. In the traditions of ethnographic writing, these parts correspond to the relevant temporal stages of my project and present methodical considerations beyond methods, namely research dilemmas and debates around my own positionality as a researcher in the field.

I began by seeking contacts and negotiating with relevant entities. The first section documents this process and compares it to existing literature on approaching organisations for embedded research. In it, I compare my own work to three existing traditions: research on maps and GIS production, research on news and media production, and various STS traditions.

Following that, I worked at the two selected organisations for a period of approximately two months, performing my research alongside pre-arranged tasks. The second section of this chapter

details this process while unfolding the ethnographic and auto-ethnographic methodologies that informed it. Specifically, I detail the difficulty of utilising new and evocative ethnographic practices when approaching my informants and explain the value of analytical auto-ethnography as the approach that was chosen.

The fieldwork retroactively informed some of my presumptions about the required theoretical foundations, and so section 3 is a short exploration of the changes to my research questions and hypotheses during this period, including the reworked role of play in my methodological approach.

The fourth and final section of the chapter deals with data analysis. I detail the required hardware and software, and discuss the methods used. In particular, this segment discusses the uses and limitations of grounded theory as the traditional method for analysing qualitative material. It details the difficulties of establishing categories arising from participants' discourse in an environment of media convergence and suggests the use of play concepts in conjunction with ANT as a possible solution.

3.1. Finding the cases, finding the method

The research proposal I wrote when applying for the position that eventually led to this dissertation included three distinct case-studies on various mapping platforms. Submitted in May 2012, I stated that

> [t]o conduct my research I will use dual methods. First, by using, analysing and comparing different types of digital mapping practices through the theoretical lens of the Actor-Network Theory, I wish to outline the affordances of political digital-mapping interfaces as enabling potential transformative action.
>
> Following, I intend to situate them into daily practices by employing participatory observations of key groups affiliated with those maps. Those groups might include the end-users but also the producers and designer[s] of the maps.

The cases varied from the everyday to the highly specialised, and in 2012, I imagined the end product in the form of a kaleidoscopic inquiry into the various types of maps and mappings as a continuous process across multiple domains. Previously engaged with the topics of political communication, persuasion and power relations between media producers and consumers, I wanted to write a broad analytical unpacking that incorporated three various types of digital maps, from their

inception to the end products in the hands of users. Moreover, my proposal had an accusatory undertone: coming from communications studies and recently introduced into the world of critical cartography, I zealously wanted to expose the map-makers for the commercial and ideological biases they imprint into their creations, tracing the exact methods through which they exerted power over their users and then empirically confirming the occurrence of distortions with said users. Furthermore, the intention was to do so comparatively, across three very distinct types of maps in a various environments and user-bases, unified by the common thread of mapping politically- or economically-contested spaces.

My original proposal was primarily informed by the North American communication-research tradition of (mainly news) media-production studies, stemming from sociological inquiry into information dissemination patterns and immediate measurable effects (Katz 1987). Based on early research into such media as radio, magazines and newspapers and aiming to assess the influence of propaganda or advertising on wider audiences (Lazarsfeld, Berelson and Gaudet 1944; Lazarsfeld and Merton 1948), many of the early communications theories were linear (Shannon 1948; Weaver and Shannon 1963) or circular (Schramm 1954) models, attempting to extend Lasswell's original dictum for communication research of '(1) Who (2) Says What (3) In Which Channel (4) To Whom (5) For Which Purpose' (Lasswell 1948). In those models, there was always an assumed sender and receiver of messages, and over the next thirty or so years of communication research, the question of how much control the sender actually exerts on the receiver persisted, albeit in continuously-nuanced forms.

This stepped understanding of the communication process led to the establishment of media-production studies, which is interested in the institutional and personal choices made by those controlling informational aces ('gatekeepers') for broader audiences. As a bachelor student first encountering the field in my early 20s, that aspect was eye-opening. The realisation that mass-media information is structured and influenced by people just like me, often socialized in existing practices through wider institutional cultures, made me examine the ways I consume mediated information very differently. Eventually, it led to me writing a seminar work based on such institutional research in a national news channel. During my first ethnographic experience, I examined the news-production cycle in Israel's only Russian-language broadcaster, which caters to the country's one-million strong community of ex-Soviet Jews (a group I belong to). I was attempting to reconcile the inherent paradox of an immigrant-oriented channel with a stated goal of bringing this population closer to the mainstream culture of the host country while undermining the economic logic of its

existence. This project broadened my understanding of how media are made through and by people. It served as the basis of my initial intent of combining newsroom-like ethnographies with a critical cartographic edge.

Tuchman (2002) identifies three distinct threads in the study of news production: political economy, which builds on Marxist and neo-Marxist notions of hegemony to explain the way ideological logics shape content; phenomenology and ethnomethodology, focusing on the roles of individuals and specific organisations in the co-construction of social reality; and textual studies, which focus on news texts as a hermeneutic method in order to uncover the processes behind them. Tuchman warns against a reading of those traditions in opposition to one another, especially as often presented in the confined disciplinary environment of media research, and instead suggests that they should be used in a complimentary way.

This had profound influence on my research and methodological preferences after completing a qualitative research project. While many of my classmates preferred to engage with short-term quantitative (mostly questionnaire-based) enquiries, for me, understanding media became very dependent on understanding the intricacies of media production. After looking into design practices and patterns during my Masters studies, those tendencies received additional reinforcement. Therefore, when initially approaching my current project, it was clear for me that a major component of the enquiry must include a similar production-institutional component that would complement and inform usage. At the time, I was already familiarizing myself with the literature on critical cartography, and while reading seminal works in the field (Harley 1988b, 1989; Crampton 2001; Wood 2010; Elwood and Leszczynski 2012), I noticed that the perspective is mostly based on hermeneutical readings and discourse analysis of existing maps. Thus, I encountered multiple texts on the ontological and epistemological changes in our understanding of digital maps; however, few of them dealt directly with the changes in the processes of their production.

It should be noted here that many in the field of cartography, in a way similar to media theory, have argued against the producer/consumer dichotomy (Perkins 2004; Del Casino and Hanna 2006), crystallizing in the processual view on mapping that I laid out in chapter 1 (Dodge, Kitchin and Perkins 2009b). However, at the same time, the material turn in social science and humanities (Harman 2010) has called into question the foundational principles of ANT (Law 2009) as applied to increasingly complex societal systems beyond the lab or the manufacturing floor. Therefore, it seemed crucial to find existing research on the compound practices, software and hardware of mapping in order to help me 'follow' the chain of actors in my own case-studies. Yet as I read

through existing material, I discovered that such a perspective was all but absent in contemporary cartographic enquiry.

By no means do I wish to say that scholars in geography and cartography have not tackled the changing landscape of map production. In his early seminal work on the relationship between traditional map-making and GIS, Muehrcke (1990) notes that '[m]aps serving as links to databases, not as ends in themselves, require design considerations that enhance this interface function. If we are to ask questions of the database through the help of a map, the cartographic interface should be as convenient to use and as intellectually stimulating as possible.' He called attention to the technological and artistic possibilities of turning maps into interfaces for underlying data structures and suggested several ways that such merger will benefit both fields. Nonetheless, this was done from a conceptual point of view, listing sweeping changes in both industries. Similarly, more recent works such as challenging GIS from a feminist perspective (Kwan 2002), considering the changing technological landscape on aesthetic design practices (Kent 2009) or user engagement with Google Maps (Dalton 2012) were all done primarily as a form of outside critique, without access to the bodies enacting the change.

One potential explanation is the overlap between map-making as profession and cartography as academic discipline. Despite being a writer who continuously points out the ongoing estrangement of those two disparate spheres (Wood 2003), Dennis Wood is a prominent example of someone who both makes maps and writes about them. Specifically, and relevant to my own interrogation, he documents the uneasy relationship between design choices and emerging power structures (Wood and Fels 2008; Wood 2010) and – as a practicing map-maker – is keen on the miniscule details important for the type of research I intended to perform. However, as a singular activist/map-maker, unaffiliated with any academic or commercial entity and working by himself in a strongly ideologically motivated fashion, he purposefully refuses to conduct action research with mainstream mapping institutions, as he sees them compliant in the atrocities performed by the Western cartographic apparatus. He also, until very recently, rejected looking into non-paper maps, which clashes with the purpose of this dissertation. Even though he writes on the politics of producing maps, he does not base it on research with the people or technologies pushing the change in these production processes. To some extent, such a lack of ethnography is also a counterpoint to the domination of quantitative principles and the turn to GIS since the mid-70s (Tobler 1976; Clarke 1990; Dodge, Kitchin and Perkins 2011c). The spiralling of cartography into a quantitative structured profession and away from the artisanal discipline has created a publishing environment where those

engaged with the hands-on components of the discipline write technical papers advancing particular problem-solving strategies to similarly competent individuals, while a growing minority criticize those practices from critical-theoretical point of view. Counter-mapping initiatives and collectives were also operating within a homogenous field. The rise of contemporary widespread commercial digital cartography, with its standardized aesthetics and simplified controls, has also been scrutinized primarily from either technical (micro) or political (macro) claims (Dodge, Kitchin and Perkins 2011a). The rare discussion on structural changes in the fields of geography and cartography often looks inwards, at the relevant departments and curricula (Wyly 2014). In both 'regular' and 'critical' cartography, large swaths of the debate seemed prescriptive and normative rather than analytical. As an outsider interested in understanding the production processes of mapped media from a processual and emergent point of view, none of those two directions suited me.

As my literature review for methodologies progressed, the scope of my own project began to shift. Instead of strictly contentious and political maps, I became fascinated with the ubiquity of emergent widespread, everyday digital mapping platforms such as Google Maps or the GPS-navigational applications for smartphones. Whereas the former had a comprehensive body of scholarship, stretching from antiquity well into the modern age, the latter had a far more dispersed corpus.

And so, the scope of case-studies shifted accordingly, and I began searching for entities creating maps for the uninitiated, the non-professionals. My research assumptions were that the institutional environments producing such assemblages are changing and are rather different than how the cartographer's workspace was represented traditionally. My first attempts involved contacting large organisations that made maps catered to many users. The way to approach such organisations required a lot of thought. Much of the methodological guidance coming from geography and cultural studies – the disciplines my PhD socialization occurred in – focused on marginalized and disempowered groups, in the traditions of action research where 'the scholar and the, usually subordinated, people being studied engage in a critical dialogue, in which they both aim to question their preconceptions about one another and the situation, in order to fetch a course of action for empowerment' (Saukko 2003, 77).

When considering my own positionality, I was advised to carefully weigh my own privileges (especially as a white heterosexual able-bodied male from a developed country) in mindfully treating those I aimed to research. However, far less was written on approaching and studying similar privileged groups, particularly as ICT employees, the population I intended to engage, were

becoming one of the most powerful classes in the world. Literature on delving into complex production processes and supply chains still focused predominantly on developing countries and the plight of their workforce. The most relevant work involving modern mapping, privileged user groups and ethnographic inquiry that I found came from exploration of OpenStreetMap users (an open-source, Wikipedia-like initiative for community mapping). Similar to my cases, the OSM users are mostly technically-savvy users engaged with transformative technologies, albeit with questionable results (Perkins and Dodge 2008; Haklay and Weber 2008; Gerlach 2015;). The differences are in the hybrid status of OSM-mappers, who act as map-makers while still operating within the bounds of the parameters dictated by the OSM governing bodies (although with an enhanced ability to alter those bounds by, for example, requesting changes in file types or additional map categories). Another relevant consideration came from the project of Ned Rossiter (2015) and his exploration of world's largest logistics companies that I unpacked in the previous chapter. My chosen methodology emerged as a synthesis of geographical approaches to exploring lived realities (Crang and Cook 2007) with media theories, particularly drawing from production studies (Tuchman 2002; Caldwell 2008) with their aim of 'complicat[ing] personal stories by locating them within larger cultural studies of discrete production communities, their material cultures, and their historical contexts' (M. Banks, Conor and Mayer 2015, iv).

Ultimately, my case selection was guided by similar principles. Like the authors in the edited volume from which the citation above was taken, I too aim to scrutinize how the interplay between the personal agency of a creator and the material-cultural circumstances of her workplace end up shaping the media product she is co-creating. Unlike them, my case-studies were not popular television series, films or YouTube clips. As I show in the preceding chapters, digital maps can be understood as media. They are produced by collectives, but the individuals involved have specific roles that help shape the production flow. Maps have always had a narrativistic component to them, and I was looking for methodologies that emphasize how such cultural narratives emerge from labour practice. Coming from both social science and humanities traditions, production studies are concerned with the spaces of production – homes and offices – or 'sites of simultaneous privilege and struggle, whether by class, race or gender' (ibid., xi). Work in this field has also been particularly interested in the transition from analogue to digital means, and in particular how similar software is appropriated by different groups to produce different cultural products (Puijk 2008). This is in contrast to the prevailing methodologies in organisational sciences that look at quantifying or at least modelling the implicit value of technological innovation (Orlikowski 2000). I aimed to find sites that

would allow me access to such spaces, to investigate the effects of digitalisation on the work cultures of their inhabitants, and to see how this shapes the (digital) end product, while maintaining the proper disciplinary focus. Unlike 'traditional' cultural media, maps are seen first and foremost as 'serious', including by the people making them. This is where the study on play detailed in the previous chapter was also very helpful in approaching the cases. Previous ethnographies of play (Geertz 1972; Malaby 2003, 2009) showed how seemingly innocuous activities carry severe societal implications, and the workplace especially (Mainemelis and Ronson 2006; Yee 2006).

Finally, much of the way I approached my case-studies was informed by ANT methodologies. They stem directly from the theoretical foundations of ANT, and some would argue that in the broader field of material-semiotics, ANT is more of a methodology than a theory (Sayes 2014). In this view, ANT involves primarily which tools one employs when approaching an object of study rather than what constitutes the ontological nature of said object. Therefore, when subscribing to ANT, one accepts the primacy of relations between actors rather than the actors themselves (Law 1991; Latour 2000), the way technological aggregates embody the temporary crystallization of such relations (Latour 1987, 1999) and the ways such crystallizations (or punctualisations of the network) are embedded with meanings that can be accepted or discarded – which I discussed in detail throughout the previous chapters (Woolgar 1991; Akrich 1992; J. Banks 2014). I understood that from a processual point of view, to speak of 'the map' in a general context makes little sense. My intentions were far from claiming that all such maps are similar in the way they mediate spatialities for their users. In fact, from an ANT perspective, the world is comprised of an interlocking chains of actors, where alliances between humans and non-humans (the user, the phone, the screen, the map) are made and unmade within the immediate and concrete. ANT scholarship is at its best when analysis arises from meticulous description, but in a way that sheds light on spheres beyond the immediate case-study, such as when charting a botanical expedition to the Amazonas reveals the practices of scientific research and the constraints of turning raw data into a published paper (Latour 1999). The role of *the digital map* is similar; it is a placeholder for a broader set of explorations into the roles that specific mapping(s) generate, by looking into particular cases.

Attempting to reconcile broader theoretical frameworks with particularities is never easy. To do so, I take precedents from other works that look into the particularities of changing digital landscapes, but without creating broad generalizations and enacting 'codes of conduct' to further explore and research instead. Thus, Kallinikos and colleagues attempt to provide a 'middle range theory […] focusing on particular practices or contexts without losing sight of those generic

processes that recur across context as the result of the diffusion of information technologies' (Kallinikos, Aaltonen and Marton 2010, n.p.), offering a general theory of digital artefact attributes – editable, interactive, reprogrammable and distributed – that arise from a set of shared qualities of data objects, but without attempting to deterministically define their actions in the world. In a somewhat similar manner, Bogost (2006, 2007) also offers a useful analogy in his approach to a different subject matter – video-game critique. He first establishes the 'unit operations' as a distinct method of analysis centred on interlocking units of meaning within a text (building on Harman's [2010] object-oriented ontology); he then proceeds to define video games as particularly prone to such analysis due to their procedural and combinatorial nature and finally demonstrates the critique in a game while constantly challenging his previous assumption in lieu of the case-study's particularities. Methodologically speaking, this allows for constructing a non-teleological and non-essentialist approach, which informs the topic of digital maps. Since, despite the fact that all digital maps are different, there are similarities between the interfaces and the underlying promises of a more accessible, understood and 'real' world they present to users (Elwood and Leszczynski 2012).

Going back to the question of ANT's applicability, I found that while it is effective for describing the cascading agency across different human and nonhuman actors, it is not enough by itself. ANT's lack of acceptances for the conceptual framework lying beyond the network has been heralded as one of its major strengths, but ultimately imposes unnecessarily limiting – and often tedious – restrictions on the researcher's role. I disagree with Nick Couldry's assessment of media studies' compatibility with ANT, which 'as a theory of networks between human and non-human actors, has very little to say about processes that come after the establishment of networks: what comes after – the acts of interpretation and attachment – becomes mysterious because, by definition, it cannot be encompassed in an account of how the broad infrastructures of actors and objects (on which, to be sure, it depends) have emerged' (Couldry 2008, 103). The notion of affordances, research done on users and usability and the increasing role of such techniques in the making of media – as detailed in chapter 1 – reinforce ANT's usefulness to tracking imbued meanings in media production. The reason I find ANT lacking is its reluctance to engage with notions of culture and its propagation. By that, I specifically mean the idea of designer culture or workplace culture and how they affect the end products of technological production. Latour famously warned that any 'invisible' conceptual structures, such as ideologies, are useless in sociological enquiry. To him, if the actants themselves are not aware of an extraneous factor, then there is no point of bringing it into the fold (Latour 2005). Explanations involving, for instance, 'capitalism' are inefficient in that they distract

from the materiality of the space being researched and the translation processes occurring there. However, in my own cases, I found such an approach limiting. While it is possible to explain notions of design influences or changing landscapes of media consumption as additional actants in the broad network, this leads to a cumbersome and somewhat artificial form of research and writing. This issue and how introducing additional cultural theories solves it will be expanded in section 3.2.2 of this chapter. For now however, let us summarize this section by looking into the detailed process through which my case-studies were selected.

After reading literature on geography and critical cartography, media studies – dealing with production in particular – and science and technology studies' ANT tradition, I decided to engage in ethnographic work into design processes of modern popular maps. Building on ANT, I wished to go into the field and 'follow the actors themselves' (Latour 2005, 12). However, in line with cultural studies of media traditions, I was also interested in the interplay between global changes in media landscapes, changes in the workplace and the resulting transmission of mediated information through maps. In the end, the case-study selection was – as it always is – a negotiation between my ability to locate and gain access to organisations and their suitability. When selecting an organisation, there were several criteria to consider:

- The levels of cartographic practice: the organisation in question had to be in the business of map-making, at least to some extent. While it did not have to be primarily focused on or even defining itself as making maps, it had to have a major map-focused project.
- The map in question should be a popular map, i.e. aimed at non-professional users and competing with other, similar services in the digital market. I discussed the need for such delineation in detail when defining 'the digital map' in chapter 1. This delimitation allows me to focus on maps as communicative tools from a media researcher's point of view and link them to broader changes occurring on digital platforms. Thus, I limited myself to not approaching organisations creating GIS-based programs for professionals (for instance, those involved with city planning or geology). The scope of a framework grounded in casual power relies on the idea of users being *uninterested* in the map beyond the immediate functions it allows them – and the ways such user's attention is captured.
- The organisations should be in a self-acknowledged process of transition, for example between different products or to a newer version of a product. This would help with comparative analysis of the changes it enacts and why. Such an organisation would be more open to questions about old versus new and the decisions that went into the change.

- Due to language limitations, it was imperative for the organisation's daily communication to be conducted in a way I could understand and document. This included not only scheduled meetings and projects but also everyday banter,

  > [g]iven that the goal of ethnographic and related qualitative research is to understand something meaningful about the lives of other people, the language(s) within and between which this understanding develops requires some detailed thought. When preparing for fieldwork, two main questions need to be addressed in this respect. First, to what extent should the researcher's linguistic competences or 'pure' research interests decide where and with whom their research is best undertaken? And, second, how effectively can they then usefully translate meanings from the language(s) used by their research participants into those that they and their likely audiences like to hear? (Crang and Cook 2007, 36).

This left me with three possible language settings, in order of mastery: Hebrew, English and Russian. While my mastery of Hebrew and the Israeli cultural setting supersedes the other two, my main concern in regard to it was the lack of professional practice, as most of my familiarity with the world of maps (and media) came from a predominantly English-speaking environment and training.

- Practical limitations, such as living costs and travel expenses were also a consideration, as well as potential visa requirements (as some of my research could be considered 'work' by the host country, leaving me and the organisation open to a legal follow-up).
- Finally, the willingness of the organisations in question to allow me access. I have approached several places both in writing and through existing social networks, and to each, I offered a tailored package in which I 'sell' my service and explain how my research could benefit them directly. Saukko (2003) suggests using rhizomatic analysis in ethnographic work: moving beyond subject/object dichotomy, she argues for a dialogic mode of engagement between the researcher and the respondents that does not aim at achieving a consensus but allows maintaining multiple viewpoints. Initially, I tried to subscribe to this view from the introduction phase, attempting to present in full my views on the world of maps and mapping, but after several rejections from various organisations I changed my tactics. While I never lied about the purpose of my inquiry, I felt it was counterproductive to present it in a way the other party would not understand or find desirable. In this, I found the following suggestion of Crang and Cook regarding multiple truths behind any research projects invaluable:

> [t]hroughout this book, however, we draw upon examples of 'ethical' research in practice that turn around every one of even the ESRC's older minimalist three-point list of considerations. In terms of the first, we have experience of situations where being 'honest' with the people involved in our research may have been 'unethical', and where such 'honesty' was extremely difficult when the purposes, methods, uses and risks of research were changing as projects proceeded. When research changes as you do it, yesterday's honesty can often become tomorrow's apparent lies. In terms of the second consideration, we have found ourselves in circumstances where confidentiality was very difficult to maintain and, indeed, where research participants have insisted on not having it. Finally, in terms of the third consideration, we have already questioned whether research can or should be 'independent' or 'impartial' when we live in a world where gross inequality and injustice is all around us (Crang and Cook 2007, 30).

I was under no illusion that I would be received with open arms, realising from my previous experience that as a temporary outsider to any team, I represent, in the best of cases, a drain on time that needed to be brought up to speed, or at worst a potential threat to the organisation's goals and image. Indeed, for the better part of my second year, I was growing increasingly desperate, as I felt ready to begin collecting material, but no such opportunities were present. Eventually, chance had as much role in my case selection as pre-planning. After all, '[d]oing research is a matter of not only following instructions and making logical choices, but also of casting nets quite widely, following hunches, looking for inspiration, being lucky now and again, seizing opportunities, thinking laterally, trying things out and trusting that all will probably work out in the end if you know roughly what to expect about your research process' (Crang and Cook 2007, 205). The two cases presented themselves, one after the other. First, during a conference on cartography, I met and conversed with the outgoing director of Israel's cartographic survey agency, who showed polite interest in my project and connected me to the organisation's chief scientist Not long after that, a friend engaged in research on crisis mapping told me about an interesting interview he had had with a CEO of a small Israeli start-up that made customisable dispatching systems for emergency services through a predominantly map-centred interface. Those became m**y cases.**

3.2.Case-studies: ethnography and auto-ethnography

After several rejections and misfires, I arranged to conduct two months of research with two organisations in Israel. This represented the optimal compromise in terms of timing, language and availability. These were:

1. Mapi[18] – Israel's national mapping agency for cartography, GIS and cadastral registry. Specifically, the web-cartography division was in the middle of a transition to a broader, more inclusive model of providing cartographic information to ordinary citizens. While it still aims primarily to collect accurate governmental geodata and provide it to professionals (other governmental institutions, planners, building contractors), it was also involving the public in its materials dissemination for the first time. The aim was to upgrade their existing public map server and make it more accessible and geared towards particular audiences (people with children, home buyers), giving them tools for decision-taking via the government's geospatial platform. My job within the organisation would have been to examine an ongoing tender for the system's upgrade, for which an outsider contractor had received a list of tasks, and comment on additional changes that might be enacted.
2. NowForce are a small-to-medium business that make dispatch and emergency systems. At the time, they were in the process of rolling out a new version of their (paid) software that put a greater focus on the map component (as opposed to a previously table-heavy UI) and was envisioned to allow multiple tracking and actions via the map, in a way more akin to other modern mapping interfaces.

For each case, three main methodologies were used: ethnography, auto-ethnography and interface analysis. Each had its own highlight and pitfalls.

3.2.1. Ethnography

ANT is closely linked to the ethnographic tradition of grounded theory (Glaser and Strauss 1977; Corbin and Strauss 1990; Denzin and Lincoln 2005). Grounded theory rejects a priori theoretical constructs, but instead relies on inductive iterative analysis of the respondents' discourses. Theory is supposed to emerge organically, from the textual analysis of transcribed interviews and

[18] The official title of the body in question in English is SOI – 'Survey of Israel'. In Hebrew, it is abbreviated to Mapi, which corresponds to the Hebrew word for a map – *mappa*. This is what all of my respondents call the organisation, and I found it much easier and less cumbersome to use it rather than the English abbreviation. It is also easier to pronounce when reading the text.

observational notes. Related concepts are bundled into groups until larger central themes emerge. Similarly, ANT largely denies the existence of structures that cannot be described outside the language of the actors themselves, but extends the voice given to respondents beyond the human, to allow sociotechnical assemblage to develop their own terminology. This happens when affordances of certain objects allow or deny co-existence, and thus cooperation, with other objects (Mol 2010). By tracing these links, one gives voice to the objects alongside their human counterparts.

The challenge involved in bringing the mapping objects to the fore was understanding the technologies of production at each organisation. Throughout each week, I spent between two and three days with each, depending on the tasks at hand. The first few days involved establishing the structure and responsibilities of different actors and charting this structure for myself. Then, I conducted interviews and observations, attended several project meetings and worked closely on my own contribution with one or two people from each organisation. Each task was different, but both similarly gave me an insight into the interrelations of the various objects. In the end, 20 interviews, ranging from 20 minutes to an hour and a half, were conducted. The average interview lasted around 45 minutes, and most of them were conducted with a single respondent. Of the interviewees, 17 were chosen as relevant to the case-study; of the other three, one was deemed too technical for the purposes of this dissertation, and two others opened an enquiry direction which was beyond the scope of this thesis, namely the relationship between governmental and private open-data policies. The interviews were semi-structured with a check-list style list of topics which also permitted shifts in the discussion if needed. The nine topics were:

1. Who are you and what does your position entail?
2. What is your professional history? How long have you been working here?
3. Did you have any map-related interests before this job? If so, for how long?
4. Sketch on a piece of paper how you see your work process.
5. Give me an example of a specific task or assignment you are working on currently. Show me on the workflow sketch where is it located in the process.
6. Who gives you data/information – on whom are you dependent for the product of your work?
7. To whom do you transfer the results of your work? To whom do you provide data? Who is your user?
8. What do you want this user to do with what you provide him or her?

9. What are your hobbies and how do you spend your leisure time? Do you use a lot of apps on mobile phones? Do you play video games?

At Mapi, Israel's National Mapping Agency, my work started with reviewing 100+-page documents intended as both conceptual and technical descriptions for a governmental tender for upgrading the existing web-based map interface for wider publics. It allowed me to familiarize myself with the language and the goals or the transition at stake, and following, conducting interviews with the team members, asking about histories, previous versions and future goals of the project, as well as additional inspirations that they had for particular components of the tender. Additionally, the technologies it mentioned provided a gateway to additional, non-human actors, and I used some of the time between the interviews to get acquainted with their technical specificities, which enabled me to further question the people involved on alternative choices for technical solutions and the reasoning behind their implementation

According to Chris Perkins' analysis of national mapping agencies (Perkins 2009), these are organisations at a crossroads. The dominance of the nation-state over mapped data has eroded, market logics have substituted national pride, the opening up of knowledge-production tools makes traditionally trained cartographers unnecessary etc. Digitalisation and the move of mapping onto the World Wide Web have, moreover, thoroughly destabilized both the products of such agencies and their work-flows. Overall, the agency today will look very different than 30 years ago (figure 3.1)

Typical organizations in 1975	Typical organizations in 2007
Official mapping agency Production-driven, functionally organized, public-funded, hard-copy maps, e.g., Ordnance Survey	Official mapping agency Market-oriented, flexible public-private partnerships, digital framework data, e.g., Ordnance Survey
Commercial map publisher Specialist market-oriented compilation and publication of derived hard-copy maps and atlases, e.g., Phillips	Portals Free web-served access to third-party mapping, with capability for user design, e.g., Google Earth
Map shop	Value-added retailers

Hard-copy map sales, e.g., Stanfords	Multiple data sets customized for targeted market, e.g., Landmark Information Group
Map library Classified hard-copy collections of published mapping, e.g., British Library	Spatial data clearinghouse Online access to spatial resources with search engine access, e.g., EDINA Digimap
Cartographic service company Survey companies, drafting companies, freelance cartographers, e.g., Fairy Survey	Cartographic service company Mapping consultancies offering turn-key services, e.g., Lovell Johns
Cartographic society Regulated membership, meetings and conferences, training, e.g., British Cartographic Society	Social networking sites Blogs, e-mail listings, virtual communities, e.g., The Map Room

Figure 3.1: The changes in various mapping agencies over time. Reproduced from Perkins (2009, 348)

My introduction to Mapi uncovered a picture corresponding to the analysis above. In parallel to my studying the tender document, I arranged for meetings with departments outside the web-cartography team and questioned them about their modes of work, products and interfaces with the web map. The goal was to create an enduring descriptive chain of associations between the various types of data and end products, within the web-cartography team and beyond it.

NowForce presented a more nuanced case. They are, in the language of the table above, a new type of cartographic service company. They target particular professional audiences (dispatchers, law-enforcement agents) who might be intimately familiar with GIS and mapping. This made them, at first sight, not very suited to the casual-power framework, as their user base seemed professionally trained. However, as I learned when discussing them with a friend who provided the initial contact, they cater to clients who are not interested in maps, but rather require efficient ways to conduct their

action in space. The map is simply a backdrop and most of them (the agents in the field) have never received any map-related training. NowForce began as a volunteer-based organisation, with commonly available off-the-shelf technology. They see themselves as a bottom-up grassroots mapping effort that now aims to capitalize their understanding of 'the end user's real needs'. Thus, my first task with NowForce was to clarify how suitable a case they are for my research. Parallel to that, them being a commercial company, I felt much more pressure to provide immediate tangible benefits from my presence there.

And so, my work there involved rapidly understanding their business models and target audience, and sitting with the Chief Technical Officer and the Product Manager in order to come up with short-term contributions to the project. Soon enough, I found out that they are, in fact, very suitable in terms of the subject matter and proceeded to carry out interviews with developers and participation in some of the project meetings.

One specific aspect of work that was unique to NowForce was setting up the usability tests for the latest version of their software. The idea behind the transition was to augment the role that the map – rather than other display elements – plays in the information-processing and decision-taking process of the dispatcher. During my stay with the company, I offered to help them test out some of the assumptions that they had about the new interface, and especially about whether even users who were previously unfamiliar with dispatching software find it more intuitive. In order to do so, I cooperated with NowForce's product manager and set up a day of usability testing. We invited three users to NowForce's offices, where one of the meeting rooms has been converted into a test room. The users were all male, aged 29, 31 and 34. They were recruited on the basis of previous ties and skill level alone: one user had no familiarity whatsoever with the type of software we were testing; another possessed some domain expertise in the field of mapping and GIS, from working in security-related position and then studying Geography at a university level; the third was a professional dispatcher working for one of NowForce's clients, but lacking any experience with the new interface. The testers did not receive any monetary compensation other than transportation to the NowForce office and some light snacks and drinks as part of the testing.

Each user sat in front of a standard consumer computer (Intel i3 with 4k of RAM), connected to two 21' screens. The set-up aimed to replicate working routines of emergency dispatchers, usually working on two or more screens to maximise efficiency. Each of the users was familiar with and could work competently with the dual-screen set-up: the intermediate and professional from their work in mapping, the beginner from his professional experience as a video editor. The users' faces

were filmed with a small camera positioned on the table in front of them. Simultaneously, both screens were video-captured using the open-source CamStudio software and its companion codecs. The recordings were then exported into an MPG4 container and put in a shared Dropbox folder accessible to the product manager and me.

Each testing session was conducted in two parts. The first required the user to perform a series of tasks on the screen (Appendix 1) involving a range of items, from general familiarity with the system to specific procedures related to understanding the map's function, such as locating a 'user' icon type on the map and giving directions. Throughout this phase, we instructed the users to perform think-aloud protocols, providing commentary to their actions on screen. After a ten-minute break, the testers went through a second phase, a simulated experience. In it, I played the role of a distressed customer on the phone, and the tester was attempting to perform the corresponding action while being engaged in a phone call.

Each test session took about one to 1.5 hours, with the set-up taking an additional hour and a half. With the need to coordinate and transport the testers, the three tests took us the entire working day. While three is less than the five tests Nielsen suggested for a usability group (Jacob Nielsen 2012), we felt that this provided us with sufficient data. Moreover, the company did not allow us to devote more than one day to the procedure. After completion, we watched the video together, grouping the issues arising from the words and actions of the users while attempting to find corresponding problems across all trials (Appendix 2). The results were also presented to the NowForce team for further feedback.

When doing ethnographic work, one must consider the question of validity. When quantifying the work I have done at both organisations, 17 final interviews and three test users do not seem to be very much. It is far more difficult to quantify the hours of observations performed, the informal talks with my temporary colleagues or the mentions of software or concepts that sent me frantically searching online for more information in order to better understand their craft. Therefore, the benefits of the type of research I perform, depth, complexity and personal interpretation also make this work difficult to validate. Moreover, while usually less of an issue to a qualitative research, validity also has implications for the findings' reliability, or applicability to broader domains beyond the immediate groups.

Crang and Cook (2007) suggest three aspects of ethnographic validity: theoretical sampling, or making sure you interview the right people on the right subjects after doing your homework; theoretical saturation, or making sure you keep your fieldwork until you start hearing the same stories

and realize that no new information is being obtained; and theoretical adequacy, meaning the iterative process of searching for and referring to additional literature not only before but during your research. I will talk more about this aspect of my research's validity in section 3.4 of this chapter. Similarly, Saukko suggests using dialogic validity – representing the points of view of every member of the researched community fairly while maintaining contextual validity by acknowledging both the uniqueness of a social context and historicity of the specific research type one is engaged in. As I will show through this and next chapters, I tried to remain true to all those recommendations.

3.2.2. Auto-ethnography

Auto-ethnography has a long tradition in both the social sciences and more humanities-oriented cultural practices (Ellis, Adams and Bochner 2011). Saukko (2003) suggests conceptualising auto-ethnography as a self-reflexive Foucauldian practice that critically engages with the writer's own experience, the discourses that engender such experience and the identities that constitute them. This follows the traditions of fieldwork as dialogic and co-constructive, rejecting the dichotomy between the means of producing knowledge and its results (England 1994). Often, such research is deeply personal and purposefully breaks away from established academic traditions of writing. Ellis and Bochner (2000) are recognised scholars in the field, with a large following advocating *evocative auto-ethnography*, which focuses on aesthetic rendering of personal research experiences in ways that blur academic writing with literary genres such as biographies or memoirs. The shift happened from previous, predominantly-positivist ways of doing ethnographic work occurred in recent years, as

> [g]radually, scholars across a wide spectrum of disciplines began to consider what social sciences would become if they were closer to literature than to physics, if they proffered stories rather than theories, and if they were self-consciously value-centered rather than pretending to be value free (Ellis, Adams, and Bochner 2011, 2).

In this view, auto-ethnographers produce 'thick descriptions' (Geertz 1973) that work alongside data to contextualise and nuance the process of data collection. Additionally, such an approach pinpoints how data collection and its interpretation occur simultaneously, as opposed to traditional linear accounts of knowledge production. This, warn the detractors, can lead to overly solipsist and narcissistic forms of writing where the 'writer's subject becomes the writer's object and the writer's object slides gently away' (Pile and Thrift 1995, 16). This does not have to be the case, though, and Crang and Cook suggest instead that auto-ethnography is not so different from traditional

ethnographic writing, as it focuses on recognising how and why a researcher becomes particularly interested in a subject, what personal connections to the subject exist, how things can and do go wrong and why it is important 'to start such writing before you know exactly what you want to say' (Crang and Cook 2007, 175). In this regard, the writing of this dissertation has been profoundly auto-ethnographic. In the following chapters, I detail the way digital maps are made, while positioning it in the context of an emerging topic, in a complex and multidisciplinary research project, and from someone seeing himself as an outsider in the field(s) and often suffering from a massive impostor complex. When listening to some of the audio logs that I recorded on my return car trips from the case-study locations, I heard myself doubting the applicability of my skills to the task at hand, the extent to which I understand the (technical) aspects of the craft and, therefore, the 'correctness' of the questions I was asking.

However, there is a slightly different way to understand auto-ethnography, which I found very useful and attempted to include in my writing as well. Anderson (2006) suggests using auto-ethnography as part of the *analytical* tradition of anthropological enquiry, tying the reflexivity of the auto-ethnographic method to the broader social context of the researcher as participant-observer and utilising it to advance theoretical knowledge rather than only exploring emergent personal narratives. Thus, the recommendation goes *against* the call to write in a way that 'refuses to abstract or explain' (Ellis and Bochner 2000, 44). This framework includes five components:

1. Complete member research (CMR) status – the researcher is part of the social order which she is writing about. This may come in the form of the 'opportunistic' CMR – as in being born into a group (commonly exhibited in illness auto-ethnography, for example) or turning an existing occupational or leisure activity into an object of study (e.g. skydiving in Anderson's case). The second, rarer condition is of the 'convert' CMR, who begins with data-oriented research and becomes part of the group in the process. In this sense, I am somewhat between the two states. My engagement with both mapping and location-based technologies began long before working on this PhD, but many of the specific skills relating to the design and production of maps, as well as the deeper understanding and appreciation for the craft of cartography, were developed during it. However, Anderson notes that as a CMR, I must also constantly acknowledge the difference of my status compared to other group members. In the most informal of settings, during excited friendly discussions about maps and user interfaces during a lunch break, without having any recording or writing equipment, I was still *also* a member of another community – that of researchers-

ethnographers. And as such, it makes my personal account less straightforward, due to my dual status that others lack.

2. Analytic reflexivity – while mainly reinforcing previously cited definitions of ethnographic reflexivity, Anderson has a different emphasis, in which '[a]s a CMR (in contrast to a more detached participant observer), one has more of a stake in the beliefs, values, and actions of other setting members. Indeed, the autoethnographic interrogation of self and other may transform the researcher's own beliefs, actions, and sense of self' (Anderson 2006, 383). In this case, my previous (failed) experience as an entrepreneur in the field of location-based gaming, my considerations of the state of the field and job opportunities inside and outside academia after the project is completed have all contributed to the manner fieldwork and research were performed.
3. Narrative visibility of the researcher's self – with this, one must strive to use the self-narrative in the text to advance dialogic theoretical understanding of others by sharing personal feelings and the decision-taking process behind the research stages. Unlike evocative ethnography however, I should avoid turning those emotions or decisions into the main aspect of the text, thereby derailing it from the issues at hand (maps, interface, power). Thus, this work will not include what was at the time a major component of my own emotional and personal state during the fieldwork: the feeling of being and working in one's country of origin and language after a period of several years' absence, and subsequently the complicated emotions following the outbreak of Operation Protective Edge, or the 2014 Israel-Gaza war. This led to many discussions at the intersection of politics and cartography, as well as several memorable interviews conducted in bomb shelters in part, or interrupted by sirens as missiles were detected en route to our area by the early-warning systems. However, in the broad scheme of things, this had little relevance to my object of study and had more to do with my feelings as an expat than with my informants' daily attitudes and conduct. After all, similar operations/wars with similar rocket strikes have taken place with increasingly regularity in the past decade (2006, 2008-9, 2012) and have unfortunately become a daily reality for many southern areas in Israel outside periods of 'official' war. Moreover, I specifically avoid referencing here the loss of civilian life on Palestinian side, not because of some political agenda or personal preference (I found the binary discourse with its inability to see shades of grey taking place in media and social media during that time utterly depressing), but instead

because of my recognition of belonging to a specific social group. Yet again, as per Anderson's recommendation, this will not be part of this thesis.

4. Dialogue with informants beyond the self – as an antidote to the pitfalls of solipsism and narcissism in auto-ethnographic writing, Anderson suggests grounding each piece of such writing in other types of data collected through the interviews. He sees author saturation as a symptom of insufficient engagement with others rather than the underlying issue and warns against generalizing from an '*N* of one' (Anderson 2006, 386). In conjunction with the previous principle, I tried to follow this suggestion and ground my own voice in those of the participants and through the types of work we performed together.
5. Commitment to theoretical analysis – finally, analytical ethnography does not aim to bring a personal narrative or insider's perspective to the fore, like autobiographical or a literary type of writing. Rather, 'the defining characteristic of analytic social science is to use empirical data to gain insight into some broader set of social phenomena than those provided by the data themselves' (Anderson 2006, 387). Such analytic practice is committed – without generalizing from the author's personal experience – to connecting the individual to larger social processes and theories through the greater body of theory. The personal voice is a part of a broader generalization aimed at elucidating a particular phenomenon.

This last aspect is why I found analytical ethnography particularly powerful and saw it addressing some of the issues lacking in ANT-type methodologies. This approach has helped me deal with the issue of being simultaneously an actor and an external observer of the described processes, which was particularly critical when I engaged with my case-studies professionally, advising them on particular issues or performing user testing with them. Returning reflexivity to the larger theoretical processes occurring in the world and documented by others allowed me to locate and analyse my own agency during the fieldwork. This dissertation is about people making mapping interfaces, but is also about *me* discovering how they are made and constantly moving back and forth between data collection and searching for theoretical foundations that would help me make sense of the data.

3.2.3. Interface analysis

From the beginning of the project, I intended to use interface analysis techniques to supplement my work. Throughout recent years, I have amassed a collection of annotated screenshots from

various mapping platforms, at different times and following different configurations. However, as time went by, it dawned upon me that my epistemological position is insufficiently anchored in my materials: performing analysis of interfaces *outside* my ethnographic case-studies seemed pointless, due to the fact that I could not tie them to my original network through any actors. Analysing the interface of maps that I became actively involved in creating and designing seemed too subjective. The solution emerged in two forms: first, I performed interface analysis on the existing maps-in-transition during my ethnographic work and integrated the results into additional interview questions to help me understand the objects better. Second, I used examples of critique from external interfaces to support or counter certain points made by my responders during the fieldwork and in the developing writing. In doing so, I was careful not to generalize in the case-studies on the basis of those maps, but instead use them for comparison and speculation. I predominantly employed the following: Google Maps and Apple Maps, two native mapping services for Android and iOS respectively; Waze, a crowdsourced gamified navigation app which was purchased by Google and presents an interesting case of interrelation between map and territory on which I have written before (Hind and Gekker 2014); Ushahidi, a crisis-mapping platform permitting rapid deployment and information collection on man-made and natural disasters; Ingress, a pervasive alternate-reality game played on a stylised map of actual existing places; and various (mini-)maps from computer games, primarily for questions concerning attention-grabbing design and usability solutions. Additionally, at NowForce, I performed action research in which we used HCI methods to execute user testing and evaluation of their new interface, as mentioned above.

Ultimately, I intended to use Stanfill's discursive interface analysis technique (Stanfill 2014) and Drucker's semantic frame analysis of structure and hierarchy of interface elements (Drucker 2011) while maintaining a Gallowayian (2012) approach to the interface as an effect rather than an object. Mel Stanfill, a communication researcher, takes cues from existing HCI usability research on the one hand and from Foucault and queer theory on the other to suggest a novel way of looking at digital interfaces. Taking the notion of affordance as applied to interaction design (Hartson 2003), Stanfill positions Foucauldian notions of power as productive to examine how users are encouraged to desire or dislike a potential action within the constraints of an interface. This also focuses on the way designers address users as Users, hailing them through the cues embedded in a particular interface and pushing them to accept their role as, for instance, either a male or female on a submission form, a 'fan' of a thing on a corporate or sport website, or a provider of an advertiser-engagement metric on a website full of moving images.

While not citing Bolter and Gromala, I find Stanfill's framework a direct continuation of their claims concerning the way designers make interfaces opaque or transparent in a process of constant adjustment in order to keep the user engaged. Marianna van den Boomen (2014) referred to this kind of interface manipulation as a metaphorical transcoding, indicating how metaphors both become naturalized in communication as meaning-making schemes and also occlude the original intentions behind them. To look at a digital map's interface is to unpack a metaphor within the convoluted space of icons, interactive and non-interactive map elements, the affordances of each such element to provide additional information (acting as a pop-up legend, for example) and many more things. For dealing with aesthetic components of the interface, such as colour or font particularities as well as particularities of images in relation to texts, I utilise visual critic Johanna Drucker's humanistic approach to internet analysis, which takes cues from visual traditions of art critique. Particularly, a very useful concept is taken from the analysis of comics, where the spatial arrangement of the different frames on the page and their transition is as important, if not more so, than the content of the frames themselves (Drucker 2011). Combining the three approaches allowed me to introduce my own, which is inspired by design practices surrounding casual games and gamified elements (Juul 2010; Deterding, Dixon et al. 2011; Fuchs 2012) and draws from persuasive design (Fogg 2002; Bogost 2007; Flanagan 2009; DiSalvo 2012; de la Hera Conde-Pumpido 2014) and software studies, with input from HCI and usability research (Jakob Nielsen and Molich 1990; Galloway 2004, 2006, 2012; Bolter and Gromala 2005; Manovich 2006; Drucker 2011; Farman 2012; Van den Boomen 2014). Such methodological approaches to interface critique are primarily concerned with (a) trying to interpret the designer's goal in addressing the user by (b) highlighting the most desirable (i.e. simple and attention-grabbing elements) and (c) considering what similar elements from *other* types of media can teach us about the metaphors behind them.

The inclusion of casual games as a design focus is not accidental. I have been fascinated with the ease and high usability possessed by those types of games – from *Farmville* to *Candy Crush* – for a long time. At the early stages of the project, I intended to show, beginning with interface analysis and supplementing it with ethnographic research, how maps are currently becoming more like casual games. However, during the fieldwork, I realised that such an argument was too simplistic and artificial, and did not fully correspond to the things I observed. Thus, it was time to make some changes.

3.3.Preparing for analysis, changing opinions

Chapter 2, with its emphasis on the multifaceted frame of analysis for maps, is a direct product of this post-fieldwork soul-searching. What began as a methodological chapter grew to a monstrous size while bringing more and more diverse theories into the fold. Following Crang and Cook's recommendation for theoretical adequacy as a component of research validity, I began searching for additional ways to conceptualise such concepts as play, experience and engagement with a designed object. The casual power framework is the product of this process. It distils the three main tropes that I ran into continuously while working through and coding my material: attention, gamefulness and quantification. It also highlighted play and playfulness as a thread simultaneously running through my understanding of the inscription process, the way user interfaces are affecting users and then the relationship between digital maps and surrounding media-scapes.

If ANT is a grounded theory produced by both human and non-human entities, then play became a sort of sensitising concept (Denzin and Lincoln 2005; Bowen 2008) for such a method. Sensitising concepts are gathered from literature in order to guide and direct emergent categories from one's respondents. They lay the groundwork for coding the results, and while they 'might alert researchers to some important aspects of research situations, they also might direct attention away from other important aspects' (Bowen 2008, 14). Thus, play became a prism revealing different kinds of relations through which the (auto-)ethnographic accounts can be read and understood. Play became a component of translation in the chain of association through which I made sense of the interface, the designer, the intent. It always came as an in-between thing, or an enabler: play as a mode of being in the world, quantification as an aspect of play, became playful engagement. This particular way of using sensitising concepts was partially inspired by Jaime Banks' (2014) methodology of object-relation mapping. In this unique take on combining grounded theory with ANT, Banks uses the basic unit of coding to understand phenomenal assemblages of play as relational links between two concepts, rather than concepts themselves.

From the beginning, my analysis was guided by the recognition of play as both a lens into the processes of map-making, as anchored in broader media culture surrounding it, and the product that is embedded in such maps. Over time, this idea became more nuanced and developed into additional components such as gamification and designing interfaces to be pleasurable and fun (Deterding, Dixon et al. 2011; Deterding 2015; Rossiter 2015), the cognitive fluency of encountering a familiar interface (Zajonc 1980) and the notion of quantification as allowing for certain types of engagement

unique to digital environments (Tversky and Kahneman 1973; Kahneman 2011; Grosser 2014; Schüll 2014).

3.4.Fabricating results

Fabrication has strongly negative connotations in the academic world. It reeks of fraud, or falsehood. However, digital ethics researcher Annete Markham is highly in favour of using this word for describing the products of qualitative research.

> [W]hen we remove the political baggage, fabrication represents the activity of combining, molding, and/or arranging elements into a whole for a particular purpose. Whether one is building ships, shaping metal for arrowheads, weaving a narrative, creating a documentary, or arranging data to make a particular point, the fabrication process is not value-laden in itself. It is only when fabrication is combined with deliberate ill-intention, deception, self-serving motives, or political gain that it earns its contemporary pejorative connotations. In anthropological or postpositivist research arenas, fabrication is actually an apt description for a process of interpretation (Markham 2012, 338).

In her view, the selections and narrowing-down inherent to each theoretical, methodological and logistical step of a research project removes most claims of unmediated truthfulness from the end result. Accordingly, there is much sense in fabricating an account that creates composites of events, people, interactions or processes in a way that, on the one hand, simplifies the argument for the reader while, on the other, helps maintain the anonymity of the people involved. While not fully subscribing to this approach, and especially avoiding the use of literary narratives as part of the writing, one technique that I adopted wholeheartedly was the idea of layered accounts. In this way, one combines personal voice with multiple voices of various respondents alongside theoretical insertions. I found this form of writing particularly productive when dealing with chapters based on a cross-section of the design process in a comparative way, rather than the traditional chapter-per-case-study structure.

For example, in chapter 6 of this dissertation, I present the ethnography of a UX company which provided services for one of my case-studies. Unlike Mapi and NowForce, the people there did not want to be named, and so to preserve their anonymity, I changed names and few other details regarding their location and clientele. I did so with the utmost care to preserve the essence of

what the people there told me and what I saw, but ultimately the burden of proof is on me. However, I did not see any other way to present the results from this part of my research along with the organisations that did not want anonymity and conflate the two. Ultimately, I prefer to fabricate rather than leave out what I believe to be crucial data.

And so, following my fieldwork, I utilized QSR's quantitative software package Nvivo version 10 (and later 11) to transcribe (and translate to English) my interviews, alternating between my laptop for writing and my PC for the transcription process. I then added my personal notes and – in one case – a non-recorded interview summarized from memory and notetaking immediately after the fact. I used Nvivo to create, among other things, nodes relating to workflows, user interfaces, quantification, conceptions of users and the role of the designer. Each node contained quotes and notes compared across both cases. This allowed me to construct a vertical slice of the map-making process while highlighting certain aspects of the production process in relation to designer intent and user participation. To code for themes, I utilised word clouds (Denzin and Lincoln 2005). Eventually, a text emerged that followed from the actors themselves.

How good is the final result? Laurel Richardson suggests the following criteria in evaluating the product of ethnographic inquiry:

> 1. Substantive contribution: Does this piece contribute to our understanding of social-life? Does the writer demonstrate a deeply grounded (if embedded) human-world understanding and perspective?
>
> 2. Aesthetic merit: Does this piece succeed aesthetically? Does the use of creative analytical practices open up the text, invite interpretive responses?
>
> 3. Reflexivity: How did the author come to write this text? How was the information gathered? Ethical issues? How has the author's subjectivity been both a producer and a product of this text? Is there adequate self-awareness and self-exposure for the reader to make judgements about the point of view? Do authors hold themselves accountable to the standards of knowing and telling of the people they have studied?
>
> 4. Impact: Does this affect me? Emotionally? Intellectually? Generate new questions? Move me to write? Move me to try new research practices? Move me to action?

> 5. Express a reality: Does this text embody a fleshed out, embodied sense of lived-experience? Does it seem 'true' – a credible account of a cultural, social, individual or communal sense of the 'real' (Richardson 2000, 254)

I believe the resulting dissertation satisfies these requirements, and I will return to them in detail in the concluding chapter.

4. **Getting the Data**

'Software operates through a technological model that places a great premium on meticulous symbolic declarations and descriptions, yet at the same time requires concealment, encapsulation, and obfuscation of large portions of code. This is why programmers talk in terms of "software interfaces" or "application interfaces". Formulated as an assertion, software requires both reflection and obfuscation'

Alexander Galloway, 'The Interface Effect' (2012:64).

The following chapter is the first of three that use observational and other ethnographic data from my two case-studies to answer my research questions. To reiterate, my main aim has been to focus on *the processes through which digital cartographic user interfaces are assembled and inscribed and the power relations underscoring these assemblages and inscriptions*. When broken down into sub-themes, the following research questions emerge:

1. How can the processes of map-making be described, traced and captured?
2. What are the digital maps' user interfaces; how can they, and in particular the processes that call them into being, be theorized; and how are they different from what we would consider the nature of paper maps' user interfaces?
3. What are the specificities of digital cartography maker practices? How do they relate to traditional cartographic practices and how to digital media-production practices?
4. How does the process of inscription allow for the configuration of future map-users?
5. What forms of *power* does such inscription enable in digital maps?

Through the theoretical unpacking done so far, I began to answer some of these questions. Specifically, I use ANT to analyse map-making processes, utilising Akrich's (1992) model of inscription/description to account for emergent power relations. However, I also claim that such a model is insufficient, as it refers to well-bounded technical objects that can be delineated between various stages (design, production, use) and are incompatible with digital maps' convergence within other popular kinds of digital media (Jenkins 2006). Understanding mapping in such a context requires eliminating various binaries (Del Casino and Hanna 2006) such as productive/frivolous, work-/leisure-related, or stationary/mobile (Gartner, Bennett and Morita 2007) Therefore, I suggested a theoretical supplement to such power relations through modes of ludic engagement

driven by quantified user interface elements. Such quantification, I argued, is tied to the emergent logic of data-driven and totalizing digital media services, and their use within regimes of computation (Berry 2011, 2014) to facilitate ongoing engagement with products within the confines of ludic capitalism (Galloway 2012). Those theoretical constructs began to shed light on the changing nature of maps and map-making, and the need for multidisciplinary and layered work in understanding them, primarily engaging with RQs 1 and 2.

And so, this chapter and the following two build on my ethnographic data to answer the remaining questions. They focus mainly on contemporary cartographic practices (RQs 3, 4 and 5) that have been explored only theoretically so far. Ultimately, the question of power and practices wrapped up with inscribing such power into the map must be addressed. I do this by focusing on the realities of the two map-making workplaces where I have conducted my ethnographic research. And keeping Richardson's (2000) and Anderson's (2006) suggestions in mind, I aim to produce a rich account that not only answers those questions, but also provides a deeper insight into the people and other things that constitute maps and my own positionality as a researcher when interacting with them.

The casual power framework accounts for how the map-makers of my cases compete for attention through various forms of map design. This also reflects the way the data is gathered and structured for the map. The map must receive updated information and output it into readable and usable forms. Continuous updates mean both moment-to-moment engagement (between the user, the map, the data-server, the satellite etc.) and long-term commitment to accuracy and usability. Tracing the user allows for shorter and more precise reaction loops within the organisation and the software, helping the map accommodate its casual insertion into the former daily routines. Keeping the user engaged and coming back to the service – the map – equals a successful operation within the context of the contemporary attention economy, where active usage time and repeat use often overshadow or even replace traditional business metrics such as earnings or distribution numbers (Stiegler 2010; Crogan and Kinsley 2012; Terranova 2012). In this framework, numbers have multiple roles in the manufacturing of modern mappings: they are embedded in the databases and Cartesian coordinate systems that power the maps; placed as numerical elements into maps' user interfaces in order to simplify and elucidate messy realities into comprehensible digital approximations; and are the driving force behind metrics and efficiency driven organisations, aiming to appropriate the quantifiable behaviour of users in order to constantly improve its own (self-perceived) efficiency (Rossiter 2015). This chapter in particular relies strongly on the notion of 'data',

itself having a particular connotation with numerical information (at least for many of my research informants).

In line with the processual nature of the theoretical framework and the methodology, as well as with recognising the non-fixed and iterative nature of the studied phenomena, the empirical chapters are also based on production stages, rather than case-studies. Each chapter encompasses a stage in making the map. Following ANT principles, such stages were selected by me, and do not represent any fixed formalist breakdown of what 'digital map-making' should consist of. Rather, they are epistemological tools that allow examination of the relevant concepts. Each chapter is built on multi-layered data from the two case-studies. Explanations about the intricacies of each stage are taken from observations, interviews and secondary sources such as trade journals or specialist websites when necessary. While I attempt to find similarities in their challenges and solutions, I remain aware that there are no necessary parallels between a large public organisation and a small private start-up, and thus avoid compartmentalizing them into obligatory binaries. Moreover, to reiterate the sentiment expressed in chapter 2, the reader should by no means treat them as 'representative' or 'exemplary' instances of '*the* digital map'. Rather, the following chapters showcase two organisations in the course of transition, fuelled by processes of increasingly mutable, digitally available and accessible mapping software.

The remainder of this chapter deals with the extraction and manufacturing of data for the maps in question. It begins with the introduction of the role that 'raw' geographical data[19] plays in making the maps of my case-studies possible. This underscores the seemingly objective nature and cultural perception of data while unpacking it as socially-constructed and value-laden (Gitelman 2013). I continue with the exploration of databases, their prescriptive nature over the forms of data that constitute the map. Mainly I unpack the power implications of application-program interfaces (APIs) that allow easy linking between various databases, but within the constraints defined by the database owner. I use this discussion to exemplify how data and APIs are crucial to understanding the organisational structure and workflows of both the case-studies in order to unpack the emerging limitations for digital map-making as a data-driven pursuit. This leads in turn to the chapter conclusion, where I assess how such limitations, coupled with the affordances provided by the digital platform, affect the process of 'user configuration' into the maps' design.

[19] I use 'data' in singular and plural, rather than using 'datum' (Rogers 2012).

4.1. Introduction: Everything is data

An early visionary of everyday computing, Vannevar Bush, famously wrote that

[i]n fact, every time one combines and records facts in accordance with established logical processes, the creative aspect of thinking is concerned only with the selection of the data and the process to be employed and the manipulation thereafter is repetitive in nature and hence a fit matter to be relegated to the machine. Not so much has been done along these lines, beyond the bounds of arithmetic, as might be done, primarily because of the economics of the situation (Bush 1945, n.p.).

The economics of this situation has been since rectified, through various technological and societal developments. Selection and manipulation of data – the cornerstones of the cartographer's craft – are now being deployed on a large scale in semi-automatic modes. Fulfilling early predictions of map researchers, in modern digital environment *everything* is data and maps are databases (Muehrcke 1990; Crampton et al. 2013; Gerlitz and Helmond 2013; Gitelman 2013; Graham and Shelton 2013). The base-maps used as the underlying images of many digital maps often come in the form of raster data relying on a grid-based matrix of discrete cells. Various map layers are in turn reliant on relational databases that permit changing and updating the layer by editing (manually or automatically) the underlying tabular data. A business appearing on Google Maps, for example, occupies a dedicated Places of Interest (POI) layer and has various metrics tied to it, defining it as an object with certain characteristics related to both the geographical nature of the map (as in address, coordinates etc.) and to its specific nature (opening hours, type of store etc.). The way such a layer is defined, whether as point-based or polygonal, influences what kind of information can be displayed in relation to such business, i.e. specific exits and entrances or the floor level it is on. Moreover, it can be tied to additional data layers, such as images of the storefront taken and uploaded by customers or collected by Google's Street View service. Changing any of this will alter the results seen by the user, but their interoperability and basic adherences to standard database structures mean that editing and updating the map is easy. This ease also allows those outside Google to link their own databases to the map, first as a hack but later as Google Map's defining feature of mash-ups and customisation (Dalton 2012).

The principles of such linking have become widespread and mean that the effective operation of a computerised mapping system often relies on the successful aggregation, manipulation and implementation of data. Networked environments and high-speed internet also mean that such maps can continuously collect user data before and during deployment of new products or product versions, that updates can be released at irregular intervals and irrespective of the users' own

preferences (the 'perpetual beta' syndrome propagated by Google), and that resulting operational and business models are drastically different from traditional paper cartography.

The chapter continues with a consideration of what cartographic data is and how it is obtained. Then, an exploration of data practices within the organisation ensues, putting to the fore the internal workflows of data within the organisation, before they reach the user. In the final sections, I look into the history of my case-studies' emergence and consider the role of data in the inscription process by focusing on the user as data recipient through the interface.

4.2.Populating the database: receiving and providing data

Immediately after entering Mapi, you have the impression that the people there know what they are doing, and that they have been doing it for a long time. An old, hive-like building filled with creaking staircases and passages sprawls on a prime piece of central Tel Aviv real estate dating back about 80 years, to the British Mandate. Spacious rooms are made smaller by endless cubicles; walls are cluttered with maps and trophies; and the occasional complicated-looking printer or scanner is often stuck in the middle of the passageway. Those who are working almost resemble the building itself: predominantly middle-aged, looking very certain and purposeful, leisurely going through the workday with a conviction that only a seasoned government employee can muster.

Mapi has traditionally been in the business of gathering data, using various technological sensors to record and measure topological, topographical and geodesic aspects of the territory under its purview. Before the foundation of the state of Israel, it existed as a small offshoot of the British Ordnance Survey in Mandatory Palestine. The first geometrically-corrected aerial photos (orthophotos) were taken by the RAF in 1944 and subsequently used to make the first large-scale maps of the land. For several years, this operation was carried out by external contractors, until in 1956, Mapi, in its new form, resumed the work and has been carrying it out ever since. At the time of my visit (August 2014), Mapi was using a 12-year-old analogue photogrammetric camera and two additional professional aerial photographers while chartering commercial flight services from two separate contractors. Mapi plans the flight paths in-house and has increased its aerial photography workload, operated by two sub-contracting companies, from 60 hours to approximately 180 hours a year in the course of three to four years.

Today, they occupy a curious position of being both the regulator and a major commercial player. This is by no means a unique position (Perkins 2009), as '[m]ore recent trends in the

developed world have seen official mapping agencies gain an increased freedom from state control, reduced support from public sources, and increasingly commercial rationales. Indeed, commercial governance has characterized much of the history of mapping agencies' (ibid., 346). Currently, 70 per cent of Mapi's aerial photography operations are being requested by commercial companies, unlike in the past, when it primarily served other government branches. These services, despite being partially funded by taxpayer money, are nonetheless sold to the consumer, which caused quite a few murmurs among the professional GIS and mapping communities in the country as the agency became increasingly commercialised over the past decade and indirectly led to the foundation of the citizen-facing web-server that is the focus of this research. Members of the web-server development team, and in the orthophotography department at Mapi as well, have mentioned to me that they did hear complaints about the ensuing situation from other actors in the field, and that Mapi intends to gradually cease their operations as a commercial service provider, maintaining only their capacity as the national geographic-database provider and the enforcer of various standards and regulations in the mapping and GIS field. Similarly, it operates a small contingent of in-house ground surveyors and a rotating cadre of sub-contractors that perform corrections and produce supplements that aerial photography cannot provide. They are also performing R&D on the use of satellite-based remote sensing capabilities to automatically trace landscape changes and thus prioritise certain areas of the country over others in terms of work placement and updates. Additionally, they have begun deploying a team of special contractors to map and measure immediate changes – such as the 'opening of new interchanges that might be crucial to know now and not in the next bi-yearly update', as stated by Moshe, head of the orthophotography department. 'In this, we have very different needs from – let's say – Geodesy. An accurate measurement of the coordinates is less of an issue than just updating the street addresses involved.'

The photogrammetry and aerial-photography department is keen on reducing its active role within the greater assemblage of map-making by enabling secondary contractors. One of the ways that the process of transition is being kicked off is through the introduction of digital cameras. Despite these technological advances, Mapi did not begin implementing large-scale digital possibilities until 2009. From a causal power perspective, the ongoing digitalisation of the cartographic work presents both a challenge and an opportunity. From a position of '[a] formerly labor-intensive industry in which little changed and where timescale was largely irrelevant' (Perkins 2009, 348), Mapi is beginning to feel the pressure of digitalised marketplaces, where data is acquired, distributed and replaced faster than ever. Yet, they also realise the cost- and time-saving potential of

digitalisation, particularly when it comes to cheaper tailored solutions for specific issues, since even now, topographical data is being obtained through very expensive and carefully calibrated analogue cameras and is then scanned and digitised with an even more expensive and carefully calibrated scanner. Digital cameras, with their ability to shoot simultaneously in various spectra and integrate additional information (such as Lidar data to accurately gauge elevation), promise a cost-effective way to outsource and distribute the process of aerial photography, making it cheaper and more widespread. Thus, in this case, digitalisation is seemingly increasing the number of actors with access to not only the cartography itself, but also to the underlying data-gathering practices.

Despite the frequently-lauded democratization of cartography (Crampton 2009; Byrne and Pickard 2016), the process of obtaining and processing the base data from which maps are made is still prohibitively expensive and requires a great deal of skill (Perkins and Dodge 2008; Haklay 2013). For a long time, Mapi was dominant in Israel's cartographic landscape merely because it was the only organisation with the resources to gather and maintain such data. The appearance of computers and geographic databases changed little, since accessing and retrieving this information still required skills and technology that the general population lacked, and it interested only specialised entities. This has changed with the introduction of the web. My main tasks with Mapi had to do with the so-called w*eb-server* team, a unifying term for several projects aiming to bridge Mapi's closed geographic-database system and provide wide swathes of professional and non-professional audiences outside Mapi with simple access to the data confined within it. With the shift to digitalisation and operation of databases, the photogrammetry department's other main duty included being in charge of the BANTAL, the national topographic database, the backbone of many Mapi operations which will be elaborated further.

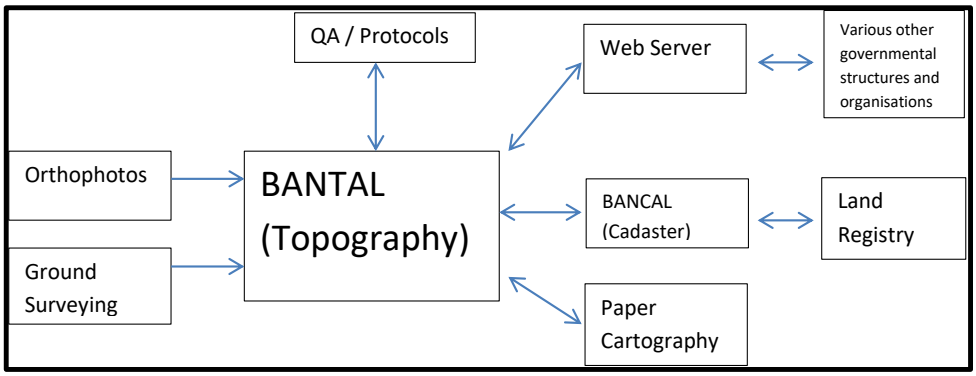


Figure 4.1: Schematic workflows between Mapi's departments and their inputs/outputs (relates only to those departments that were covered in my research).

NowForce, on the other hand, has a very different view of data. They not only provide data to their customers, they also receive data from them, integrate data into their own map-based display and deliver solutions based around fast and effective control of (mainly emergency) responders in varying situations. NowForce also prides itself on optimising what is shown on the map towards the non-professional – or less-professional – user. Amit, VP of research and development at NowForce, confirms this in an off-hand remark made on 21 July, 2014: 'we aim for the system to be intuitive. We want people to use it without training or with a minimal – half-hour maybe – tutorial.' This goal changes how they integrate their systems. It reduces the skill level required of potential users in stark contrast to traditional GIS-based responder systems that come pre-packaged with dedicated hardware. The latter require weeks of integration and training involving the seller's representatives at the place of implementation.

Part of this new model is to evoke the map only when it is needed. This is a distinction that will become increasingly clear throughout the coming chapters: for NowForce, the map component of its software is first and foremost a facilitator; thus, going through the process of developing a more map-centred display is still focused on the need to keep the users as engaged and cognitively-fluent as possible, whether using the map or not. Unlike Mapi's historically-grounded cartographic DNA, NowForce does not, strictly speaking, *need* to have a map at all. It just happens to be the best, easiest solution for delivering their collected information on a specific event to either an emergency dispatcher or an agent in the field. It is their way of inscribing an interface with the right information, to attracting and maintaining their user base. Miki, NowForce's sales director, laments the difficulty of finding new clients (July 27, 2014): 'the only way to define our business model is "managing operations and tasks in the field". Without the field element, the geography element, we have no unique selling point […] but the scope is very broad and we have to maintain focus. I keep rejecting proposals from delivery or taxi companies because they are outside our core business.' Despite the company's focus on map-based solutions (Miki acknowledges the visual power of the map as a control and reporting tool to captivate mangers' attention and convince them to purchase their product), she sees the web- and mobile-enabled map primarily as one item on a list of features, even though this feature is what makes them unique. I feel none of the reverie for the map-specific type of knowledge representation that I saw at Mapi. When I sat down to talk with Ronen, one of the two original developers who began working at the company, he seemed at first like the stereotype of the computer programmer: quiet, a man of few words – but with a sarcastic bent. He did not stop

working while talking to me, so our interview became somewhat awkward as I waited for exceedingly long pauses between his responses, looking over his half-turned shoulder at the work he was doing.

Me: So, is there anything special about this new map-based version that you are working on that makes it different from other Google Maps-based stuff?

Ronen: Well, yes, but just the things that are system-specific. [long pause, then looking at the new version] Things that have to do with missions, polygons, all those custom layers that the users define themselves.

Me: [looking at the varying icons on the display] OK, so [is there] anything specific in those layers? For example, do you ever get any requests to change the icons, the symbology of the map?

Ronen: No. The users can define everything themselves. Colours, lines, their starting location. The less we touch anything, the better.

Me: [trying to probe the topic from a different angle] All right, then is there any difference in terms of how you yourself work on the map, on those layers? Especially compared to other types of projects you've been involved before NowForce?

Ronen: No. Everything is code.

Me: I mean, even with the location-based stuff? The level of accuracy…

Ronen: Listen, all in all, I've been a developer for… eight years, you know. After a while, you get to the point that everything is the same. It doesn't matter what [programming] language you write in, doesn't matter what the underlying technologies are.

Ronen has been with the company since its inception, when it transitioned from a particular volunteer-based organisation to a commercial enterprise recognising the need for software-based dispatching solutions. In fact, he is the only one of the 20-some people at NowForce's Jerusalem office who does not actually work there. He is employed at a major software company that provided NowForce with initial coding services until it began to grow and hire its own staff. Ronen remained as an in-house external hire ever since, but at some point in one of our future conversations, he admitted that this status makes him care somewhat less about the product than most of his colleagues. After all, even if the company ceases to exist, for him it just means waiting for another assignment at another company. He also asks to borrow another employee's personal phone when he wishes to show me the NowForce app and its use of the phone's native (Android or iOS) map. He does not have the app installed himself. An employee just like Mapi's workers (albeit probably better paid), he distances himself from the product that he has been working on from the very inception, equating it, and the maps he came to specialise in, with any other type of service-oriented,

mass-consumer software aiming to compete for audience attention on a primarily commercial landscape.

Unlike the chat I had with the orthophotography-department members maintaining Mapi's main database (more on this to follow), Ronen cares very little about photogrammetry or maintaining seamless coverage of his client's territory through the map he provides them. NowForce does not even have a dedicated database employee, relying on a part-time contractor. Not even once during a conversation with him or any other NowForce employee did I hear any professional cartographic or GIS terms. When Mapi employees talk of data, their terminology refers to the data of latitudes and longitudes, or endless classification tables that precisely define the formats through which geographic objects (building, roads, pastures) are represented in their various databases in such a way that they can still communicate with and serve each other. When NowForce employees talk of data, it is first and foremost *Google's data* that power the base-map of their software, and NowForce project its proprietary, task-oriented layers on top of that. Those layers are comprised of NowForce's UI and the data provided by the customer for whom the map is tailored.

In each individual case, the various layers in question must communicate with the Google geodata (set through the API), NowForce's data structure and various client's systems which provide the situational data of units and events. Such a web-based and layered system does not provide all the functionality and integration with their competitors, who make more complex computer-aided dispatch (CAD) systems that can also link radio and phone systems into a single entity. But while such competitors promise to install and run their systems in a timespan of between three and six months, NowForce supports the ability to have the system running, at least in its basic form, in three to six days. Working primarily with US customers and offering services to anyone from rural police departments to private ambulance companies, their ability to make custom-tailored maps from existing data and technology is leveraged into a business edge.

Perhaps most telling, the difference is encapsulated in the old display cabinets found around both offices (figure 4.2). Mapi proudly displays an impressive collection of geographical and geodesic tools dating to the early 1950s. They trace their lineage (and their approach to data) from tools designed to extract the information directly from the physical space. Contrary to that, NowForce's cabinets portray a shorter, yet not less proud, history of mobile devices on which their app has run or at least was used in conjunction with. Their notion of data is tied directly to the numerical component of digital technologies and the quantification-cum-tracking lens that I identified in my unpacking of casual power: the data from recording users' locations, either directly or through

integration with their clients' servers. Yet no matter how different, those two organisations now speak a similar language, realising the need to deliver, receive and integrate data continuously and flawlessly, even when their current reality is still far from this ideal.

Figure 4.2: Tools of the trade: a historical display of surveying instruments in the Mapi building (above) and legacy mobile phones at the NowForce offices.

4.3.Data flows: APIs and beyond

Whereas the data flow primarily internally at Mapi, NowForce prides itself on its ability to quickly and decisively integrate other external data into their system. Let us examine this contrast in detail.

Starting with the photogrammetry and aerial-photography department, one of Mapi's main jobs is maintaining the BANTAL – the national topographic database. Once every two years, each area of the country, according to shifting priorities and workloads, is mapped using aerial photography supplemented by land crews and other means. Most of this happens at the 1:12,000 scale, while the Negev, a large southern region comprising mainly desert with few population clusters, is mapped at 1:20,000. The imaging resolution is 25 centimetres, with some densely-populated areas now being considered for 12.5-centimetre resolution. All this collection and use is performed and used by civilians alone – the military has its own parallel services, albeit conveniently located nearby and maintaining ongoing working relations with their civilian counterparts. This data go into the national database, and the team behind it is charged with harmonising and updating this data to make it compatible across many systems As proudly explained by Noam, the BANTAL 2D Layers team leader, on 10 July, 2014: 'we are the geographical backbone for each citizen in the country. If a person with some project comes to me – and it has happened – and says, "I don't know how to define a building, how to process it", I tell him: here, look at our specs, we have it covered.'

This is an aspect that remains obscure for many everyday map-users: the process of transition undergone by various objects depicted on the map, from something that exists in the world to something depicted on the map. As I discuss in detail in chapter 1, this notion of saliency and selection is one of the underlying principles of enquiry in critical cartography. Yet, the situation is even more complex when dealing with digital mapping. While the scholars in the field recognise the presence of political bias in human geography and its cartographical endeavours (Harley 1988) or even the fuzzy boundaries of physical phenomena such as ridges (Wood 2010), they still mostly hold the cartographer responsible. Of course, previous work has also indicated that the cartographer has always been limited a priori by the data provided to her, and thus has always been part of an ongoing chain of data rather than its sole purveyor (November, Camacho-Hübner and Latour 2010). However, the point I wish to make goes deeper: here, not only the mapping data is pre-defined, but also *the definitions of what kinds of data can even be collected*. Galloway calls this protocological control, or the way computer systems, and governance structures that are based on them, impose order through

stating *how* a thing is to be transmitted rather than *what is the content* of such thing. Such control is punctuated by the fact that 'since digital information is nothing but an undifferentiated soup of ones and zeros, data objects *are nothing* but the arbitrary drawing of boundaries that appear at the threshold of two articulated protocols' (Galloway 2004, 52). A further exemplification of this claim and its relevance to the cartographic project can be seen in the following conversation I overheard one day at Mapi while waiting by the coffee machine. Two of my previous interviewees sitting in the adjacent cubicle were each peering over their own computer screens, both looking at what seemed like an endless Excel sheet. The conversation went as follows (13-07-2014):

Do you have a 'concrete pedestrian path"?

Yes. Wait, no….

OK, what about an 'underpass'?

Hmm… Let me look.…

This went on while I was making coffee and, I presume, continued for some time thereafter. I walked over and asked them what they were doing, and they told me that this was some routine harmonisation maintenance of the categories in the database. This list is what makes Mapi so powerful – it not only makes maps in the graphic sense, a topic which will be unpacked in the next chapters, it also collects the data for such maps and defines what kinds of things can and cannot be in their maps and how such things are to be measured. While somewhat similar to Wood's (2010) observation on the propositional power a national mapping agency exerts over the formation of a national park and its maintenance, which is based on the cartographer's ability to list specific terrain features and attach a price tag to them, the implications here are somewhat different. The mapping agency in Wood's case had almost complete authority over the terrain and was required to provide an expert opinion to decision-takers. Their opinion, however, could have been disputed by counter-mapping, as shown throughout the cases Wood discusses next. But as Noam said before, Mapi prides itself on being 'the geographic backbone', offering to public and commercial entities services that are usually too costly or difficult to perform on their own. For an institution or a company to work in the country, they must adhere to Mapi's database specifications on the most technical level; otherwise, their systems simply would not be able to talk to each other. This, of course, is not only based on the technical specifications and work routines of Mapi, but also on the culture specificity of Israeli cartography, rooted in security considerations and the hegemony of the state in applying standards. In fact, Israel's very active open-source and open-data community is involved in constant procedural and legal struggles against Mapi (among other organisations) to force it to uncover and

distribute its databanks and the underlying protocols. Nonetheless, Mapi's clients currently have to accept the database's ordering power implicitly, or in Galloway's words:

> [o]nly the participants can connect, and therefore, by definition, there can be no resistance to protocol (at least not in any direct or connected sense). Opposing protocol is like opposing gravity – there is nothing that says it can't be done, but such a pursuit is surely misguided and in the end hasn't hurt gravity much. While control used to be a law of society, now it is more like a law of nature. Because of this, resisting control has become very challenging indeed (Galloway 2004, 147).

This controlling structure, the BANTAL database, stores such topographical information maintained by approximately 20 employees working there who are organised into various teams that arrange and scan aerial photoshoots, coordinate ground teams, keep the data structures aligned and so forth. They are not the focus of this dissertation, since most of their work is highly technical and computing-/photogrammetry-/GIS-related and – while definitely impacted by the rapid digitalisation – not so different from the types of tasks they have been performed in the past. Yet, it is crucial for the future exploration of popular maps that Mapi makes, because they are all dependent on it.

Bashir, head of the BANTAL quality assurance (QA) department, explained his duties in relation to data structures on July 14, 2014: '[y]ou see, it's not just the BANTAL.… There are 14 different products[20] derived from it that need to be looked after.' One of his main duties is making sure that all the changes to the database's input specifications remain consistent; otherwise, inconsistencies in the definitions of various objects will be carried over to other databases as well, and from there to specialist and consumer mapping products. He elaborated:

> [l]et's say a client wants to differentiate between a standard dirt path and one which is suitable for SUVs. It means that we have to re-classify our entire existing database to accommodate these new types of roads, and it might be very costly. So, my first role is to sit down with the client and give an initial ballpark figure – this is feasible, that is not, this will be too costly, that will ruin the database for others.

[20] The list includes complementary databases like these of the Cartography and Cadastral Department discussed below, the web-server and a slew of others, highly technical outputs within Mapi and other governmental bodies.

These often highly technical and specific problems in the underlying data objects nonetheless have a very direct effect on the resulting map forms, and subsequently on the everyday interactions of the user with the world through the map. One particular example was an abandoned project to reflect vegetation patches on avenues they divide. Despite being crucial information for citizens, and pushed by the web-server team, it was deemed to be impracticable due to the way roads were defined and enumerated and the ensuing workload of breaking and re-coding those roads manually. On the other hand, a similar issue where newly built roads split off existing ones was solved by including custom-written software provided for free to the surveying sub-contractors which allowed the re-worked road to automatically pass on some of its attributes to the new one.

All this is done through application-programming interfaces (APIs) that allow different systems to understand each other. APIs are now-standard ways to add useful functions for receiving or sending information provided by an ICT platform of program in a way that keeps the internal workings of the system hidden (Bogost and Montfort 2009). For example, Google Maps provides an external function through which a developer might query a location and receive latitude/longitude coordinates (figure 4.3), but it does so without disclosing how it performs the calculation. It provides a developer with a standardized way to send the request and then an example of the output in two pre-set file formats.

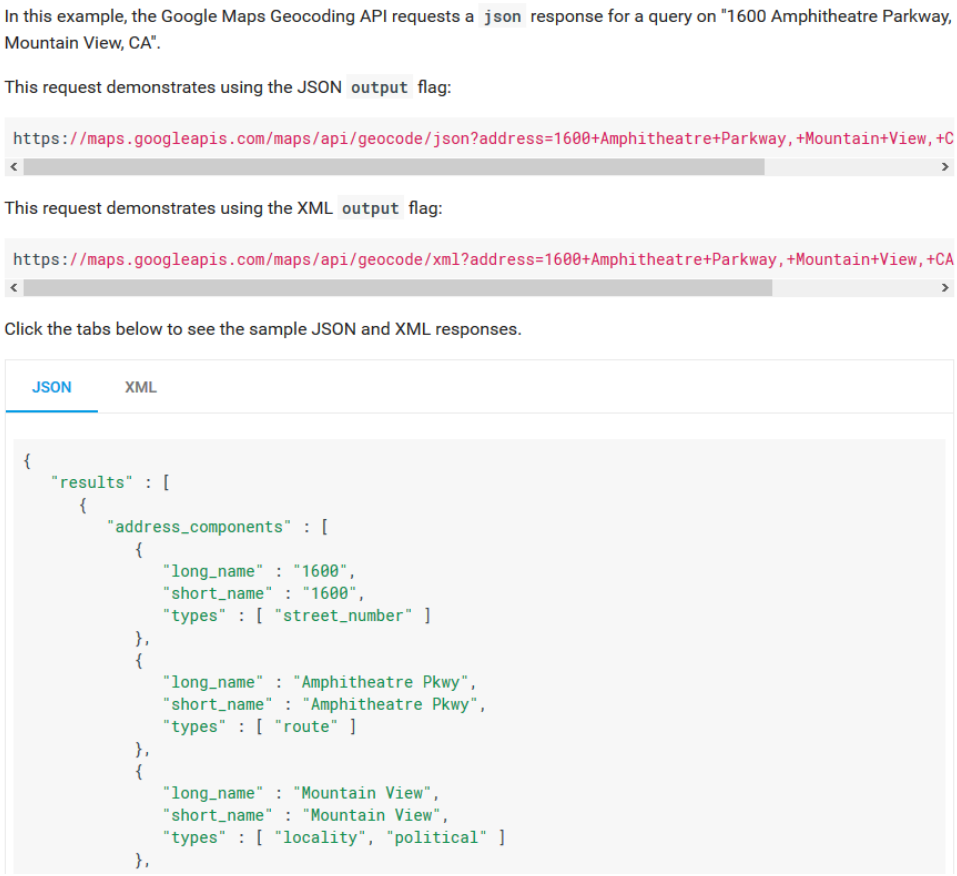


Figure 4.3: How to ask Google Maps for coordinates of an address; screenshot from https://developers.google.com/maps/documentation/geocoding/intro#GeocodingResponses, accessed March 2016.

NowForce is substantially based on the API-enabled infrastructure. Through their own API, they allow various organisations to perform actions on the map – such as generating assignments or prompting users. But they also use various other APIs – mostly Google's – to process information quickly. Their API is also used internally in a way similar to Mapi. Kfir, a NowForce developer, told me that there are several 'clients' for the API. Two of them, according to him, are the new *dispatcher program* (the redesigned map-based PC user interface for their software) and the mobile app – both internal projects of the company. It is worth noting here that most of NowForce's clients use their SAS database, meaning that their data is stored remotely in Amazon's cloud-based global server. Using SAS means that all the functionality is web-based, which is somewhat anomalous in the world

of emergency responders.[21] So, while different organisations are located on the same database, they are compartmentalized within their own users and custom display settings. This means, however, that for NowForce, the world map is populated seamlessly by different emergency and security services, and they are able to see them all at a glance, missions, users and polygons alike. Looking at the NowForce interface from the developer console evokes a sense of joy: the map comes alive, populated by various icons that move and go about their business in different parts of the world. Controlling the data and providing/limiting access to it through the API has a playful component that resembles my use of Sicart's (2014) *playfulness* in my discussion of casual power: amassing the data is a form of autotelic play, part of the global games of information and attention accumulation under ludic capitalism.

While popularly used to limit or at least control computing functionality, APIs are also simply handy for an organisation that maintains separate systems: they allow each system to operate and be worked on independently, provided that the input and output functions remain compatible with previous versions. Otherwise, the data need to be trimmed and processed manually before being integrated into the database. For NowForce, this means being able to maintain access to their database from their legacy system and rolling out the new one at the same time. For Mapi, it can mean accepting or rejecting the inclusion of data from discordant map formats in their main database. Such was the case with high-accuracy maps developed with 827, an old mapping standard used by the telecom and electrical companies to communicate precision information concerning the location of sewage lines and underground cables amongst each other. The BANTAL workers became aware of those maps when they had to postpone their ongoing update work for a year during a recent technological update. When the work resumed, they were looking for ways to speed up and prioritise the database update process. 827 maps were used in some areas and some others were updated using the information from the Ministry of Construction and Housing that contains regional, but non-geographic, data about ongoing construction projects and thus the degree of landscape change in various areas. Those two information sources, while contributing to the speedy re-launch of the server update process, were nonetheless processed manually and not linked for a permanent or continuous feed, precisely because of their lack of data in accessible and parsable forms.

---

[21] When asked about the dangers of running a web-based emergency responder, the VP of development shrugged and dismissed the concern on 09-07-2014 with 'there would have to be a very serious crash of the entire internet to break the connections to all Amazon servers'. He then told me that only one client (based in Africa) requested a local installation.

In terms of output, one of the major 'products' that the BANTAL generates goes into the cartography department. With about 15 workers, mostly women who have been working in the department for 30 to 40 years, there is a lot of map-making experience there, albeit largely rooted in pre-computer techniques. Approximately eight years ago, Mapi, unwilling or unable to replace existing personnel, retrained its entire cartography department for GIS. The initial results were not promising. Shirley, Assistant Director of Computerized Cartography, recalled on 10-07-2014:

> [t]he first time we did all our maps with the ESRI systems, we sent it off to the printer and their computers crashed. They came back to us and said: 'do your homework!' Now we just use Adobe stuff – we create a PDF of each layer and downsize it.

Until then, the cartography department worked with etching equipment to prepare maps and mass-produce them on the in-house printer located in the basement. According to Shirley, the move to digitalisation forced many of the workers to pick up new skills and the department to shut down its printing operations, moving to external printers as sub-contractors. Here, the nature of Mapi as a traditional and inertia-bound national survey shows: no-one is perplexed that such a transition did not take place until the late 2000s. The explanation is rooted both in the resistance of large structures to change as well as in labour conditions stemming from decades-old agreements: there was a need to retrain a large cadre of mechanically-oriented technical workers for the digital era. The transition was not smooth and required new ways of working with new skills. Even when the data for the maps was available and stored properly, the tools provided to the cartographers were not up to spec. In the case described above, it turned out that the ArcMap editor was reading the BANTAL and interpreting every item on it as a multitude – every road or building was seen by the operator as a single whole, but in fact 'under the hood', it was calculating each point separately. It generated hugely dense files, fit for complex GIS calculation but far too complex to be processed visually into normal maps. Mapi's cartography employees had to retrain not only to use ArcGIS but also to use it for particular graphic purposes. Consequently, two of the cartographers in the department received additional graphic-design training. In many ways, this underlined the move from visually-oriented to data-oriented map production. I will go into these aspects of the cartography department's work in the next chapter. For now however, it is crucial to understand that the move to data-centred work impacted even the most hardcopy map-oriented department of Mapi, not only those departments that derive digital maps from it. Initially, the work process was cumbersome and prone to accidents. The newly-retrained cartographers tended to delete each other's work and otherwise disrupt the

maps' update process. Today, after much trial and error, the integration of ESRI's ArcSDE server-software subsystem allows all cartographers to work on the same map, and according to Shirley: '[w]hat took us years now takes days.'

From a technical point of view then, Mapi utilises primarily *relational databases*. Those are the traditional types of data-management systems, the ones that might be employed in the operation of a warehouse, for example, where an inventory requires a large number of rows for the different items, with pre-specified columns for the item attributes (weight, serial number etc.). A relational database, today working primarily with Structured Query Language (SQL), similarly allows maintaining and accessing large numbers of digital objects, provided they have been properly defined and stored in the database. For maps, this means using agreed rows and attributes for each row: a place is to be defined through its coordinates and elevation, a street through name and traffic allowance etc. On the other hand, NowForce uses a non-relational database based on object-oriented principles that group items not according to a predetermined structure, but rather into object classes. This allows the database to grow eclectically, and customising various classes to different clients while still keeping it all on a singular SAS-based database available through cloud computing. It imposes on NowForce very different limitations and creates additional possibilities when it comes to making maps. Yet, both impose a certain numerical logic that I deconstructed above – by grouping real-life physical *things* into discrete *numerical* categories, these organisation make choices about how to record the world, and consequently, how to present it to their users. A Mapi web-server user casually checking the environment around her house will not know or care that certain types of data were deemed too complex or unfit for the system to see, yet she will see a map built on a data infrastructure intended more for city planners or decision-takers than ordinary citizens. Thus, she will not see on her map many pedestrian paths or the routes of public transport, because of the way streets were constructed as a subset of specific geographic objects, and because they have not been changed.

By pointing to the relational/non-relational divide, I wish to draw attention to the formative role that databases and APIs play – as ways to link discrepant pieces of software – to enable the construction of the end product which is visible to the user. Working with GIS is different from making maps, and both require a different set of skills for setting up databases, running servers or connecting various software functionalities via code. In fact, the only person I met during my entire fieldwork experience who more or less possessed at least some of these skills in their entirety was Yovav, the man responsible for creating a specific API that aimed to unify all property-related layers

at Mapi. His job required allowing the various separate and sometimes competing governmental agencies and ministries that deal with land management to communicate on the same level. Currently intended for government but with plans to be opened (for a price) to commercial entities, this 'Project Rainbow' falls somewhat outside the scope of my research, and so I ran into him by accident – he was sitting in the cubicle next to the one I was assigned during my stay at Mapi. Originally a geographer and GIS operator, he worked at Mapi for some time before becoming interested in web development. He retrained and left Mapi to work as a .net developer at another government agency, returning to his current position about a year before we met. Possessing a unique perspective of the current mapping landscape – seeing both the inside and outside of the systems he is involved in – he proved an interesting conversation partner. Regarding the specificities of his task, he told me that when approaching the API's development, he had two things in mind. First, he wanted to avoid the look and feel of the previous map that was built for similar purposes and used Oracle ADF technology to provide static display with a limited number of available layers. Second, he recognised the rising popularity of Google Maps API and the actions it allowed users to perform, mostly regarding the easy embedding of existing maps in other pages and services while retaining the search functionality. Similarly to this, the new Project Rainbow API allows, for example:

1. Querying the map for an address and retrieving it in visual form on your own website.
2. Retrieving X and Y coordinates (on the ITM grid) of a specific point.
3. Drawing a polygon and retrieving the coordinates of all its vertices.
4. Retrieving data about a point on a specific layer only within the view on screen (when discussing the rationale for this function, Yovav used the example of the Housing Ministry wanting to locate only specific types of buildings within the map view, for tax reasons).

All these actions might seem trivial to modern map users, but they require an intimate knowledge of the user's needs and the possibilities enabled by the system. When discussing the visual components of the maps in the following chapters, it is worth keeping in mind that Mapi has a requirement for a full-time project manager who is versed in GIS and software development to generate the actions we have come to take for granted from our maps.

Integration, through the API, with external agencies requires extensive knowledge of the BANTAL. It is the main database, but not the only one. Other databases at Mapi are integrated into the BANTAL, feeding it and being fed by it. One such database, which might be of high relevance to the everyday map user, is the BANCAL, or the National Cadastral Database. It is concerned with

very different things: land ownership and boundary parcellation. It maintains the standards through which such concepts are communicated between the Land Registry, municipal and regional entities, land owners and commercial boundary surveyors that supply such information. The two databases are separate, and those working on the BANTAL lament the different cartographic scales between the two that result in distortions and misplaced landscape features. The BANCAL does not receive updates from the topography department, relying instead on the data provided by the Land Registration and Settlement of Rights Department in the Ministry of Justice. However, they do generate some layers that go back *into* the BANTAL, which will be discussed later.

Initially, the BANCAL was built through meticulous work of digitising original paper maps and creating what became the infrastructural layer of the cadastre. The accompanying alphanumerical data – such as parcel numbers – had to be registered separately, either by OCR (computer-aided text recognition) or manually. On July 10, 2014, Etti, head of the cadastral department, clarified the role that digitalisation has played in their work-flow:

> [e]verything that goes into the database comes from computer files of the surveyors, not digitised [as in not taken from an analogue source and then made digital]. Everything goes directly from the surveyor into the system – untouched by people.

The cadastral department is attempting to implement a new standard, the Coordinate-Based Cadastre, which aims to harmonise the various measurement systems at an unprecedented precision. The aim of this kind of measurement is to eradicate the various unassigned spaces that exist on current land ownership maps, usually in the seams between existing parcels. Through the introduction of this standard, which uses numerical (analytical) rather than graphic systems and the resulting cadastral maps, the nature of land ownership will inevitably change. Here too, the space becomes an infrastructural resource to harness and order into a map (Rankin 2011).

Accelerating processes of digitalisation make these transitions more rapid. The BANCAL manufactures several cadastre-specific layers for the main database (BANTAL) which make it accessible to bodies outside Mapi. Until very recently (ca. 2013), this happened twice a year, and the internal ongoing work of the cadastral department was mostly separated from these bi-annual products. Digitalisation of the old paper maps was not the same as turning them into digital maps – the process was still manual and cumbersome, even if the results allowed a limited amount of manipulation with a computer. The mechanical, hand-skilled nature of such work, the need to coordinate it and the resulting departmental tension precluded the creation of a smooth and

totalizing 'interface effect' (Galloway 2012) driving the data from one server to another in a way that emits totalizing protocological control. However, with the new APIs and protocols in place, the main server now updates its cadastral layers every two days: every other night, the collected data goes into the government's main server farm, and the night after that, it is integrated into the BANTAL. This gives the government – and potentially citizens – an unprecedented scale of mapped information of land use, land ownership and the commercial activities associated with it. It also potentially changes user's notions of the map's truthfulness, further implanting the cartographic illusion of the digital interface: what was slow is now fast and up-to-date. Especially interesting for this dissertation is that this change was prompted by the demands of the web-server team to make the data available online.

4.4.The web-server team: Turbulent foundations

'At first, the people upstairs didn't even want to hear about this whole "internet" thing and giving GIS away for free.'

Gila, web-server developer, Mapi, on July 27, 2014:

Under the unassuming name of 'the web-server team', which consists of only four (and originally two) people, the Govmap web-portal project is somewhat of an anomaly at Mapi and the focus of my enquiry within the organisation. They work diligently on a task that originally fell completely outside Mapi's domain: free (and partial) accessibility of Mapi's extensive databases to other governmental agencies and, ultimately, the public. This is done through integration of the various databases from Mapi's internal network into an online web-server that aims to utilise a simple interface to make the complex geo-spatial data available to everyone.

Ultimately, the web-server team definitely came out on the winning side of the changes that have swept Mapi in recent years. Yaki, the leader and one of the original facilitators of the web-server team, told his version of the web-server struggles. A spry man in his sixties, he visibly enjoyed recalling the trials and tribulations that led to the current status quo on 807-2014.

> Yaki: What you see in front of you, in its current state, the web-server has existed for two years, and we call it a second-generation portal. But the first generation was something completely different, and it existed for 5 to 6 years, based on ArcIMS, which was outdated even when we started with it and it was imposed on us. The managers of Mapi didn't see any point and were against the whole thing, but it was difficult for them to resist me, since I was

doing my own thing, didn't bother them and so they didn't bother me. They probably thought 'at least we're getting some quiet from him', because I had previous histories of conflicts [laughs], so they decided not to mess with me. Consequently, I initiated the portal on a whim.

Me: What do you mean on a whim? Because…?

Yaki: Because I felt things were happening globally and in the country. I felt that if we don't act upon it quickly, the private market will take it upon itself, and with it, all our data. The government, I said, must take an official step for the public.

Me: And it was around 2005-6, I assume? With Google Maps launching?

Yaki: Right, so probably a year, year and a half after that, we began.

The first-generation portal was very basic and did not provide much in terms of functionality. It was launched by the then-general director of Mapi to serve as a communication tool between various emergency services – each having its own maps – in a case of a large-scale fire disaster. The map offered a unified view of the police, fire departments and other first responder's points and stations, and allowed, through a rudimentary legend, coordination of actions. Ironically, that general director was tragically killed, and the project dwindled, with Yaki moving to other things. Even more ironically, a catastrophic fire broke out few years later, incurring major costs in life and property. The post-event national inquiry commission found out that the lack of communication between the police and the firemen was to blame for the unfolding of the event, which concurred with the analysis during the map-portal project. Had it been implemented, some of the outcomes could have been prevented. Thus, basic funding was provided and the first web-server map portal was launched with several data layers and minimal features. Its uniqueness, however, was not in function but in concept: it changed the established working relationship between Mapi and other governmental agencies. Mapi is a technically-demanding organisation that comes with high bottom-line costs, and thus receives conditional budgeting pending its own income.

Yaki, on July 22, 2014: At the time, whether rightfully so or not, Mapi was simply loathsome to other governmental organisations because it was forced to sell them the data. A justifiable cry went out: why must I pay for public data, especially being part of the government? And because of this barrier of resentment the other agencies simply stopped sharing data with us.

Me: And you broke through this barrier?

Yaki: [getting more excited] You have to understand! Even stuff that we needed, even stuff that the public needs, like cadastral data, they wouldn't buy it from us on principle! They would say: 'you have good data, but I'll get it from somewhere else.' There was a sort of an internal consumer boycott within the government structure, and it was very unpleasant to even work here at the time. So then, when we set up the portal, we began to receive voluntary data from others for the first time. Suddenly, we got 40 to 50 layers of free data!

Yaki and another member of the department, Gila, set up a server repository for metadata for keeping track of what layer types they receive and what is on them. While documenting this, the two decided on their own to include the actual layers in the display, triggering positive feedback from other agencies. Besides the outdated server technology, an external advisor was appointed to the project to facilitate the development. This advisor, an ex-Mapi director who had gone into the private sector and opened a cartographic-design consultancy, provided a visual cartographic style based on Mapi's official one, which the web-server team found lacking and insufficiently attuned to modern web developments. The advisor's maps were still being implicitly made to accommodate the aesthetic and professional sensibilities of Mapi employees and GIS practitioners, not regular people. The web-team were not happy about it, but as Gila and Yaki agree, it was better to accept an imposed style with a functioning web-server than no web-server at all.

Despite the success, many at Mapi were against the project. During that time, the agency showed a sharp drop in profits, and some blamed it on the sudden availability of proprietary data available via the newly-fleshed-out? web-server, whereas it was available in the past only through established intra-institutional procedures. The backlash reached the highest levels of Mapi, which pressured the web-server team to change their data-sharing scheme though they have declined to do this time and again for ideological reasons, since Yaki believed that what he saw as 'public information should be provided to the public for free'. Eventually, management went along with the team and presented the project to the Treasury, receiving a substantial budget boost intended for maintenance and development of the web-server.

> Yak: [smiling impishly] During a revolution, you don't know whether you're on the winning side, so it was a 'condemn or condone' situation. The higher-ups went along but kept their distance – if it didn't work, they could easily disown us.

But it did work, the funding was approved and the second generation of the web-server, which is currently online, was thus born. The web-server team was allowed to do its own design, and the

money was used to outsource the development process rather than hire another advisor. According to Yaki, 'this is when the real cartographic revolution happened'. No longer content with merely collecting the data from other agencies for a limited display and internal distribution, the web-server team also changed the ways data are circulated and displayed in other Mapi departments. Today, they are in the process of setting up the third generation of the web portal, which aims to further upgrade its interactivity, open the cartographic database to additional audiences and integrate it into a modern web environment. At least, this is how the team building it views its role: as a mediator between a previously mostly-closed governmental database and a public that lacks the knowledge or skill to access it.

Despite the many differences between them, NowForce's founders tell a very similar story, both in tone and narrative. Born of necessity in a community of volunteer first responders, it was established as a supplement to the main computer-aided dispatch system (CAD). The idea was that in parallel to the main CAD which is intended for the professional first responders, a platform-agnostic web-based operation that can be easily installed on multiple types of devices will cover the volunteers. The latter can then indicate their availability by signing into the corresponding application on their mobile phones. As additional organisations began to show interest in the product, the founders managed to secure initial start-up funding and launched the first commercial version around the time that Yaki was fighting to set the first generation of the web-server into motion.

Both teams arrived at a similar 'product': a map-based UI running in a web browser which aimed to familiarize untrained users with complex spatial data. And while the types of the data and the actions that can be performed with it are different, it is nonetheless fascinating that they went down a similar path and reached a comparable point: one being a small team in a professional, GIS-oriented governmental organisation, the other a technology-proficient volunteer group with no mapping background. Drawing from the first chapter of this dissertation, this development occurred under the conditions that I named 'uniquitous cartography': the tendency of modern cartographic assemblages to assume forms that, while being widespread and accessible, also allow for personalized experience by tracing and predicting user movements. In a mediatized environment (Hepp 2013) in which the ethos of fun transcends the bounds of leisure to supplement other modes of engaging with the world, for better or worse (Galloway 2012; Berry 2014; Sicart 2014), those two organisations co-opted the map's form for their needs. In doing so, they took their core business model of collecting and optimizing geo-spatial data and turned it into lived world, a particular chorography (Della Dora 2012) that separates the usable map from a purely mathematical construction. As data

becomes the new resource fuelling the attention economy (Stiegler 2010; Crogan and Kinsley 2012), turning the use of geo-spatial data into a habituated and pleasant experience necessitates a move towards domestication, which comes in the form of the map – familiar and seemingly innocuous.

Both teams realised that making maps with data-enabled infrastructure while enabling the availability and usability of layer-based logic of traditional GIS systems will benefit the non-professional end user. Both took cues from the successful launch of Google Maps, with its simplified cartographic features. Both recognised that through API integration, their respective products can benefit a varied cadre of users previously blind to the potential of digital maps. In the end, both realised that digitalisation processes today are about fluency and convenience. The web environment and the devices that enable it are

> increasingly sold as an entertainment media, they are sold in some sense to combat the boredom created by the excess generated from the computational efficiencies that are changing our economies. It is an ironic twist of computationality that the very tools that have created new spaces by their efficient management of information, time, space and working life should now be deployed to reorganize our non-working time too (Berry 2014, 200).

Thus, selling spatial data was not enough, and the web-team was set to repackage the data into a more modern form.

The effect is seen through the steady decline of visitors to Mapi's storefront. Previously, clients interested in purchasing aerial-photographic images had to physically come to the store located at the Mapi complex, sit across from an operator and browse the images on a double-screen system that allowed them to attempt to explain their needs to him. Today, due to the specification made by the web-server team, the archive 'cuts stamps' of the images, i.e. downgrades them to lower resolution and optimizes them for web viewing. They also put on their website the flight paths and dates of all survey flights. Potential buyers can then browse those images from their homes and offices and then purchase the high-resolution imagery mailed to them on CD. As Amnon, director of Mapi's Aerial Photography archive and store, commented somewhat bitterly on July 10, 2014: '[b]ecause of the digitalisation, people today won't even go to get an analogue image if they need it. You tell them: "go to the storage unit, row this-and-that, shelf such-and-such", and they'll be: "nah, forget it". ' At the time of my enquiry, one of the newest components in the web-server was an update integration of the aerial-imagery archive with the base-map. It will be interesting to see how this further alters the relationship between Mapi as a data broker and the public and companies requiring such data.

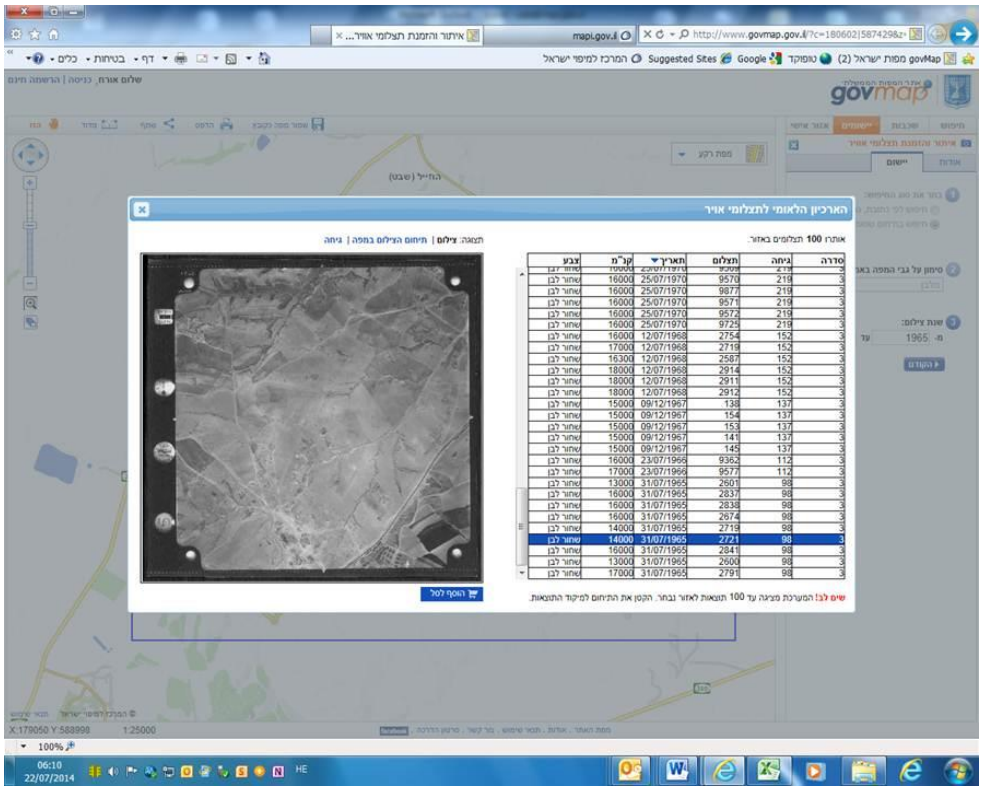


Figure 4.4: A screenshot of the aerial archive component on the current (second generation) web-server that was sent around via Mapi's internal mail at its launch during my ethnography work.

And so each organisation had to address a 'lazy' user: one which does not have the time or the surplus of cognitive attention to master a map. Harking back to Rankin (2011), one can say that as modern cartographical apparatus turned space into utility, the web environment has accustomed users to utilities being available in fluent and ever-present access, through multiple devices and while competing for your attention, rather than demanding it. Mapping interfaces are thus the easy and convenient way to simplify the world for the user. However, one question – which both organisations struggled with ensues – who is the user? How can one build for potentially endless types of users present in web environments? How can an organisation accommodate multiple types of devices, screen sizes, competencies and interests? The answer that emerged reaffirmed Woolgar's (1990) observations from the early days of widespread computing: the easiest way to define your end user is to pre-configure one.

4.5.Conclusion: Towards a user ecology

Who are Mapi's users, exactly? For the photogrammetry department, which also maintains the topographic database (BANTAL), the user is their colleague from another department intending to make 'a product' from the database, such as using it for GIS calculation or generating a visual map from it. But users are also geography professionals working for governmental and commercial entities that want to purchase specific snippets of this database or the photos that were taken to make it. And to some extent, the user can also be the person deciding to fund a new company that wants to compete in the recently opened digital-photogrammetry service provider markets, relying on Mapi's standards and specifications to operate.

For the cadastral department and their BANCAL, the user is first and foremost the boundary surveyor in the field, then a colleague from another department or the Land Registry. To some extent, the ultimate user is the citizen, who needs the fruits of Mapi's meticulous cadastral effort to be able to legally function as a property owner in a modern society, for example. But this type of user always seems remote and her agency is relegated to the surveyor or the clerk. This department's contribution to the web-server is limited, despite Yaki's admission that cadastral data is Mapi's unique selling point compared to commercial services. Outside of maintaining their database, the cadastral department mostly work on their own separate professionals-oriented web-product called TopoCad, through which they aim to commercially compete for the surveyor's attention in a way similar to how the web-server competes for the non-professionals.

The cartography department, which I have already discussed briefly and will expand upon in the next chapter, also has many different types of users. They slice and paste the BANTAL, and freeze it into paper formats or static (non-slippy) computerised maps. The user can be the school pupil learning geography or the traveller walking along a trail in a national park. Ultimately however, their main user can be seen as either an employee of a map-making company or that of a professional printing shop tasked with turning images in the form provided into physical pages.

The web-server's user is supposedly each and every citizen of the country, especially when taking into account the ideological zeal for free information displayed by the team members. It is not so simple however, as the team's structural existence at Mapi is still very much motivated by providing cross-platform data to various branches of the national and municipal governments. Many of the features and applications on the web-server (portal) website are cumbersome or gated behind specialty passwords.

Finally, who is the user for NowForce? They make a solution for dispatching and controlling responders through geographic spaces and sell it to interested organisations. Those organisations, however, can differ from each other quite drastically – from a small rural fire department interested in cutting the costs of expensive CAD systems to a major car-insurance corporation using NowForce to track its fleet of insurers and their replacement vehicle fleet. And in any case, each company possesses multiple employees in custom roles: different kinds of dispatchers at the back-office, various types of agents in the field. For NowForce, manufacturing a map that allows the former to observe the situation and make the latter act upon it requires having a wide selection of users in mind.

In this chapter, I claim above that my case studies the underlying data structure, and the APIs that connect them have turned their processes of map-making into a radically different procedure than what it used to be. Through the a priori demarcation of what can and cannot be recorded, as well as structural, financial and practical limitations on the organisations involved, which face fierce competition on multiple fronts, maps are tailored to a specific user. Those who make those maps have the user in mind, whether implicitly or explicitly (Akrich 1992; Woolgar 1990), and the design process is a double-sided membrane through which the user both enacts and is acted upon through the system's configuration and ultimately through the affordance provided in the graphical user interface. The Gibsonian notion of cognitive ecology (J. J. Gibson 1977, 1986; E. J. Gibson and Pick 2003) can in this case be supplemented by the concept of user ecology. Not only does the person experiencing the map receive perceptual cues from the affordances imbued by the designer, the creators are also ever-conscious of the user's ghostly image hovering in the office space.

In the next chapter, I will discuss the next stage of the maps' development. In it, the data exemplified in this chapter are transformed into the more familiar visual form of the map. I will elaborate how the map-makers continue configuring their user through the choices made in this transformation, while being themselves configured by these imaginary constructs and the market conditions in which they operate. In the chapter thereafter, I will further expand those ideas into a consideration of the role of the user interface in this inscription process, looking into the penetration of design practices outside mapping's traditional domain into my case-studies.

5. **Visualizing**

'To prevent visual overstimulation, shrewd designers avoid signage that is too showy or bright, or that rises too high above machines, potentially drawing patrons' attention up and away from them. Likewise, they avoid signage bulbs that flicker too frenetically, too erratically, or too slowly. They take care to softly pixelate video monitors, and to reduce their glare. Graphic engineers, whose color palette increased from 256 to millions of distinct colors over a relatively short period, strive for pleasing tones, imagery, and animation – nothing that might jar or unsettle a patron at play. WMS has recently introduced banks of machines with "emotive lighting" choreographed according to game outcomes, to reinforce play. Visuals should be "consistent with what players want," the company indicated in the G2E magazine advertisement that accompanied its 2006 What Players Want campaign'

Natasha Dow-Schüll, 'Addiction by Design' (2014, 76).

To follow the processual logic of this dissertation (Kitchin and Dodge 2007; Perkins 2008; Dodge, Kitchin and Perkins 2009; Perkins 2011) and Actor-Network Theory's translation logic (Latour 1987; Law 1992; Latour 2005), the mapping interfaces of my case-study link the underlying data of the cartographic assemblage with the interpretation of the user. The last chapter presents how data influences the work of such assemblages. It shows how map-makers are limited by what data goes into the maps and are simultaneously required to generalize and simplify the data to make it comprehensible to the map reader. It concludes with the open dilemma of reconciling the fluid parameters of 'the map-user' with the cartographer's overarching goal of creating a clear, usable and engaging product.

This chapter unpacks this translation process, from data to image. It focuses on how these processes around the digital version of the map differ at each organisation and draws common themes around the specificities of such design. I begin with a brief consideration of the translation into the visual when faced with an undefined and mutable user. Following that, I look into what comprises the visual layer of the map for my case-studies, focusing on symbology, framing, selection and contextualisation of the map as a way to communicate with the map reader. This allows me to focus in the third part of the chapter on what digital maps excel at: embedding exploratory techniques into the user interface that allow users with varying objectives, skills and abilities to make

the most of the data beneath. This discussion is interjected with assessments of the varying conditions for NowForce as a commercial entity and concludes with an analysis of those search elements in light of attention, quantification and gamification as I have discussed before. The next two sections deal with user testing and tracking users, respectively. These are ways through which map-makers define their visual styles to accommodate certain uses and discourage others. The sixth section highlights a running thread in the discussion so far: how does all the above reflect on each organisation's perceived objectivity and what sort of power relations arise from this distinction? Finally, I conclude with a reflection on how the uniform and customisable visual components of the maps in question are in tension yet also complementary in manifesting what I previously called uniquitous mapping.

5.1. One map, many users

As discussed in the first chapter of this dissertation, visual interpretation of a map is contingent on many cognitive, social and cultural issues. Two different people examining the same map might read it in completely different ways. The same can be said about the emergency responder trying to reach an accident through her NowForce app or a homeowner attempting to use Mapi's web-server to assess the potential implications of a new governmental construction project in her neighbourhood. Who are they? What would they see? And how do the cartographic assemblages that I study – people, knowledge, equipment – approach this multitude in their design processes?

A good starting point is data. As exemplified in the previous chapter, under the surface of the maps produced by my case-studies lies a list, often in the form of a computerised table, with places, their coordinates and potentially other attributes. In fact, Ptolemy's *Geography*, probably the most influential book in mapping's history, contains no maps at all, but rather a list – today we would call it *a database* – of approximately 8,000 known key locations in the Hellenic world, organised according to latitude and longitude. It is the discovery of this text, along with its mathematics and calculations, during the European Renaissance that has triggered the emergence of modern cartographic cultures (Pickles 2004). But it was the precursor to mapping, absent the map itself: tabular data, no matter how accurate, is not understood as an approximation of a landscape in the same way a graphic depiction is (Kent 2009; Della Dora 2012). The visual inscription on a flat surface is what came to define a map and how it is recognised today (Vasiliev et al. 1990), be it on paper or screen. And so, this chapter investigates the next crucial stage of turning a map into such a thing: the processes of

selection and generalisation, and other attempts to visually guide user focus to specific areas and symbols of the map (Krygier and Wood 2005) that transfer the digital data flowing between various databases and servers via hardcoded links and dedicated APIs into what a 'regular person' would recognise as a map.

Adding to the already complicated relationship between data and data visualization (Tufte 1990, 1997), the digital map must overcome its own limitation as a second-order visualization, a map *and* a user interface. It is simultaneously framed by the limitations of the digital format and its cartographic pedigree. Recalling Galloway's warning about the inherent un-representability of the user interface, we are left with yet another translation:

> Any visualization of data must invent an artificial set of translation rules that convert abstract number to semiotic sign. Hence it is not too juvenile to point out that any data visualization is first and foremost a visualization of the conversion rules themselves, and only secondarily a visualization of the raw data (Galloway 2012, 83).

In this context, map-makers choose visualizations with a certain anticipation of the user's ability to unravel this conversion, as part of the broader goal of maintaining attention on the visual forms that are produced. In cartography, the role is to 'strip away selected details and flatten the earth's surface, showing what we could not otherwise see' (Krygier and Wood 2005, 12). This stripping away is in the foci which the organisations I study attempt to anticipate, supplemented by the various arrangements of visual interface elements surrounding the map. This anticipatory stance plots the distances traversed by the user's eye from object to object, envisions the concomitant mouse-click, prevents unwanted taps or swipes. They do this in an attempt to carefully present a calibrated world to their map-users. Unlike Akrich's (1992) electrical engineers, the process of de-scription of this world does not occur through physical tools and switches, but through withholding or allowing certain aspects of data in the visual presentation. Mapi and NowForce aim to preconceive the user's goals and performance, creating perceived affordance for the user (Gibson 1977; Norman 1988; 2002; Nagy and Neff 2015).

A wealth of data does not translate to easy visualization, and it often is, in fact, harder to visualize complex data. As Tufte warns in his discussion of timetables and route maps – among the most ubiquitous types of visualizations – '[a]nd the audience for schedules is diverse, ranging from experts at timetables such as travel agents to those who are not travel agents, an audience of uncertain skills, eyepower, patience' (Tufte 1990, 101).

Mapi has encountered some of these issues when moving from paper to digital. In the previous chapter, I bring up the frustrations of Shirley, deputy head of the cartography department, who oversaw the transition to digital map-making in her paper product-oriented department. The story of this struggle provides a good window into the interoperability issues facing Mapi as it transitions into data-driven visual service.

5.2.Unfit images: Symbology struggle for the eye of the user

Let us look at the screenshot of the Mapi web-server as it first appears to the user entering the website (figure 5.1). It presents Israel in traditional National Atlas style rendering, emphasizing physical geography and highways and without any internal or external political boundaries.[22] It begins at 1:3,000,000, a standard country-size scale, though it looks rather strange in this particular rendering, given the vertical space the coloured region of interest occupies in an otherwise bland, horizontally-orientated main view.

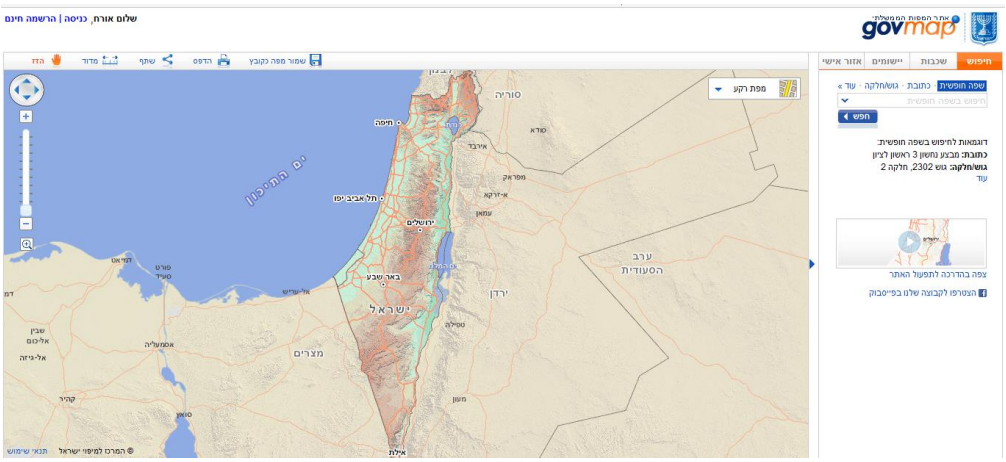


Figure 5.2: Initial view of the web-server; screenshot by the author.

Based on existing design and HCI principles, the user's eyes are drawn to the top right-hand corner first, which is occupied by four different tabs and the infobox.[23] The infobox on the first tab that is opened by default is the search tab, prompting the user to perform a freeform search. This

[22] For information on the political complexities of Israel's official maps, especially with regard to Palestinian representation, see the comprehensive dissertation of Jess Bier (2014).

[23] For the Hebrew right-to-left reader, the eye is drawn to the topmost right corner of the browser window, then along the horizontal line to the left, and following this, downwards (Parush et al. 2005).

search feature was very important to the web-server team, and I will reflect on it in depth in the next section. Now however, I wish to focus on the map itself, and especially its symbology, or the style chosen through colour and size of the icons and labels on the map. It is, without a doubt, a dominant feature of the screen and positioned to attract the user's focus. When looking at it through the casual power lens, one can speculate that the filling out of the state's contours against the bland background and the clear presentation of feedback mechanisms is an application of Juul's 'juicy' design – an immediate visceral indication focusing on the enjoyment of action rather than on any utilitarian elements (Juul 2010). I will further expand this notion of visual feedback when discussing the designer focus on interfaces as enabling exploration in section 5.3.

First, and in stark contrast to paper cartography, a clear control scheme is presented at the top left-hand corner of the screen. It would be familiar to most web users, being clearly reminiscent of Google Maps' original slippy viewing controls that have since disappeared from the latest version (figure 5.2). According to the web-server team (personal interviews, 14-22 July 2014), and unlike the preceding version of the portal, this map was designed with the amateur user in mind: the map fills the majority of the screen and is presented in a way that attempts to signal to the mass market and non-expert web user that it is interactive and can be manipulated. There is an intentional scarcity of additional information fields, nothing to distract or confuse the user. This map, however, is not really a digital map, at least not in the way I have defined it throughout this dissertation. Rather, it is a cropped image from the cartography department's paper-oriented database. The web-server team mentioned this to me in passing, as a joke, on 22 July, 2014:

> Nir: [laughing] It's just a JPEG we cropped from the BANTAL's topographical layer! We did it back then to appease the management with familiar look and feel. And it also saves time for the web users: it doesn't load the actual map tiles immediately, until you zoom in.

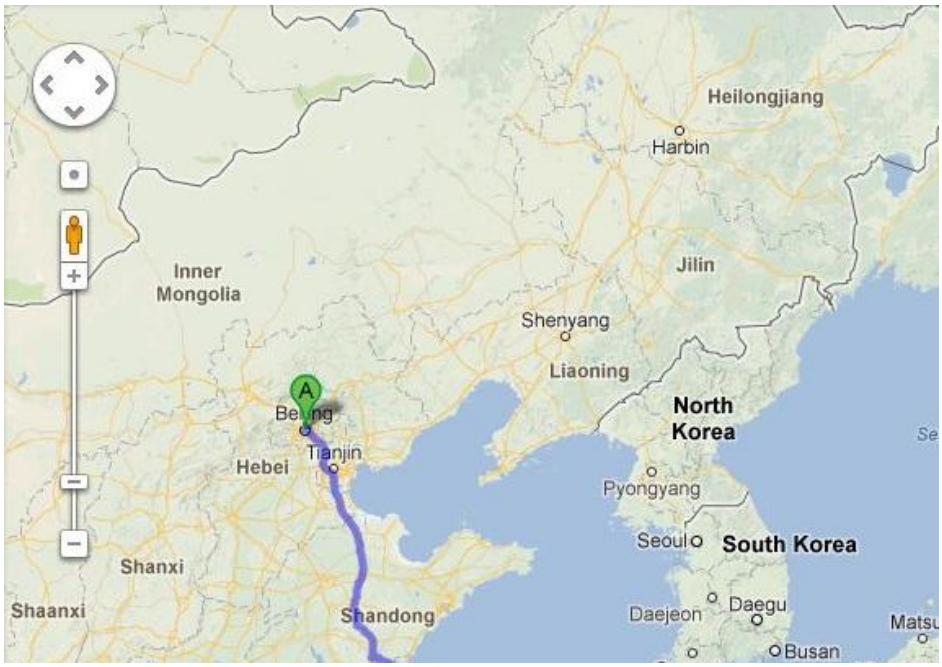


Figure 5.3: The old version of Google Maps' graphic-user interface controls for panning and zooming the map; screenshot by the author.

Not much happens when the user zooms in once, to the medium scale of 1:1,000,000. The display re-renders the text tags over the static image to fit the new size and position, to re-assert them for the new view frame, but no new details appear on the map – it is still a static image, brightly coloured and lacking any identifying features except dots indicating the largest urban areas (figure 5.3).

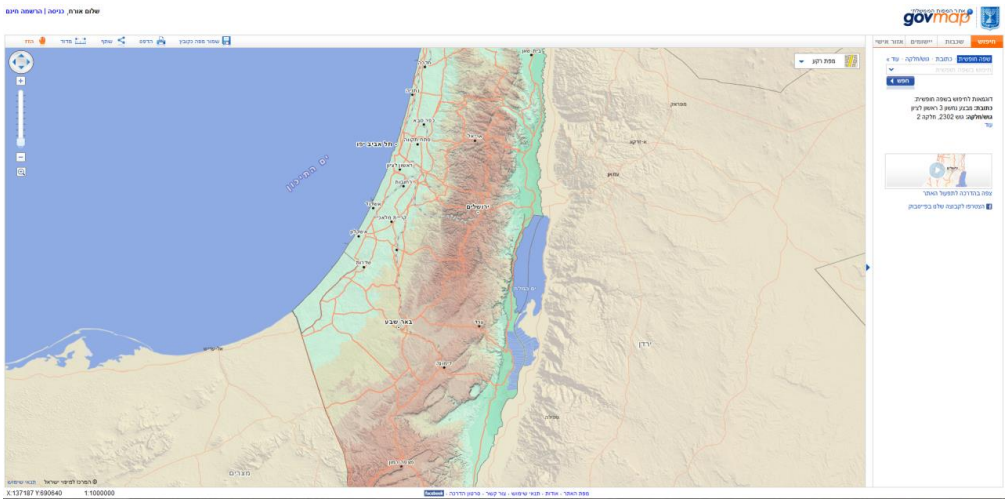


Figure 5.4: First zoom level of 1:1,000,000 uses the same static image; screenshot by the author.

Only when the user zooms in for the second time, to the 1:500,000 scale, is the static image replaced by the cached tiles that were loading underneath it (figure 5. 4). Yet, the map presented by those tiles looks rather different than the preceding one. Gone are the bright colours and the strong relief features. White with pale shades of yellow and green dominate the map, and a further zoom to the 1:100,000 scale (figure 5.5) reveals additional information. An outline of urban sprawl appears, with clear positioning of neighbourhoods and roads. Road numbers appear inside shields of different colours for main, auxiliary and side roads. Many additional smaller settlements and villages appear along with their names, and this is the first zoom level that shows railroad tracks, a relatively underdeveloped feature in car-oriented Israel.

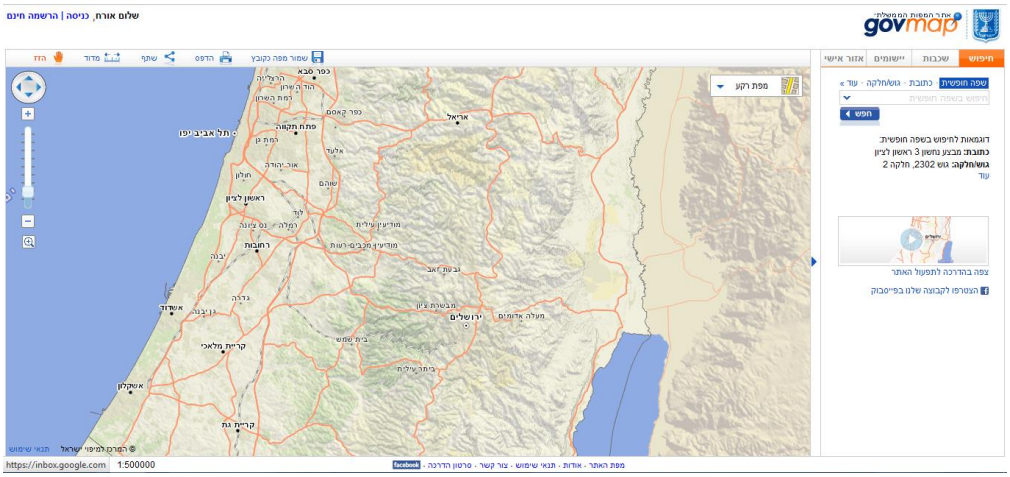


Figure 5.5: 1:500,000 scale shows additional symbology: administrative borders, railway tracks. ; screenshot by the author.

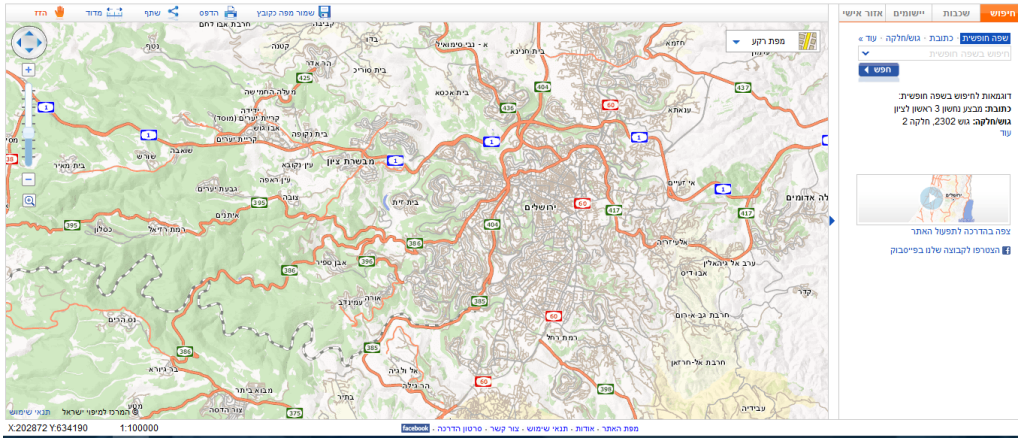


Figure 6.5: 1:100,000 scale: contours of urban areas, neighbourhood names and highway numbers appear. The green and orange shades fade into the background; screenshot by the author.

'We had our entire symbology remade and re-developed', said Shirley, head of (paper) cartography, somewhat reluctantly on 10 July, 2014. 'An outside PhD candidate also did external work to adapt it for the BANTAL (the main geographic database). I have no idea what the web-team did with it.' She was referring to the decision made by the web-team to pay only lip service to the traditional and iconic symbology and colour schemes used in Mapi's official publication over the last few decades. Moreover, the web-team also chose to disregard the work done by external paid consultants and academics from the GIS field in adjusting this symbology to be screen-friendlier

while moving from the typography-orientated CMYK colour scheme to the screen-native RGB. 'We chose to do everything in-house, even though it created a lot of tension within the organisation', recalled Gila, the web-team developer on 21 July, 2014. On 22 July, 2014, Yaki, the director of the team, evoked a more vivid struggle around the way his maps look with the now-retired CEO:

> [t]he symbology developed by the external consultant, it was too colourful, too messy. Even though some people complained when we moved to this new look. But mostly the older professional crowd, the ones that have gotten used to the way things looked before. For every scale level that we delivered, it was an immediate 'no!' The CEO didn't want the 3 million scale, or the million one. And below that, 'it's even worse!' he would say. At one point, we argued because of the combined satellite view – we had lower resolution tiles of the sea in some areas, and it looked ugly when we stitched them together. 'I want the sea as the sea, and if you don't have it just cut it all out! Put some blue colour around it or something' the CEO told me. So we did, but when he left – we brought it back. We didn't care much about these things and neither does the public.

From this, we can deduce that the design of the web-portal emphasizes function over look. This switch from aesthetics to utility is common to the new types of digital cartographies under scrutiny here and will be thoroughly discussed in the next chapter. The old guard might push against what they see as the lowering of standards (Kent 2009), but when maps become mediated and mediatized (Hepp 2013), the user of the digital map begins to resemble the media consumer in the desire for fast and clear information immediately, no matter the quality.[24] And those who make such maps are often aware of this, as Yaki unequivocally finished his story: '[r]elevant data now is better than beautiful data next year. The general public is willing to let many things slide [in terms of design] as long as you give them the data.' In terms of distinguishing oneself from potential competition, the web-server team here combines the visual style of authority (underscored by the adoption of the initial symbology and colours of old state maps) with the discursive algorithmic innovations of rapidly-updated data. Allowing the user to master the interface regarding of the actual aesthetics is reminiscent of the argument for the machine zone as a form of designer control – automatizing actions and preventing the possibility of reflexivity as arising from missing or incomplete data will limit the potential problem of map-users leaving the interface unsatisfied and searching for another

[24] As often exemplified by the use of smartphone footage and other low-level imagery by major news organisations, which previously employed only high-quality imagery from professional photographers (Westlund 2013; Newell 2014).

mapping service. At this point, I recall the discussion I had with the orthophotography team cited in the last chapter and the recent changes that were implemented into their work procedures, switching from structured biannual nationwide surveys to a hybrid system wherein structured surveys are interspersed with on-demand sweeps accommodating recent (construction) changes. The demands of busy mapping markets might impose on a reluctant bureaucratic organisation the need to adapt a more rapid information-retention and -processing scheme, like the changes in the data collection process that occurred when the new tender for version 2 of the web-server was issued. This demanded faster processing of survey data, tighter integration between governmental agencies and the method of showing it all to the public without delay. All this aligns with the aforementioned switch to service-oriented cartography: a national mapping agency might not compete with commercial service providers officially, but they are well aware of their slipping grip over traditionally state-centred cartographic data in the face of information consumption patterns prioritising the immediate and relevant.

But technological solutions are not necessarily simple ones, and while the 'public is willing to let it slide', the map-maker is still a gatekeeper with certain pre-conceptions that pre-emptively define how much such a public will tolerate. Shirley confessed in our conversation about symbology that she does not trust automatization when it comes to workable visuals:

> I was at an international cartographic conference a few years ago, when the Netherlands people showed how they've automated their entire map-production processes through a click of a button. Turns out they've checked the costs and saw that it's worthwhile to invest some money in the technological infrastructure over a few years, to be able to automatize the process thereafter. When they were asked about the problem with different scales and how they're dealing with display mistakes, they just said that it's not economical to worry about it and they would rather have a fast and cheap process. Now, employees at the Swiss national agency that were present as well were horrified by this! They then presented their own digitisation efforts, which went completely in the other direction: everything hand-crafted, beautiful website by the way [probably refers to *http://www.schweizmobil.ch*] So I've come home and tried to make some automatic maps myself, using the then-new representations feature of ArcMap[25] to make some automatic 1:10,000 scale maps. I used the digital

[25] http://desktop.arcgis.com/en/arcmap/10.3/map/working-with-layers/what-are-representations-.htm

symbology that we developed for the BANTAL (which is also primarily in this scale) and generated some city maps – but it was just not it.

Shirley has encountered a new, digitally-mediated way to generate maps through the larger networks of cartographic conferences. When attempting to replicate it at home, she discovered that it does not fit the quality level expected of her products. Her solution was essentially to specialise her workforce in the use of digital graphic tools, generating maps in the form of image fields from GIS software and then editing them on graphic design and publishing software such as Adobe Photoshop and Illustrator. Unlike the preference of the web-server team for speed over quality, for the cartography department this is possible only when clients request a specific map of a chosen region at a particular scale. Thus, a curatorial effort is likely, as the department's work-process is organised in such a way that finite products are generated over a given period of time. Symbology is then hand-corrected on graphic software, not unlike the work that would have been done on traditional drawing tables. But cartographic *interfaces* require a different approach.

5.3.The exploratory approach to map visual design

This section explores the specificities of such interfaces. Chiefly, I argue that my case-studies employ an exploratory rather than focused mode of engaging with the map visually. By this, I mean that much like in other web interfaces, users are constantly led through a series of links, where each user action opens additional possibilities and so users with varying skills can benefit equally from the map. The notion of exploratory interfaces can be traced to the early work of merging GIS and paper maps that began in the 1990s. As computer screens and other related technology became available for wide public use, proponents of participatory GIS advocated for the inclusion of GIS components in public meetings, policy planning and other spatial activities (MacEachren 1994, 1998, 2000). Many of the map features taken for granted by my respondents were unresolved issues at the intersection of cartography and GIS, which were separated with the introduction of affordable computing in the 1960s and again began merging with the advent of the personal computer and the web (MacEachren and Kraak 2001). In particular, the notion of interface design was shifting from being suitable for a knowledgeable expert searching for particular answers to a predefined question in one's area of expertise, to an amateur – in the broad sense of the word – exploring geodata in an open-ended form. One of the main ideas that can be traced in the literature of that period is the notion of an interface as a cognitive tool that enables new forms of thinking (Cartwright et al. 2001). Thus,

> [t]his cartographic attention to interaction and dynamics is consistent with the focus initially proposed for 'cartographic' visualization – on personalized, highly interactive tools that facilitate a search for unknowns (see MacEachren, 1994). From this perspective, maps designed to support visualization go well beyond information presentation to support information exploration and knowledge construction. With exploration, an **abductive** process is followed, one in which display use starts without hypotheses about the geospatial data, and the visualization tools assist in an interactive, unencumbered search for structures and trends, with one goal being to prompt hypotheses (MacEachren and Kraak 2001, 3).

Both case-studies employ some of this philosophy in undressing the multiple-user issue of their maps. Both use exploratory means to facilitate visual exploration of information. From the perspective of causal power, such design draws the many potential users in and keeps their attention by utilising *juiciness* (Juul 2010) to reward the actions taken through the mapping interface. To highlight this, let us examine the conceptual change in relation to the map within Mapi as it moves from paper to screen outputs. The artisan approach of the cartography department contrasts with the web-team's attitude. They see themselves as curators not of the particular map seen by users, but of the overall experience of participating in an information exchange between the user and the (government) map data facilitated by the web-server (project meeting, 22 July 2014). Their view is a conversational one which assumes an ongoing back-and-forth between the system and the user. Nir and Gila, web-team developers and GIS specialists, talked about embracing the uncertainty of what the user will see or do with the map, and the need to circumvent it with clever design:

> Nir: The panel is important [talking about the static search and information UI element to the right of the main map view].
> Gila: It is something permanent and fixed that grounds you.
> Nir: Yes… But you can also make the map larger.
> Gila: Exactly what I wanted to show. In the previous version, we had two map views where you'd search on one or the other, and it was important for us to have [in the new version] just one big unified map view where the search and various layers are integrated into tabs and don't show unless you want them to.
> Nir: But when you enlarge it you can still see…

Gila: Yes, with the information bubble that you get when you 'prick' a location. Which we've put a lot of thought and effort into. It shows you additional information, allows you to link to your personal area, external websites, all sort of things.

Nir: And it has a certain logic behind it as well! You press here [clicks on a building], it will direct you to a geocode, in another place

Me: [impressed] Really?

Gila: Yeah, here, let me show you – here there are no layers turned on and I click here, so it knows to tell me that I probably 'pricked' a school; if I click here, it shows me the street name. It still knows how to query the data even when there's nothing here. If I prick somewhere which really has nothing, it'll give me the settlement. There's a logic here that states [to the map software] 'constantly look for something'.

Above, we see how the web-server team want to validate each user's action. The map is broken down / into components that can be turned on and off, based on what the users know and want. A user who does not understand the more complex functions will encounter the most basic functions that the designers deemed relevant to them, without being exposed to more complex options (figure 5.6; project meeting, 22 July 2014). Whenever a user is unsure of what she is seeing, the system will prompt suggestions, whether in the form of an info-bubble or a list of potential links. The map also features a natural-language search tab in a prominent spot for those unwilling or unable to decipher the cartographic component.[26]

This logic of the search is the web's logic, and it is not quite the same as the logic of the paper map. For the map-maker, the paper map is an exercise in generalisation and simplification, reducing the world's complexity for the perceived user's benefit. In their design of the web-server map interface, Mapi still aims at reducing complexity, but now they are not limited to the flatness of a single-layer, immutable inscription. Instead, through their visual and interaction design, they try to evoke a sense of ongoing exploration, with the map screen acting as a guide for the information queried by the user: information that the user expects to find, but also – which might be more important – things she did not even consider when first accessing the map. When I discuss casual power in chapter 2, a major component of my theoretical reasoning was that predictive interfaces make information-retrieval tasks frictionless and enjoyable, while the designers subtly influence the

[26] Though somewhat lacking in the current version, especially compared to Google Maps' proficiency with natural language processing.

scope and direction of user choices through the imbued affordances. In the example above, this logic is fully implemented. First, the map is central in the overall screen space. Second, it affords the ability to continuously explore it no matter what knowledge one possesses over the actual scope of what the map aims to represent. Thus, the users are guided towards continuous interaction with the various layers of the map. Such design underscores the interchangeable occlusion and transparency features through which the map-makers black-box the working logic of the system (Bolter and Gromala 2005). At the same time, the top level map serves as an entry metaphor mediating directions of subsequent exploration.

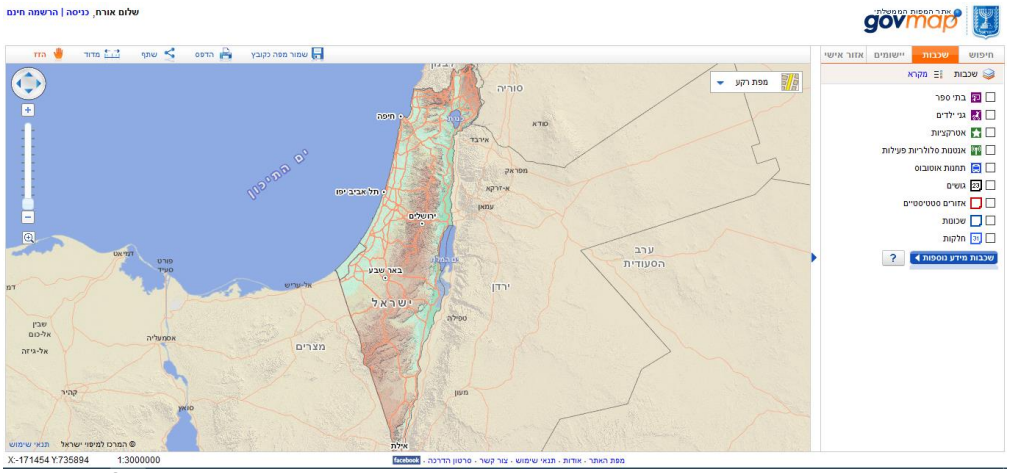


Figure 5.7: Only nine layers which would have an immediate relevance to the 'average user's' life are present by default on Mapi's web-server: schools, kindergartens, attractions, active cellular antennas, bus stops, administrative areas, statistical zones, neighbourhoods and plots. The rest is hidden behind an Additional Layers button at the bottom; screenshot by the author.

While discussing the major changes between the first version (intended for internal GIS consumption) and the current and future iterations (20-22 July, 2014), the web-server team continuously pointed out the skill-level requirement, as reflected in the visual changes to the map. For Yaki, the lack of a map legend is a big achievement. 'When you stand over it without moving [he mouses-over an icon], you are given an explanation of the symbology. The CEO wanted it to be constantly present on the side of the map, because that's what he knew from the paper map. We resisted – you want to see it, you see it. You don't, then no.' The other team members referred to a different aspect that shook the local cartographic community: the disappearance of the previously-ubiquitous 'i' button that had traditionally allowed interaction with objects (rather than scrolling or zooming in) in various GIS software packages and early web maps. 'The cancellation of the "i" was

the worst,' Nir confessed. 'This is something that nobody has done, there are many mapping websites in the world that still have this function. We wanted the information to be available at a click.' Gila interjected: '[e]ven though we still get feedback asking, "how can we get the information [on the objects] in the map?" it hasn't gone away completely.' Nir then defended their design choice by pointing out that unlike in Google Maps, their mouse cursor changes into the 'pointing finger' icon traditionally associated with interactable elements on the web. 'The icon only changes into the dragging icon when you click and hold, but other than that we always wanted to hint to the users that they can click the map.'

Me: But this is like the long press on Google Maps, right? On the phone?

Nir: (surprised) What do you mean?

I pulled out my phone and showed him that on the mobile interface, which requires a long press to open contextual menus if there are no immediate POI icons available. A single tap on a map area merely centres or moves it, while a long press opens additional options. He confessed that he was not even aware that Google Maps had this option, despite the research they have undertaken. 'This is pretty awful [design-wise]', he said with disdain.

Later, he told me the reasoning behind one of the functions Mapi put in the tender for web-server's next version – the public-transport heat map. 'I want a person to be able to ask something very specific, like, give me the weekly average of bus delays leaving for Tel-Aviv between the hours of 06:00 and 07:00, and see all the results from various areas on a quick-to-read heat-map.' I asked him who he envisions using such a function. 'People who are thinking of moving', he said readily. 'If you already live in a certain area and you have to use public transport, then there's not much to do, but if you're planning to move into a place, it's nice to be able to see what is relevant and what isn't.' He paused for a moment. 'Like, in my neighbourhood – there are no morning buses at all. In all the other neighbourhoods around us, there are, but in ours not really, for some reason. It's good to know, good to see [on the map].' Thus, Mapi aims at making the map an assistive tool that presumes nothing about the user's cartographical skills and instead tries to present an array of answers to potential questions. 'Every time we write a tooltip or a headline we think, "What is the most basic way to describe *what does this thing do*?" ' Nir says. Coming back to the idea of exploratory mapping and the casual power framework, we can see how the map-makers work on the shortening of response cycles between seeing a button and clicking on it. This ties back to the idea of animated

digital maps as more prominently affording the cartographic illusion due to their ability to remove time from the act of using the map and therefore 'resulting in modes of information access and manipulation that are increasingly experiential, thus increasingly similar to multisensory interaction with the real world' (MacEachren and Kraak 2001, 8).

Still, this streamlined approach is not for everyone, and according to the web-team, many of the old users complain about lack of high-end functionality. Gila recognised their issues, but was adamant regarding the team's choices, as one has to move with the times: 'they don't understand that what worked on a desktop-centred environment won't work on the web, on mobiles. Things have to be fast and they have to be relatively simple – in the old version, we had all the various layers grouped into folders, and it was… sort of intimidating. We decided that instead we'll have a very short list and then a button that shows the information overload' (figure 5.6). Now, when she opens up ArcMap, 'it takes me a moment to remember how to operate things'. She laughed, 'I go, "Oh right, I need to click the little i-button." '

5.3.1. NowForce and search

This focus on search-oriented exploratory information retrieval rather than goal-oriented hierarchies of the paper maps was a continuous theme in my daily interactions with both organisations. NowForce, as a profit-oriented company and concerned with financial considerations involving the acquisition and retention of user attention, is perhaps even more acutely aware of the need to systematically optimise their visual presentation of information into an efficient – and thus, cost-saving – form. The defining feature of their newest version is the primacy of the cartographic display. The old system was modelled on familiar computer-assisted dispatch (CAD) systems for emergency services (figure 5.7).

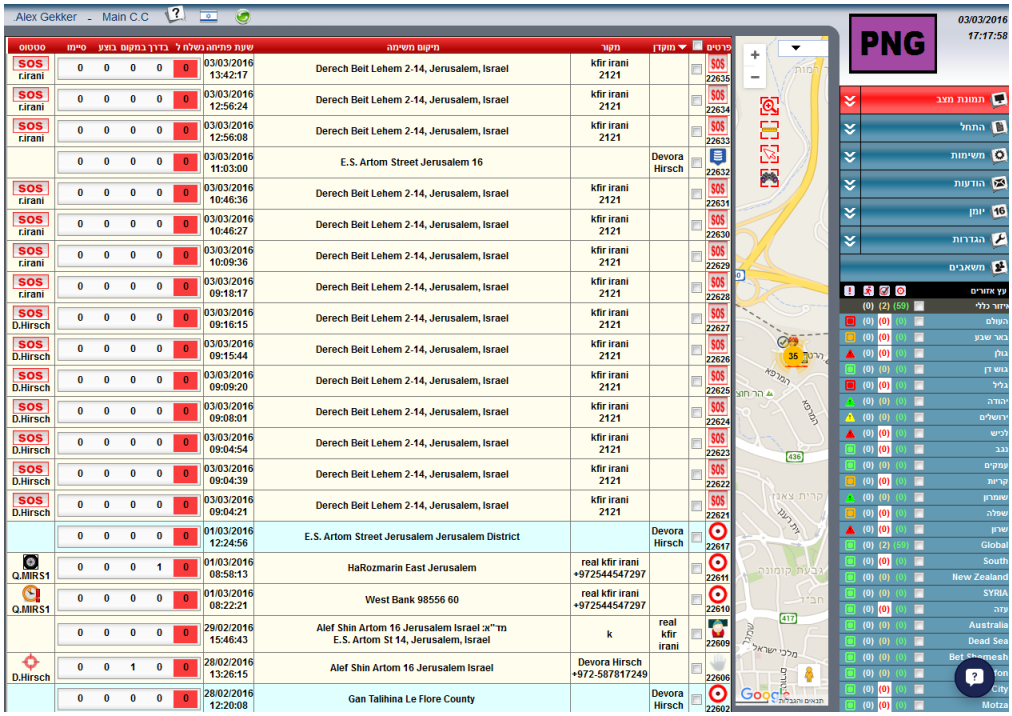


Figure 5.7: Current (original) version of NowForce's dispatch-user interface; screenshot by the author from the test server.

Here, the information is organised in a table, while the map is tacked on to the side. Events are ordered according to the time of the call and the urgency of the task. The map is present, but it is merely an assistive tool – as you click on a task, the map display zooms in on it, allowing some rudimentary measurement (i.e. distance between two spots). The majority of the work is done through textual input, detailing the location and details of a case and then assigning operatives to it, using the map only for broader orientation. This design is anchored in an aesthetic that pre-dates the web, having more to do with computerisation in the workplace in recent decades (Kerssens 2016) than with modern web-based, ubiquitous computerised styles. It does not consign spatial data into a different domain than other kinds of data, treating emergency events as an additional list of objects.[27] This was obviously not to the liking of NowForce managers, who wanted to differentiate their product from other types of CAD systems on the market and appeal to broader audiences (personal communication, 11 August 2014), and thus, the new version prioritises the map interface, and

[27] I discuss this aspect in greater depth when considering relational and non-relational databases in the previous chapter.

affordability of actions through and alongside it (figures 5.8 and 5.9). When I talk about gameful design, and in particular the notion of juiciness, we can see some of it in the design of these screens.

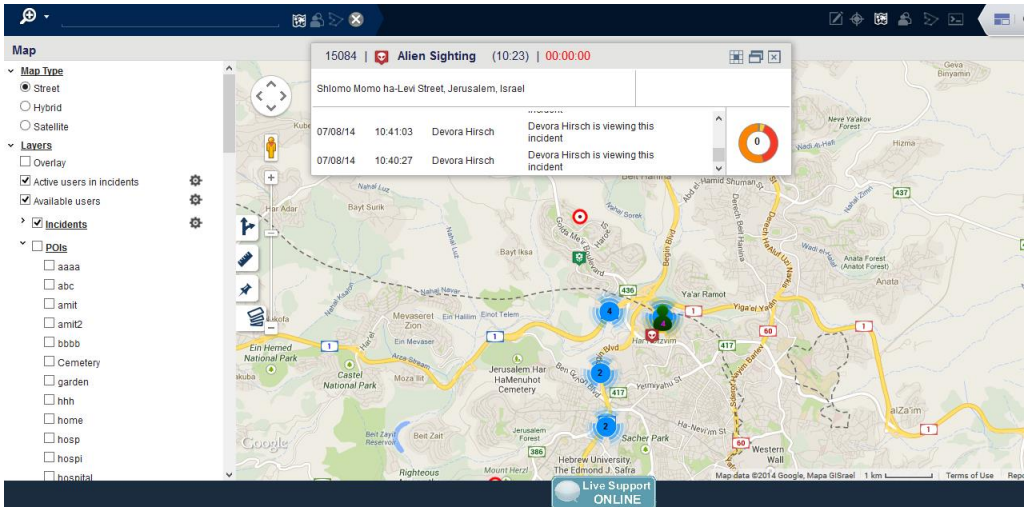


Figure 5.8: The map works without any additional panels; screenshot by the author from the test server.

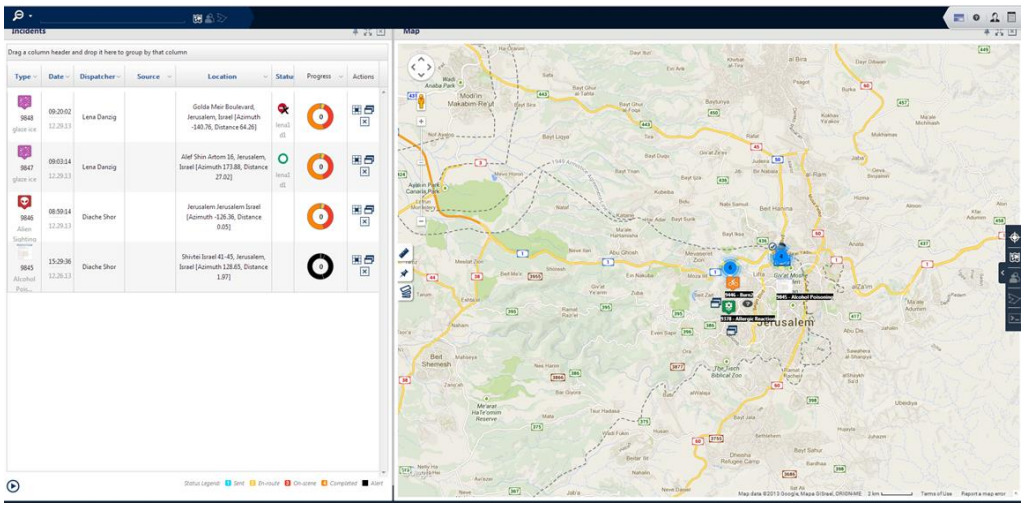


Figure 5.9: The event list is still present, but works alongside the map; screenshot by the author from the test server.

Information is not merely present on the map: it is active, alive, blinking and prompting attention. The icons are aggregated and generalized as one ascends to a higher scale, but are always available to click on and be re-centred. Transitions from the map to the screen are flawless and the

functionality of the various sections of the screen to be dragged and rearranged adds to the fluidity of the action. Overall, the new 'light' dispatcher and the accompanying mobile app (figure 5.10) present a wealth of graphic information. The idea is to 'try and create a single-screen application', said Amit, NowForce's VP of development, on 21 July, 2014. 'In the old version, the dispatch works with about ten open tasks – ten open tabs – simultaneously. The new version permits the user to rearrange the preferred layout. There are various panels that start in a certain grid, but can be rearranged and snapped into place. We are also working on an automated function that rearranges the currently open panels automatically.' The switch to map-oriented display is thus the driving force of the light-dispatcher development, present in both the dispatcher software and the tighter integration of the map into the overall tasks in the responder app, which will be discussed in the next section.

5.3.2. Gamification and quantification: controlling users through numbers

One aspect that must be mentioned regarding the query-based design mode of the map is the prevalence of numbers as cognitive shortcuts. To recall, in chapter 2, I suggest my casual power framework, focusing on how numerical interface elements compress and simplify the world through the map's user interface. I tie this to the notion of gamification, and specifically to the rhetoric of systems (Deterding 2015) that accentuates the linkage between rule-bound persuasion in computer environments and gameful design. I claim that the use of numbers allows the user to experience a form of immediate gratification through the heuristic of cognitive ease and associated affective states. In the examples above, one can see how the people involved pay close attention to numbers. The example screens of NowForce's light-dispatcher and responder app (figure 5.10) prioritise numeric information at the top of the map and around it in bold fonts and colours. ETAs, distances, time elapsed, the number of additional tasks (in the familiar 'red popup' style closely associated with social media) – all this might contribute to what Grosser (2014) called *the desire for more*, in the form of a constant need to tweak and check the changing information reflected in these numbers.

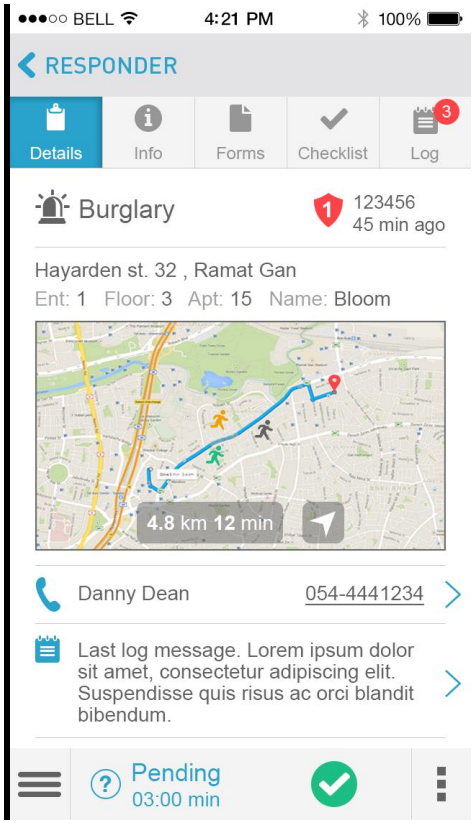


Figure 5.10: The planned design for smartphone-based mobile-responder interface; design sketch from NowForce.

This can be seen as a form of gamification which is often beneficial to the product owner rather than the user (Fuchs et al. 2014). In fact, the use of quantification is often pinpointed by outspoken critics as the types of shallow behavioural modification most prevalent in datafied and gamified systems (Dragona 2014). Instead, the use of numbers usually corresponds with leader boards, rankings and competitive elements – *paidia* rather than *ludus* (Caillois and Barash 1961; Deterding 2015). While far from claiming that the makers' intention was to design a game, returning to Sicart's (2014) distinction between play as activity and playfulness as attitude, we can envision the numerical elements here serving a very similar purpose, in a corresponding way (Rossiter 2015): on the one hand, to entice the user into continuous and 'fun' engagement with a given digital system while simultaneously providing those in charge with ways to monitor and *dividuate* (Deleuze 1992) their *playbourers* (Terranova 2000; Kücklich 2005) into controllable data. The interface serves a prime role,

as it creates a constant demand for action from the user and refuses static (figures 5.9 and 5.10): indicators go up or down, notifications arrive and require attention, the map zooms in and out on a certain area depending on the current focus on a task. This results in what was envisioned by Cartwright and colleagues (2001) as *geoagents,* or perceived entities that filter and focus user attention on spatial action available in space. However, while their vision centred on providing a usability solution to informational overload, NowForce's interface design uses such an approach to simultaneously engage users in affective states of an effortless – yet powerful – control over the spatial affairs. I will exemplify this aspect through a discussion of NowForce's clients and their potential aversion to being tracked and/or tricked by map.

I sat down at a busy Tel Aviv café with Miki, head of sales for NowForce. She is rarely in the Jerusalem office, spending her days chasing potential leads at various organisations who could become NowForce clients, mainly in the health and security fields. The conversations I've had with her, unlike the many with the developers and designers, shed a different light on user configuration. She is the mediator between the shifting forms of NowForce's software, at the end of technical staff's keyboards, and the potential users at various organisations. Through her feedback, product managers like Menachem may upgrade the priority of an item on the next software update, introduce a user-request feature or end up changing the design specifications of the system altogether. Menachem himself is cautious about it, though, seeing the sales staff as an additional kind of user that needs to be managed, and lamenting the fact that he does not have the opportunity to go out and meet more of their external user base personally: 'you will always have inevitable clashes between the needs and desires of different users.' Miki does not see herself as a user, though. Coming from a background of psychology and communications, she perceives her role as that of a translator, bridging the low-threshold, down-to-earth needs of the various organisations she encounters daily with NowForce's technology-cantered vision.

Morning, 27 July, 2014. She had just come from a meeting with a major healthcare provider who showed interest in implementing NowForce at their institutions. To them, the main appeal – according to Miki – was dealing with 'hidden unemployment' among the staff, or the fear that the employees do not perform their duties while on the clock. Beyond providing a quick and efficient tool to organise healthcare in a spatial way, it would also allow them to surveil the employees involved and compare them to other employees, or the same employee at different times. This is not the first time this has happened, she confirmed – many of the organisations they approach are happy to accept their software at the management level but encounter strong resistance from the workers

and the unions. 'When we perform implementation', she said, 'there are always two aspects to it: the technical and the cultural. The technical implementation is easy, because of our APIs and previous knowledge. The cultural is much more difficult, and further divided into two aspects: understanding the way NowForce operates within the established organisational practices and overcoming the "wait, am I being followed?" mentality of the workers.'

The trick, she confided, is to turn NowForce's tracking features into selling points. The same perceived total visibility and accountability that the map affords can become attractive if one understands the needs of the workers as well – for example, by allowing field personnel to clock in and out without having to visit the office. The appeal of automated platforms is their promise of seeming to offer neutral, 'fair' record-keeping (Nahon 2015; Gillespie 2016). Miki gave a personal example of reporting a broken smoke alarm at her university and receiving an automated tracking message: 'the mere fact that you've received a response – that the information was passed on – calms me down. Even though it's not a human [that received it]. Even better! Here: there's a number, an ordered number that tells you that your request is being worked on. Similar things happen in the labour unions [of the organisation NowForce integrates into], there are those who work very hard, but they are not seen and instead get reprimanded. Suddenly, there's a rating system, for who's the quickest, who's done the most calls. Suddenly, it's nice to get an earnest "thank you!" for your hard work! Till now, who even knew you were such a good worker? The ones who got recognition were only the ones with all the bells and whistles!' At the meeting she had just attended, she continued, when the topic of singling lazy workers came up, the workers' representatives immediately started complaining about privacy issues. At this point, she interrupted and said that instead of thinking it as a system for punishing the worst workers, it is worth considering as a bonus system for the best – 'otherwise, the [responder] app will "disappear" from everybody's phones within a week', she summarised.

Unsurprisingly, as the one dealing with decision makers, she sells NowForce as an empowering tool:

> just the fact that I can install the app on some security head's phone, press the button and suddenly appear as a user on the laptop screen makes a huge impact. Today, it's becoming the new norm: allowing more control, looking out for your employees' safety, generating after-action reports. Now, the boss can come home in the evening, check his iPad, see how the task list is clear or where each employee is on each task and go watch a movie with his

> wife with a clear head. Generating reports easily and automatically is also very important. We had a client who was only interested in detailed location-based reports, not real-time control. He would say: 'operationally speaking, I know my guys well, I don't need this. But I need reports for the big bosses abroad, so they would see what we do and provide more budget.'

In this case, we can see how NowForce, like many other types of mapping and map-based artefacts beforehand, acts as an argument, or a translator in a network of associations, rather than a straightforward representation. Again, we return to the twin notions of gamification and quantification through the map – both for ensuring control and as a way of keeping users engaged with and motivated to work with the product.

While far more pronounced at NowForce, as a commercial enterprise, than in Mapi's public service sphere, those trends are nonetheless reflected in both organisations' approach to interface design. In the same way as Miki's sales knowledge, Mapi's web-team often evokes past interaction with external 'clients' such as other governmental offices leading to their maps being more adaptive and engaging for users, with a progressive shift towards catering to non-professionals: 'We want the users to be able to fully customise colours, fonts, even backgrounds', said Nir on 27 July, 2014, eschewing his GIS training and decades of cartographic codes that has developed along with it. 'We want them to be able to define their own symbology when they are logged in, and then we want a pre-set cycler that would change between two different types of symbologies at the click of a button.' The users are allowed and encouraged to see the maps they are comfortable with, not the ones made for them. Critically, we might say that this function is there for the user to spend more time and upload additional personal information onto the platform.

To conclude this section, a common thread running through both organisations' attempts to reconfigure users for new forms of visual engagement with the map, one that prioritises quantification and customises the design. The map becomes conversational, where information can be queried and searched without requiring professional familiarity with the subject. This enables the map to facilitate emergent discovery, sometimes providing types of information that users were not aware they could receive through the map. This ensures satisfaction with the map experience, and subsequent returns (or purchase, if the goal is commercial). In the previous chapter, I refer to this as a subset of casual power, or the idea that power is exerted over users in habituating use patterns to make them natural and innocuous.

As discussed in chapter 1, this is done primarily through the dual methodologies of pre-emptive attempts at testing and configuring new user interfaces in a laboratory setting, and real-time user tracking in existing versions of the product.

5.4. User testing and the visual alignment of attention

The primary stage in configuring technology and users for each other occurs when developers and designers attempt to guess what their respective users will want in a product, how they would approach it and what critical errors that could interrupt or distort the user experience can be avoided (Woolgar 1990). Doing so usually entails imagining the potential users and their ways of use early in the design process and/or including potential users as (paid) testers in various stages of product development (Ash 2010) in order to encapsulate them in the present-oriented spatiotemporal bubble of the interface envelope (Ash 2015). This will be shown with regard to both the specific practice of user-oriented documentation and usability testing.

On 26 July. 2014, Menachem, the product manager of NowForce, talked about the difficulty of integrating user-orientation into the development process. He specifically noted that while the company might think in features, merely providing the description of a feature instead of its intended use often results in uncertainty. He gave an example of a popular feature request by the client for the mobile (responder) app:

> let's say somebody wrote: 'I would like for the alarm tone to be changeable.' Now for me, it's clear that we should turn it into a descriptive text [like] 'I would like to be able to assign different alarms to different events so that I would be able to differentiate between various incident types, and know without checking my phone [to see] whether a kid has fallen from a tree or somebody is having a heart attack.' It might sound cumbersome, but without this, what often happens is that someone sits down and begins working on a feature without understanding the context. And this can lead to an exponential loss of resources down the line and user confusion.

This form of documentation shows the desire to define and contextualise potential users even before work on the features begins, creating affordances for future use patterns.

When setting up my fieldwork, all potential contacts showed interest in performing usability testing together. Eventually, we did not go through with testing at Mapi, due to the fact that

development did not begin and they did not have a working prototype (and saw no reason to test the current version, which was to be phased out). NowForce, on the other hand, was very interested in the potential to perform such testing. My initial discussions with Menachem revealed that usability testing – and more user-oriented design is general – is something that he always wanted to do but never had the resources for. As a start-up born of a specific lack experienced by its founders, the NowForce team had a clear idea of who their users and their needs are – because they consider themselves part of the same group. Over time, however, this has changed. Miki, the sales director, told me that several times the clients she introduced were rejected because they did not conform to the founders' perception of the types of companies that would use the product. Menachem recalled arguing with the CEO over what he considered unsubstantiated assumptions about the product's design features. Amit, the VP of development, acknowledged that there are now multiple clients that require unique features not requested by others, making development difficult.

The usability tests that we set up (see section 3.2.1 for details) were then as much for the product manager as they were for me, since my arrival gave him the opportunity to do something that he wanted the company to engage in for some time. 'Sometimes I feel as if we're very focused on shots in the dark', he said. 'I hope NowForce can go through some maturation process. And we'll end up relying on data rather than on logic.' By 'logic', he meant the imagined user as conceived by the company's ethos of who and what their customer base is. In a way, despite the cultural and market difference, NowForce is experiencing as much internal strife as Mapi : though it was born in a digital era, its maturation is now occurring at a time when mobile devices and digital maps have reached a quotidian status, changing the assumptions of what it means to sell a map-based dispatch solution, and what the clients expect of their maps. Thus, our usability tests were also a sort of argumentation, showcasing the problems that might have been overlooked due to the company's prevailing ideas concerning what they do and who their users are. As described in the methodology section, all our trials consisted of the same tasks, administered to users at three proficiency levels: a user without any background in mapping or GIS, a user with some experience and relevant proficiency and a user familiar with the previous NowForce dispatch system from his work. We asked them to perform tasks of varying complexity such as finding an address or dispatching a responder to an event only if she has the proper equipment, while providing 'think-aloud' commentary. The second test included a simulated phone call to an emergency service where the subjects (after gaining some familiarity with the system) were supposed to operate it under some

pressure (Appendix 1). We recorded each test via screen video and external voice capture. The resulting videos were coded and analysed (see section 3.2.1 for details).

Many of our concerns were with traditional cartographic concepts, such as clarity or map generalization, but transferred to the digital domain. For example, one task involved looking at a group of responders at a certain zoom level. At this scale, they were grouped ('clustered') into a new type of icon with a number attached to them. We were interested in whether our test users would understand the visual logic of clustering and the attempt to disentangle them. Yet, only one of them – the mid-level user – saw the effect when zoomed in and proceeded to use it throughout the rest of the test. Neither the beginner nor the older-version expert made use of it.

Most of our results tended to gravitate towards the aesthetic and experiential: were the icons and popups clear? Were the panels easily re-arrangeable? Did the user feel confident in her ability to perform a certain action? Could she easily reproduce it after learning it?

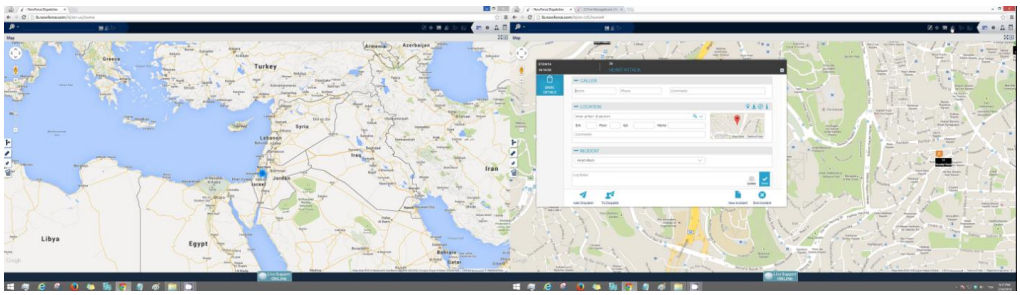


Figure 5.11: An intermediate user attempts to figure out the best way to dispatch an agent to a task; screenshot by the author of a usability-test video from the test server.

Both users who were unfamiliar with the system felt comfortable searching and navigating it, despite the map being rather more complex – in terms of information density – than standard, everyday applications. One of them commented that making it look like a Google Maps map might have helped to instil a sense of ease. In the end, the product manager and I had a long debate while interpreting the different videos. Locating the important bits and coming up with common themes that unified the three users forced us to develop a common language; to dwell on definitions of certain functions; to repeatedly watch the same ten seconds of footage over and over again, arguing about whether *that* was simply a miss-click or a failure to understand the system's visual language. The results (Appendix 2) showed that much of the confusion came from misunderstanding specific icons, which users tend to glance at without reading the descriptive tooltips.

When we presented our findings to the entire NowForce team during an extended version of the daily morning meeting, reactions were mixed. The developers did not necessarily have strong reactions to the material. Some tried to argue with our findings, clearly taking umbrage at how we criticised design decisions they had made by pointing out how what was clear to them was not necessarily clear to the users. Others remained quiet, but later some of them told me in informal conversations that while being interesting, the testing did not help in their daily tasks. This shows that there is an ongoing mismatch between different design intentions.

This reaction also shows how, through personal preferences and cemented ideas, the NowForce team created their imaginary users and populated their user interface with visuals that fit such an imaginary user's skills. Those imaginary users become cemented until testing changes them and a new user mythology arises. The actual users will then only see the maps made for their imagined selves, and they will then conform to or contend with the prescriptions embedded in those devices. For example, when one of our test users remarked that the 'mission' icon looks too similar to Google Maps mobile version's 'centre on my location' icon, we made a note to change it. This issue from one user came to represent to us an entire class of future users, who will now see only the new icon. We do not know whether this was a widespread issue, as we lacked the resources to attempt to reproduce it – as many small organisations do – so for us, this became 'a win' against our uncertainty concerning the interface's opaqueness, another solved issue to be checked off. By preventing potential confusion, we hoped to prevent the user from questioning her actions or the information presented on the map and thus facilitate a smooth transition between the potential actions or the user finding herself on the map and finding the necessary task.

An important side note should be made about the distinctions between various visual-design aspects on desktop and mobile screens. A common complaint that I heard from Nir, Gilla and Yakin from Mapi, as well as Menachem and Ronen from NowForce, was that it is difficult to design maps without knowing the screen size and resolution that will be employed for the map. This was especially relevant when discussing responsive – screen-adjustable – design and the difficulty of predicting user behaviour in such environments. Their concerns are consistent with the ongoing academic work – mainly in HCI – on the unique challenges that mobile screens present to mapping (Bellotti et al. 2003; Van Elzakker, Delikostidi and van Oosterom 2008; Delikostidis and Van Elzakker 2009; Kuparinen, Silvennoinen and Isomaki 2013). However, this aspect did not come up in my own work often, since both organisations' new mobile interfaces were at a very early stage in planning.

To conclude this section, user tests represent a crucial stage in the visualization of the map, as this is when pre-conceptions of real and imagined users can clash with regard to displayed information. Formerly, map-usability tests were associated with the empirical testing proposed by Arthur Robinson for a clear target audience, often within the professional cartographic community:

> Robinson's great achievement is that he included the map user in the equation. This design focus had the goal of improving the efficiency and functionality of maps as communication devices via empirical experimentation. Disciplinary apparatus was engaged for this project: personnel (faculty with cartography specialties, cartographic technicians), facilities (the cartographic 'laboratory'), and a range of courses (design, projections, etc.) (Crampton and Krygier 2005, 20).

The user testing conducted in my research by way of contrast underpins how modern map-users' world of associations has expanded, and how multiple content – mostly from web browsing and phone use – interfere with perceiving the map's visuals. When talking about the difference between the various versions of Mapi's web-portal, Yaki mentioned this predicament on 8 July, 2014: '[i]n the first generation, we brought mapping specialists [to consult with]; in the second one, we were pressured to hire "web specialists", but we decided to do it ourselves. We looked around, saw what others were doing, and made our own choices about how [the map] will look.'

5.5.Tracking users

But what happens when the design fails, and the real users end up being radically different from the imagined ones, dispensing with the pre-scripted actions and finding alternative meanings (Latour 2000)? In such cases, the map-makers have a choice of either incorporating the divergent scripts into their own future products, trying to modify the design to allow (or disallow) certain functions, further attempting to influence use patterns or just not paying attention to it at all. As discussed in chapter 2, tracking is directly related to notions of quantification in my casual-power framework. The inherent data-driven states of the political economy surrounding digital maps' production are reliant on precise measurement of users, audiences and their gaze, quantified into various metrics of time of use, dominant map categories (or screen areas) and the like. The tracking process is thus internalised in the visual configuration of the interface: map-makers want to capture the gaze of their imagined user for the sake of the map's inherent function, but also for the sake of future commodification and

calculation that will be further fed into iterative versions. User testing is but a first stage of such an assemblage, but it lays the foundation for it.

For example, one of the tasks during the user testing we performed was to dispatch a suitable responder to an event. What we did not tell our testers was that we were interested in whether they would use the new 'users' panel for this or do it directly from the tasks panel. Only our beginner-level tester used the new panel, while the intermediate user used the tasks panel and the professional started by looking at the users panel at the appropriate moment, but then closed it and failed to finish the task. Needless to say, we were somewhat underwhelmed. This panel represented a major departure from the previous method of dispatching to what we thought was a more natural and visually-aligned map-assisted decision-taking process. What went wrong?

In this case, it seems that all users understood the point of the user panel, but failed to locate other types of information necessary for their task to complete the assignment: one could not figure out how to obtain the location of each user on the map, and the other became frustrated with the fact that he did not seem to be able to see the users even after figuring it out, due to the fact that he accidentally turned on a layer filter that removed the 'users'-type icons from the map. Despite all our careful planning and despite the expert's familiarity with the software, personal interpretations, especially at the map's visual level, still drastically changed what seemed to us a straightforward task. Though anecdotal, one remark serves as a perfect illustration of our intermediate user ignoring most of the text and focusing on the icons while performing an assignment. He spotted a heart-shaped symbol and said, 'What's here, a love affair?' Then after taking a second to notice the text beneath, he concluded, 'Oh, it's a heart attack. Well, I was close.'

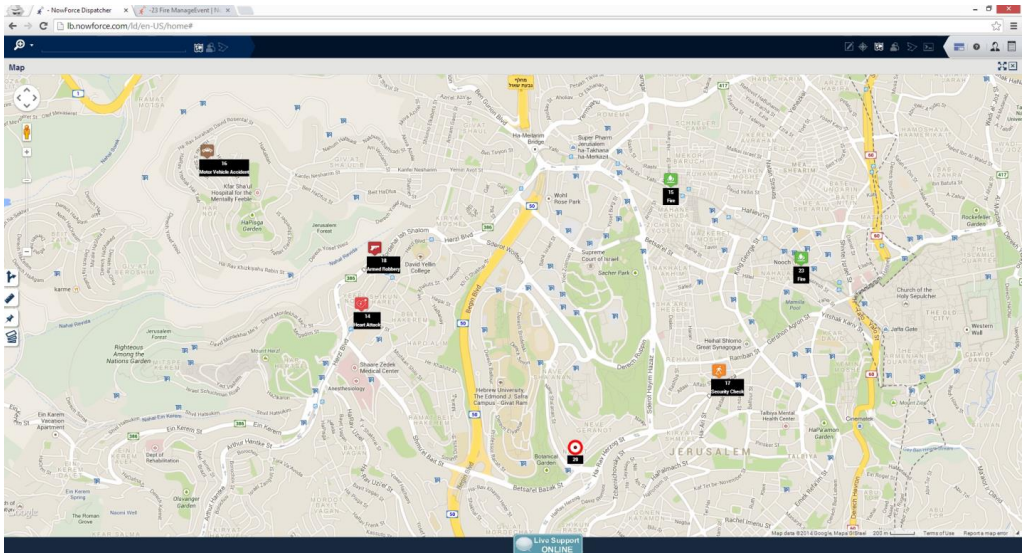


Figure 5.12: That's not the shape of a heart: personal interpretation of icons; screenshot from the user testing's video capture. Screenshot by the author of a usability-test video from the test server.

So how do the cartographic organisations plan for such occurrences? While in the past, the answer lay in continuously accumulating customer complaints and issues of errata appendices, contemporary digital platforms provide a much quicker answer. Today, they have the ability to integrate various forms of trackers into the software to analyse the user actions en masse and correct it on the fly, or at least after the next version's release. Both Mapi and NowForce use Google Analytics code snippets in their products. Originally intended as a marketing tool and seemingly unfit for slippy map displays lacking changing URLs or subdomains, they nonetheless track specific instances in certain subsections of the screen in relation to the opened map, and also generate and trace coordinate-specific URLs for their map display. Menachem said on 26 July, 2014 that he spends a lot of time getting familiar with the product-management field, not necessarily only emergency or dispatch-system services: 'one day, I saw on a product-centred blog that someone used analytics not as a marketing tool but for improving the product. I thought to myself, I could attach tracking to certain application events and do the same.' Similarly, Nir said on 22 July 2014 that he does not care what pages users visited, but was much more interested in 'which layers did they turn and off, which map applications they've run. Now, we also know this from the "share-map" functionality that we already have, as we see in the long URL that is being shared exactly what were the users doing.' This

is a manifestation of the pressures exerted by the attention economy and the need for quantified interfaces to be gameful and engaging in order to keep user attention.

Those working on such features understand the ethical murkiness of integrating surveillance into their maps, but often justify this both through the technological foundations of their maps and the culture shifts. Both in Mapi and NowForce, I was told that they follow best practices in modern software development that includes keeping open feedback loops with their users. Officially, this allows for quick bug and security patches, though unofficially, this also leads to (big-)data-driven decision-taking concerning the prioritisation of some map functions over others. To paraphrase and aggregate the broad range of responses that I received, the general sentiment regarding those issues is as follows: contemporary maps, grounded in the user's presumed geo-location availability (through WiFi network position, GPS or both) and relying on IP protocol (thus being open to a limited geo-location), are inherently invasive. Therefore, to offer the users the same level of convenience they have gotten used to, the developers must ask for the same privacy toll.[28] This does not necessarily mean that they agree, but rather that they are complacent regarding similar types of sociotechnical assemblages as the users for whom they create the products. We can compare this to Rankin's (2011) changing geo-epistemology, which repurposes space as a resource to be used and consumed. Gila, the GIS specialist on Mapi's web-server, said on 22 July, 2014e that she does use her mobile phone that much, and that she only upgraded to a smartphone recently. Now, she uses it primarily as a navigation tool for both public transportation and driving. She admitted that she likes the ease that those featured introduced to her life, but often 'feel[s] like they know everything about me and I don't like it'. I asked her whether some of the features she uses now are influencing her design choices. She gave the example of the social navigation app Waze's ability to share route and ETAs in real time over social media, to facilitate group travel. 'I remember how it was before', she laughed. 'Wait for me at 12:00 at the gas station. And then it begins: you call and they don't answer, or suddenly they go… "Oh, you meant THAT gas station." Now it's easier.' Those principles, she says, went into the design of the personal area functionality on the web-server, which allows users to similarly upload files to create custom maps and share them.

Earlier, I described the conversation with Miki, sales director for NowForce, about how the cultural integration for their clients is harder than the technological one, and how privacy concerns among workers play as significant role in this cultural shift. But in recent years, she has felt the sea

[28] I have previously written on the exceptional stance we take regarding geo-located privacy, and how it is problematic when taking a historical view of such issues (Gekker 2014).

change in this regard: 'we live in a different age. Before, did you ever go to a restaurant and let your 500 [Facebook] friends know about it? Now everybody wants to know everything in real time. So it slips into business as well.'

5.6. Conflicting visions: Public vs. private responsibilities

While I draw many parallels between Mapi and NowForce, especially in the way their design work shapes users, the former is a governmental agency and the latter a private company. Though both, through their map-making, are actively engaged in transduction (Kitchin and Dodge 2007) of lived worlds for their users, each has a different set of priorities and responsibilities when it comes to map design.

In my discussions with Nir and Gila (Mapi web-team), they postulated that the logic of their layered map is such that users will continue to discover information even if they do not know which layers are active or what layers are there (compare this to our usability tests at NowForce when a tester could not perform an action since the specific layer was not visible). However, we must take into account that such layered logic is not necessarily visually comprehensive. For instance, as part of their goal to collect as much information as possible, the web-server team has received multiple data layers from various ministries, even if they were not fully optimized. But Yaki, their team leader, wanted the data to be available for the public, even though it creates occasional visual clashes. While explaining this, he shows me a certain high school on the map. Automatic integration of the data from the Ministry for Education has created two entries for this school. One, based on Mapi BANTAL's accuracy, is the correct one, and the name is written on the base-map next to the actual building. The other school location was received from the Ministry, and it is shown as an interactive icon on a different layer. It is located one hundred meters from the correct location, but the trade-off in accuracy is compensated by the availability of alphanumerical data about the type of school and the associated statistics (figure 5.13). Again, he told me on 22 July 2014 how these sorts of visual mismatches were met with outright hostility from some of his colleagues, who considered them errors unbecoming an official governmental website. But he sees it differently:

> this might push the Ministry to correct their data, and in fact, they are doing it now, going around with GPS devices and correcting it, which is also really beneficial to them. And a public member might look at it and say, 'How can you, as the government, put out such

obviously erroneous information?!' But we know that the gains here are greater than the losses. This actually shows the public what the government knows [even if it is wrong].

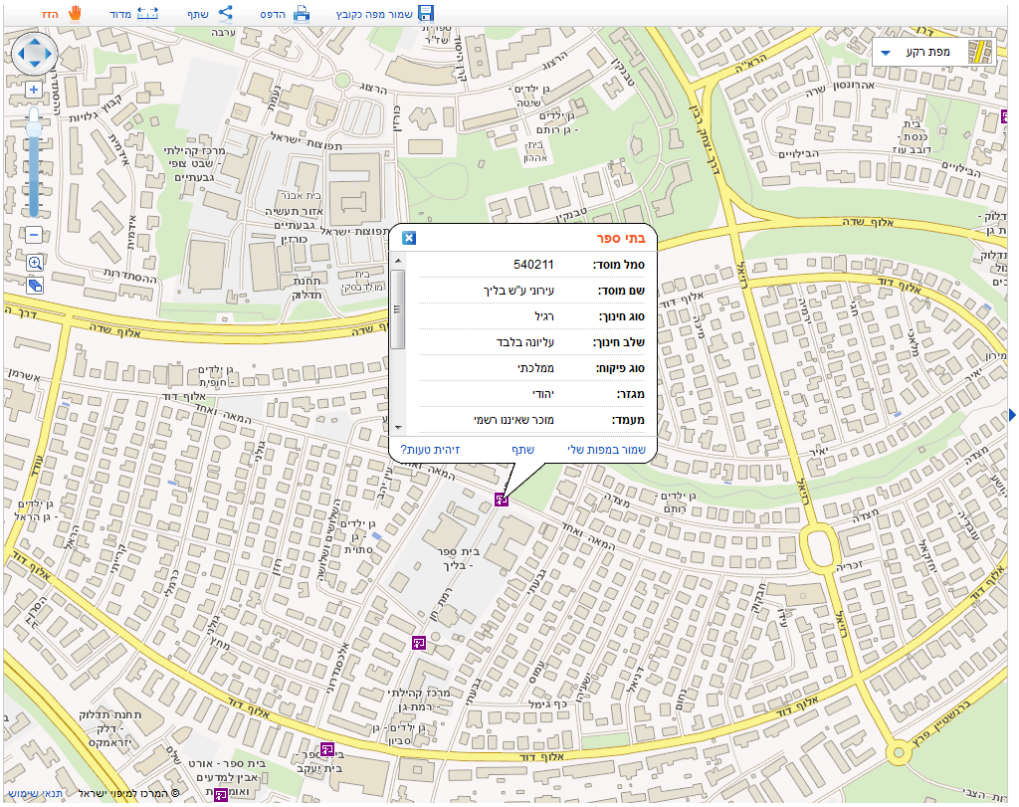


Figure 5.13: The Blich High School's location in two different spots; screenshot by the author

Mapi has claimed repeatedly that they do not compete with the private sector, but supplement it and 'provide […] official governmental data, like the Meteorological Service', according to Nir. However, this may also reflect the uneven resources that the government has to deal with the rise of private geodata companies or even its inability to compete with them in some areas, even if they wanted to.

For example, Yaki told me on 8 July 2014that it was important for him to show bus routes and stops. The argument he heard against it is that there are private companies doing better work, and he constantly convinced other parties that it is their duty to provide what the government knows and sees, as a public service. According to Yaki, his point of view was accepted. Gila told the story on 22

July, 2014 slightly differently though, recalling how after several years of development, followed by a decision to buy a public-transport engine from a German supplier, the project was simply scrapped. According to her, the entire aspect of navigation, whether by public transport or otherwise, became a huge issue: '[w]e found out that the BANTAL is simply not built for that. A street is just a line, and if we want traffic, we'll need to split each existing line into two.' The web-team then simply requested periodical information from the bus companies, creating a rudimentary route representation on the map that did not allow for any routing or navigation. Bashir, the database administrator, was even more categorical on 14 July 2014. He agreed that Yaki wanted a pathfinding system, but is adamant that such a system will never be possible in the current configuration. 'We told him that such system, that takes into account pedestrian movement, would require the map contain each and every street crossing in existence, and it's not possible.' I pointed out that Google seems to be doing that with their maps and ask how do they do it without having access to the wealth of Mapi's cartographic knowledge. 'I don't know', he answered with a hint of disbelief in his voice. This exemplifies the volatility of the cartographical assemblages, and the need of each organisation to provide its own vision for their maps, based on available data and skills.

Here, we arrive at the inherent difficulty of balancing the usable, convenient and truthful aspect of mapping. From the quotes above, the web-team in Mapi, and to some extent other parties involved in production of the web-server, are mindful of a certain responsibility to strive for truthfulness in their representations. This can be linked to the prevailing ethos of the national mapping agency, as evidenced by the many references my interviewees made to historical maps and technologies used by their organisation in past decades when justifying choices. The designers at NowForce, on one hand, appear not to be overly concerned with these issues as long as their product is accurate enough to be effective and purchased by clients. Then again, NowForce are only in the integration business; they do not collect or own any of their geographic data and rely on Google for the maps and their clients for the points of interest. NowForce can always defer some of their judgment regarding exactly what the user will see on the map to other parties, something that Mapi is reluctant to do. Bashir tells me about the recently-built Airport City office park next to Ben Gurion International Airport. It quickly became popular with both car-rental companies and conference organisers, creating a steady demand for cartographic information concerning where things are in the area and how to get to them. The streets received generic names from the developer, and address numbers were added to these streets in the customary way. The web-server team naturally wanted to update the relevant tile caches to include this information. Bashir declined,

and continues to do so thus far. The office park, located under the jurisdiction of the airport rather than a standard form of a municipal authority, ran into some issues with its registration with the Ministry of the Interior, and before those issues are resolved, Bashir refuses to showcase it officially. He is aware that all those street names are widely used, especially in various commercial mapping and navigation platforms, but he does not budge: 'official data needs to be official.'[29]

5.7. Conclusion: visual arrangement of maps, uniform yet customisable

The trends of what I called uniquitous mapping are present in the visual-interactive design for both NowForce's and Mapi's user interfaces (and the software that powers them): these are maps made for the non-professional user, intended to be accessible in broad variety of situations and organisations, yet attempting to satisfy the needs of all specific users through active and passive customisation of the actions available through the cartographic interface. This is done primarily by using the map-like component of the interface as an entry metaphor mediating paths for further discovery. The map interfaces are designed with an exploratory approach in mind, mimicking the best practices of other web and mobile interfaces. By doing so, NowForce and Mapi aim to engage a spectrum of user skills and requests, and attempt to solve cartography's traditional dilemma of showing too much or too little. They do so in that their maps are uniform, yet customisable.

5.7.1. Uniform

Consider the neutral base-map's reliance on the layered logic traced in both instances. As I discuss in chapter 1, this comes from the proliferation of Google Earth design principles, later integrated into Google Maps and – through the introduction of the map-mashup and the resulting API – the rest of web cartography. In this instance, the user recognises the map as a template made of familiar colours and symbology. According to the design documents of NowForce and Mapi's tender specifications, the user has come to expect a clean look, lacking such features as relief or high points which were customary in large-scale paper cartography.

There are vision controls on the topmost left-hand corner of the map for panning and zooming. They are omnipresent, even on Mapi's web map, which is not built on Google Maps and is, in fact,

[29] A similar issue is occurring with Terminal 5 of the UK's Heathrow airport and the way it (and the access to it) is shown on various mapping platforms. For a comparison, see Open Street Map's official blog: https://blog.openstreetmap.org/2008/03/27/the-state-of-terminal-5/

primarily intended for users who read right to left, who will scan the map in the reverse order compared to the majority of Google Maps users.

Beyond the cartographic, each map is designed around panel logic, organised into grids. Most of them are collapsible so not to obstruct the view. Such design exhibits its proclaimed animosity towards visual clutter and its preference of a query-based mode of navigation over traditional mimetic ones (November, Camacho-Hübner and Latour 2010). In this context, it is worth highlighting how navigation panels remain as constants even when a fixed legend disappears – the digital map wants its users constantly moving, absorbing the information coming to them, instead of attempting to understand whether it is even relevant to their broader enquiry.

In general, Gila's explanation on 22 July, 2014 of their focus in working on the current, 3rd generation, of the web-server is symptomatic of the unifying approach both organizations take to their maps:

> we are thinking about every element and want to be as convenient as possible, with as few clicks as possible, without long explanations instead of being opaque, with clear signposting that illustrates what the end result of your action will be before you take it.

5.7.2. Customisable

On the other hand, NowForce and Mapi have integrated various features into their software, aiming to make the map feel particular and bespoke. The actions employed range from creating individual and group personal areas that can be accessed by logging on to Mapi's web-server to customising colours, icons and workspace layouts with NowForce's system.

This customisation varies from one organisation to another and within the various technological limitations of both: Mapi does not yet allow users to upload polygonal personal layers, allowing only the creation of point-based ones; NowForce will let you work with Google's KML files, but limits each client's personal routing information based on their payment level.

There is a great deal of focus on customisation in the new Mapi tender. On 27 July, 2014, Nir talked with enthusiasm about a simple function that he introduced into the planning – drawing freeform shapes on the map with whatever layers the user has, and then saving it as an image. 'It could be very useful if you want to print a map to a wedding or something, and have an arrow saying

"the parking is here".' It is also an interesting way to make a map comprised of everyone's data uniquely yours.

Both Mapi and NowForce use some form of attentive user interfaces (Knoller and Ben Arie 2014) to turn map interaction into a predictive search-oriented affair designed to minimise the user's cognitive load and promote frictionless interaction. While NowForce also utilises software algorithms to tweak the UI based on user's previous actions, according to Gila, Mapi only uses algorithms for large-scale user-data analysis and then integrates them into their next design stage.

This chapter discusses such tensions between uniformity and customisation, as witnessed in the specific map production stage when 'raw data' (Gitelman 2013) are being visualized. It discusses the focus on discoverability of information in a clear and accessible way, while attempting to maintain some form of control over the unified user experience. In the next, and final empirical chapter, I will detail how this process of visualization can be understood through yet another institutional aspect of modern map making. Namely, I analyse the reliance on external user-experience consultants and the integration of broader 'UX-design' practices into the world of map-making.

6. **Outsourcing the User Experience**

'With something as important as happiness, no measure ever seems quite adequate to the philosophical importance of the matter. We are generally content to accept that the map of the ocean floor is not the same as the ocean floor itself, but merely a presentation with various advantages and disadvantages. But with happiness, there always remains a frustration. The sense that quantified smiles, heart rate, money and "just noticeable differences" miss something crucial about the nature of emotional experience is overwhelming. A smile may indeed reveal something of the person – but surely not as a scientific representation'

William Davies, 'The Happiness Industy' (2015, 37).

This chapter deals with a phenomenon I encountered while conducting my fieldwork and which I consider to have profound implications for the world of contemporary digital cartography: the outsourcing of certain design aspects to external companies, mostly those specialising in what they call *User-Experience* (*UX*) *Design* and often in mobile device-centred work that can be measured and optimized (Law, van Schaik and Roto 2014). Those external entities do not come from the world of maps, and instead position themselves as interface specialists – able to create any product on any platform better simply by virtue of understanding, or claiming to understand, the cognitive and affective states of users who will engage these products (Law et al. 2009; Garrett 2010). Thus, in this final empirical chapter, I examine a concluding and unexpected stage of making a digital map. After the data were collected and prepared in the proper form to be read from the database and integrated through various APIs, and after certain digital visualization methodologies were implemented to translate this data into a user interface accessible to the non-professional user, an external expert was invited in both my cases to suggest modifications to the way the map was presented, in order to make it better – according to their own view.

This in itself is not new, as the notion of usability as an outside expert has been prominent in the engineering and design world (Norman 2002; Law et al. 2009), prompted by the spreading of concepts from the field of human-computer interaction (HCI), with its hybrid status as both an academic discipline and an industry standard (Sampson 2016). However, the change seen in both my case-studies revolves around the presumption behind such interventions. While for the usability expert, the user is envisioned as primarily rational – or at least consistent – the idea of a dominant

trope of usability tweaking revolves around making the product straightforward and easy to understand by most. In the context of cartographic pursuits, this fits within the traditional work around the visual components of the map, designed with various skill levels in mind (Cartwright et al. 2001; Van Elzakker, Delikostidis and van Oosterom 2008; Delikostidis and Van Elzakker 2009; Delikostidis 2011). In contrast, the experience approach envisions the user as primarily an affective creature, yearning for stimuli and easily bored. For the practitioner, it adds to the usability considerations above the requirement to stand out from other similar digital artefacts by virtue of affective and cognitive tuning designed to attract and engage the user's attention.

Understanding UX and its implementation into the maps of my case-studies allows for the unpacking of how notions of engagement and the economisation of attention, which are central to the casual power framework, are employed by map-makers to configure users. The experiential interface engages the user in a playful mode that adds the notion of fun to telic interaction, altering the mode of being in the world through the map (Sicart 2014). It relates to questions of power and resistance to such power in maps' interfaces, and highlights how the cartographic assemblages that I research incorporate, by virtue of ongoing digitalisation, additional aspects of the software industries. Today, more than ever, this mode seems to be computational industries' consensus view of how relations between users and devices must be framed: as emotional and experiential rather than utilitarian.

Therefore, this chapter is an attempt to tie the world of map-making with broader institutional trends that occur in digital media, namely consolidation – or convergence (Jenkins 2006) – of various types of content and platforms into previously unknown forms, often under the pressure of globalized market logics and alongside the larger trend of the web's platformization (Helmond 2015). It builds strongly on the mediatization research presented in chapter 1 (Hjarvard 2008; Hepp 2011, 2013), as a way of understanding the significance of labour relationships and work structures of media-producing personnel (who work with maps, in our case) for the lived experiences of their users. It does so by pinpointing the intervention of UX advisors into the map and unpacking the logic of such interventions vis-à-vis the goals of the map-maker.

Above all, this is another thread in the line of argument about how map interfaces can be designed with the overarching goal of engaging the user while reducing their self-reflexivity. Specifically, I claim that by outsourcing the tweaking of the interface under the mantle of 'user-experience design' to companies outside the field of cartography, the map-makers I have researched join a larger trend. This trend views the core functionality of digital products as something that can

be re-packaged into more fun, playful and engaging form by external specialists. By doing so, the case-studies I present augment the cartographer's ethos with that of the interaction designer, and the web 2.0 (or 3.0) mogul. Such logic postulates *attention* as the main currency of the contemporary web (Stiegler 2010) fostered by new media companies to facilitate a type of consumerism that benefits their business model (Kücklich 2005; Nieborg 2015). Nonetheless, I wish to stress again that there is no inherent dichotomy between the idea of play or leisure and the idea of work, but rather that the merger of the two in the name of management has been an ongoing process of post-modern work environments (Terranova 2000; Scholz 2008; Galloway 2012; Andersen and Pors 2014) and, in fact, that such spaces might highly benefit from the reimagining of work-play relation into what Galloway (2012) calls ludic capitalism.

The chapter begins with my introduction to the term of UX as employed throughout my ethnography alongside my attempts to position it in relation to the other technical and design workflows I encountered at Mapi and NowForce. Then, it unpacks the curious position that NowForce's map has with their UX consultant, as just one component among many, and discusses this position as it relates to NowForce's own views. In the third section, the chapter focuses on the terminological transition from UI to UX design over the past few years, and what this transition might entail for mapping. This conclusion relates to two aspects of the map: track-ability of the users and the primacy of affective over cognitive experience. Sections 4 and 5 of the chapter, respectively, deal with those two aspects. I conclude the chapter by briefly returning to the idea of casual power as exerted over small quotidian habits of users and discuss it within the context of the UX industry.

6.1. Encountering UX industries

In his Frankfurt School-grounded explanation of the move from cultural to computational industries, David Berry (2014) highlights the role of adapting computerised logics into broader societal domains by tracing computation to the early processes of 20th century rationalisation:

> [i]n advanced capitalist societies, economic anarchy is interwoven with rationalization and technology to create fewer chances for mental and reflective labour. These include the rationalization and standardization of production and consumption; the mechanization of labour; the development of mass transportation and communication; the extension of training; and the dissemination of knowledge about the execution of jobs. […] This creates the conditions for a decline in critical thinking (Berry 2014, 35–36).

Computation, then, is seen as rational and logical, ordering and structuring the world in a way that is seemingly politically neutral (Nahon 2015). It envisions the slow surrender of bodily and cognitive rhythms to the overbearing logic of digital processing and the interfaces it manifest, through various 'machine zones' (Berry 2011; Schüll 2014). When I set out to explore the world of digital-map production, my expectations were along these lines: uncovering practices ingrained in what seems rational and neutral. In the two preceding chapters, I lay out the processes that correspond to such rationalisation while accounting for its messiness and serendipity – the reliance on rigid databases and data format to structure knowledge about territory, the API ecosystem dictating the scope of information available to various actors and the choices made in translating data to digital environments accommodating common digital tropes such as reliance on search and discoverability. However, in the course of my research, I have come to identify a component of the computational industries that does not seem to build on rationalisation, but instead seems keen on hiding the streamlined processes associated with computerised work. On the contrary, this component stems from the proponents of *affective computing* (Hook 2016) and is comprised of attempts by designers to hide the calculating nature of the machines we use behind interfaces that engage us emotionally and turn mundane use into *experience*. However, in line with Berry's analysis, this is not necessarily done for the benefit of the user, and in fact, in his critique of HCI, theorist and designer Tony Sampson notes that

> [d]spite a considerable shifting of ground, mainly brought about by changes in technology and scientific approaches to brain-body coupling, the goals of the efficiency management – to combat and conform bodies, minds and brains to the quickening rhythm of capitalism – remain consistent.
>
> Indeed, as ergonomics and cognitive science give ground to the neurosciences, and digital technology becomes increasingly ubiquitous, the efforts made to exorcise inefficiency and nonconformity from computer work also becomes more intensified. This is a manifestation of neurocapitalism in which brain activity, assumed to relate to emotions, affect, feelings and decision-making processes, are put to work in the fight against inefficiency (Sampson 2016, n.p.).[30]

[30] While this excerpt is taken from a blog post detailing an upcoming talk, I use it in conjunction with the full presentation that I attended during the "Streams of Consciousness" conference at the University of Warwick, May 2016. I also wish to thank Tony Sampson for his presentation and for the fruitful discussions we had afterwards, which further

To him, increasingly additional spheres of life are coupled with the attempts of affective manipulation, directly related to the neuroscience paradigms aiming at isolating certain areas of the brain and mapping them. This leads to design that focuses on the emotional and experiential as a way to achieve the rational telic goals of the institution in question.

The first hint at this approach appeared while studying the tender document posted by Mapi to facilitate the upgrade of its third-generation web-server. Section 4.1.2.1 (a) of the tender required the prospective contractor to consider within the makeup of the future development team the position of 'user(-experience) interface designers'.[31] This bracketed word signifies the uncertainty in the shift between the former world of user interface, cemented in engineering disciplines, and the encroaching acceptance of the interface as experiential, rather than utilitarian. When I asked around about this component of the interface re-design, the team seemed unsure of what it entails. They felt the term better reflected the popular appeal they wanted for their system, as opposed to the previous, more GIS community-oriented versions. By deciding to avoid the use of external consultants and instead investigating and defining their own product specification, the Mapi web-server team eventually stumbled upon a newly popular market term. They adapted it, but reluctantly, bracketing it behind the more familiar ones.

Later, it was brought to my attention that the company who had won the tender brought on two sub-contracting companies to deal with the map's mobile interface. One of them specialised in development for mobile devices. The other was a UX agency. My attempts to understand the difference between the two were met with yet more ambiguous answers from the three different members of the team. Asked on two different occasions, Yaki mentioned it as a general 'thing' that they wanted, while Nir and Gila argued slightly amongst themselves about the exact meaning of the term: the two were definitely distinct, and the UX aspect had to do with more than just the mobile version, but my interviewees were not completely sure themselves on where those differences lie.

I was not surprised to learn that NowForce also utilised the service of a UX agency. The discovery happened quite coincidentally: amongst the materials provided for my study was a folder with design mock-ups, with a name I did not recognise. This turned to be a well-established usability specialist firm of about thirty people who provided NowForce with user-interface and user-

---

shaped my perceptions of the matter. Needless to say, I alone am fully responsible for the possible inaccuracies in the following pages.

31 Original Hebrew version of the tender available on http://mapi.gov.il/professionalinfo/tenders/documents/%D7%A2-377%20%D7%9E%D7%9B%D7%A8%D7%96%2030.12.13.pdf

experience services. And while Mapi's UX sub-contractor was not available at the time,[32] NowForce's company was open to me visiting their offices, interviewing some of the employees and observing work practices. Moreover, mentioning my interest in playfulness as a design concept led to some interesting discussions and to a request to present my work during one of the agency's monthly seminars. Much of my work in this chapter is based on my experience with the company and the interviewees, and the discussions with the employees. Because of my agreement with them regarding anonymity, I will refer to them in this chapter as 'the UX company'. The rest of the material comes from other sources at Mapi and NowForce that I found related to UX.

Moreover, I utilise a deeper comparative approach that takes into account the wider world of web cartography, primarily through looking at the design guidelines of major web platforms and through my own self-tracking in relation to maps and mapping. In my conversations with the UX company, I pinpointed design aspects of the some of the other maps and apps that I discussed with my two case-studies, or that they pointed out as an inspiration to their work. Doing so allowed me to analyse their response to the cartographic changes not as map-makers themselves, but as providers of a very specific service to a company who happens to be making maps. This highlights the inherent tension between the concepts of user interface design and user-experience design.

6.2.The map as one component among many

I summarised the previous chapter by highlighting the tension in each of my case-studies between uniform and customisable map elements. This distinction goes beyond the mapping world and can be seen as a defining feature of the UX industry: a design rhetoric that prioritises the unique, but only as long as it conforms to certain standards. If vying for attention is the goal of such a pursuit, then visual and interaction design must be balanced in a way that reduces the time to recognise and operate on-screen elements (making it familiar) while differentiating itself enough from the competition (making it unique).

To highlight this tension, let use examine the spatial relationship between the map and additional control panels on NowForce's interface (figure 6.1).

[32] My work at Mapi occurred soon after the tender's winner was announced, and while they presented a company to act as their UX sub-contractor, this part of the work was planned for a later stage.

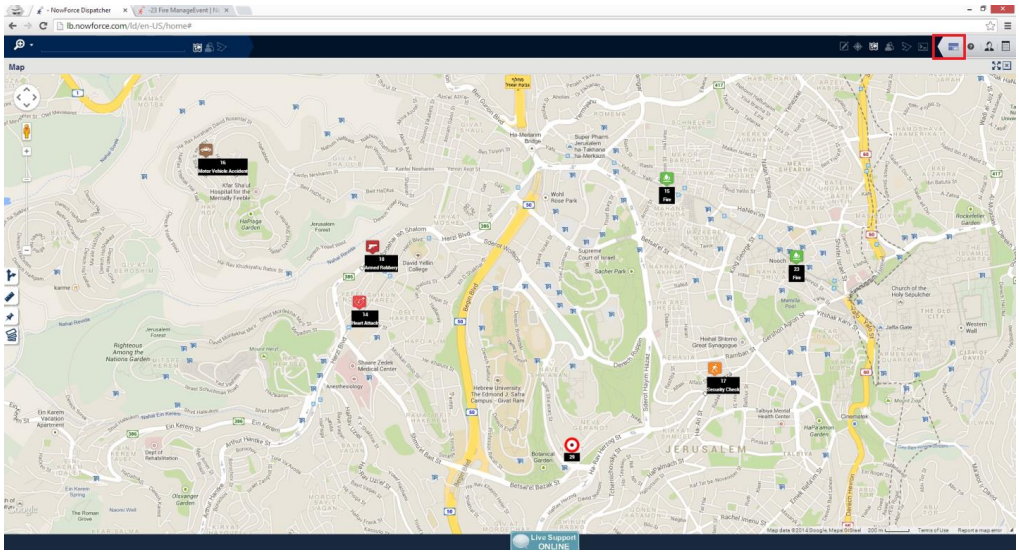


Figure 6.1: NowForce's map view. Snap-to-grid button highlighted in red, top right-hand corner; screenshot from a user test video.

In this screenshot, I have highlighted the 'Sort Panels' buttons in the top right-hand corner. This interface element was the subject of a heated discussion between NowForce and their UX consultant. In my initial introduction to NowForce, Amit, the VP for development, and I talked about the salience of the map compared to other UI elements in the new version. He started playing with the various window (panel) sizes and layouts before clicking the button in question to neatly snap them into a custom grid formation that fit the screen, while preserving to some extent their relative sizes and positions. The rationale behind this was due to the layered nature of the map and the ideal of a single screen interface: the more time a user spent on this screen, the more additional windows popped up. The button's aim was to minimise visual clutter by allowing users to quickly arrange the information in front of them. A similar function exists on both Windows and Macintosh operating systems, where windows can be automatically snapped into position for desktop optimisation. The function seems to be appreciated by the users, and I later witnessed our test users utilise it constantly throughout the session (figure 6.2).

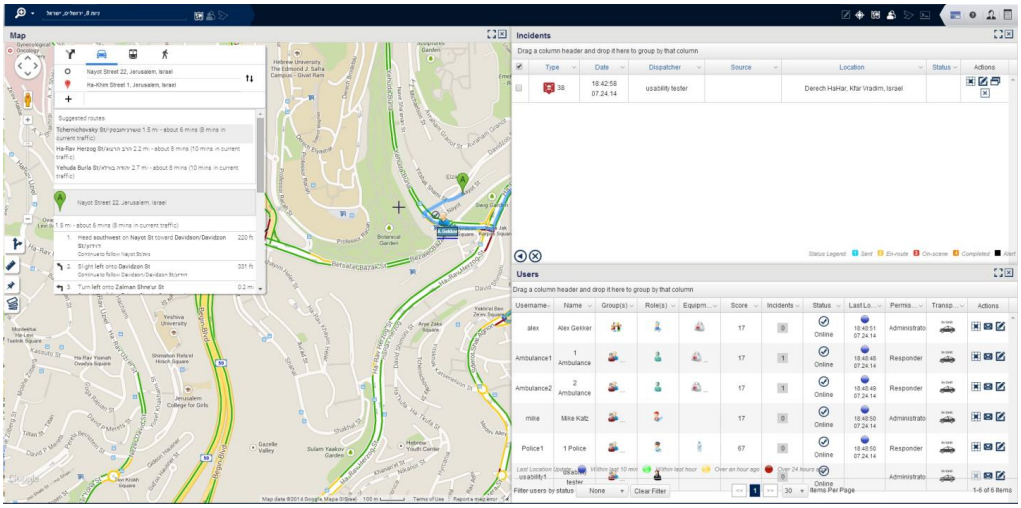


Figure 6.2: Tester opening and then snapping several panels into place while using the map for routing and distance assessment; screenshot from a user test video.

Yet, the UX company strongly resisted the inclusion of such an option in the interface. From their point of view, controlling the grid is not a task for the user. The UX designer working on the project suggested that all panels, which could be turned on and off, would occupy a permanent space on the screen. A concession they were willing to make was to have the standard grid customisable on an organisational level, so that for every client, an administrator would define which panels are active and their location on the screen.

Menachem, NowForce's product manager, saw the dispute as reflecting diverging views between NowForce's core team, who had themselves been (past) users of similar systems, and the UX company's 'experts', whose aims were to streamline and standardise users. To me, however, there is another component to consider: from the map-maker's point of view, the issue at hand deals with supplementary information while ensuring that the user still engages primarily with the map. For the UX company, this is another project that needs to be set within the boundaries of the web and app-based design language, and – no less importantly – their future portfolio for other potential customers. Thus, the map loses its primacy and regresses from its role of facilitating spatial engagement. The benefit of a cartographic interface is, in this case, its affordance to assist in orientation and navigation. But for an external company, the map is just one of the many basic building blocks that apps and software are now constructed from. The difference stems from the juxtaposition of two sets of expertise: the one concerned with knowing the needs of the map-user,

and the other knowing the needs of *every* user, including but not limited to map-users. Bob, a senior designer at the company, was somewhat defensive when I made this observation[33]: 'we are now and have in the past developed projects with a geographic component, including security and healthcare.' For him, the map is a unifying component when working on such cases: 'the specific – geographic – content is interesting in this case because it has a direct relation to the role of the user, on what the user wants to do with it, but beyond this there are many things that are common – how to display, how to map…' At this point, his colleague Alice, another senior designer and the one working on the NowForce project, interjected: 'yes, but the major difference [compared to other systems] is that at NowForce, the map is not the decision-taking tool, but auxiliary information.'

I found this statement strange, and pointed out to her that according to the people I had interviewed, the focus of the new light dispatcher and the accompanying responder app was making the map a decision-taking tool. The new version positions the map as the praxis for the controller by allowing multiple actions that were previously available only via the other user interface-panel components. For me, I tell them, it seems that the NowForce map aims to emulate complex command and control maps like those found in the military. She disagreed:

> [w]ith all due respect to NowForce's fire hydrants – and I'm not saying this cynically, don't get me wrong – but a fire hydrant is a static thing, so you, as a fire-fighter, need to know which street has one. But it's not like in a military system, where you can see troops coming from there and there, and now you have to take a decision. I also think that the dynamics of the data are different – you don't get stuff popping up suddenly. Well, yes, maybe you have additional people responding and they appear on the map. But you don't get additional forces [movement] or anything like that.

Our exchange continued for a while. I pushed the point of view I had documented at NowForce so far, that they see the web-based, easy-to-use map as one of their main competitive edges, that the map's role in the software is to make the complex reality accessible to the layman and thus reduce the time needed for training and integration, and that the types of clients that NowForce has do require a high degree of dynamic action on the map and through the map. But Alice remained unconvinced. She pointed to the fact that according to her knowledge of the system, there are no multiple areas of action and that the NowForce map is always centred on a single site with a single

[33] All direct quotes of the UX Company designers come from two interview session undertaken on 21 July, 2014

event, which reduces the need for up-to-date information. It began to dawn on me that she sees the role of the map in a rather different light than the NowForce staff I had communicated with so far. What she said reflected her focus on the unitary session of the dispatcher-map-responder rooted in a specific event. NowForce talk about their map(s) differently; they always describe their end-user as a participant in a larger chain of events, taking into account, for example, various administrative, managerial or even marketing aspects of running a responder force and how the map may assist them in a systemic fashion. And yet, while putting much effort into bringing this holistic worldview into their data structures, visual language, customisation options and much more, NowForce chose to partly remove its own agency from the design of certain aspects of the user interface, which aims to bring such a worldview to the user. All the while, a representative of an external company that is paid to do this work does not seem to share NowForce's ethos to its fullest extent.

6.3. The UI(X?) industry

The term 'UX company' seemed to cause unease among some of the employees at the aforementioned UX company. Alice emphasized that theirs is an old enterprise, specialised in usability and ergonomics work for a large cadre of international clients. To her, the recent turn to 'UX' as an industry identifier signifies the lowering of standards. In passing, I mentioned a friend who has gone through several months of 'UX training' and now works as a user-experience designer at a major web company. Alice did not look pleased and talked about how the recent explosion of similar courses, often offered by individuals without much significant credentials and for exorbitant costs, 'flood the market with graphic designers or [other] people who did a two-month course and think of themselves as interaction designers. [This creates] an incompetence problem.' On the contrary, those working as usability designers (she prefers this older term) at her company 'now come mostly with a background, a masters in cognitive psychology or a masters in ergonomics. But there are, of course, exceptions. I don't have a formal education in this field myself. I was a programmer and made a shift into this field when it was only starting, so there was not much formal education. I learned most of it from reading books and from work experience. And intuition, I think that intuition is a major component to it.' Later, she admitted that 'today, perhaps I would not be able to get this job with my credentials.'

So what does the job entail? According to Alice, there was a sharp delineation in their line of work between usability and graphic designers up until about five years ago. The former would

interact with a prospective client, understanding the goals, problems and outputs of a computerised system in depth and in a dialogical manner. Eventually, after an iterative design process which focuses on issues of usability, they would produce schematic representations of the user interface for the system in question. It would include wireframes and diagrams of the various screens involved, but also the relationship between those screens and the representation of the workflow that a user undergoes when interacting with them. A graphic designer would then find the best way to manifest those schemas into the actual computerised environment, providing an aesthetic rendering of the suggested solution. 'We treated it as the add-on, the "skin" ', Alice recalled. 'This is the system – now make it pretty!' The graphic design was clearly marked as a second stage, and the designers were mindful to not undermine the primacy of the usability expert. Importantly, both the usability experts and graphic designers were only provided by the UX company, as their clients mostly lack these type of positions in house. More often than not, the UX company would stand in for the client's users during design sessions, as Alice clarified:

> [o]n some occasions we would meet the end users, but rarely. Most projects come from very complicated domains, and it's not like you develop for consumers, where you can just do focus-group testing. It's a system for an engineer who then spends a year learning how to operate it.

This seems rather removed from the kind of work her company does today, especially when you consider the project she performs for NowForce: instead of a single, detailed and highly trained end user working on a complex system, she needs to optimise an interface for a software product with a multitude of different (and possibly conflicting) users. I tried to understand what has changed and how they see their role in relation to NowForce's design. The answers that I received seem to broadly fall into two categories: the first was that the change lies in the ability to track users, harkening back to the 'best practices' of a surveillance approach that I highlight in the previous chapter. The second evokes the rise in the status of aesthetics, visual design and 'experience' fuelled by the web and apps ecosystem.

6.3.1. Maps that know you

The company's affinity with map-based projects (or geographical interfaces, as one of my interviewees repeatedly termed it) was a major component in their self-perceived expertise provided to NowForce. The map as a defining feature seems to be a benchmark through which they evaluate

the project in comparison to their former projects, even if they disagree with the client over what benefit the map actually brings to the user. Bob explained:

> [t]he thing that almost always defines a geographic interface is the informational overload, and how you decide what needs to be shown and what does not.…The main feature of such a system is to give the user context-relevant information. This is what allows us to overcome informational overload […] and present only what I want, as a derivate of the specific location, along with my guess of what is important to the user. And this context specificity is getting better because the systems know how to collect more and more data on us. As a result we – the system – know what the users want.

Thus, user tracking is changing the way consumer software, and mapping in particular, codifies the approach to interface design, discussed previously as uniquitous mapping: it is no longer strictly necessary to inscribe the designer's vision of use through meticulous research of the work practices or scrupulous definition of the user (Forlizzi and Battarbee 2004). Those practices still help in the inscription processes, but they are being trumped by the ability *to write conversion rules that re-structure and re-purpose the map towards individual users by building on the data collected from their actions*. What is important to note here is still the role of the designer in defining what data is collected and how this is reflected on the end user and the degree of control they give users in defining such collection.

Unlike in my conversations at NowForce and Mapi, at the UX company, the topic of tracking users came up often and was immediately linked to their ability to provide better user-interface service.

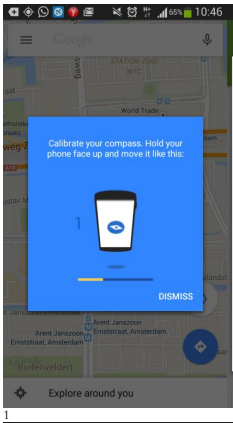
> Bob: Waze, for example, asks me in the morning whether I am heading out to work. This is a small thing, and not hard to guess, but still, I have to say, this little feature is wonderful to me. I know how to drive to work, but I have three potential paths, and the first thing that I do when I get in my car is open Waze to see if there's a reason not to use one of them – so this little feature saves me time.
>
> Alice: By the way, Google Now does even more – don't know if it's more impressive or cheekier, because it kind of annoyed me – but it noticed that I went to a certain place on Tuesday afternoon a couple of times, so it began asking me only on Tuesday afternoons whether I wanted to get directions there, and after a while suggested that I give this place a name.…

Bob: Yes, well, there's always the balance to be struck between cheekiness and usefulness.

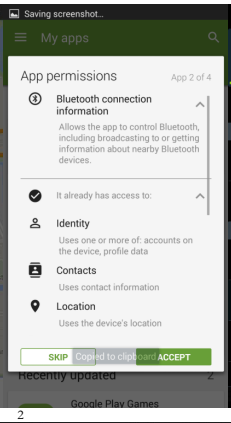
Me: Not crossing the creepy line… It's the way Google's previous CEO, Eric Schmidt, defined their approach to privacy: getting right next to the 'creepy line' without crossing it (Richmond 2010).

Bob: OK, but of course this line changes from person to person.… Well, in any case, this is the main point of any geographic interface. Probably in others as well, but in geographic ones, it's more critical due to the informational-overload issue.

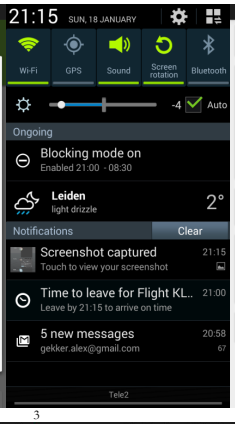
Thus, the UX company is keenly aware of their ability to track users and use this information for personalization, trying to avoid the limits of what users might find creepy or unseemly. The employees are also very well versed in various consumer devices, software and applications, and I was constantly peppered with relevant examples from their daily lives as well as from previous projects they had worked on. In turn, I presented them some of my own self-use history and impressions from engaging with such software (figure 6.3). Over time and by coupling online accounts with physical devices (primarily my mobile phone), the ability of the various location-based applications (maps included) to track me are increasingly important for the range of services I have come to expect from them . What began as prompts within the app, mostly in the Google Maps app, expanded to the notification area of my phone, then incorporated other data from my email and travel agenda, such as the change in countries and languages. This tracking relies on constant feedback from me – the apps ask for permission, verify that what they assume of me is true and query whether they managed to anticipate what interests me. When succeeding in satisfying my wishes, they ask me to contribute information, to maintain the feedback loop and help them gauge my reactions (and probably the reactions of similarly-profiled users). Moreover, current phones often come equipped with a combination of hardware and software used for tracking, often in the form of various health apps that use the phone's GPS and an accelerometer to nudge me into more physical activity (Thaler and Sunstein 2009; Karanasiou and Kang 2016).



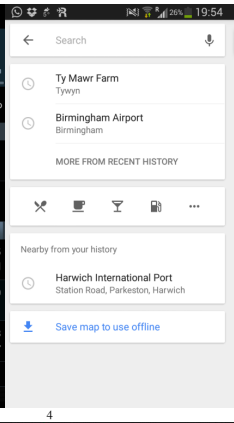
1



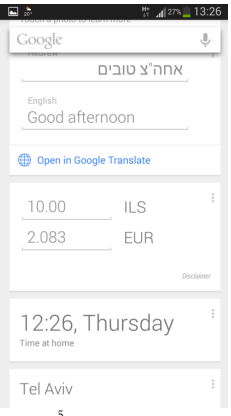
2



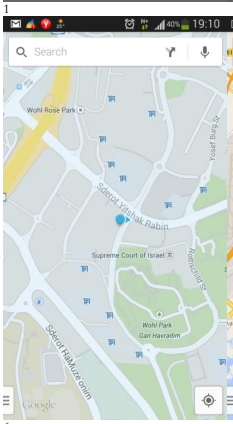
3



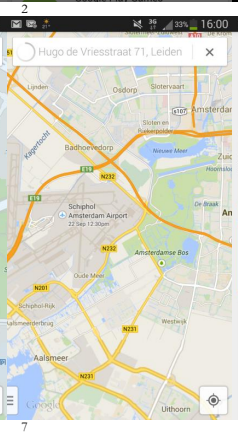
4



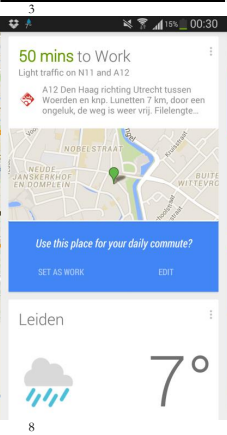
5



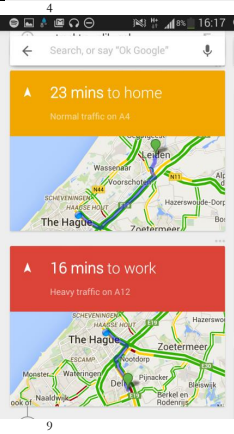
6



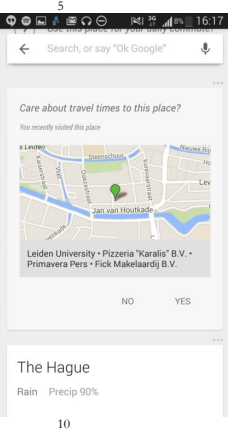
7



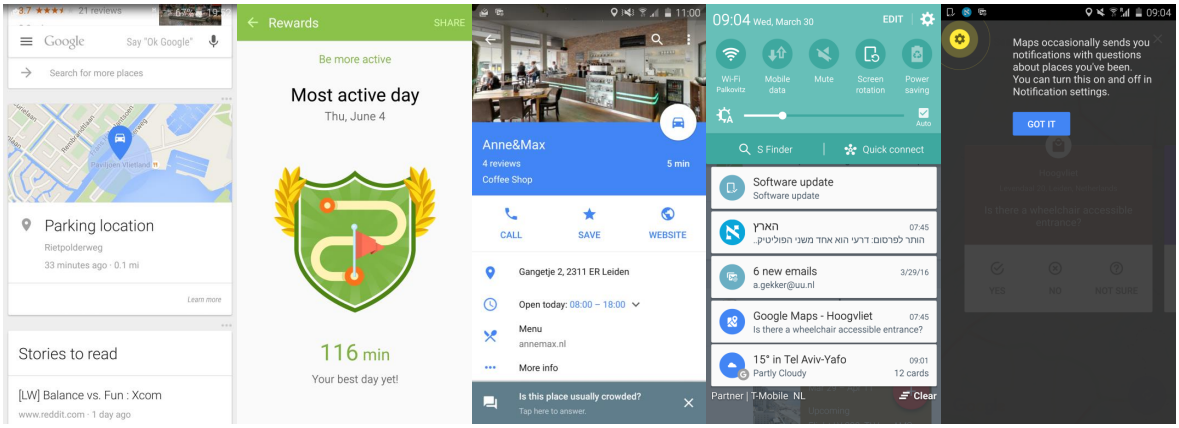
8



9



10



11 12 13 14 15

Figure 6.3: Crossing the creepy line? Beginning on the previous page, from right to left:
Google Maps wants to calibrate my phone (1) and obtain access to multiple permissions, including to my Bluetooth (2). Without running the app, Google Now prompts leaving for a flight (3). When opening the search in Google Maps, it shows me a location nearby that I have been to in the past (4). Upon arrival to conduct my fieldwork, Google Now assumes that I am a tourist and suggests useful titbits like a common greeting and the currency conversion rate (5). When I arrive in a new city by car, Google Maps highlights all the parking garages around me (6). When casually browsing, Google Maps reminds me with the layout of the airport that I have an upcoming flight, from the information in my Gmail inbox (7). Google Now wants to know whether a place I have driven to a few times in the morning is my daily commute (8). It then prompts me with driving times to both home and work (9). Occasionally, it asks me to indicate the importance of places other than home and work (10). It also automatically notifies me where I parked my car (11). Overall, the accelerometer embedded in my phone is used quite often: here, my Galaxy phone's health app congratulates me (12) on my most active day ever (as far as it knows)! But my phone also wants to ask me things. When checking a café I frequent through regular Google search, it asks me to indicate whether this place is usually crowded (13). Answering this leads to more place-related prompts appearing, now outside my search, but in my phone's notifications 14) informing me that I can turn it off after it has already begun (15); mobile screen captures by the author between 2012-2016.

As can be gathered from the conversations, as well as from my own screenshots above, customisation through tracking allows for a more engaging experience. However, after spending some time at the map-making organisations, I became acutely aware of the multitudes of processes, parties and decisions that go into the digitalisation and automatization of the map. And while the user interface is an important component, surely the UX company does not have much say in changing the foundational blocks of the map, thus being rather limited to what they can do with the user data.

> Bob: We have the ability to interfere with the algorithmic layer of the user interface [he is referring to the aspects of the UI that attune themselves to the user]. At some point in our work process, we are not only receiving demands but also issuing them, to be sure. In our processes, we achieve a very deep understanding of the systems that are in front of us, and often the client lacks anybody who knows exactly what they want. And as we occasionally know their field as well as they do, due to our experience, this line of defining **what** the systems does and **how** it does it is blurry, and we can intervene.
>
> Alice: Many times, we stray away from the display layer and really intervene into what goes into the system, or at least make offers – based on our experience, our knowledge.
>
> Bob: If I understand the user's roles well, this is the basis for the entire system and – in the end – I can say what is really required.

To conclude, the UX consultants cited above see themselves as understanding the users and the mapping world, sometimes better than the client. They strive to integrate tracking and customisation elements into the map, because they see it as a standard in modern cartographic interfaces which enables them to discern contextual information from non-relevant bits and preventing informational overload for the user. And as part of the established industry practices and work processes, they have achieved a modicum of influence not only on what the user sees, but on the deeper structures of software and data, accommodating the need for whatever they envision the user's needs to be. And, as I will show in the next part, they do so while taking cues from the playful design practices that are widespread in the world today.

6.3.2. Maps that are fun

According to Alice, the UX company's main line of work used to revolve around systems for 'engineers who spent a year learning the system.' This is, however, no longer true:

> [t]hings have been going through a major shift in recent years. This thing called 'user experience' is becoming popular and the role of design paramount, without a doubt when it comes to smartphone UIs, but not only. Even in the most professional, 'square' systems, most non-fun systems, people are looking for it [the fun aspect]. And one of the demands made of us is that we help our clients sell the system. So design has become a much bigger consideration today.

Gila, from Mapi's web-server team, made a complementary statement on 22 July, 2014: 'I think many of the design features we put into our map come from people getting used to the experience of using a map on mobile phone.'

This obviously does not happen all the time and in all scenarios, since different projects require different concessions. However, from the quotes above, we can discern a certain trend, which can be tied simultaneously to the Regime of Computation (Berry 2011) and the emerging rhetoric of play as systems (Deterding 2015). In it, the desire for ordering and measuring through software encounters the shifts in notions of work and leisure prominent in ludic capitalism (Galloway 2012) and the mutable playfulness of the digital form (Perkins 2009; Sicart 2014) to highlight a different type of design. In such modes of work, the idea of making the interface 'fun' is also expressed through various forms of gameful design, such as the inclusion of metrics to boost productivity, or otherwise promoting employment of the user interface as an experience to remember. While the ties between fun and play, especially one formulised in the strict rules of systems, are tenuous at best (Malaby 2007), the UX company internalises such logic and use it as a selling point (Bogost 2015). As the number of projects that subscribe to this trend grows, the role of the graphic or interaction designer in the system's characterisation process has expanded. Alice:

> [t]here are systems – even serious systems – where [we want] this aspect of fun, of experience, of something larger than life, where [graphic] designers participate from the very early concept stage. Later, our ways part, of course. After that, we [the UX specialists] go and do the functional specifications by ourselves, we are not a games company, we are not a 'show-off' company.

The graphic designers in the company feel similarly. After a presentation on my research I gave during my second visit to the UX company, a few of them confided in me the feeling that their job descriptions are changing. Accordingly, they are under more pressure to learn and apply not only the graphic standards of web and/or interface elements, but they try to keep up to date with the notion of experience design.

The change is felt also in the way large entities in the digital-media world communicate about their design. Those entities are often crucial in allowing or preventing developers' access into their walled gardens,[34] and thus their guidelines have far-flung consequences for the look and feel of many applications and similar software (Helmond 2015). Google's *material-design* guidelines highlight how they encourage both their employees and those developing for their platforms to use traditional print-design styles together with recent technological developments. This aims to create a design that works across different screen sizes and input methods and 'create[s] hierarchy, meaning, and focus. Deliberate colour choices, edge-to-edge imagery, large-scale typography, and intentional white space create a bold and graphic interface that immerse [sic] the user in the experience' (Google 2016, n.p.). Similarly, Apple encourage things to be built for their desktop OS X environment in a way that 'integrates seamlessly into this environment, while at the same time providing custom functionality and a unique user experience' (Apple 2016b, n.p.); for its iOS mobile platform, it warns developers not to forget the app's underlying functionality, since '[a]lthough a crisp, beautiful UI and fluid motion are highlights of the iOS experience, the user's content is at its heart' (Apple 2016a, n.p.). Facebook, a platform with the largest amount of users to date (Constine 2016), provides only design guidelines for embedding advertising in its applications, and not regarding the design of those applications themselves. They tie experiential and economic rationales together, promising that 'Facebook takes care of showing the right ad to the right person – improving your user experience and maximizing your revenue potential' (Facebook 2016, n.p.).

The shift from graphic design being the add-on to experience design being the core focus of the software industry is not as new, as Alice pointed out. HCI specialist Jodi Forlizzi began promoting research into this notion from both theoretical and practitioners' points of view in the late 1990s. In an early research paper, Forlizzi and Ford plot out an enquiry direction that today sounds very much like the type of roles Alice and Bob took upon themselves vis-à-vis a client:

[34] A term denoting a closed system which is tightly controlled by a single entity – think Apple's App Store or Microsoft Xbox and its authorized access to game developers, as opposed to the open standards of the web (Zittrain 2008).

> [c]ritical areas of exploration include how interaction designers can talk about experience, and what we mean by an experience; and what connections there might be between product design attributes and experience. A successful and useful theory must directly support the design of products, services, environments, and, possibly, experiences (Forlizzi and Ford 2000, 419).

In a widely cited later article, Forlizzi and Battarbee (2004) list several ways in which experience can become the cornerstone of a multidisciplinary design team, building on philosophical, sociological, behaviourist and anthropological research. They conclude with the suggestion that

> [i]nteractive systems for work use can benefit from a more experience-oriented approach, but for new technologies **with no immediate perfect use**, the experience-oriented approach is the only real way that user-centered design can impact the technology push. By understanding experience, meaningful and experiential applications can be found for technology as well (Forlizzi and Battarbee 2004, 266; emphasis mine).

Here, we can witness the beginning of the shift that positions design – reimagined as an experience-engineering domain – as an intervention into the world of technological innovation in order to *make meaning* rather than simply *enhance it*. This approach, reflected in my ethnography of the UX company, positions the designer – the UX designer – as a custodian of 'fun' or 'playful' experience with the map that contextualises its use through broader media practices beyond the world of cartography. This position also explains the conviction UX designers might feel regarding their better understanding of the client's domain expertise than the clients themselves. If experience is what gives a product its meaning, and UX designers are advocates for the users, then the broader archetype of 'the user' is what matters, rather than the specific (map) user in a particular case.

And while Alice underscored the fact that their company's work often focuses on 'serious' products unlike the entertainment- and marketing-oriented work done by the newly-appearing UX studios, she still wants the experience to be perfect. 'The problem in our field is that every single person has an opinion. We sometimes sit with a client and every last programmer has an opinion. Which is difficult, because I saw many applications that immediately made me think, "Wait, that's just Visual Studio!" ' Here, she references the popular programming-development suite by Microsoft (figure 6.4), implying that the technical staff on those teams tend to interject complex user interfaces into the design based on the one they themselves use. This remark leads us back to the sort grid

button example with which this chapter begins, which NowForce pushed in while Alice did not want users to have the ability to quickly re-arrange her workspace:

> I see myself as a pretty technologically-oriented person. Thirty years of relevant experience. But I know that when I sit in front of an application that lets me drag and drop things around, at some point something will always go wrong and I will get lost. So when I think about this dispatcher, and in my mind – excuse my stereotyping – an overweight black lady in Houston, Texas, sitting in front of many screens, she starts re-arranging her windows? It's not right. So yes, there are features that programmers drag in and it's our job to represent the user, who he is, what his age is, what his experience is, this is our say in the matter.

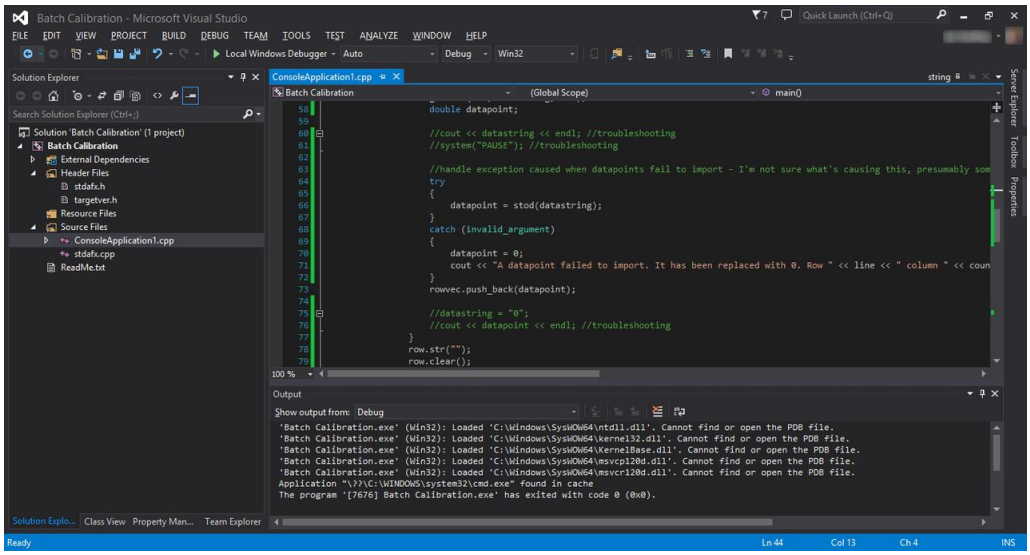


Figure 6.4. Microsoft Visual Studio 2013. According to Alice, many developers unconsciously copy the user experience of the software they work on themselves when building their products; screenshot by Source (WP:NFCC#4), https://en.wikipedia.org/w/index.php?curid=44331177

6.4.Conclusion: experiencing the innocuous power of maps.

When looking into the work done by the UX company for NowForce, one might question the amount of their cartographic influence. After all, they have had, according to their own admission, very little to do with the map's tiles and their main contribution was to the task-management component that runs parallel to the map screen. Yet, I claim otherwise and see the design of the interface as key component in the digital maps' overall functionality (Cartwright et al. 2001). I wish to

emphasise the holistic nature of the digital map, which due to its layered nature is inclusive of various non-cartographic elements as part of its core functionality. The role of predicitive interfaces also changes what it means to design a map, with exploratory approaches to visualisation structuring certain modes of engaging with the world through the map more than others (MacEachren 1998; Dodge, Kitchin and Perkins 2009). When highlighting the processual approach to cartography (Kitchin and Dodge 2007), we must pay attention to how the arrangement of other interface elements that operate alongside and complementary to the map help the emergent experience of the user (Schüll 2014; Grosser 2014; Beer 2015). And this experience, as I have shown here, should probably be referred to as Experience based on the rise of an entire design field that aims at fine-tuning it for the end user and the modicum of influence this industry has on its clients.

The UX company represents the user for NowForce, who lack the time and resources to engage in user testing. Such representation (in the way agency is transferred, rather than semiotically) takes place through the suggestions and demands they make in relation to the algorithmic and graphic layers of the user interface, thus affecting other core functionalities of the map. They do so while intrinsically relying on modern geographic software's inherent ability to track users and fine-tune the experience, all while preventing such experiences from becoming too technical or unintuitive. In doing so, the UX company often tries to keep the experience of use 'fun or playful' through the inclusions of juicy interface elements that engage the user in the act of manipulating the map. At the very least, they present their work as such to their clients, tying it to industry trends (Bogost 2015). This ties back to them being required to make the map not only usable but also – by helping the clients sell it – to make the map profitable. And as mentioned before, attention is the ultimate currency of contemporary media-scapes, lending itself to financial success through user-data sales and advertising.

This is the manifestation of casual power: focusing on the experiential, 'juicy' component of the map in order to habituate the user to certain modes of non-reflexive use. UX considerations, whether those brought up by external consultants or absorbed through the design zeitgeist, make the map much more than the functional product originally envisioned. Like many maps before it, but now enhanced by the digital affordances, it becomes a platform for engagement, a captivating artefact that borrows functions and design from successful non-map products in order to compete with them for user attention. However, it is also seemingly innocuous and neutral, exerting ever greater power over users' daily spatial pursuits.

7. **Conclusions: Paying Attention**

'In these real-time stream computational ecologies, the notion of the human is one that is radically reconceptualized in contrast to the "deep attention" of previous ages. Indeed, the user is constantly bombarded with information from multiple data streams, all in real-time, and increasingly needs complementary technology to manage and comprehend this data flow to avoid information overload.... Additionally, this has an affective dimension as the user is expected to desire the real-time stream, to be in it, to follow it, and to participate in it, and where the user opts out, the technical devices are being developed to manage this too through curation, filtering and notification systems. Of course, this desiring subject is therefore then expected to pay for these streaming experiences, or even, perhaps, for better filtering, curation and notification streams as the raw data flow will be incomprehensible without them'

David Berry, 'Critical theory and the Digital' (2014, 173).

When writing a book about the changes occurring in serialised drama about 20 years ago, television scholar Robin Nelson chose to begin it with a chapter on the internet. Specifically, he referred to it as 'cyberspace' and focused on the emergent practices of fan engagement online and how they lead to shifts in television production and distribution practices (Nelson 1997). His chapter opens with an epigraph from another scholarly work and reads: '[i]t is an undeterred truism that all television *aspires to the condition of soap opera*.... The structure of television defers attention away from consequence' (Maltby 1983, 303–4; emphasis mine).

With 'condition of soap opera', Nelson continues Marshal McLuhan's prevailing argument about electronic media's power of form over content. Nelson identifies the goal of television as captivating large groups of audiences for as long as possible and inducing them to return regularly. The soap opera excels in this task. Building on identifiable and recurring tropes, it leaves a point of entry for the uninitiated, requiring very little previous knowledge of the previous episodes. By appealing to the most basic and universal themes of the human condition – love, hate, betrayal – it wishes to draw the attention of each and every viewer and make them want come back for more.

Throughout the process of researching and writing this doctoral thesis, it occurred to me that all digital user interfaces might secretly aspire to the condition of the gambling machines described by

Schüll in her conceptualisation of the machine zone. Such interfaces excel in two aspects, which are crucial to the way computational industries manage users' attention: habituating mechanical rhythms of consumption and decoupling actions from consequences, resulting in the loss of self-reflexivity. In an environment over-saturated with information, the noise-to-signal ratio becomes increasingly high, and people-turned-users scramble to find the most meaningful and most engaging experiences available. In such a state, the notion of addiction transcends its negative connotations and becomes an aspiration: to be addicted is to gain a meaningful relationship with activity; it is the ultimate form of engagement that one can achieve with a television show, a hobby or even a job (or a 'calling' in the parlance of self-fulfilment). Instead of shying away from addiction, it is lauded and advertised, at least when it comes to convincing consumers to try out new video games, which are – as we have established – intimately linked to the conditions of digitalisation (figure 7.1).

What has led to this fleeting consideration is my encounter with the UX industry, with its creed of making user interfaces – all user interfaces – affective and experiential. If all types of devices, suited for various tasks, can be made (at least in principle) to engage through the prism of Experience, built on the foundational principles of behavioural and cognitive sciences, human-computer interaction and the rising art of gamification, then why not position gambling machines as the ultimate goal?

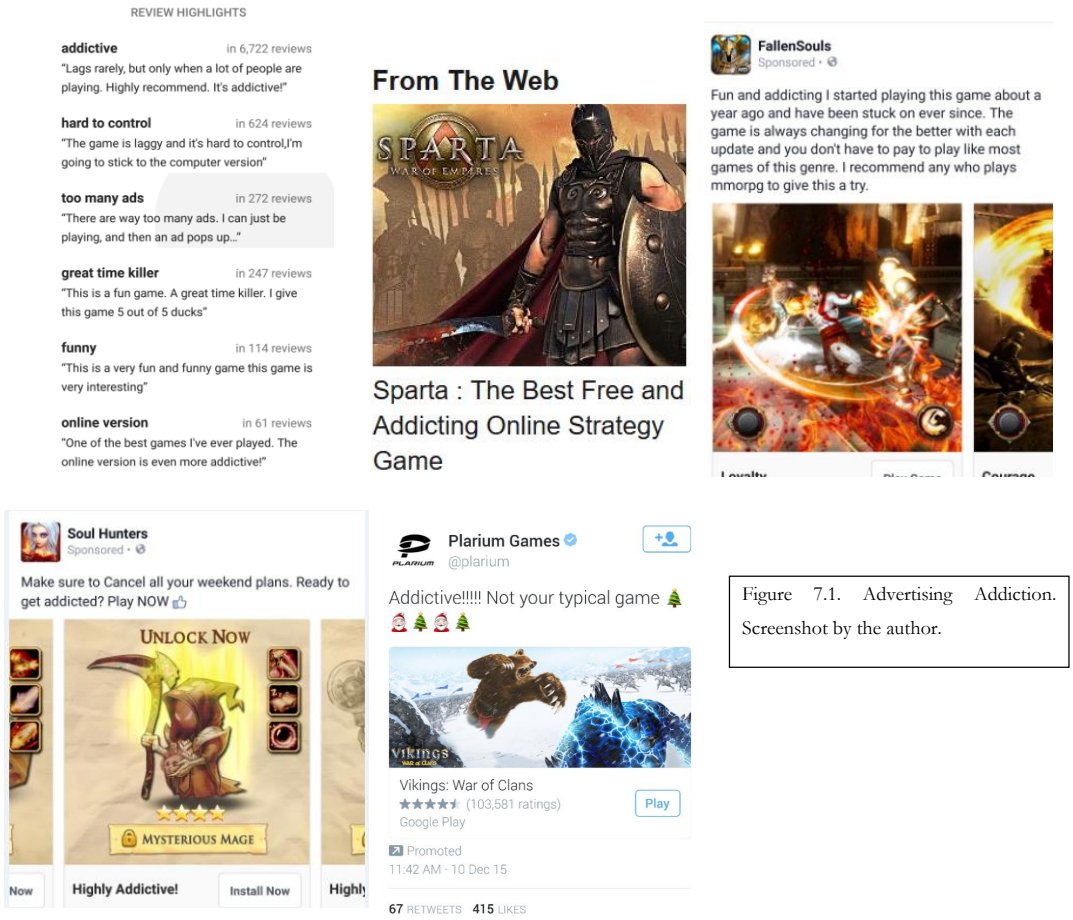


Figure 7.1. Advertising Addiction. Screenshot by the author.

It has consequently occurred to me that this is somewhat of a bleak outlook and that my own case-studies suggest that the circumstances are never as black and white. At Mapi and NowForce, larger web trends where all interfaces are becoming more non-reflexive and addictive run against the corresponding organisational ethos. For some, it is the belief in public service and the benefits of state-enabled cartography, with all its occasional cumbersomeness compared to commercial enterprises, especially for the less-able citizens. For some, it is professional socialisation that prevents them from backing down on principles that have become mainstays in their milieu, like the demands for accuracy, verification or aesthetic standards. Others resist trends due to the desire to innovate, to make something different. In the end, the messy reality of cartographic assemblages resists becoming yet another web or phone application.

Now, I have begun to suspect that all user interfaces secretly aspire to the condition of the digital map. In many aspects, I found the maps generated by my case-studies – along with the many maps that I looked at, used and documented throughout the last four years which were not included in this dissertation – the perfect results of an analogue object's translation into the digital. A map is an object that is already a metaphor, deeply cemented in the public's collective consciousness as a way to interact, interpret and overcome space. It is fixed enough to be instantly recognisable, yet mutable enough to allow flexibility in use and design. Digitalising it makes sense, as the techno-media-scapes that we inhabit flood us with information, and – being spatial creatures (Lakoff and Johnson 1999) – we can use maps to make sense of the things closest, biggest or simply most relevant to our immediate situation. After all, Wlado Tobler's oft-cited first rule of geography – 'everything is related to everything else, but near things are more related than distant things' (Tobler 1970, 236) – still stands, albeit probably in a different way than he originally intended (Tobler 2004). Today, closeness is also defined by such factors as social proximity propagated through decision-taking computer algorithms on social-networking sites as much as through physical distances. The map allows visualizing such relations in a way that is very familiar to most users. It does not require special training to recognise or contextualise, as most people will encounter maps to some extent in the course of their lives.

Digital maps also mesh well with other digital objects. While the interoperability of various file types lies in the basis of new media (Manovich 2002), maps seem to be better suited than most other forms of displays for integrating those objects in the form of layers. Layered logic, which has been incorporated into GIS and subsequently popular digital cartography, is dominant in contemporary media culture (de Souza e Silva 2006; Manovich 2006; Verhoeff 2012). The recent rise in augmented-

reality applications delivered via smartphones (with *Pokémon Go* being a prime example) reinforces what Galloway (2012) meant when talking about the interface effect: while the average technology consumer suspects there is *something* beyond the screens she uses, it might as well be just a different type of a screen. With the continued domination of mobile screens and the potential rise of augmented-reality devices, such layeredness works well with maps, which serves as a seemingly-neutral backdrop onto which anything and everything can be projected.

To reiterate Galloway's stance on interfaces that has informed much of this dissertation, the interface is never static, never merely an object, but an effect. It is a mediating presence that must simultaneously occlude the working of software and present it to the user. When sitting in front of a screen, one must recognise the falseness of the presented metaphorical claims, yet only through this recognition can the non-reflexive engagement with the interface actually work: I know that the words on the screen that appear when I type this are nothing but cleverly concealed bits displayed via LEDs arranged into pixels, but I cling to the illusion of immediacy to facilitate the act of writing.

In the beginning of this dissertation, I ask what such acts of simultaneous occlusion and revealing, of un*representability*, might mean for a digital map's interface, which purports to do just that, to represent. To the billions who use maps on their computers and phones every day, these are not complex assemblages, or critically-assessed images. They show streets, villages, mountains, coffee shops, hospitals, homes, workplaces and all the routes between them. They show the world in a way that most assume to be natural and straightforward, as they are evoked when needed while quickly fading into the technological unconsciousness after the users find what they are looking for (Dodge, Kitchin and Perkins 2011). To examine such a discrepancy between the critical world of academic cartography and the mundane conducts of the millions of non-professional users of such maps, I looked into the cases of two map-making organisations and the way they gear their maps towards specific uses. I framed my research question in the following way: **what are the *processes* through which *user interfaces* that enable *digital cartography practices* are *assembled and inscribed,* and what are the *power relations* underscoring those assemblages and inscriptions?**

I then divided it into subsequent constituent questions, which are addressed as follows.

7.1. RQ 1: how can the processes of map-making be described, traced and captured?

To begin, let me reiterate the operationalised definitions that I developed to delineate what constitutes a digital map and what does not. After Vasiliev and colleagues (1990), I look at maps that

are *cartographic*, i.e. claim resemblance to territory; *popular*, meaning intended for broad audiences and the non-professional user; and *layered*, or rooted in the inter-changeability of data and the mash-up culture that arises from that. However, this still leaves many questions, specifically concerning the language with which to define and describe such maps, as well as where they start and where they end.

Approaching the topic of the digital map in preparation for my case-studies, I was continuously burdened with this uncertainty. It was difficult to separate and delineate the object of study, the first logical step of doing research. As maps became embedded in other digital devices, and mapping creation and deployment practices spread throughout multiple sites and publics, a conceptual framework was required to begin unravelling them. The branch of science and technology studies (STS) associated with Actor-Network Theory, with its inclusive attitude towards humans and non-humans alike, was a good point of departure. Within it, Madeline Akrich's (1992) notions of inscription and de-inscription provided a path to begin defining map-making. As a negotiated process bound within a technological object but open to interpretation through material-semiotic means, this framework allowed me to simultaneously capture the rigidity of maps' perceived form alongside the flux of meaning inscribed and perceived by their readers. The advice to 'follow the actors' made sense when the boundaries between the objects' 'inside' and 'outside' were increasingly vague, and such an approach offered a venue of clarification by focusing on 'find[ing] disagreement, negotiation, and the potential for breakdown' (Akrich 1992, 207).

Taking an historical view of cartography and the scholarship of cartography that emerged in response, which I detail in the first chapter, it becomes clear that one such major point of breakdown is how fixed a map actually is. For the majority of maps' modern history, when critically examining a map, the focus remained on the map-making assemblage as an attempt to distract or mislead the reader (Crampton 2002; Wood and Fels 2008; Wood 2010). STS literature, however, shows that technologies, and mapping technologies among them, are always suspected of taking on a life of their own after exiting the labs and workshops in which they were conceived, rendering the territory reflected by a map a 'spurious referent' (November, Camacho-Hübner and Latour 2010, 588). Such an approach questions the necessary mimetic relationship between what is on the map and what is being mapped, and hence questions the necessary prescriptive power that cartographers wield over their readers: if the map changes with each user and use, how much can it truly be wielded as a tool of restriction and control? Moreover, when mapping is taken as a performative act involving the conscious and unconscious; cognitive, emotional and bodily aspects, is there even a methodological

point in differentiating between the maker and the reader, user and producer? After all, digital media scholarship – and digital maps sit firmly within this scope – strongly argues for hybrid categories ('produsage') that take into account the growing spectrum of skills and literacies required to operate in contemporary media-scapes (Bruns 2007). The solution, then, is to abandon mapping binaries for the benefit of new methodologies and accompanying ontological and epistemological shifts (Del Casino and Hanna 2006). Specifically, I subscribed to the processual view of cartography (Kitchin and Dodge 2007; Perkins 2008; Dodge, Kitchin and Perkins 2009). Such an approach still recognises the power of the creators to inscribe certain meanings into the map, while also accepting that the cultural, situational and personal aspects of a mapping process have emergent properties that preclude unidirectional influence. Particularly useful in relation to my case is Kitchin and Dodge's (2007) use of Simondon's transductive metaphor – in which a mapped meaning unfolds like the structure of a crystal, each layer dependant on the layer under it, with its changes and permutations.

Consider for a second Mapi's web-team and their attempt to design the next generation of the web-portal. Are they the makers of this map? To a certain extent: they did the research, drafted the guidelines and put out the tender that attempts to specify all that. They are not *the only makers*, however. This tender is an attempt to encapsulate in a robust framework all their knowledge and design ideas, to govern the relationship with the future contractor. The web-team has neither the ICT expertise nor the manpower to develop such a thing themselves, and so they must rely on their ability to frame their ideas into a governmental contract, supervising it until completion. Moreover, complicating their role as 'makers' even further, we should consider the intersections of various internal struggles and narratives within Mapi. Throughout the project's history and the three current iterations of the web-portal, the team behind it clashed with managers and colleagues with regard to technology, aesthetics and economics numerous times. Now, it seems that history has proved them the winners, as the web, and web cartography in particular, was recognised within Mapi as a cause of systemic change in their operational logic. The web-server team will potentially move from the underdog position to that of a closely-scrutinised frontrunner. And as my own research shows, the technical processes within a software-based mapping organisation are never straightforward and never merely technical. In the same way as the desires of NowForce's clients mesh and clash with the company's own views on what their product should do and be, Mapi's relations with their sub-contractors will inevitably also, especially as more scrutiny takes place. And the relationships amongst those secondary parties and with other companies external to the mapping world will undoubtedly be

complicated. As noted in chapters 4 and 6, Mapi's retinue of sub-contractors includes a mobile development developer and a separate UX consultancy.

Mapi's web-team are also map-users. By this, I mean not only of other maps, although Nir's folder of map screenshots and Gila's experience with social navigation have contributed greatly to the final form of the product. No, they are also avid users of the web-portal itself, often acting as local experts at the mapping agency and other governmental institutions that both rely on and provide information for the portal. They have been involved in all the previous versions and have overseen the web-portal's transformation from a small side project into the well-funded attempt to open up governmental geodata to citizenry. Thus, while genuinely trying to represent the interests of the non-professional, popular, casual user, they are arguably the most specialised group in relation to this product; their use is not the use they want to build.

There is no normative call here. In all my interviews and observations, the people working at all organisations came across as hard-working, earnest and intelligent professionals. Most of them recognise the limitations of their position, and they all treat their work with the grain of scepticism that allows technological innovation to rise in the face of challenges. However, the fuzziness of such positions made it extremely difficult to clearly delineate objects and subjects, fields and areas of expertise. The straightforward question that lies in the basis of each doctoral dissertation, 'exactly what is it that you are researching and where do you stop', was proving to be difficult.

Several theoretical lenses helped narrow it down.

First, the mediatization-research tradition (Schulz 2004; Krotz 2007; Hepp 2011, 2013) allowed me to think beyond the reductionist 'everything is media' direction. Yes, digital maps are part of – and enable – the mediatized and mediated landscape. The NowForce app is as much a result of the iPhone's launch and subsequent smartphone penetration as it is of cartography's grand history of helping rescue organisations deal with strife and disease. But being enmeshed with something does not mean one should not take a surgical approach and unravel the specificities of these connections. Rather than a direct effect, we can begin to disentangle moulding forces of media practices (Hepp 2011). A persistent analytical framework shows how institutions, cultures within such institutions and the culture arising *around* such institutions can be localised, contextualised and dissected without losing the local, but with a comparative eye towards simultaneous global changes: a 'translocal' view (Hepp 2013, 72).

Second, the rise of human-computer-interaction methodologies in academia and industry leads to an ongoing process of reconfiguration of user, makers and the hybrids thereof. Techniques such

as persona design (Pruitt and Adlin 2010), heuristics (Kuparinen, Silvennoinen and Isomaki 2013) and various forms of user testing (Flink et al. 2011) maintain a cycle of measurements, evaluations and adjustments that shape the map. The move to web-enabled digital maps with fast internet access and experienced through sensor-infused devices also means that such processes never truly cease, but continue as more data are collected and more users join.

Third, such an approach understood through an ANT methodology points to the user interface as the primary actor of research. It is the point of fuzziness that maintains or breaks the cartographic illusion, which is implemented on everyday computational machines. The work of Galloway and Ash strengthens this argument, the former arguing for interfaces as the synecdoche for modern computational environments by virtue of their unrepresentatbility, the latter by highlighting the post-phenomenological ways in which such interfaces enact spatiotemporal proprioception for users. Within the interface of my maps specifically, an encounter point emerges where the moulding forces of the designer agency, inscribed into the material-semiotic signs of software and screens, encounters the user's interpretations, feelings, thoughts and actions to make a map (or *mapping*). Therefore, the first research sub-question of this dissertation can be summarized as follows:

To understand a particular instance of making a digital map, we must look to its user interface. Taking into account the working cultures of an organisation engaged with the mapping, the various methodologies of acquiring and configuring users, and the inherent hybridity of the produser position, the interface is recognised as a place of contention. There, we can define a map in situ by focusing on the cascading effects of design choices inscribed into affordances, and the way they are read, de-inscripted and challenged.

7.2.RQ 2: What is the digital maps' user interface?

This brings me to the next question, regarding the nature of such interfaces. As I claim throughout the dissertation, digital interfaces excel at creating spatiotemporal envelopes that habitualise user actions by keeping them in the present (Ash 2013, 2015). Such interfaces operate above and below the thresholds of user cognition, in embodied ways that manifest the deep hold of the computational industries on the multitudes of performative action we carry out in our daily lives (Berry 2011, 2014). These interfaces are never static, but rather exhibit overarching effects, in the sense that they facilitate an ongoing process between the user and the black-boxed information inside the machine by tapping into user familiarity with other types of interfaces to create a self-

perpetuating loop. They disclose the information behind them by obfuscating the rules through which the visualization of such data occurs (Galloway 2012) – as exhibited by Mapi's attempt to engage citizens with public-transport planning or NowForce's ongoing addition of features based on the scope of the type of organisation they consider their clients. Those choices are not transparent, but instead rely on hiding the options from the user. She is not aware whether the data she sees when looking up bus lines come from the government or the bus company, whether they were translated into visuals correctly, whether the lines traced on the screen reflect the true route.

Building on the notions of inscription, I claim that describing the mapping interface that exists under such conditions requires me to look into the processes through which designers make digital mapping interfaces different from their paper counterparts. To do so, I focus on three components: the intertwining of the cartographic illusion which the map reifies with the unique conditions of the attention economy, the attempt to infuse the everyday and ordinary with a sense of fun and play and the particular place that quantification plays in such map interfaces through their inherent reliance on numerical information, and the way such information is displayed to the user. By underlining those aspects, I argue that digital maps are not simply computerised versions of paper maps, and that the qualitative difference in scale, access and availability of such maps results in a qualitative difference that requires different methodological tools.

The notion of attention, as well as capturing, measuring and operationalising it, is crucial to understanding maps. Mapi are a governmental mapping agency whose staff repeatedly stated that they do not compete with commercial mapping services like Google Maps. Rather, they claimed to be on par with other governmental data providers like the Central Bureau of Statistics or the Meteorological Service. However, they do not provide bulk data – they are investing millions in rebuilding a cartographic user interface to have greater appeal to ordinary citizens. These claims to being above competition have become difficult to sustain, as both Mapi's web-server and Google Maps occupy the same platforms and play similar roles for people accessing data. A consumer will use one or the other, or supplement one with another when a single website/app is lacking. Moreover, I show that by adopting a platforms-as-service mode of work, a single visit from a user does not facilitate the growth of such platforms, and thus Mapi must attempt to keep its visitors coming back. This conforms to contemporary theorizations of attention as the most sought-after metric in new media (Stiegler 2010; Crogan and Kinsley 2012; Terranova 2012).

I have argued that the solution for captivating said attention is often to be found in the practices of gamification – or gameful design (Deterding et al. 2011; Fuchs et al. 2014). Especially since I

subscribe to the systems rhetoric of gamefulness (Deterding 2015), which regards play as arising from the system of rules that constitute a game (or a game-like object) and thus draw parallels between games and digital media in general. By using Sicart's notion of play as being in the world, I have argued that mapping interfaces can become autotelic and appropriative, wherein users accessing the map might end up 'getting lost in the map', experiencing the pleasure of mastery over it and of the cognitive work that the map does for them in flattening the world. An apt example from my cases would be NowForce's foray into the world of efficiency management and nudging[35], which is closely associated with the notion of gameful design (Rossiter 2015). By selling their interface as a surveillance control tool whilst simultaneously emphasizing its ability to generate positive affects in the workspace by encouraging underappreciated workers, it taps into the world of achievements, ladders and badges that are so prevalent in gamified implementations (Lieberoth 2014). Again, I wish to stress that the experience of being lost in the map is not unique to the digital mapping interfaces that I have researched. A counter-example of the immersive power of a paper map as an interface that draws one in can be seen in the way fantasy authors commonly use maps to transport readers[36] into the worlds they create. However, the digital interface acts as a membrane that can not only captivate, but also harness the attention, making the user ever so closer to the desired state.

A central component to such captivation is the modes of quantification that occur within the map. As Grosser (2014) points out, the use of numerical prompts in such interfaces helps cultivate an unending 'desire for more'. Accumulation of additional connections or the appraisal through numbers attached to 'likes' or comments taps into human feelings of self-worth, while the constant quantification of elapsed time creates a false sense of urgency, tapping into the generational fear of missing out on something or someone (Dossey 2014). The example of gambling machines and the ensuing machine zone (Schüll 2014) shows the potential of combining mechanical rhythms of usage with black-boxed devices providing a stable numerical output to engross and entice users to the extent that winning or losing becomes unimportant – the desire is just to keep using. NowForce's constant tweaking of routing and ETA is an interesting case: they offer their own routing algorithm at a premium price to supplement and enhance Google Maps' embedded one. Their new visual design prioritises this routing by grouping users according to arrival time and highlighting time over distance. Yet by doing so, they might be undermining the purpose of moving their dispatching

[35] A recently popular theory from behavioural economics suggesting benefiting users by subtly limiting the choices in front of them (Thaler and Sunstein 2009; Sugden 2009)

[36] Or viewers – as exhibited by the hugely popular title sequence of HBO's hit *Game of Thrones*, which depicts a map in the form of clockwork unfolding.

systems to a map-centred interface. If the affordances for the operator prioritise quick decision-taking based on comparing times for various actors in the field (especially when time is precious), then the complexity and situatedness of the map expedites the imposed logic of numerical determinism.

A digital mapping interface is one that successfully captivates the attention of the user, through calibrated obfuscation and disclosure of the data that lies beyond it. The designers of such interfaces inscribe within them notions of fun and experience in order to attempt to disengage users' self-reflexivity toward the space between the map and the world. By doing so, they wish to habitualise the naturalistic mode of using the map in the world, and compete with other digital objects for the users' time and money.

7.3.RQ 3: What are the specificities of digital cartography maker practices?

The next question takes those interface affordances unique to digital maps and applies them to my case-studies: what is unique about the *digital* aspects of their work? To start with, from a processual-epistemology point of view (Kitchin, Gleeson and Dodge 2013), the answer to this can never be a concise list of bullet points. Just as the deployment of maps is never static, neither is their production. Yet, throughout the interviews, observations and cooperation at Mapi and NowForce, I can discern certain repeating patterns that can be generalized in digital cartography-specific issues. And while I have not performed a comparative study of digital and non-digital maker practices, some of my findings in relation to Mapi and the reliance on existing literature allow me to extrapolate.

Digital cartography is digital in two complementary ways: it is both increasingly reliant on digital tools for data collection, visualization and dissemination and produces objects that themselves operate in a digital media-scape. It operates through configuration of a software and economic rationale which I refer to, after Berry (2014), as the computational industries. The forces behind such configurations are economically and structurally inclined to introduce software into more diverse spheres of life, operating under what Berry calls, after Hayles, a Regime of Computation (Berry 2011, 12), where even the analogue is deemed at least potentially computable, after proper digitalisation. The logic of digital map-makers is then one of turning spatial features into discrete digital data and featuring such data on a computerised user interface.

When looking at both workplaces I have examined, we can see how the presence of various software tools alters working conditions. NowForce, built around the ideas of the lean modern start-

up and employing Agile Development methods (Martin 2003), is concerned with organising its workflows around iterations of product versions, which they refer to as 'sprints'. New bugs are queued endlessly from iteration to iteration, judged by product managers according to their perceived value to the user, and thus the company. User needs and desires from a broad array of various clients are aggregated into a single list, from which ideas of imaginary potential users are derived. The software in the workplace, from chat and email solutions to project-management suites, allows endless compartmentalization of tasks across time and the workforce. Simultaneously, the near real-time feedback from the software embedded in the maps themselves joins these streams of tasks to further define priorities and decisions regarding future versions, further advancing the unstable becoming of the mapping interface.

Similarly, while rooted in a different work ethic and from a contrasting institutional history, the Mapi web-server team speak of versions and 'generations' of their product, albeit on a far more limited scale. They cannot stand still as the software tools around them become more advanced (consider the move to a new version of ArcServer, for instance), thus providing more possibilities but also exerting more pressure to use them. The mention of fighting off the need for 'internet consultants' that management attempted to impose the moment the new generation of the web-server was authorised is a good example how the logic of versions and teleological progress intersect with GIS and consumer-electronics trends to produce new epistemologies and agents who shape them (Berry 2011).

Nowhere is it more apparent than by examining how internal disagreements, which were always in the purview of large sociotechnical projects (Latour 1996), are increasingly powered by metrics in the spaces of cartographic production. By this I mean that disagreements over the scale and scope of maps, over what to include and what not to include, that were previously decided based on lengthy market research or experiences and the 'gut feelings' of the people involved, can be quantifiably expressed and included in an argument. User data are continuously harnessed by embedding tracking within the map. Such tracking can take the form of geo-locative surveillance using the map's reliance on GPS or similar technologies, but is also possible through the granular, analytics-focused practises of the contemporary web (Thatcher 2014).

Both of my case-studies embedded various forms of Google Analytics – originally a marketing tool – as a way to gauge user engagement with certain aspects of their map. Participants in Mapi mentioned to me that they changed which functions are immediately visible and which are not on the basis of previous versions. NowForce's product manager expressed a desire for more data-

oriented decision-taking at the company. This should be seen within the context of growing prioritisation of (big-)data approaches within the software industries, which are regarded as objective and desirable as opposed to flawed and biased decision-taking, in what Richard Rogers refers to as the post-demographic era of big data and machine learning (Rogers 2009). These terms highlight the approach between consumer segmentation according to pre-defined categories (such as gender, income or race) and the ability to construct new user categories inductively based on the online tracking of such users. A common example of such a practice is the way the film and television streaming service Netflix is constructing internal categories for its content based on actual viewing patterns rather than relying on traditional film classifications. In this case, Netflix's business model of charging a flat monthly subscription fee allows for growing acquisition of users who contribute more viewing data to allow the creation of viewer profiles with pinpoint accuracy, which are taken into account when approaching content creators. In such way, Netflix seemingly reduces much of the risk involved with televised-content production, since it can predict with a higher degree of probability what types of cultural products will have an audience and approach production companies and investors alike (Mann 2016). In post-demographics, users are counted and 'dividuated' (Deleuze 1992) into discrete units of data so they can be better categorised and measured according to their potential to be grouped. According to Rogers:

> [p]ost-demographics is preferred over post-demography, as it recognizes popular usage of the notion of a 'demographic,' referring to a segment or niche that may be targeted or polled. Crucially the notion attempts to capture the difference between how 'demographers' and, say, 'profilers' collect as well as use data. Demographers normally would analyze official records (births, deaths, marriages) and survey populations, with census taking being the most well known of those undertakings. Profilers, contrariwise, have users input data themselves in platforms that create and maintain social relations. They capture and make use of information from users of online platforms (Rogers 2009, 2).

This approach, however, varies somewhat between the two case-studies. NowForce, with its start-up ethics, relies on post-demographic classification far more than Mapi, which still abide by user categories, which is rooted in its public-service history. NowForce's approach of creating a service for users 'to perform actions in the field' opens up a wide range of possibilities for the enlisting of various clients, some of whom do not meet the original profile of emergency services. When such disagreements arise, accurate data of sales figures, numbers of users, profits etc. come

into play. However – just like with Mapi – the data can still be overruled by management's decision, since – as I claimed before – the companies' respective cultures and the ethos associated with their undertaking still hold sway.

An additional issue dominating the work practices of those digital cartographers is the rise of alternative modes of production and the pressure they exert. I refer to it by suggesting the term *uniquitous cartography*, which incorporates the digital maps' tendencies of being made by various means and distributed across wide ranges of devices, yet forming granularly, appealing to growing audiences through meticulous personalisation. I ascribed the rise of such practices to Google's disruption of the virtual globes, GIS and mapping markets by introducing Google Earth and Google Maps (Farman 2010; Dalton 2012). Such practices range from prosumer capabilities of creating various forms of mash-ups, the rise of Open Street Map, the adoption of cartographic tools by general developers and so forth (Haklay and Weber 2008; Perkins and Dodge 2008; Della Dora 2012; Dalton 2015). The pressure exerted by the various neocartography and other produser tendencies are apparent in the way Google Maps is contrasted and compared in Mapi or meticulously studied at NowForce with each new iteration.

As a side note, it is important to consider the fact that such pressure is experienced on the data-gathering level as well as in the map-rendering practices. Cartography has always relied on access to accurate and sufficient surveying data, and today, such data comes in much faster and in fluid forms. Cartographic data is produced at the map-making organisation or purchased from external providers, whether through surveys, orthophotogrametry, LIDAR scans, remote sensing or any combination thereof. Open-source organisations, competing governmental branches, commercial entities and private citizens with access to appropriate tools can all contribute, change, contest and obscure such data. Even when producing paper maps, Mapi became greatly reliant on digital data and software tools for its manipulation. The failure to produce maps from a geo-spatial database and the need to retrain an existing workforce, not only in the working of GIS software but also in image-manipulation suites, showcases some of the challenges that older cartographic organisations face. And while Mapi's cartographic division was willing and able to retrain a large number of older employees in this case, one wonders how much traditional, paper-based cartographic knowledge and experience is disappearing as the mapping world moves to an increasingly digital mainstream.

Finally, digital map-making practices are strongly aligned with user-interface manipulation practices. Cartographic data and user data are mixed and visualized through a GUI to provide users access. As Galloway reminds us, a process of data visualization is always the visualization of data's

own rules of translation from mathematics to semiotics first, before the translation of the actual thing that is being displayed can begin. Thus, images and shapes that appear on the screen hide the logic of the generation of such visual forms from numerical data, even before the potential 'traditional' cartographic biases appear. Mapi and NowForce's focus on 'search' as their system's navigational metaphor underscores this: they set the rules for translation in a way that allows users of varying skills to access the data through the map's interface, in a way that always exposes additional layers of it. Users can then be traced and tagged further, for example by extrapolating their interest from the layers they choose to activate or by tracking the external links they followed from the map.

Such data is constrained and construed by the types of databases they reside in and the APIs that govern its flows. Mapi's example of the BANTAL is telling. Defining a geographic entity at Mapi requires first and foremost specifying what can and cannot be defined. Several examples for this include the decision regarding whether to differentiate regular dirt roads from those that are traversable by SUVs, or the existence of overpasses and underpasses in the database's classes. The most prominent example, however, is streets being defined as uniform lines and the subsequent abandonment of the navigation and public-transportation planning map. There, Mapi deemed the project unfeasible because of the resources required to separate and re-define all existing streets to include lanes and pavements.

Ultimately, we can summarize the specifics of digital cartographies in the granular ways users are defined and constructed. Various forms of data come together to define an emergent product that is always changing in relation to user actions and external actors. The goal of such practices is to inscribe a user interface with certain affordances, and through such inscription capture and maintain the attention of potential users.

7.4.RQ 4: How does inscription allow for the configuration of future map users?

As mentioned before, we must caution ourselves when delineating map-maker from user and writing from reading in relation to maps. Is the emergency dispatcher demarcating various areas on her assigned territory using NowForce's polygonal layer a user or maker? Is the responder, being pinged by this dispatcher to a scene, a NowForce user when he navigates using the NowForce app – which incorporates his native phone-mapping provider (Apple or Google)? Echoing the concerns of who exactly the user is (Woolgar 1990; Grint and Woolgar 1997), such questions, building on the processual understanding of cartographic production (Dodge, Kitchin and Perkins 2009; Kitchin,

Gleeson and Dodge 2013), stand in sharp contrast to the very notion of interface inscription and the power that such inscription carries (Akrich 1992).

And yet, inscriptions do occur. Despite the hybrid and fluctuating roles of the map-making assemblage and possible open readings of the user interface, the ontic reality of the map production cannot be challenged. When examining punctuated relations in a network, there are actors in place who *create* a specific user interface, and there are those who *experience it* at a given time. With proper methodologies, such relations can be traced and frozen momentarily (J. Banks 2014). One of the goals of this dissertation is to find a way to reconcile between the processual understandings of maps as emergent with the inscriptive qualities of the maps' interface that nonetheless guide and shape the aforementioned understanding to a degree (Bittner, Glasze and Turk 2013).

My conclusions lie on a cross-section of several designer practices: an attempt to pre-emptively define users, the user testing occurring at the various production stages and the overarching influence of the UX industries. Overall, I argue that in order to effectively inscribe user interfaces with meaning, maps – and to some extent other digital objects – must walk the tightrope between being uniform and recognisable, and allowing the user customise and personalize in order to make the use frictionless. With a map, the designers must maintain such uniformity not only for the specific interface and other maps, but also for the perceived likeness of the interface with the world, limiting colour palettes or symbology choices (Krygier and Wood 2005).

For instance, the ability to upload your own set of icons or symbols to NowForce's UI presents an interesting case that speaks to the limits of customisation. As we have found in our own user testing, one of the users was mistakenly interpreting a default 'goal' icon designed by NowForce, due to its resemblance to Google Maps' 'my location' icon. This icon has gone through many iterations, and the NowForce theme had an instinctive and clear meaning. By using such an icon on their map, they wanted to indicate to a user that she must make efforts towards this location. Through their design guidance, this icon became a mainstay of the interface, and their clients were trained to perceive it as NowForce intended. Yet, after the testing session I facilitated, changing this icon is planned, which will impact the many future users of the system. This small intervention by the product manager and me had the potential to alter future unfoldings of the map. By allowing organisations to customise their interface, NowForce wants to minimise the chances for misinterpretation and give clients the ability to make the map speak a language consistent with their own. Yet, one must wonder how many of the follow-up choices made by the clients' administrators clash with the map's components which cannot be changed? Especially considering the disdain of

Alice, the UX consultant, for the tendency of technically competent individuals in a workplace to replicate such complexity in their perceptions of their users, and the resulting mismatch between user skills and system goals.

Critical cartographers have accused map-makers of many things: promoting certain types of knowledge over others, trampling the rights of indigenous people, contributing to colonialism, dissuading unpopular worldviews and much more. I do not think that my case-studies are particularly guilty of any of these (at least not more than with any similar map), and this type of criticism lies somewhat outside the boundaries of my argument. However, and this *is* important, I wish to level an accusation against maps that I believe is new and relates directly to the processes of inscription. Specifically, in the modern development environment of fun and profit (Dalton 2015) constrained but embedded in ludic capitalism (Galloway 2012), digital mapping interfaces must be *interesting* above all else.

This seems to be not as important an issue for a map as building an empire or rooting out ideologies with the help of one. However, consider the examples of the games in the opening screenshots of this chapter. In the sea of noise, they frame addiction as promise, as something that will hold user attention at least slightly longer than the competitor will. Boredom is the primary enemy of the attention economy, because '[i]f information is bountiful, attention is scarce because it indicates the limits inherent to the neurophysiology of perception and the social limitations to time available for consumption' (Terranova 2012, 13). Under such conditions, not being engaged with a digital device, not consuming or producing, not providing 'eyeballs' to advertisers that can be counted and commodified through views, clicks and likes is a problem. And when transforming their maps for digital platforms, map-makers must conform to those norms and craft their interfaces accordingly, constantly asking themselves whether they have truly done everything in their power to keep the user engaged. I believe that my case-studies – and other digital mapping platforms in general – do not fully subscribe to this position yet. Especially when traditional cartographical values, often associated with beauty and accuracy of the information provided, interfere. Yet throughout this thesis, we can see the beginnings of change, through the focus on appealing to a broader and broader user base, to the justification of user tracking and analytics and mostly by looking into my analysis of the mapping industry's encounter with the UX industry in chapter 6.

To summarize, the inscription process occurs through the application of design choices centred on keeping users *interested* within the confines of familiar interfaces while offering them venues for personalization. This enables the maps to differentiate themselves from competition, yet open up to

new users. However, the process is never straightforward and inscriptions are guaranteed to fail, as users bring their own sensibilities, and de-inscript what is given to them.

7.5.RQ 5: What forms of *power* does such inscription enable in digital maps?

Ultimately, all my previous research questions rest on the assumption that my case-studies presented an opportunity to study power relations between map-makers and their users. Based on my review of existing literature on cartographic power and its implications for a processual view of maps (Harley 1989; Wood and Fels 2008; Dodge, Kitchin and Perkins 2009) I suggested looking into media theory for an updated understanding of digital maps as user interfaces. Specifically, I looked into mediatization theory to account for an institutional meta-process that may shape map production (Hepp 2011, 2013) and into software and platform studies' work on contemporary digital (locative) media as platforms of governmentability that encode certain power relations through code and the resulting software (Berry 2011; Farman 2012; Galloway 2012). In particular, I found digital games and the industry surrounding them to be a helpful institutional comparison, due to the distinction between creating specialised software and using such software for game design, and due to the move away from specialised narrow audience experiences towards popular, casual games as an attempt to broaden the appeal and increase the potential of the industry products' appeal.

In doing so, I arrived at a conceptual prism that I present in chapter 2, which I dubbed casual power. The idea behind it lies in identifying the ways digital map-makers attempt to embed into their interfaces affordances that reduce user reflexivity, make using the map seamless and enjoyable, blur the differences between the map and the world it purports to represent and overall become naturalized objects in the habitual chains of actions that users perform vis-à-vis the world. While we can locate the origins of such power relations in the way paper maps have traditionally structured space and the uneven knowledge distribution between those with access to cartographic praxes and those without (Ingold 2000, 2010; Wood 2010), my assumption, following existing work on digital cartography, was that the change emanating from the digitalisation of maps was more than merely a question of scale (Kingsbury and Jones 2009; Parks 2009; Rankin 2011; Dalton 2012, 2015; Della Dora 2012). Specifically, I have located three conceptual lenses that should be used when examining the inscription process I summarise above.

First, I acknowledge that the cartographic illusion of maps changes when maps are transformed for screens. This happens due to the nature of contemporary media-scapes to operate under the

conditions of the attention economy (Stiegler 2010; Crogan and Kinsley 2012; Terranova 2012). From a static representation of the world, the animated map becomes a dynamic actor that aims to represent the world in (near) real-time while competing for the increasingly scarce attention of the user. The co-habitation of the map on digital platforms with other objects that actively demand user attention necessitates this, and the economic conditions that commodify such attention through views, clicks, shares and the like promote it further. Second and in conjunction, the digital map can be seen as inherently playful, especially when considering playfulness as an attitude expressed through objects and the view of play as systems (Perkins 2009; Sicart 2014; Deterding 2015). This is emphasized by the developing form of gameful design, and especially those that attempt to enact 'juiciness' (Juul 2010) in user interfaces, underscoring autotelic engagement with the map rather than its use for a certain purpose. In line with processual and navigational views of cartography (Kitchin and Dodge 2007; November, Camacho-Hübner and Latour 2010), mapping interfaces can thus be designed to be used 'for fun' rather than to serve any particular rational goal. Third and following the previous two, this is achieved through the numerical forms of the digital map that both underpin its existence as a data object and are used as interface elements to affect users. In particular, I claim that such modes could be understood by looking into quantifiable interactions within the context of neo-liberalism and the desire for more (Grosser 2014; Sandvig 2014; Rossiter 2015), as well as a digital design technique grounded in decoupling the understanding of processes grounded in physical world from the perception of the screen (Schüll 2014). This is achieved through the creation of positive feedback loops that allow for cognitive ease and the substitution of complex spatial questions with those that could be expressed on a numerical scale (Tversky and Kahneman 1973; Zajonc 1980)

None of the categories above stand by themselves or are mutually exclusive. They rely on each other and merge, fuelled by processes of digitalisation and the rapid spread of new forms of power through mobile communication networks (Poster 2004; Castells 2006). Examining my case-studies, I find strong examples of exerting power through the notion of usability testing and following it, the inclusion of analytic software in both case-studies. The notion of designing for and with discrete information about the users allows companies to predict on an individual user level which aspects of the map are interesting and which are not. I show that such processes of user configuration are predicated on balancing the uniform and customisable aspect of the map, so as to make it recognisable yet adapting. Repeated interaction allows for a process of continuous improvement: personalization yields positive effects for the designers in terms of the keeping users occupied within

the map, while designing for exploratory ways of use guarantees that *some* kind of answers will be available through the interface.

The usability testing performed with NowForce showed how different types of users react differently to the placement of various visual elements, and how by performing such a test, map-makers can trace contingencies and guide different types of users towards desired results. Yet, it also showed that such methods are prone to errors and that no totalizing linear scheme for forcing preferred types of reading and interaction exists.

The use of the map as a base for additional layered information and the ease with which external actors can access and sometimes add such information through the enrolment of APIs constitutes another component of the power relations between makers and users. The changes in the velocity and scope of data updates available for digital cartographers dwarf previously common timescales. Notions of accuracy and rigour are challenged by the web environment's ethos of immediate gratification. Simultaneously, the move to service- rather than product-oriented economic models mean that user grievances can be addressed within the scope of the next version (or within the same one if the changes are miniscule).

More than anything else, my encounter with the UX industry has helped clarifying the power of map-making assemblage. In particular, as mediatization theory suggests, it shows that such an assemblage should be extended beyond the map-maker/map-reader duality (Del Casino and Hanna 2006). The way notions of experiential design are propagating a certain view of what it means to engage with a map and the way expertise is transferred between various domains under the guise of user representation reveals an additional shift in traditional cartographic power relations. Now, power is also being exerted on the map-maker by such external actors, due to the fragmentation of attention, technological complexity and new labour conditions that call for outsourcing and freelance work. Thus, answering the final rub-question allows me returning to my main one, and position digital cartography in relation to issues of maker practices, interface inscription and power.

Overall, the power of the digital maps in this study is multifaceted and refuses generalization. The way digital environments enforce their own logic and the rise of user-centred design can be seen as democratizing effects within the map-making process. This is especially so when taking into account the proliferation of mapping and the rising skills of users in recognising and operating maps – as can be seen in my ethnography when the designers begin operating on the basis of user requests and demands rather than personal preferences. Yet, as Haklay (2013) reminds us, we should not confuse limited openness and true democratization. The protocological power of digital platforms

(Galloway 2004) is such that it renders certain forms of resistance impossible by their mere design. Where paper maps could be scribbled on, crumpled up, thrown away and otherwise contested, most actions performed within the frame of digital maps leads to implicitly accepting their creators' assumptions about the world. One of the only forms of resistance remaining is to refuse to use it altogether (Selwyn 2003, 2004), and this becomes more difficult when you consider Mapi's role as a national agency, in the context of this dissertation, or Google Maps' global ubiquity in general.

On a concluding note, I feel compelled to mention that I did not find some aspects of power that I expected to find. Initially, I hypothesised that the structured nature of digital maps and its enmeshed status in producing code/space (Kitchin and Dodge 2011) for non-professional users makes it an ideal tool for wielding great power over such users. I expected to find evidence of procedural persuasion occurring through the design of such maps, where users are led to certain conclusions and actions in space by virtue of specific discursive arguments, made absolute through surveillance embedded in software (Bogost 2006, 2007). I am glad to say that no such certainty exists (as yet), and that map-making still remains a relatively risky endeavour in relation to presenting the world to the user. While digitalisation permits greater possibilities of control, it also opens up a wide variety of alternatives, which diminish the power of a specific mapping interface. The greatest power that digital map-makers possess is still rather similar to that of paper cartography: persuading users to avoid questioning the map. And while the use of such maps habitually and casually underscores this ability, it also weakens the proscriptive ideological power that has been the main concern of critical cartography for last few decades.

7.6.Future Research

In the last part of this dissertation, I will address the repercussions of some of the findings discussed above, especially in relation to potential directions of future research in the field of digital mapping and beyond. I will specifically refer to the digital map's dual position of a map and a computer interface, as well as positioning it in the emerging practices of platform studies and the softwarization of society.

First and foremost, everything brought up in this dissertation relates to two specific organisations in one country. Throughout the dissertation, I attempt to look beyond the cultural specificity and the unique conditions and supplement my (auto-)ethnography with a broader theoretical foundation in order to say something meaningful about the world of digital maps and the

web in general (Anderson 2006). I have picked cases that, to the best of my knowledge, represent a situation that can be encountered globally, especially as the web-enabled world moves into relatively similar modes of software and knowledge production (Appadurai 2001). Thus, around the world, old cartographic agencies are dealing with the pressure of digitalisation while new, often young, technological elites seek new ways to weave software into lived spaces, often through mapping interfaces (Perkins 2009; Dalton 2015). Yet, as with any site-specific research, especially when built on participatory observations, my conclusions should be understood primarily as relating to those particular cases. The next logical step is then to carry out similar research at other map-making organisations around the world and see if there is consistency in terms of labour conditions, the role of the user, the institutional pressure exerted from the web and its surrounding attention economy and so forth. While anecdotal evidence coming from my discussion with other researchers and people in the industry suggest that what I observed in Israel is part of a global trend, I do believe that *the* digital map (a generalization I attempted to avoid throughout this dissertation) occupies a place in modern sociotechnical assemblages that merits closer methodological scrutiny.

But why does the digital map matter? Or more specifically, why does it matter to anyone beyond the small sub-section of academics who happened to get involved with the topic? What societal impact (a word favoured by university administrators) would such research entail? This is a dangerous question to consider in the midst of working on your doctoral dissertation, as the answers are not always flattering. More often than not during academic pursuits, one realises that the topic of one's dissertation matters mainly *because* it is the topic of one's dissertation, and it may hold little appeal to those outside a very narrow circle of specialists. Yet in the concluding chapter, looking back at the four years of research and the project that surrounded it, and after well-documented saturation with the chosen topic, I attempt to look at my object of study clearly. And despite the above, I wish to make a bold attempt at defending the digital map as a crucial component of the digital economies, one in desperate need of additional scrutiny from varying points of view, for the benefits of scholarly knowledge and society at large.

To summarize my main points of warning throughout this dissertation: digital mapping interfaces are located on a variety of platforms, are generally perceived by their users as objective and trustworthy, have a close affinity with performing actions in the physical world due to the conditions of their habitual deployment and are being built with affordances that take into account all the above. Each these merits a further unpacking.

7.6.1. Digital maps are everywhere: A becoming of new maps

In April 2016, Joshua Brown, a US-based automobile enthusiast, uploaded a clip to the popular video sharing site YouTube titled 'Autopilot Saves Model S' (Joshua Brown 2016). In it, he films himself driving the Tesla model S electric car with the recently enabled autopilot feature, which allows the vehicle's computerised systems to make driving interventions without the driver's input. The video shows him talking about the feature when suddenly the car swerves and the exhilarated Brown explains that the vehicle just avoided a collision with a lift lorry that he did not see. A few months later in May, Brown became the first know fatality in a self-driving car incident, when the same Tesla collided with a semi-trailer. The vehicle's sensors failed to register the white rig against the clear sky and attempted to drive beneath it, killing the driver. Some forensic findings suggest that Brown was watching a DVD film at the time (Levin and Woolf 2016).

Elon Musk, Tesla's CEO, previously acknowledged that the autopilot feature is a method of enabling high-precision GPS mapping of the lanes driven by the cars and entering it into a central database, referring to it as a 'fleet learning network' (Perkins 2015, n.p). In this effort, Tesla joins Google, Apple and Here (formerly Nokia's mapping division, now owned by a consortium of German auto manufacturers) to create digital maps for machines rather than people. Peter Skillman, Here's head map designer, explains that one of the greatest challenges for such maps would be to make it legible and reassuring to humans, who would be able to read, but not act upon, such a map. In an interview for *Wired*, he compares the maps of future autonomous vehicles with a stagecoach map in London circa 1720:

> [a]s the vehicle navigated the labyrinthine streets of London and headed for the countryside of Surrey with uncommon speed, the passengers must have felt a bit unnerved. Having selected their destination, they'd relinquished control. They had no communication with the driver, but they could check their progress on a map (Miller 2014, n.p.)

To him, this is one of the guiding principles of the map Here makes. The interface of the map hides a different map, one of intense complexity utilised by a car that relies on algorithmic precision instead of human common sense and acquired skill. The interface must communicate to the passengers the decisions the car makes, but at speeds and levels of detail suited for human cognition rather than the actual calculative possibilities of the computer. In this capacity, the map maintains a complicated ontological state of simultaneously being a way for the car to understand the world and

also a conduit for the human passenger/driver to understand the actions that car performs or is about to perform. The first fatality in a self-driving car brings such a future seemingly closer, as car manufacturers, engineers, related cartographers and regulators will undoubtedly double their efforts to make automatic driving safe and widespread.

The self-driving car maps are but one example of how digital mapping shapes future relations with what Kitchin and Dodge (2011) call code/space. Another prominent example from the automotive world would be the way 'taxis without cars' services like Uber use map display and dynamic pricing algorithms to create 'surge costs' for passengers to pay higher fares during peak hours and/or in areas of high demand. Both categories of Uber users, drivers and passengers alike, develop tactics to combat or take advantage of this, for example by moving outside the pre-defined map areas to game the system. The Uber interface also employs high levels of quantification, as drivers and passengers rate each other, and the times and distances are compared and contrasted. From a point of view of casual power, we might say that the Uber map designer wishes to eliminate the consideration of distance and uncertainty by turning every journey into a potential payday. Here, the map display also serves a rhetorical role to differentiate Uber from traditional cab services by seemingly giving the passenger information about the driver and route before the journey commences.

In this capacity, the map also has a somewhat uncomfortable relationship with the changing labour conditions of what is becoming known as the 'precariat' (Standing 2014): the freelancers employed by various internet companies, often devoid of the legal status that became the staple of 20th century work conditions. Those who work for Uber, as well as various others performing 'micro-task' jobs of the 'gig economy', never enter into a full relationship with the web- and app-enabled platforms that provide them and instead are relegated to the role of user as much as the passengers they carry or the delivery recipients they service. The mapped interfaces eliminate the necessity for some companies to have centralised locations such as offices, distribution centres or garages. The maps in these cases permit a seemingly straightforward translation between the users' desires of spatial mastery (to be somewhere else to receive money for performing a delivery) and the satisfaction of such desires by a third party. Such conditions benefit the platform owners enormously, while generally greatly diminishing social ties between service providers and recipients, at the same time sabotaging the possibilities for internal organisation of labour amongst the employees.

The transferability and interoperability of digital data also makes 'mappification' a lucrative business opportunity: there are currently numerous commercial proprietary and open-source services (figure 7.2). They straddle the line between 'real' GIS and popular displays, catering to companies and organisations that make all types of maps. This is a rich field of activity and enables the creation of fascinating maps that run the gamut from teaching citizenship (Gryl and Jekel 2012) to crisis relief (Asmolov 2015). Particularly of interest in this production assemblage are the possibilities for (mis)use of digital mapping interfaces for persuasive purposes. Looking into the mutability and shareability of such maps along the perceived neutrality reveals them to be productive message containers, especially in times of conflict or disaster (Muehlenhaus 2014). The inherent problematics of numerical information display on the map-as-a-database-interface also makes it a difficult tool for dealing with fluid information categories such as development or aid – fields that make great use of mapping information, as I have discussed elsewhere (Zoomers, Gekker, and Schäfer 2016).

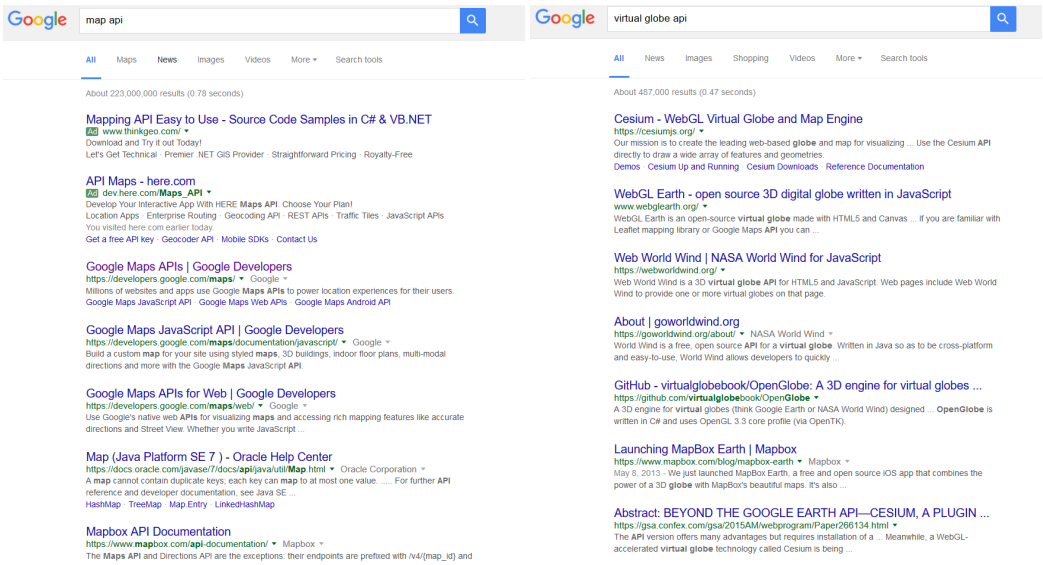


Figure 7.2: A search for mapping and digital globe API results in hundreds of thousands of different custom-made solutions; screenshot by the author.

In general, it seems that in the digital era, mapping interfaces penetrate and transform additional spheres of life. As spatial tools for spatial beings, they prove to be effective in filtering out information overload, by showing users in an immediately-recognisable and (potentially) easily-discernible way the most relevant information at a given moment. As claimed by various critical cartographers, there exists a certain insidiousness of the map, often tied to its perceived neutrality and harmlessness. And as I show in this dissertation, the designers of such maps are aware of the maps' potential and use various tools to gear their maps for maximum impact, whatever it might be. We should be concerned about how casual power will manifest in the world of self-driving cars and other filtering and attention-focusing interfaces.

7.6.2. Maps are perceived as objective and trustworthy: Call for a new epistemology

I claim that future manifestations of casual power call for a new epistemology of digital maps. Following Kitchin, Gleeson and Dodge (2013), such an epistemology should be relational and multifaceted, building on the processual understanding of maps as 'lines of becoming' (Ingold 2010) and the necessity of comparing and contrasting processes of map production, maintenance and reading. It involves adopting methodologies from geography, STS, anthropology and other disciplines that deal with the complicated relations between humans and objects in the manufacturing and distribution of knowledge. However, I also wish to emphasize the role of media studies in this toolbox, which is absent in Kitchin et. al.'s discussion. This despite the fact that case-study selection in the empirical half of the paper was inspired through being part of a cross-institutional academic blogging project, which at one point decided to document the topic of 'ghost estates' – abandoned unfinished housing schemes – in Ireland. The authors' detailed description of the methodology that arose from this project is rife with detailed accounts of their interaction with various local and national media institutions and how they changed the deployment parameters of the successive maps they made. In particular, this section details the results of a national television channel's invitation issued to one of the authors to debate the issue with other interested parties:

> [t]he programme's producers knew we were working on a new 'ghost estate' mapping and asked for an exclusive to show the results, with the mapping published on the IrelandAfterNAMA blog at the time of broadcast. The day was spent cleaning the data and doing multiple, detailed error checks, refining the mapping design, and involved a whole series of conversations about the data

> and their mapping, which went through several iterations. MapInfo was used to construct the mapping and this software shaped to an extent, in a contingent fashion, the 'look and feel' of its outputs due to the way in which cartographic conventions are built into its algorithms and the options available to its user (Kitchin, Gleeson and Dodge 2013, 10).

There are many aspects to this account, and the ones that surround it are interesting from a media-scholarship point of view. In particular, the way the 'coagulated actions' of the political and broadcast institutions – in the form of debunking unfavourable research, representing certain interests, operating within exclusivity, rating considerations and so forth – influenced the becoming of the authors' own map. This discussion is altogether missing from the analysis, and it is understandable: after all, none of the authors have a particular interest in media theory and demanding such rigour of them is unreasonable. However, the brief mention of the MapInfo desktop GIS package (which would not be familiar to readers outside the field and is not explained in the text beyond the quotation) refers to the resulting product as being influenced by the algorithms and options of MapInfo. Of course, every academic paper must balance length and depth, and avoid unnecessary details so to avoid a state where 'the end product might well be banal' (Akrich 1992, 206). It is interesting, however, that such a brief sentence covers a lot of assumptions about the relation between the visual and data or the work practices of cartography professionals and academics vs. expectations of television producers (especially since the latter 'construct' television audiences in a way similar to how digital map-makers 'configure' users).

The description above is by no means a critique of the authors' results or methodologies. But it does serve to point out how the computational industries are adept at hiding their own agency, and how even critical cartographers might miss the massive question of the agency of their own software tools. This is why I specify the distinct contribution of new media theory in the introduction to this dissertation and presented in figure 7.3.

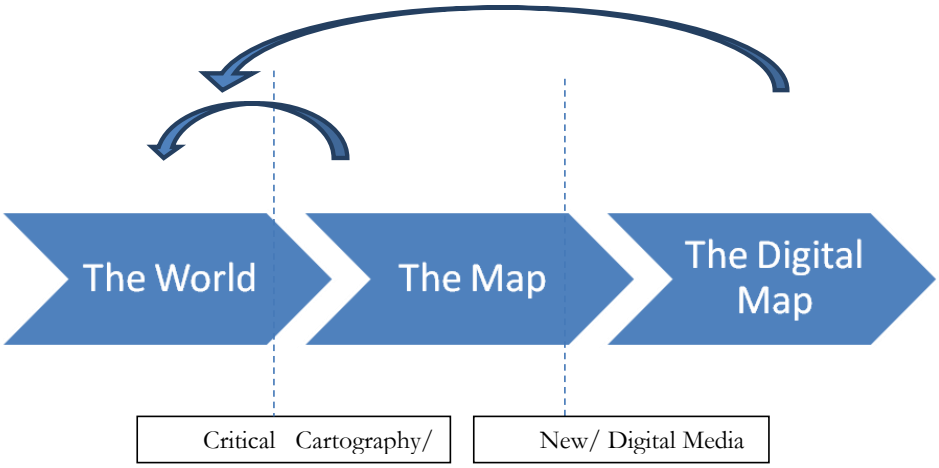


Figure 7.3: The digital map as a double referent; from the introduction chapter of this thesis.

Media and communication scholarship, especially when rooted in cultural studies traditions, has a fine epistemological tradition of self-referentiality and critical observation of the most mundane and commonsensical things. Those who study communication as both an interpersonal and technological channel are well aware of the tautological nature of the pursuit. In a widely cited introduction to his influential *Communication as Culture*, James W. Carey notes that

> [t]here is a truth in Marshall McLuhan's assertion that the one thing of which the fish is unaware is water, the very medium that forms its ambiance and supports its existence. Similarly, communication, through language and other symbolic forms, compromises the ambiance of human existence. The activities we collectively called communication – having conversations, giving instructions, imparting knowledge, sharing significant ideas, seeking information, entertaining and being entertained – are so ordinary and mundane that it is difficult for them to arrest our attention (Carey 1989, 19).

Carey could not have known at the time of writing that in 30 years, the technological assemblages of 'smart' machines and smart people who make such machines look smart to others will colonise and remediate many of those mundane actions through no less ordinary-seeming user interfaces. When I talk of the perception of maps' innocuousness, it is worth remembering that by

coupling map-making with the world of new media, software takes upon itself some of the qualifications of the map-making tools and imparts in return some of its own biases and preconceptions. Thus, critical cartographers or GIS researchers who are used to dealing with the tricks of the mapped form might fall victims to the hidden tyranny of software (Kwan 2016).

As claimed throughout this dissertation, attention is central to this arising epistemology. Attention today is formed and manipulated by assemblages of people and software commoditised, traded, reversed, gained, lost and spent in an increasingly paradoxical situation of being simultaneously incredibly valuable and unbelievably sparse. My framework of casual power shows how mapping interfaces could be understood as being designed for discrete manipulation of user attention. In this call for new epistemologies, I aim to highlight the fact that the notion of attention should also be turned inward, towards the researchers' and practitioners' cartographic community, understanding that we implicitly participate in the same global sociotechnical assemblages that underscore the use of mapping platforms by 'ordinary users' and question what effect that might have.

The resulting epistemology relies on a multiple cross-disciplinary methodology which follows Caquard's (2014) call for the inclusion of traditionally empiricist cognitivist methods in the literary theory-inspired study of map narratives. As elaborated in this dissertation, the world of cognitive research is very interesting for understanding digital map-making assemblages, both due to their potential to offer experimental work for understanding the power of designers in manipulating attention and due to cognitivism's role in cementing HCI-inspired methods in the work processes of such assemblages. This is but one of many examples of necessary collaborations and breaking down of barriers between disciplines for this new epistemology. The article cited at the beginning of this section is titled 'Unfolding mapping practices' (Kitchin, Gleeson and Dodge 2013), cleverly playing with the word's meaning both as a clarifying act and for the action associated with paper maps. Such a call, however, becomes less relevant when those maps inhabit screens. Rather than unfolded, those maps are opened, clicked or tapped into being, manipulated, pinched and zoomed in on, copied, embedded and deleted. In reference to to digital maps' graphic engine component, I call instead for a *rendering* of new digital-mapping epistemologies.

7.6.3. Maps and actions of the world: Leveraging play

This brings me to the proximity of the opening of a digital map on a screen (particularly if the screen is mobile) and the physical actions potentially resulting from it. As the popular claim goes,

location-based services (LBS), and LBS-enabled mapping displays in particular, allow for a close affinity of digital information intake and physical action, since it is conceivable that a person using such services on the go is more susceptible to suggestions from nearby people and objects (Pura 2005). It is arguably the reason why modern tech giants are adamant about constantly leveraging their map divisions and providing free services and GIS capabilities to individuals in return for their data (Thatcher 2014; Dalton 2015). More than any of my case-studies, NowForce's close coupling of the web-dispatcher and mobile-responder interfaces into continuous chains of actions-reactions, and the outsourcing of such work to the UX company, shows how crucial such links between mapping, LBS and actions have become. In this section, I will discuss the ramifications of uniquitous cartography and the casual power prism for understanding and implementating such closeness, primarily through practices of gameful design and the deconstruction of the tracked and tracking mapped users.

Since May 2016, I have been participating in Google's Local Guides program. My involvement began – as it often does with contemporary platforms – rather casually, when the Google Maps app on my mobile phone prompted me to rate a restaurant I frequent in my town. Doing so further prompted the app to offer me membership in an elite group of local guides that helps others discover their town and earn points in return.[37] My continued participation now prompts my phone to nudge me occasionally with requests to rate and write reviews of the different places I visit, or at least answer with a concise 'yes/no/I don't know' long lists of specific questions such as 'Is this place wheelchair accessible?', 'Does this place have a nice selection of teas ?', 'Is this places popular with students?' and so forth. Needless to say, I have not enjoyed the interruptions, nor has my wife, who increasingly frowned every time I started answering questions while or immediately after visiting dining establishments with her. My inclination as a researcher prevailed and I remained in the program nonetheless.

The goal of this is clear. By tapping into the local ambitions of wannabe restaurant critics, Google assembles a global database of not only spatial entities and the relations between them, but of the unique human viewpoints and needs that cannot be answered in a straightforward way by visual data collection and GIS analysis. The way it encourages users to do so without monetary compensation relies on gameful design that rewards dedication with virtual points and tangible (albeit dubious) perks in the form of access to Google services. More than anything else, it reminds me of progression systems in so-called open-world video games, when designers fear that the mechanics

[37] I do not remember the exact wording, but those familiar with modern web-marketing vernacular will recognise the style.

alone are not sufficiently engrossing, so they add 'achievements' to appeal to the 'completionist' types of players (Bartle 1996; Hamari and Tuunanen 2014). If one compares these achievements to those of Google Guides (figure 7.4), some similarities appear. In particular, note that three of the achievements presented from the game involve the mere act of discovering the hidden map.

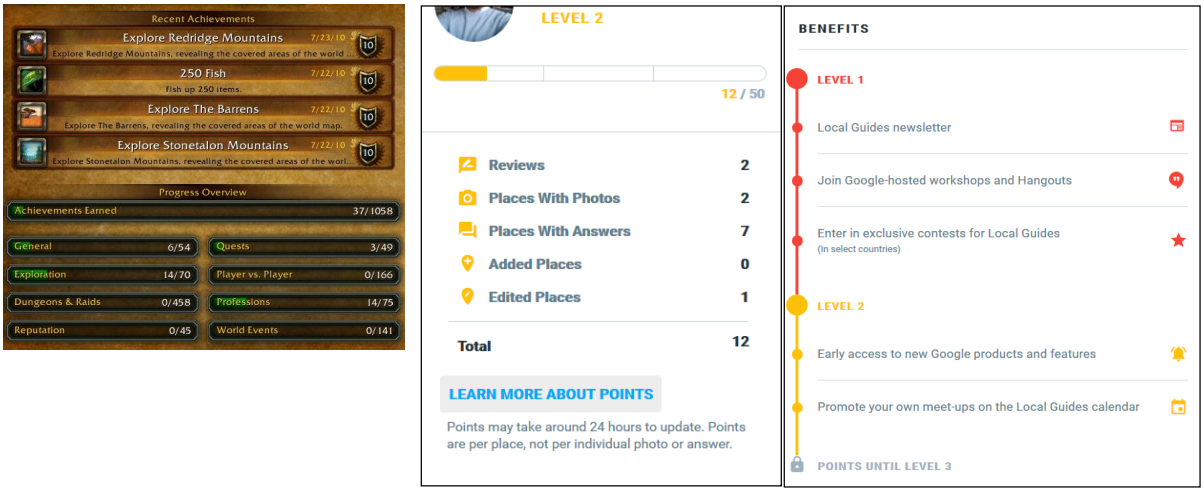


Figure 7.4: Left: the achievement list from the popular massively multiplayer online role-playing game World of Warcraft, circa 2010. Bottom: snippets from my personal Google guides page; screenshot made in August 2016.

This coupling of exploration and action stand at the forefront of gameful elements in a spatial context. Foursquare was one of the first to do so, when it commodified acts of serendipitous discovery and urban patronage into a tiered competition system (Foxman 2014). The inclusion of points is not necessary, however. In the case of Google Guide, it can be argued that by 'noticing' Maps users are at a commercial location and prompting them to translate this physical presence into digital data, Google is already introducing gameful design into the mix. After all, this type of allocentric re-orientation of the world around the player stands at the basis of Chesher's comparison between video games and satnav systems, where '[c]ontemporary social space is increasingly structured by the capacities of digital spatial media, translating the wider political and economic forces of consumption in technospatial terms. These new media are oriented to subjective spaces, in contrast to public maps.'(Chesher 2012, 327) In other words, a generation of users are growing acquainted with maps through the digital screens of video games and satnav devices, which perceive space through the lens of consumption, centred on their digital avatars. Moreover, such interfaces usually have guiding and rewarding components, setting goals for the users and rewarding them for completing such goals. The Google Guide platform is a far more direct example of gameful design than any of my case-studies, though it is reminiscent of the suggestion made by NowForce's sales director to market their system as an employee-management tool which includes the subsidiary / peripheral ability of rewarding the most efficient workers through LBS tracking.

In contrast, the augmented-reality game *Pokémon Go* released by Niantic in July 2016 shows how the introduction of game elements to a real-world context can facilitate positive results. In this gamified cartographic interface, players are rewarded for being active in the form of collecting virtual critters of varying rarity, which in turn are used for a simple king of the hill-like battle mechanism in certain areas. Particularly interesting is the mounting evidence for strong affordances for positive social interaction that the game facilitates. Players report fostering social ties with neighbours and others playing the game in the vicinity, and the game features in much anecdotal evidence of physically-inactive or socially-awkward people using it as a stepping stone towards improving their situation, at least according to initial media reports (Conditt 2016; Maffei 2016). This surprising commercial success joins many activist and scholarly initiatives of using playful and gameful elements, mostly in urban contexts, to alleviate social anxiety and foster cohesion. Such a playful component of maps is therefore a truly promising avenue for research. If engagement is paramount and gameful design takes place, what does this mean for the future co-habitation of maps and games

on digital platforms? The *playful* city already offers solutions to the problems of urban space (de Lange 2015) when activist and designers resist the calculative imperatives of efficiency to re-introduce the human element into the city. Mapping interfaces are at the forefront of such activities (de Souza e Silva and Hjorth 2009; Hjorth and Richardson 2014), and it is pertinent to explore how this can facilitate positive action research.

Games and play researchers talk about 'bleed' effects, situations where the player, often in contexts of role-playing games, is influenced by the feelings, emotions and experiences of the character she portrays, and retains some of that influence after the game. In her critique of the bounded nature of play's magic circle, Mia Consalvo (2009) utilises Goffman's frames theory in Fine's role-playing research to describe the ways players 'up-key' or 'down-key' from different frames (from a game to the physical world, to a phone ringing and back to game etc.). While not utilising the term 'bleed', she nevertheless recognises the complexity of playful experience within a multifaceted world and the pleasure which often relies on player's ability to juggle multiple frames at once, never really dividing them into 'playful magic circle' vs. 'serious real life'. Finnish game designer and researcher Markus Montola sees bleed not only as a player effect, but also as a game-design technique which aims to break down the distinction between character and player. Researching 'extreme' role-playing, he notices that 'to produce as intense experiences as possible, bleed designs tend to weaken the protective frame with numerous techniques, making the play feel more dangerous.' (Montola 2011, 221)He contrasts bleed effects to those often experienced by alternate-reality games (McGonigal 2011), which to some extent include *Pokémon Go*. The difference lies in whether the designers attempt to let some of the known – 'true' – world into that of the game, or conversely, whether they intend to teach players something about themselves in the real world through actions they perform in game.

In a locative setting, the nature of the space often constitutes design cues for developers. Indeed, one of the main appeals of location-based games is their promise to 'infect' players' daily routines with a touch of the unique. As can be seen with *Pokémon Go*, the map interface often serves as a gateway to such design. Employing the cartographic illusion, the game's map hints to the player, as if saying: this is your hometown; this is the park you frequently walk through, only now it has an additional layer, where a rare monster might appear. When examining it from Montola's game design perspective, the intended bleed in this case occurs from juxtaposing the mundane represented through the map with the bizarre and uncanny of the game. By saying 'the space you inhabit **is not** the space you inhabit', the game strengthens this illusion for the players' benefit and enjoyment.

A question thus arises: can digital map-makers implement the techniques used by (locative) game designers in order to make the mundane appealing through the virtue of playful interaction? Google's Guides platform seems to hint at such design, where the playfulness arises not from the inclusion of some otherworldly elements into the map but rather through the playful coupling of mundane actions (visit a place, open Google Maps) and the potential for a unique experience in return (my photograph of this restaurant will soon appear on this map for others to enjoy). When used as an experiential membrane for a locative game, the map suggests to the user that 'the space you inhabit *is not* exactly the space you inhabit'. Gameful design in digital maps not intended for games might instead invoke a playful attitude towards the world, quietly suggesting that 'the space you inhabit *might not* be precisely the space you inhabit'. And this suggestion can be used to make the ordinary exciting and the mundane surprising, potentially improving the lives of many. At the same time, we should be mindful of the dangers such systems represent, especially in a world where mapping interfaces operate through and propagate ceaseless collection of user data.

7.6.4. Rapid changes: New methodologies for studying maps

Finally, we must acknowledge that many of the aspects detailed in this dissertation are rapidly changing, and that the various actors involved in such changes are also aware of maps' unique role in modern sociotechnical assemblages. At a recent academic conference, I overheard a university student doing an industry internship complain about the content of the talks. According to this student, the topics and the discussions were relevant to what was pertinent and being discussed within that industry only three or four years prior. Indeed, the production cycle of institutional academic knowledge has a hard time keeping up with the hyper-attentive world of web-enabled computational industries and its offshoots in such varied fields as video games, marketing and digital maps. Some of the propositions in this dissertation have an expiry date that might pass before it is sent to print. In late July 2016, Google took to heart many of the criticisms levied against it regarding aesthetics and cartography by introducing a new design scheme which was lauded as 'putting cartography back on the map' (O'Brien 2016, n.p.). One component of such an update is the inclusion of an 'areas of interest' feature (figure 7.5), presenting orange-shaded areas which Google – in a somewhat cryptic way – defines as

> places where there's a lot of activities and things to do. To find an 'area of interest' just open Google Maps and look around you. When you've found an orange-shaded area, zoom in to see more details about each venue and tap one for more info. Whether you're looking for a hotel in a hot spot

or just trying to determine which way to go after exiting the subway in a new place, 'areas of interest' will help you find what you're looking for with just a couple swipes and a zoom (Bailiang 2016, n.p.).

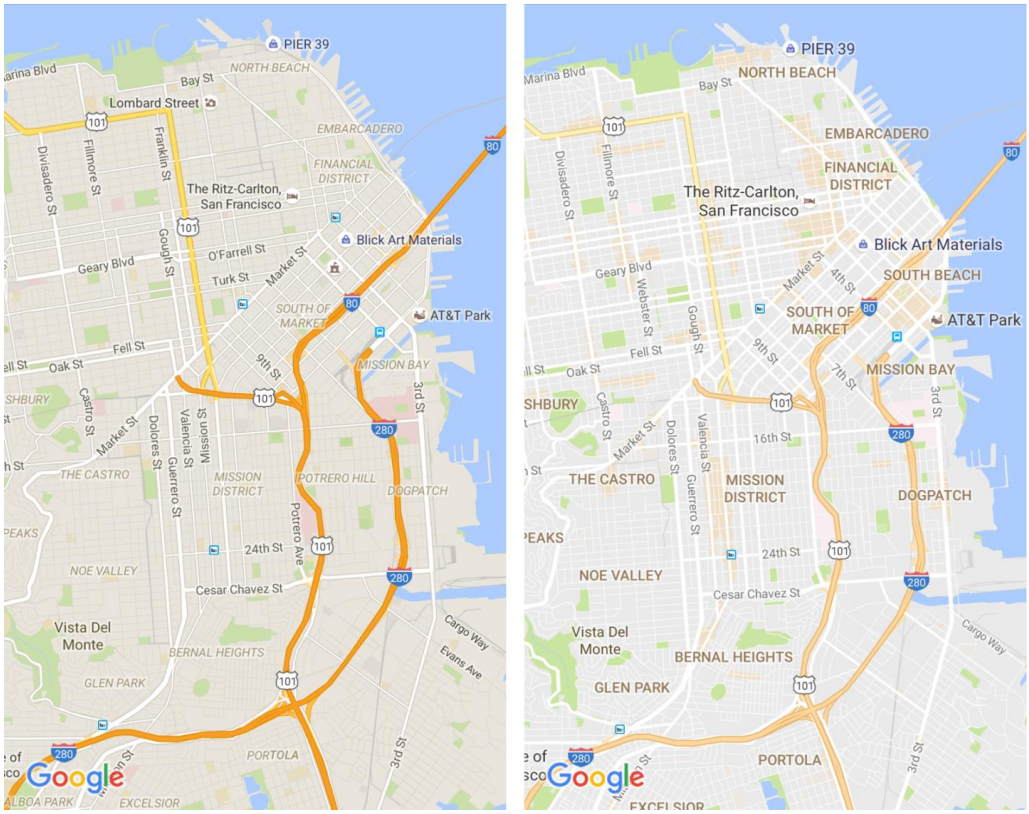


Figure 7.5: Google Maps update from July 2016, emphasizing 'areas of interest'; source: Google Maps' official blog, https://maps.googleblog.com/2016/07/discover-action-around-you-with-updated.html

The implications of such a feature are very interesting for those dealing with critical cartography and/or user interfaces in digital form. Research questions immediately spring to mind around which areas are to be included and which are not, the role that Google takes on in delineating historical, commercial, political and cultural boundaries of urban spaces and the practical effects on commerce and tourism. There are questions of aesthetics and visualization, questions of algorithmic maps generations and questions of navigation that can and should be asked about this new version. For me, this leads to a series of follow-up research questions regarding my own case-studies: for example, what will NowForce do with their overlays that rely on a 'clean' base version of Google Maps with a

single colour? Or will Mapi respond in some way by also incorporating a similar feature, but with an emphasis on the interests and values of an official mapping agency?

Yet, to follow Bruno Latour's advice in his (in)famous interlude in the form of a dialogue between a professor and a doctoral student in *Reassembling the Social*:

> P: You stop when you have written your 50,000 words or whatever is the format here, I always forget.
> S: Oh! That's really great. So my thesis is finished when it's completed. So helpful, really, many thanks. I feel so relieved now.
> P: Glad you like it! No seriously, don't you agree that any method depends on the size and type of texts you promised to deliver?
> S: But that's a *textual* limit, it has nothing to do with method.
> P: See? That's again why I dislike the way doctoral students are trained. Writing texts has *everything* to do with method. You write a text of so many words, in so many months, based on so many interviews, so many hours of observation, so many documents. That's all. You do nothing more (Latour 2005, 148).

As the deadline for submission of the dissertation approaches and the committee is assembled, I too must submit to the conclusion that my choice of method, in particular the necessity for prolonged presence at my case-studies' workplaces, means that some questions will have to be left for another time. Yet, I do think that this dissertation achieved its stated goal: showing the changes that occur in the transition from paper to digital maps by focusing on two very particular organisations that make them. The resulting 'text of so many words' illuminates a specific aspect of the work processes and decision-taking that occurs when creating such maps, highlighting certain aspects that are universal. While not speaking for *the digital map-maker*, I nonetheless tried to use my primary material in conjunction with literature from academia and media to make claims that rise above the particularities of the current moment and place.

Specifically, I wish to draw attention again to the idea of the map-maker as a cultural media producer, and of how mapping interfaces should be understood as technical inscriptions. This calls for a new production-studies approach to digital cartography that returns to some of the fundamental ideas of media studies to examine how collectives of people are manufacturing, curating and disseminating information through media devices (M. Banks, Conor and Mayer 2015). An

interesting place to start is the industrial-auteur theory (Caldwell 2008), which accounts for the intersection of technical skill and creative vision, and how leaders of large collectives manage to imprint such vision through the work practices of individual members. While traditionally applied to television, film and music production, digital maps in their navigational capacity could be read as a similar form of media. Only now, such a methodological approach must also account for what I refer to above as the Regime of Computation (Berry 2011, 12), or the implicit position of the digital in scientific and popular thinking as a primary mode of understanding and engaging with the world. Just like the popular 19th century perception of the universe as clockwork or Marshal McLuhan's theories of the world as an electrical grid that extends the human nervous system, we are now more and more inclined to believe that brains, markets, cities and many other things are 'like a computer'. To me, it also signifies a liminal shift from accepting that some previously analogue things *could* be quantified and calculated to the demand that all things *should be*.

This emerging field of study around quantification, calculation and rationality is very productive for understanding maps. Shanon Mattern's (2013, 2015) work on developing 'the science of cities' and the resulting shifts in urban planning can help us understand the interaction between space-mapping and decision-taking. The research about economic (and other) dashboards from the Reading Dashboards project highlights how cognition, measurement and computerisation become interwoven in today's world, for instance by applying the logic of measurements to human emotions (Davies 2015).[38] The implications of such processes on decision-taking can be seen in *The Seduction of Quantification* (Merry 2016), which deals with the ramifications of dividualisation for human rights and aid matters. In looking at how various intersectional categories pertaining to such sensitive topics as human trafficking or violence against children are quantified and ordered, she warns that

> [i]ndeed, it is the capacity of numbers to provide knowledge of a complex and murky world that renders quantification so seductive. Numerical assessments such as indicators appeal to the desire for simple, accessible knowledge and to a basic human tendency to see the world in terms of hierarchies of reputation and status. Yet the process of translating the buzzing confusion of social life into neat categories that can be tabulated risks distorting the

[38] A lot of my thinking of the subject has been influenced by participating and presenting at the Streams of Consciousness conference organised by the project at the University of Warwick in April 2016. I am grateful for Nate Tkacz and Ana Gross for organising such a stimulating event, and to all the other speakers for a truly interdisciplinary discussion.

> complexity of social phenomena. Counting things requires making them comparable, which means that they are inevitably stripped of their context, history, and meaning (Merry 2016, 1).

I refer to such simplification extensively as one of the main tools for understanding the work mapping interfaces do for non-professional users. Future research is required for contextualising how map-makers make use of digital maps' potency for spatiotemporal effects. Such methodological approaches directed at the modes of making maps should take into account notions of attention, data, quantifiability, precarity and play that are examined throughout this dissertation. Let us render maps anew.

8. **English Summary**

This thesis is concerned with the production and deployment of the digital maps in contemporary computational culture. By bringing together theories from Media Studies, Critical Cartography and Science and Technology Studies (STS) I look at digital maps as interfaces, designed to be implemented on various screens and modes. Building on production-studies informed ethnographies within a major public mapping organization and a smaller private commercial developer, I point out the tendency for such digital maps to be simultaneously ubiquitous in their desire to be available to all users, on all devices while being personalised by implementing various ways of tracking the user. Thus, I suggest the term 'uniquitous' to describe such configuration, and tie it to the changing nature of digital media and cartographic practices. Consequently, I offer a new conceptual framework to understand the emerging relations between mapmakers and map-users, which I name 'casual power'.

The framework identifies the ways digital map-makers attempt to embed into their interfaces affordances that reduce user reflexivity, make using the map seamless and enjoyable, and blur the differences between the map and the world it purports to represent. Such maps become naturalized objects in the habitual chains of actions that users perform vis-à-vis the world. Specifically, I have located three conceptual lenses that should be used when examining the inscription process I summarise above.

First, I acknowledge that the cartographic illusion of maps changes when maps are transformed for screens. This happens due to the nature of contemporary media-scapes to operate under the conditions of the attention economy. From a static representation of the world, the animated map becomes a dynamic actor that aims to represent the world in (near) real-time while competing for the increasingly scarce attention of the user. The co-habitation of the map on digital platforms with other objects that actively demand user attention necessitates this, and the economic conditions that commodify such attention through views, clicks, shares and the like promote it further. Second and in conjunction, the digital map can be seen as inherently playful, especially when considering playfulness as an attitude expressed through objects and the view of 'play as systems'. This is emphasized by the developing form of gameful design, underscoring autotelic engagement with the map rather than its use for a certain purpose. In line with processual and navigational views of cartography, mapping interfaces can thus be designed to be used 'for fun' rather than to serve any particular rational goal. Third and following the previous two, this is achieved through the numerical

forms of the digital map that both underpin its existence as a data object and are used as interface elements to affect users. In particular, I claim that such modes could be understood by looking into quantifiable interactions within the context of neo-liberalism and the desire for more, as well as a digital design technique grounded in decoupling the understanding of processes grounded in physical world from the perception of the screen.

Key words: digital maps, interface critique, processual cartography, production studies, play, gamefulness, design, user experience, Actor-Network Theory

9. **Wetenschappelijke samenvatting**

Deze dissertatie richt zich op de productie en het gebruik van digitale kaarten in de hedendaagse 'computational' cultuur. Middels het samenbrengen van theorieën die ontwikkeld zijn in Mediawetenschappen, 'Critical Cartography' en STS (Science and Technology Studies) heb ik digitale kaarten, en met name hun productie, beschouwd als interfaces, ontworpen om geïmplementeerd te kunnen worden op verschillende schermen en op verschillende manieren. Ik heb hiertoe etnografisch onderzoek gedaan bij zowel grote organisaties waar digitale kaarten worden gemaakt als bij een kleiner commercieel bedrijf. Geïnformeerd door productie-studies, laat ik in mijn onderzoek zien dat zulke digitale kaarten zowel alomtegenwoordig zijn, in de wens om door iedereen gebruikt te kunnen worden, maar tegelijk uniek in hoe zij zich richten op specifieke individuele gebruikers en het volgen van deze gebruikers. Ik introduceer de term 'uniquitous' om dit dubbele proces te begrijpen en om dit te relateren aan het veranderende karakter van digitale media en cartografische praktijken. Op basis hiervan ontwikkel ik een nieuw conceptueel raamwerk om de nieuwe relaties tussen kaartmaker en kaartgebruiker dieper uit te werken. Ik introduceer het begrip 'casual power' om dit verder te analyseren.

Dit conceptueel raamwerk stelt mij in staat om mijn vinger te leggen op de manieren dat digitale kaartmakers proberen om interfaces te ontwikkelen met 'affordances' die de gebruiker limiteren in de mate van vrijheid om te reflecteren, en kaarten zo makkelijk en prettig in gebruik maken. Dit zorgt voor een ervaring waarin de kaart en de wereld die deze representeert naadloos in elkaar lijken over te vloeien. Kaarten worden zo genaturaliseerde objecten, opgenomen in alledaagse series van handelingen. Ik identificeer drie conceptuele lenzen die ons in staat stellen om de hier bovenbeschreven inscriptieprocessen te duiden.

Ten eerste moet onderkend worden dat de zogenaamde cartografische illusie van kaarten verandert als kaarten via digitale schermen gebruikt worden. Dit heeft alles te maken met de aard van het hedendaagse medialandschap dat sterk bepaald wordt door de hedendaagse aandachtseconomie. De wereld wordt niet langer statisch gerepresenteerd en in plaats daarvan worden digitale kaarten dynamische actoren die tot doel hebben de wereld in real-time te representeren en concurreren om de al schaars beschikbare aandacht te trekken van de gebruiker. Dit proces wordt geïntensiveerd door het feit dat kaarten platforms delen met andere digitale objecten die ook de aandacht van de gebruiker vragen door te kijken, te klikken en te delen. Ten tweede kunnen digitale kaarten benaderd worden als speelse objecten, hetgeen samenhangt met mijn eerste focus en met name de

aandachtseconomie. Dit is in het bijzonder het geval als we spel beschouwen al een houding tot een object en spel zien als een relationeel systeem. Het ludische wordt verder versterkt door vormen van 'gameful design', gericht op de innerlijke voldoening en het plezier bij het gebruik van digitale objecten in plaats van het bereiken van een specifiek doel. Ten derde en volgende uit de eerste twee visies in mijn onderzoek, besteed ik in mijn onderzoek aandacht aan de numerieke vormen die de basis vormen van digitale kaarten. Het numerieke ondersteunt zowel het bestaan van zulke kaarten als data object, als dat het ten grondslag ligt aan het functioneren van de interface.

Key words: digitale kaarten, interface critique, processuele cartografie, production studies, spel, design, user experience, Actor-Network-Theory

10. **Bibliography**

Abt, Clark C. 2002. *Serious Games*. Lanham, Maryland: University Press Of America.

Akrich, Madeleine. 1992. "The de-Scription of Technical Objects." In *Shaping Technology/Building Society*, edited by Wiebe E. Bijker and John Law, 205–24. Cambridge, MA: MIT Press.

Akrich, Madeleine, and Bruno Latour. 1992. "A Summary of a Convenient Vocabulary for the Semiotics of Human and Nonhuman Assemblies." In *Shaping Technology / Building Society: Studies in Sociotechnical Change*, edited by Wiebe E. Bijker and John Law, 259–64. Cambridge, MA: The MIT Press.

Alter, Adam L., and Daniel M. Oppenheimer. 2006. "Predicting Short-Term Stock Fluctuations by Using Processing Fluency." *Proceedings of the National Academy of Sciences* 103 (24): 9369–72. doi:10.1073/pnas.0601071103.

Andersen, Niels Åkerstrøm, and Justine Grønbæk Pors. 2014. "Playful Membership: Embracing an Unknown Future." *Management & Organizational History* 9 (2): 166–83. doi:10.1080/17449359.2014.891796.

Anderson, Leon. 2006. "Analytic Autoethnography." *Journal of Contemporary Ethnography* 35 (4): 373–95. doi:10.1177/0891241605280449.

Appadurai, Arjun. 1996. *Modernity Al Large: Cultural Dimensions of Globalization*. Minneapolis, MN: University of Minnesota Press.

———, ed. 2001. *Globalization*. Durham, NC: Duke University Press Books.

Apple. 2016a. "iOS Human Interface Guidelines: Designing for iOS." Accessed June 13. https://developer.apple.com/library/ios/documentation/UserExperience/Conceptual/MobileHIG/.

———. 2016b. "OS X Human Interface Guidelines: Designing for Yosemite." Accessed June 13. https://developer.apple.com/library/mac/documentation/UserExperience/Conceptual/OSXHIGuidelines/.

Arthur, Charles. 2013. "Apple Maps: How Google Lost When Everyone Thought It Had Won." *The Guardian*. November 11. http://www.theguardian.com/technology/2013/nov/11/apple-maps-google-iphone-users.

Ash, James. 2010. "Architectures of Affect: Anticipating and Manipulating the Event in Processes of Videogame Design and Testing." *Environment and Planning D: Society and Space* 28 (4): 653–71. doi:10.1068/d9309.

———. 2012. "Technology, Technicity, and Emerging Practices of Temporal Sensitivity in Videogames." *Environment and Planning A* 44 (1): 187 – 203. doi:10.1068/a44171.

———. 2013. "Rethinking Affective Atmospheres: Technology, Perturbation and Space Times of the Non-Human." *Geoforum* 49 (October): 20–28. doi:10.1016/j.geoforum.2013.05.006.

———. 2015. The Interface Envelope: Gaming, Technology, Power. New York: Bloomsbury Academic.

Asmolov, Gregory. 2015. "Crowdsourcing and the Folksonomy of Emergency Response: The Construction of a Mediated Subject." *Interactions: Studies in Communication & Culture* 6 (2): 155–78. doi:10.1386/iscc.6.2.155_1.

Badger, Emily. 2013. "The Potential Problem With Personalized Google Maps? We May Never Know What We're Not Seeing." *The Atlantic Cities*. May 17. http://www.theatlanticcities.com/technology/2013/05/potential-problem-personalized-google-maps-we-may-never-know-what-were-not-seeing/5617/.

Bailiang, Zhou. 2016. "Discover the Action around You with the Updated Google Maps." *Google Lat Long*. July 25. https://maps.googleblog.com/2016/07/discover-action-around-you-with-updated.html.

Bakhtin, Mikhail. 1968. *Rabelais and His World*. Translated by Helene Iswolsky. Cambridge, MA: The MIT Press.

Banks, Jaime. 2014. "Object-Relation Mapping: A Method for Analysing Phenomenal Assemblages of Play." *Journal of Gaming & Virtual Worlds* 6 (3): 235–54. doi:10.1386/jgvw.6.3.235_1.

Banks, Miranda, Bridget Conor, and Vicki Mayer. 2015. Production Studies, The Sequel!: Cultural Studies of Global Media Industries. Routledge.

Bartle, Richard. 1996. "Hearts, Clubs, Diamonds, Spades: Players Who Suit Muds." http://mud.co.uk/richard/hcds.htm#1.

Beer, David. 2015a. "Productive Measures: Culture and Measurement in the Context of Everyday Neoliberalism." *Big Data & Society* 2 (1): 2053951715578951. doi:10.1177/2053951715578951.

———. 2015b. "When 'special measures' become ordinary." *openDemocracy*. August 7. https://www.opendemocracy.net/ourkingdom/david-beer/when-%E2%80%98special-measures%E2%80%99-become-ordinary.

Bellotti, F., R. Berta, A. De Gloria, and M. Margarone. 2003. "Supporting Efficient Design of Mobile HCI." *Human-Computer Interaction with Mobile Devices and Services* 2795: 241–55.

Bennett, W. Lance, and Shanto Iyengar. 2008. "A New Era of Minimal Effects? The Changing Foundations of Political Communication." *Journal of Communication* 58 (4): 707–31. doi:10.1111/j.1460-2466.2008.00410.x.

Berry, David M. 2011. *The Philosophy of Software: Code and Mediation in the Digital Age*. 2011 edition. Houndmills, Basingstoke, Hampshire, New York: Palgrave Macmillan.

———. 2014. *Critical Theory and the Digital*. Critical Theory and Contemporary Society. London: Bloomsbury. http://www.bloomsbury.com/uk/critical-theory-and-the-digital-9781441166395/.

Bier, Jess. 2014. "Mapping Israel, Mapping Palestine." Unpublished Doctoral Thesis, Maastricht: Maastricht University. https://www.academia.edu/6843233/dissertation_full_text_-_Mapping_Israel_Mapping_Palestine_MIMP_J._Bier.

Bittner, Christian, Georg Glasze, and Cate Turk. 2013. "Tracing Contingencies: Analyzing the Political in Assemblages of Web 2.0 Cartographies." *GeoJournal* 78 (6): 935–48. doi:10.1007/s10708-013-9488-8.

Bogost, Ian. 2006. Unit Operations: An Approach to Videogame Criticism. Cambridge, MA: MIT Press.

———. 2007. Persuasive Games: The Expressive Power of Videogames. Cambridge, MA: MIT Press.

———. 2011. *How to Do Things with Videogames*. Minneapolis: Univ Of Minnesota Press.

———. 2015. "Why Gamification Is Bullshit." In *The Gameful World. Approaches, Issues, Applications*, edited by Stephen P. Walz and Sebastian Deterding, 65–79. Boston, MA: MIT Press. http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=2463983.

Bogost, Ian, and Nick Montfort. 2009. "Platform Studies: Frequently Questioned Answers." In *Digital Arts and Culture 2009*. Irvine, CA: University of California. http://escholarship.org/uc/item/01r0k9br.

Bolter, Jay David, and Diane Gromala. 2005. *Windows and Mirrors: Interaction Design, Digital Art, and the Myth of Transparency*. Auflage: New Ed. Leonardo. Cambridge, MA: MIT Press.

Bolter, Jay David, and Richard Grusin. 2000. *Remediation: Understanding New Media*. 1st edition. Cambridge, MA: The MIT Press.

Bornstein, Robert F. 1989. "Exposure and Affect: Overview and Meta-Analysis of Research, 1968–1987." *Psychological Bulletin* 106 (2): 265–89. doi:10.1037/0033-2909.106.2.265.

Bowen, Glen. 2008. "Grounded Theory and Sensitizing Concepts." *International Journal of Qualitative Methods* 5 (3): 12–23.

Bravo, Michael T. 1999. "Ethnographic Navigation and the Geographical Gift." In *Geography and Enlightenment*, edited by David N. Livingstone and Charles W. J. Withers, 199–235. Chicago: University of Chicago Press.

Brown, Barry, and Eric Laurier. 2005. "Maps & Journeying: An Ethnographic Approach." *Cartographica: The International Journal for Geographic Information and Geovisualization* 4 (3): 17–33.

———. 2012. "The Normal Natural Troubles of Driving with GPS." In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1621–1630. CHI '12. New York, NY, USA: ACM. doi:10.1145/2207676.2208285.

Brown, Barry, Moira McGregor, and Donald McMillan. 2014. "100 Days of iPhone Use: Understanding the Details of Mobile Device Use." In *Proceedings of the 16th International Conference on Human-Computer Interaction with Mobile Devices & Services*, 223–232. MobileHCI '14. New York: ACM. doi:10.1145/2628363.2628377.

Bruns, Axel. 2007. "Produsage." In *Proceedings of the 6th ACM SIGCHI Conference on Creativity & Cognition*, 99–106. ACM. http://dl.acm.org/citation.cfm?id=1254975.

Bryant, Levi R. 2010. "Flat Ontology." *Larval Subjects*. February 24. https://larvalsubjects.wordpress.com/2010/02/24/flat-ontology-2/.

Burnett, Gary E., and Kate Lee. 2005. "The Effect of Vehicle Navigation Systems on the Formation of Cognitive Maps." In *Traffic and Transport Psychology: Theory and Application*, edited by Geoffrey Underwood, 407–18. Amsterdam: Elsevier.

Bush, Vannevar. 1945. "As We May Think." *The Atlantic*, July. http://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/303881/.

Byrne, Denise, and Alison Jane Pickard. 2016. "Neogeography and the Democratization of GIS: A Metasynthesis of Qualitative Research." *Information, Communication & Society* 0 (0): 1–18. doi:10.1080/1369118X.2015.1125936.

Caillois, Roger, and Meyer Barash. 1961. *Man, Play, and Games*. Chicago: University of Illinois Press.

Caldwell, John Thornton. 2008. "Industrial Auteur Theory (Above the Line/Creative)." In *Production Culture: Industrial Reflexivity and Critical Practice in Film and Television*, 197–231. Durham, NC: Duke University Press.

Caquard, Sébastien. 2014. "Cartography III A Post-Representational Perspective on Cognitive Cartography." *Progress in Human Geography*, March, 309132514527039. doi:10.1177/0309132514527039.

Carey, James W. 1989. Communication As Culture: Essays on Media and Society. Boston, MA: Unwin Hyman.

Carroll, Lewis. 2008. *Through the Looking-Glass*. http://www.gutenberg.org/ebooks/12.

Cartwright, William, Jeremy Crampton, Georg Gartner, Suzette Miller, Kirk Mitchell, Eva Siekierska, and Jo Wood. 2001. "Geospatial Information Visualization User Interface Issues." *Cartography and Geographic Information Science* 28 (1): 45–60. doi:10.1559/152304001782173961.

Castells, Manuel. 2001. The Internet Galaxy: Reflections on the Internet, Business and Society. New York: Oxford University Press.

———. 2006. "Communication, Power and Counter-Power in the Network Society." *International Journal of Communication* 1 (1): 238–266.

Chadwick, Andrew. 2008. "Web 2.0: New Challenges for the Study of E-Democracy in Era of Informational Exuberance." *I/S: Journal of Law and Policy for the Information Society* 5 (1): 9–41.

Chesher, Chris. 2012. "Navigating Sociotechnical Spaces: Comparing Computer Games and Sat Navs as Digital Spatial Media." *Convergence: The International Journal of Research into New Media Technologies* 18 (3): 315–30. doi:10.1177/1354856512442762.

Clarke, Keith C. 1990. *Analytical and Computer Cartography*. Englewood Cliffs, NJ: Prentice-Hall. http://infoscience.epfl.ch/record/2893.

Ćmielová, Beata, and Jiří Pánek. 2016. "Visual Comparison of Web Map Changes of Openstreetmap and Commercial Online-Map Providers: A Research Note." *International Journal of E-Planning Research* 5 (2): 40–54. doi:10.4018/IJEPR.2016040103.

Cohan, Peter. 2012. "Apple Maps' Six Most Epic Fails - Forbes." *Forbes*, September 27. http://www.forbes.com/sites/petercohan/2012/09/27/apple-maps-six-most-epic-fails/.

Coleman, Stephen. 2011. "Representation and Mediated Politics: Representing Representation in an Age of Irony." In *Political Communication in Postmodern Democracy: Challenging the Primacy of Politics*, edited by Kees Brants and Katrin Voltmer, 39–56. Houndmills, UK: Palgrave Macmillan.

Çöltekin, Arzu, Benedikt Heil, Simone Garlandini, and Sara Irina Fabrikant. 2009. "Evaluating the Effectiveness of Interactive Map Interface Designs: A Case Study Integrating Usability Metrics with Eye-Movement Analysis." *Cartography and Geographic Information Science* 36 (1): 5–17. doi:10.1559/152304009787340197.

Conditt, Jessica. 2016. "Pokemon Go's Mental Health Benefits Are Real." *Engadget*. August 13. https://www.engadget.com/2016/07/13/pokemon-go-mental-health-science/.

Consalvo, Mia. 2009. "There Is No Magic Circle." *Games and Culture* 4 (4): 408–17. doi:10.1177/1555412009343575.

Constine, Josh. 2016. "Facebook Climbs To 1.59 Billion Users And Crushes Q4 Estimates With $5.8B Revenue." *TechCrunch*. January 27. http://social.techcrunch.com/2016/01/27/facebook-earnings-q4-2015/.

Corbin, Juliet M., and Anselm Strauss. 1990. "Grounded Theory Research: Procedures, Canons, and Evaluative Criteria." *Qualitative Sociology* 13 (1): 3–21. doi:10.1007/BF00988593.

Couldry, Nick. 2008. "Actor Network Theory and Media: Do They Connect and On What Terms?" In *Cultures of Connectivity*, edited by Andreas Hepp, 93–110. Creskill, NJ: The Hampton Press.

Craib, Raymond B. 2000. "Cartography and Power in the Conquest and Creation of New Spain." *Latin American Research Review* 35 (1): 7–36. doi:10.2307/2692056.

Crampton, Jeremy W. 2001. "Maps as Social Constructions: Power, Communication and Visualization." *Progress in Human Geography* 25 (2): 235–52. doi:10.1191/030913201678580494.

———. 2002. "Thinking Philosophically in Cartography: Toward A Critical Politics of Mapping." *Cartographic Perspectives* 12: 12–32.

———. 2003. *The Political Mapping of Cyberspace*. Chicago: University Of Chicago Press. http://www.press.uchicago.edu/ucp/books/book/chicago/P/bo3642672.html.

———. 2009. "Cartography: Maps 2.0." *Progress in Human Geography* 33 (1): 91–100. doi:10.1177/0309132508094074.

Crampton, Jeremy W., Mark Graham, Ate Poorthuis, Taylor Shelton, Monica Stephens, Matthew W. Wilson, and Matthew Zook. 2013. "Beyond the geotag: Situating 'big data' and leveraging the potential of the geoweb." *Cartography and Geographic Information Science* 40 (2): 130–39. doi:10.1080/15230406.2013.777137.

Crampton, Jeremy W., and John Krygier. 2005. "An Introduction to Critical Cartography." *ACME: An International E-Journal for Critical Geographies* 4 (1): 11–33.

Crang, Mike, and Ian Cook. 2007. *Doing Ethnographies*. Los Angeles, London: SAGE. http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=258446.

Crawford, Chris. 1982. *The Art of Computer Game Design*. http://www.vancouver.wsu.edu/fac/peabody/ game-book/Coverpage.htm.

Crogan, Patrick, and Samuel Kinsley. 2012. "Paying Attention: Toward a Critique of the Attention Economy." *Culture Machine* 13: 1–29.

Csikszentmihalyi, Mihaly. 1990. *Flow: The Psychology of Optimal Experience*. New York: Harper Perennial.

Dalton, Craig M. 2012. "Mashing-up Maps: Google Geo Services and the Geography of Ubiquity." University of North Carolina – Chapel Hill. http://oatd.org/oatd/record?record=oai%5C%3Adc.lib.unc.edu%5C%3Aetd%5C%2F475.

———. 2015. "For Fun and Profit: The Limits and Possibilities of Google-Maps-Based Geoweb Applications." *Environment and Planning A* 47 (5): 1029–46. doi:10.1177/0308518X15592302.

Davies, William. 2015. The Happiness Industry: How the Government and Big Business Sold Us Well-Being. London, New York: Verso Books.

de la Hera Conde-Pumpido, Teresa. 2014. "Persuasive Structures in Advergames. Conveying Advertising Messages through Digital Games." Utrecht: Utrecht University. http://dspace.library.uu.nl/handle/1874/291047.

de Lange, Michiel. 2015. "The Playful City: Using Play and Games to Foster Citizen Participation." In *Social Technologies and Collective Intelligence,* edited by Aelita Skaržauskienė, 426–34. Vilnius: Mykolas Romeris University.

de Souza e Silva, Adriana. 2006. "From Cyber to Hybrid: Mobile Technologies as Interfaces of Hybrid Spaces." *Space and Culture* 9: 261–278.

de Souza e Silva, Adriana, and Larissa Hjorth. 2009. "Playful Urban Spaces: A Historical Approach to Mobile Games." *Simulation & Gaming* 40 (5): 602–25. doi:10.1177/1046878109333723.

Dean, Jodi. 2003. "Why the Net Is Not a Public Sphere." *Constellations* 10 (1): 95–112. doi:10.1111/1467-8675.00315.

DeGusta, Michael. 2012. "Are Smart Phones Spreading Faster than Any Technology in Human History?" *MIT Technology Review*. May 9. http://www.technologyreview.com/news/427787/are-smart-phones-spreading-faster-than-any-technology-in-human-history/.

Del Casino, V., and S. P. Hanna. 2006. "Beyond the 'Binaries': A Methodological Intervention for Interrogating Maps as Representational Practices." *ACME: An International E-Journal for Critical Geographies* 4 (1): 34–56.

Deleuze, Gilles. 1992. "Postscript on the Societies of Control." *October* 59 (January): 3–7.

Delikostidis, Ioannis. 2011. "Improving the Usability of Pedestrian Navigation Systems." Enschede: University of Twente.

Delikostidis, Ioannis, Holger Fritze, Thore Fechner, and Chris Kray. 2014. "Bridging the Gap between Field- and Lab-Based User Studies for Location-Based Services." In *Progress in Location-Based Services 2014*, edited by Georg Gartner and Haosheng Huang, 257-271 . Vienna.

Delikostidis, Ioannis, and Corne P. J. M. Van Elzakker. 2009. "Geo-Identification and Pedestrian Navigation with Geo-Mobile Applications: How Do Users Proceed?" In *Location Based Services and TeleCartography II*, edited by Georg Gartner and Karl Rehrl, 185–206. Lecture Notes in Geoinformation and Cartography. Springer Berlin Heidelberg. http://link.springer.com.proxy.library.uu.nl/chapter/10.1007/978-3-540-87393-8_12.

Della Dora, Veronica. 2012. "A World of 'Slippy Maps': Google Earth, Global Visions, and Topographies of Memory." *Transatlantica. Revue d'études américaines. American Studies Journal*, no. 2 (October). http://transatlantica.revues.org.proxy.library.uu.nl/6156.

Denzin, Norman Kent, and Yvonna Sessions Lincoln. 2005. *The SAGE Handbook of Qualitative Research*. Thousand Oaks, CA: SAGE.

Deterding, Sebastian. 2015. "The Ambiguity of Games: Histories and Discourses of a Gameful World." In *The Gameful World. Approaches, Issues, Applications*, 23–64. MIT Press. http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=2463983.

Deterding, Sebastian, Dan Dixon, Rilla Khaled, and Lennart Nacke. 2011. "From Game Design Elements to Gamefulness: Defining 'gamification.'" In *Proceedings of MindTrek 11,* 9-15. New York: ACM

Deterding, Sebastian, Miguel Sicart, Lennart Nacke, Kenton O'Hara, and Dan Dixon. 2011. "Gamification. Using Game-Design Elements in Non-Gaming Contexts." In *Proceedings of the 2011 Annual Conference Extended Abstracts on Human Factors in Computing Systems*, 2425–2428. New York: ACM. doi:10.1145/1979482.1979575.

DiSalvo, Carl. 2012. *Adversarial Design*. Cambridge, MA: MIT Press.

Dodge, Martin, Rob Kitchin, and Chris Perkins. 2009a. "Mapping Modes, Methods and Moments: A Manifesto for Map Studies." In *Rethinking Maps: New Frontiers in Cartographic Theory*, edited by Martin Dodge, Rob Kitchin, and Chris Perkins, 1 edition, 220–43. New York: Routledge.

———. 2009b. Rethinking Maps: New Frontiers in Cartographic Theory. 1st edition. New York: Routledge.

———. 2011a. "Introductory Essay: Cartographic Aesthetics and Map Design." In *The Map Reader*, edited by Martin Dodge, Rob Kitchin, and Chris Perkins, 194–200. John Wiley & Sons, Ltd. http://onlinelibrary.wiley.com.proxy.library.uu.nl/doi/10.1002/9780470979587.ch15/summary.

———. 2011b. "Introductory Essay: Cognition and Culture." In *The Map Reader*, edited by Martin Dodge, Rob Kitchin, and Chris Perkins, 298–303. John Wiley & Sons, Ltd. http://onlinelibrary.wiley.com.proxy.library.uu.nl/doi/10.1002/9780470979587.ch15/summary.

———. 2011c. "Introductory Essay: Conceptualising Mapping." In *The Map Reader*, edited by Martin Dodge, Rob Kitchin, and Chris Perkins, 1–7. John Wiley & Sons, Ltd. http://onlinelibrary.wiley.com.proxy.library.uu.nl/doi/10.1002/9780470979587.ch15/summary.

———. 2011d. "Introductory Essay: Technologies of Mapping." In *The Map Reader*, edited by Martin Dodge, Rob Kitchin, and Chris Perkins, 115–21. John Wiley & Sons, Ltd. http://onlinelibrary.wiley.com.proxy.library.uu.nl/doi/10.1002/9780470979587.ch15/summary.

Dossey, Larry. 2014. "FOMO, Digital Dementia, and Our Dangerous Experiment." *EXPLORE: The Journal of Science and Healing* 10 (2): 69–73. doi:10.1016/j.explore.2013.12.008.

Dragona, Daphne. 2014. "Counter-Gamification: Emerging Tactics and Practices Against the Rule of Numbers." In *Rethinking Gamification*, edited by Mathias Fuchs, Sonia Fizek, Paolo Ruffino, and Niklas Schrape, 227–50. Lüneburg, Germany: meson press eG.

Drucker, Johanna. 2011. "Humanities Approaches to Interface Theory." *Culture Machine* 12 (0). http://culturemachine.net/index.php/cm/article/view/434.

ECREA. 2012. "ECREA (European Communication Research and Education Group) Temporary Working Group 'Mediatization': Objectives." Accessed January 25. http://www.mediatization.eu/ECREA_Temporary_Working_Group_Mediatization/Home_files/mediatizaton_objectives.pdf.

Edney, Matthew H. 2005. *The Origins and Development of J. B. Harley's Cartographic Theories. Cartographica Monograph 54*. Cartographica 54. Toronto: University of Toronto. http://works.bepress.com/matthew_edney/13.

Elden, Stuart. 2007. "There Is a Politics of Space Because Space Is Political: Henri Lefebvre and the Production of Space." *Radical Philosophy Review* 10 (2): 101–116.

Ellis, Carolyn, Tony E. Adams, and Arthur P. Bochner. 2011. "Autoethnography: An Overview." *Historical Social Research / Historische Sozialforschung* 36 (4 (138)): 273–90.

Ellis, Carolyn, and Arthur Bochner. 2000. "Autoethnography, Personal Narrative, Reflexivity: Researcher as Subject." In *Collecting and Interpreting Qualitative Materials*, 733–68. Communication Faculty Publications. http://scholarcommons.usf.edu/spe_facpub/91.

Elwood, Sarah, and Agnieszka Leszczynski. 2012. "New Spatial Media, New Knowledge Politics." *Transactions of the Institute of British Geographers*, no–no. doi:10.1111/j.1475-5661.2012.00543.x.

England, Kim V. L. 1994. "Getting Personal: Reflexivity, Positionality, and Feminist Research." *The Professional Geographer* 46 (1): 80–89. doi:10.1111/j.0033-0124.1994.00080.x.

Evans, Leighton. 2015. *Locative Social Media: Place in the Digital Age*. Houndmills, Basingstoke, Hampshire, New York: Palgrave Macmillan.

Fabrikant, Sara Irina. 2013. "How to Measure and Visualize Emotion When Using Maps." Presented at the 26th International Cartographic Conference, Dresden, Germany, August 29.

Fabrikant, Sara Irina, and Amy Lobben. 2009. "Introduction: Cognitive Issues in Geographic Information Visualization." *Cartographica: The International Journal for Geographic Information and Geovisualization* 44 (3): 139–43. doi:10.3138/carto.44.3.139.

Fabrikant, Sara Irina, Stacy Rebich-Hespanha, Natalia Andrienko, Gennady Andrienko, and Daniel R. Montello. 2008. "Novel Method to Measure Inference Affordance in Static Small-Multiple Map Displays Representing Dynamic Processes." *The Cartographic Journal* 45 (3): 201–15. doi:10.1179/000870408X311396.

Facebook. 2016. "Design Guideline - Facebook Audience Network - Documentation - Facebook for Developers." *Facebook Developers*. Accessed June 13. https://developers.facebook.com/docs/audience-network/guidelines/native-ads.

Falaki, Hossein, Ratul Mahajan, Srikanth Kandula, Dimitrios Lymberopoulos, Ramesh Govindan, and Deborah Estrin. 2010. "Diversity in Smartphone Usage." In *Proceedings of the 8th International Conference on Mobile Systems, Applications, and Services*, 179–194. MobiSys '10. New York: ACM. doi:10.1145/1814433.1814453.

Farman, Jason. 2010. "Mapping the Digital Empire: Google Earth and the Process of Postmodern Cartography." *New Media & Society* 12 (6): 869–88. doi:10.1177/1461444809350900.

———. 2012. Mobile Interface Theory: Embodied Space and Locative Media. New York, London: Routledge.

Flanagan, Mary. 2009. *Critical Play: Radical Game Design*. Cambridge, MA: MIT Press.

Flink, Hanna-Marika, Juha Oksanen, Ulla Pyysalo, Mikko Rönneberg, and L. Tiina Sarjakoski. 2011. "Usability Evaluation of a Map-Based Multi-Publishing Service." In *Advances in Cartography and GIScience. Volume 1*, edited by Anne Ruas, 239–57. Lecture Notes in Geoinformation and Cartography. Springer Berlin Heidelberg. http://link.springer.com.proxy.library.uu.nl/chapter/10.1007/978-3-642-19143-5_14.

Flyvbjerg, Bent. 2001. Making Social Science Matter: Why Social Inquiry Fails and How It Can Succeed Again. Cambridge: Cambridge University Press.

Fogg, B. J. 2002. "Persuasive Technology: Using Computers to Change What We Think and Do." *Ubiquity* 2002 (December). doi:10.1145/764008.763957.

Forlizzi, Jodi, and Katja Battarbee. 2004. "Understanding Experience in Interactive Systems." In *Proceedings of the 5th Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*, 261–268. ACM.

Forlizzi, Jodi, and Shannon Ford. 2000. "The Building Blocks of Experience: An Early Framework for Interaction Designers." In *Proceedings of the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*, 419–423. DIS '00. New York: ACM. doi:10.1145/347642.347800.

Foxman, Maxwell. 2014. "How to Win Foursquare: Body and Space in a Gamified World." In *Rethinking Gamification*, edited by Mathias Fuchs, Sonia Fizek, Paolo Ruffino, and Niklas Schrape, 71–90. Lüneburg, Germany: meson press eG.

Fuchs, Mathias. 2012. "Ludic Interfaces. Driver and Product of Gamification." *G|A|M|E Games as Art, Media, Entertainment* 1 (1). http://www.gamejournal.it/ludic-interfaces-driver-and-product-of-gamification/.

Fuchs, Mathias, Sonia Fizek, Paolo Ruffino, and Niklas Schrape. 2014. *Rethinking Gamification*. Lüneburg, Germany: meson press eG.

Galloway, Alexander R. 2004. *Protocol: How Control Exists After Decentralization*. Cambridge, MA: MIT press.

Galloway, Alexander R. 2006. *Gaming: Essays on Algorithmic Culture (Electronic Mediations)*. University of Minnesota Press.

———. 2012. *The Interface Effect*. Cambridge, UK; Malden, MA: Polity.

Garrett, Jesse James. 2010. The Elements of User Experience: User-Centered Design for the Web and Beyond. New York: Pearson Education.

Gartner, Georg, David A. Bennett, and Takashi Morita. 2007. "Towards Ubiquitous Cartography." *Cartography and Geographic Information Science* 34 (4): 247–57. doi:10.1559/152304007782382963.

Geens, Stefan. 2012. "Apple Maps and the Diaoyu/Senkaku Islands." *Ogle Earth*. September 25. http://ogleearth.com/2012/09/apple-maps-and-the-diaoyusenkaku-islands/.

Geertz, Clifford. 1972. "Deep Play: Notes on the Balinese Cockfight." *Daedalus* 101 (1): 1–37.

———. 1973. The Interpretation of Cultures: Selected Essays. New York: Basic Books.

Gekker, Alex. 2014. "Geo-Locative Privacy and Interfaces Futures." In proceedings of Media in Transition 8 Conference. Cambridge, MA: MIT Press. http://web.mit.edu/transition/dontindex/MiT8_Book/GEKKER_Alex.pdf.

Gerlach, Joe. 2015. "Editing Worlds: Participatory Mapping and a Minor Geopolitics." *Transactions of the Institute of British Geographers*. http://onlinelibrary.wiley.com/doi/10.1111/tran.12075/full.

Gerlitz, Carolin, and Anne Helmond. 2013. "The Like Economy: Social Buttons and the Data-Intensive Web." *New Media & Society* 15 (8): 1348–65. doi:10.1177/1461444812472322.

Gibson, Eleanor J., and Anne D. Pick. 2003. *An Ecological Approach to Perceptual Learning and Development*. 1st edition. Oxford, Toronto: Oxford University Press.

Gibson, James J. 1977. "The Concept of Affordances." In *Perceiving, Acting, and Knowing: Toward an Ecological Psychology*, edited by Robert Shaw and John Bransford, 62–82. Hillsdale, NJ: Lawrence Erlbaum Associates.

———. 1986. *The Ecological Approach To Visual Perception*. 1st edition. Boston: Psychology Press.

Gillespie, Tarleton. 2016. "Algorithms, Clickworkers, and the Befuddled Fury around Facebook Trends." *Social Media Collective*. May 18. https://socialmediacollective.org/2016/05/18/facebook-trends/.

Gitelman, Lisa, ed. 2013. *"Raw Data" Is an Oxymoron*. Cambridge, MA; London, UK: The MIT Press.

Glaser, B. G., and A. L. Strauss. 1977. The Discovery of Grounded Theory: Strategies for Qualitative Research. New Jersey: Aldine Publ.

Goffman, Erving. 1961. "Fun in Games." In *Encounters: Two Studies in the Sociology of Interaction*, edited by Erving Goffman. Oxford, UK: Bobbs-Merrill.

Google. 2016. "Introduction - Material Design." *Google Design Guidelines*. Accessed June 13. https://material.google.com/#.

Graham, Mark, and Taylor Shelton. 2013. "Geography and the Future of Big Data, Big Data and the Future of Geography." *Dialogues in Human Geography* 3 (3): 255–61. doi:10.1177/2043820613513121.

Grint, Keith, and Steve Woolgar. 1997. *The Machine at Work: Technology, Work and Organization*. 1st edition. Cambridge, UK; Malden, MA: Blackwell Publishers, Grosser, Benjamin. 2014. "What Do Metrics Want? How Quantification Prescribes Social Interaction on Facebook." *Computational Culture a Journal of Software Studies*, November. http://computationalculture.net/article/what-do-metrics-want.

Gryl, Inga, and Thomas Jekel. 2012. "Re-Centring Geoinformation in Secondary Education: Toward a Spatial Citizenship Approach." *Cartographica: The International Journal for Geographic Information and Geovisualization* 47 (1): 18–28. doi:10.3138/carto.47.1.18.

Haklay, Mordechai. 2013. "Neogeography and the Delusion of Democratisation." *Environment and Planning A* 45 (1): 55 – 69. doi:10.1068/a45184.

Haklay, Mordechai, and Patrick Weber. 2008. "Openstreetmap: User-Generated Street Maps." *Pervasive Computing, IEEE* 7 (4): 12–18.

Hamari, Juho. 2011. "Perspectives from Behavioral Economics to Analyzing Game Design Patterns: Loss Aversion in Social Games." In proceedings of CHI 2011 conference. Vancouver, Canada. h https://www.researchgate.net/publication/262261651_Perspectives_from_behavioral_economics_to_analyzing_game_design_patterns_loss_aversion_in_social_games.

Hamari, Juho, and Janne Tuunanen. 2014. "Player Types: A Meta-Synthesis." *Transactions of the Digital Games Research Association* 1 (2). http://todigra.org/index.php/todigra/article/view/13.

Harley, J. B. 1987. "The Map and the Development of the History of Cartography." In *The History of Cartography Volume 1: Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean*, edited by J. B. Harley and David Woodward, 1:1–42. Chicago: University of Chicago Press. http://ww.chicagomanualofstyle.com/books/HOC/HOC_V1/HOC_VOLUME1_chapter2.pdf.

———. 1988a. "Maps, Knoweldge and Power." In *The Iconography of Landcape*, edited by Denis Cosgrove and Stephen Daniels, 277–312. Cambridge: Cambridge University Press.

———. 1988b. "Silences and Secrecy: The Hidden Agenda of Cartography in Early Modern Europe." *Imago Mundi* 40 (1): 57–76. doi:10.1080/03085698808592639.

———. 1989. "Deconstructing the Map." Cartographica: The International Journal for Geographic Information and Geovisualization 26 (2): 1–20. doi:10.3138/E635-7827-1757-9T53.

———. 2001. "Text and Contexts in the Interpretation of Early Maps." In *The New Nature of Maps: Essays in the History of Cartography*, edited by J.H. Andrews, 31–49. Baltimore, MD: John Hopkins University Press.

Harman, G. 2009. Prince of Networks: Bruno Latour and Metaphysics. Re-press.

———. 2010. *Towards Speculative Realism: Essays and Lectures*. John Hunt Pub. http://books.google.com.proxy.library.uu.nl/books?hl=en&lr=&id=EWsqTjt6LYkC&oi=fnd&pg=PA1&dq=graham+harman+&ots=zQJdKvvjjw&sig=agDVgzu0RVHnIX8zAg08gTUHkJs.

Hartson, Rex. 2003. "Cognitive, Physical, Sensory, and Functional Affordances in Interaction Design." *Behaviour & Information Technology* 22 (5): 315–38. doi:10.1080/01449290310001592587.

Hayles, N. Katherine. 2005. *My Mother Was a Computer: Digital Subjects and Literary Texts*. 1st edition. Chicago: University of Chicago Press.

Helmond, Anne. 2015. "The Platformization of the Web: Making Web Data Platform Ready." *Social Media + Society* 1 (2): 2056305115603080. doi:10.1177/2056305115603080.

Hepp, Andreas. 2011. "Mediatization, Media Technologies and the 'moulding Forces' of the Media." In *Annual International Communication Association Conference*. Boston, MA.

http://www.mediatisiertewelten.de/fileadmin/mediapool/documents/Vortraege_ICA_Virtuelles_Panel/Hepp.pdf.
———. 2013. *Cultures of Mediatization*. 1 edition. Cambridge, UK; Malden, MA: Polity.
Hind, Sam, and Alex Gekker. 2014. "'Outsmarting Traffic, Together': Driving as Social Navigation." *Exchanges: The Warwick Research Journal* 1 (2): 165–80.
Hind, Sam, and Sybille Lammes. 2015a. "Digital Mapping as Double Tap: Cartographic Modes, Calculations and Failures." *Global Discourse: An Interdisciplinary Journal of Current Affairs and Applied Contemporary Thought* Special issue: Politics and the Later Latour.
———. 2015b. "Digital Mapping as Double-Tap: Cartographic Modes, Calculations and Failures." *Global Discourse*, March, 1–19. doi:10.1080/23269995.2015.1019732.
Hinka, Jaime. 2013. "Google Maps Is the World's Most Popular Smartphone App." *ITProPortal*. August 8. http://www.itproportal.com/2013/08/08/google-maps-is-the-worlds-most-popular-smartphone-app/.
Hjarvard, Stig. 2008. "The Mediatization of Society. A Theory of the Media as Agents of Social and Cultural Change." *Nordicom Review: Nordic Research on Media & Communication* 29 (2): 105–34.
Hjorth, Larissa, and Ingrid Richardson. 2014. "Reconceptualising Casual Play." In *Gaming in Social, Locative, and Mobile Media*, 43–55. Springer.
Hook, Kristina. 2016. "Affective Computing." *The Encyclopedia of Human-Computer Interaction*. The Interaction Design Foundation. Accessed June 9. https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/affective-computing.
Hosono, S., M. Hasegawa, T. Hara, Y. Shimomura, and T. Arai. 2009. "A Methodology of Persona-Centric Service Design." In *Proceedings of the 19th CIRP Design Conference – Competitive Design, 30-31 March 2009*. Cranfield University Press. https://dspace.lib.cranfield.ac.uk/handle/1826/3649.
Hurst, Paul, and Paul Clough. 2013. "Will We Be Lost without Paper Maps in the Digital Age?" *Journal of Information Science* 39 (1): 48–60. doi:10.1177/0165551512470043.
IDC. 2014. "IDC: Smartphone Vendor Market Share." *www.idc.com*. http://www.idc.com/prodserv/smartphone-market-share.jsp.
Ingold, Tim. 2000. The Perception of the Environment: Essays on Livelihood, Dwelling and Skill. Reissue edition. London, New York: Routledge.
———. 2010. "Bringing Things Back to Life: Creative Entanglements in a World of Materials." Working Paper. Realities / Morgan Centre, University of Manchester. http://www.manchester.ac.uk/realities/publications/workingpapers/.
Jacob, Frank, and Wolfgang Ulaga. 2008. "The Transition from Product to Service in Business Markets: An Agenda for Academic Inquiry." *Industrial Marketing Management*, 37 (3): 247–53. doi:10.1016/j.indmarman.2007.09.009.
Jacoby, Larry L. 1991. "A Process Dissociation Framework: Separating Automatic from Intentional Uses of Memory." *Journal of Memory and Language* 30 (5): 513–41. doi:10.1016/0749-596X(91)90025-F.
Jacoby, Larry L., Colleen Kelley, Judith Brown, and Jennifer Jasechko. 1989. "Becoming Famous Overnight: Limits on the Ability to Avoid Unconscious Influences of the Past." *Journal of Personality and Social Psychology* 56 (3): 326–38. doi:10.1037/0022-3514.56.3.326.
Jarrett, K. 2008. "Interactivity Is Evil! A Critical Investigation of Web 2.0." *First Monday* 13 (3): 34–41.
Jenkins, Henry. 2006. *Convergence Culture: Where Old and New Media Collide*. New York: New York University Press.

Jenkins, Henry, Sam Ford, and Joshua Green. 2013. *Spreadable Media: Creating Value and Meaning in a Networked Culture*. New York ; London: NYU Press.

Johnson, Garf. 2012. "Apple Maps Trying To Make 'LoDel' Neighborhood Happen." *Gothamist*. November 23. http://gothamist.com/2012/11/23/apple_maps_is_trying_to_make_lodel.php.

Joshua Brown. 2016. *Autopilot Saves Model S*. https://www.youtube.com/watch?v=9I5rraWJq6E.

Jung, Heekyoung, Erik Stolterman, Will Ryan, Tonya Thompson, and Marty Siegel. 2008. "Toward a Framework for Ecologies of Artifacts: How Are Digital Artifacts Interconnected Within a Personal Life?" In *Proceedings of the 5th Nordic Conference on Human-Computer Interaction: Building Bridges*, 201–210. NordiCHI '08. New York: ACM. doi:10.1145/1463160.1463182.

Juul, Jesper. 2003. "The Game, the Player, the World." In *Proceedings of Level Up: Digital Games Research Conference*, edited by Marinka Copier and Joost Raessens, 30–45. Utrecht: Utrecht University.

———. 2010. A Casual Revolution: Reinventing Video Games and Their Players. Cambridge, MA: The MIT Press.

———. 2013. The Art of Failure: An Essay on the Pain of Playing Video Games. Playful Thinking. Cambridge, MA: MIT Press.

Kahneman, Daniel. 2003. "Maps of Bounded Rationality: Psychology for Behavioral Economics." *The American Economic Review* 93 (5): 1449–75.

———. 2011. *Thinking, Fast and Slow*. London, UK: Penguin Books.

Kallinikos, Jannis, Aleksi Aaltonen, and Attila Marton. 2010. "A Theory of Digital Objects." *First Monday* 15 (6). http://journals.uic.edu/ojs/index.php/fm/article/view/3033.

Karanasiou, Argyro P, and Sharanjit Kang. 2016. "My Quantified Self, My FitBit and I." *Digital Culture & Society: Quantified Selves and Statistical Bodies* 2 (1): 123–44.

Katz, Elihu. 1987. "Communications Research Since Lazarsfeld." *Public Opinion Quarterly*, January, S25–45. doi:10.1093/poq/51.4_PART_2.S25.

Kent, Alexander J. 2009. "Cartographic Blandscapes and the New Noise: Finding the Good View in a Topographical Mashup." *The Bulletin of the Society of Cartographers* 42 (1): 29–37.

Kerssens, Niels. 2016. "Cultures of Use - 1970s/1980s: An Archaeology of Computing's Integration with Everyday Life." Amsterdam: University of Amsterdm.

Kim, John. 2015. "The Origin of the See-through Graphical Interface World War II Aircraft Gunsights and the Status of the Material in Early Computer Interface Design." *Convergence: The International Journal of Research into New Media Technologies* 21 (2): 213–27. doi:10.1177/1354856514543249.

Kingsbury, Paul, and John Paul Jones. 2009. "Walter Benjamin's Dionysian Adventures on Google Earth." *Geoforum* 40 (4): 502–13. doi:10.1016/j.geoforum.2008.10.002.

Kitchin, Rob, and Martin Dodge. 2007. "Rethinking Maps." *Progress in Human Geography* 31 (3): 331–44. doi:10.1177/0309132507077082.

———. 2011. *Code/Space: Software and Everyday Life*. Cambridge, MA: MIT Press.

Kitchin, Rob, Justin Gleeson, and Martin Dodge. 2013. "Unfolding Mapping Practices: A New Epistemology for Cartography." *Transactions of the Institute of British Geographers* 38 (3): 480–496. doi:10.1111/j.1475-5661.2012.00540.x.

Knoller, Noam, and Udi Ben Arie. 2014. "The Holodeck Is All Around Us." In *Interactive Digital Narrative: History, Theory, and Practice.*, by Harmut Koenitz, Mads Haahr, Gabriele Ferri, Tonguc Ibrahim Sezen, and Didgem Sezen. Routledge Studies in European Communication Research and Education. Routledge.

Korzybski, Alfred. 1933. "A Non-Aristotelian System and Its Necessity for Rigour in Mathematics and Physics." *Science and Sanity* 1: 747–761.

Kraak, Menno-Jan. 2003. "The Space-Time Cube Revisited from a Geovisualization Perspective." In *Proc. 21st International Cartographic Conference*, 1988–1995.

———. 2006. "Visualization Viewpoints: Beyond Geovisualization." *IEEE Computer Graphics and Applications* 26 (4): 6–9. doi:10.1109/MCG.2006.74.

Krotz, Friedrich. 2007. "The meta-process of 'mediatization' as a conceptual frame." *Global Media and Communication* 3 (3): 256–60. doi:10.1177/1742766507003003103.

Krygier, John, and Denis Wood. 2005. *Making Maps: A Visual Guide to Map Design for Gis*. New York: Guilford Press.

Kücklich, J. 2005. "Precarious Playbour: Modders and the Digital Games Industry." *Fibreculture Journal* 3 (September). http://www.journal.fibreculture.org/issue5/kucklich.html.

Kuparinen, Lisa, Johanna Silvennoinen, and Hannakaisa Isomaki. 2013. "Introducing Usability Heuristics for Mobile Map Applications." Presented at the 26th International Cartographic Conference, Dresden, Germany August 29. http://www.icc2013.org/_contxt/_medien/_upload/_proceeding/424_proceeding.pdf.

Kwan, Mei-Po. 2002. "Feminist Visualization: Re-Envisioning GIS as a Method in Feminist Geographic Research." *Annals of the Association of American Geographers* 92 (4): 645–61.

———. 2012. "How GIS Can Help Address the Uncertain Geographic Context Problem in Social Science Research." *Annals of GIS* 18 (4): 245–55. doi:10.1080/19475683.2012.727867.

———. 2016. "Algorithmic Geographies: Big Data, Algorithmic Uncertainty, and the Production of Geographic Knowledge." *Annals of the American Association of Geographers* 106 (2): 274–82. doi:10.1080/00045608.2015.1117937.

Lakoff, George, and Mark Johnson. 1999. Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought. New York: Basic Books.

Lammes, Sybille. 2009. "Transmitting Location: Digital Cartographical Interfaces as Transformative Material Practices." In proceedings of Media in Transition 6 Conference . Cambridge, MA: MIT Press

———. 2010. "Postcolonial Playgrounds: Games and Postcolonial Culture." *Eludamos. Journal for Computer Game Culture* 4 (1): 1–6.

———. 2011. "The Map as Playground: Location- Based Games as Cartographical Practices." In *Think Design Play: The Fifth International Conference of the Digital Research Association*. Hilversum, the Netherlands. http://www.academia.edu/925304/The_map_as_playground_Location-_based_games_as_cartographical_practices.

Lammes, Sybille and Chris Perkins. 2017 (in print). *Cartographic temporalities: Time in Digital Mapping*. Manchester: Manchester University Press.

Lange, Ryan L., Nicholas Bowman, Jaime Banks, and Amanda J. Lange. 2015. "Grand Theft Auto(mation): Travel Mode Habits and Video Games." *International Journal of Technology and Human Interaction*. 11 (3): 35–50.

Lasswell, Harold. 1948. "The Structure and Function of Communication in Society." In *The Communication of Ideas*, edited by L. Bryson. New York: Institute for Religious and Social Studies.

Latour, Bruno. 1987. *Science in Action*. Cambridge, MA: Harvard University Press.

———. 1991. "Technology Is Society Made Durable." In *A Sociology of Monsters: Essays on Power, Technology, and Domination*, edited by John Law, 103–32. London: Routledge.

———. 1992. "Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts." In *Shaping Technology/Building Society: Studies in Sociotechnical Change*, edited by WE Bijker and John Law, 225–58. Cambridge, MA: MIT Press. http://www.bruno-latour.fr/articles/article/050.html.

———. 1996a. "On Interobjectivity." *Mind, Culture, and Activity* 3 (4): 228–245.
———. 1996b. *Aramis, or the Love of Technology*. Cambridge, Mass: Harvard University Press.
———. 1999. Pandora's Hope: Essays on the Reality of Science Studies. Cambridge, MA: Harvard University Press.
———. 2000. "The Berlin Key or How to Do Words with Things." In *Matter, Materiality and Modern Culture*, edited by Paul Graves-Brown, 10–21. London: Routledge.
———. 2005. Reassembling the Social: An Introduction to Actor-Network-Theory. Oxford: Oxford University Press.
———. 2008. "A Cautious Prometheus? A Few Steps toward a Philosophy of Design (with Special Attention to Peter Sloterdijk)." In *Proceedings of the 2008 Annual International Conference of the Design History Society*, 2–10. https://books.google.com/books?hl=en&lr=&id=3B5bbv0r-EkC&oi=fnd&pg=PA2&dq=%22%E2%80%93+which+would+otherwise+remain+too+clumsy,+too+severe+or+too+bared+if%22+%22%E2%80%9Cfunctionalism%E2%80%9D),+approximated+function+as+closely+as+possible.+%E2%80%9CDesign%E2%80%9D%22+%22definition+from+my+youth+as+a+base+line+from+which+to+fathom%22+&ots=BGLTxNHPY7&sig=V-fLRqUIMvIBHj9SJ1WAIlaX-_c.
Law, Effie Lai-Chong, Virpi Roto, Marc Hassenzahl, Arnold P.O.S. Vermeeren, and Joke Kort. 2009. "Understanding, Scoping and Defining User Experience: A Survey Approach." In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 719–728. CHI '09. New York: ACM. doi:10.1145/1518701.1518813.
Law, Effie Lai-Chong, Paul van Schaik, and Virpi Roto. 2014. "Attitudes towards User Experience (UX) Measurement." *International Journal of Human-Computer Studies*, Interplay between User Experience Evaluation and System Development, 72 (6): 526–41. doi:10.1016/j.ijhcs.2013.09.006.
Law, John. 1991. "Introduction: Monsters, Machines and Sociotechnical Relations." In *A Sociology of Monsters: Essays on Power, Technology, and Domination*, edited by John Law, 1–25. London: Routledge.
———. 1992. "Notes on the Theory of the Actor-Network: Ordering, Strategy, and Heterogeneity." *Systems Practice* 5 (4): 379–93. doi:10.1007/BF01059830.
———. 2009. "Actor Network Theory and Material Semiotics." In *The New Blackwell Companion to Social Theory*, edited by Bryan S. Turner, 141–58. Chichester, UK: John Wiley & Sons.
Lazarsfeld, Paul F., Bernard Berelson, and Hazel Gaudet. 1944. *The People's Choice. How the Voter Makes up His Mind in a Presidential Campaign*. New York: Columbia University Press.
Lazarsfeld, Paul F., and Robert Merton. 1948. "Mass Communication, Popular Taste, and Organized Social Action." In *Communication of Ideas*, edited by L. Bryson, 95–118. New York: Institute for Religious and Social Studies.
Lefebvre, Henri. 1992. *The Production of Space*. 1st edition. Oxford: Wiley-Blackwell.
Lessin, Jessica E. 2012. "An Apple Exit Over Maps." *Wall Street Journal*, October 29. http://online.wsj.com/article/SB10001424052970204840504578087192497916304.html.
Levin, Sam, and Nicky Woolf. 2016. "Tesla Driver Killed While Using Autopilot Was Watching Harry Potter, Witness Says." *The Guardian*, July 1, Technology section. https://www.theguardian.com/technology/2016/jul/01/tesla-driver-killed-autopilot-self-driving-car-harry-potter.
Lewis, Chris, Noah Wardrip-Fruin, and Jim Whitehead. 2012. "Motivational Game Design Patterns of 'Ville Games." In *Proceedings of the International Conference on the Foundations of Digital Games*, 172–179. FDG '12. New York: ACM. doi:10.1145/2282338.2282373.

Lieberoth, Andreas. 2014. "Shallow Gamification Testing Psychological Effects of Framing an Activity as a Game." *Games and Culture*, December, 1555412014559978. doi:10.1177/1555412014559978.

Lobben, Amy K. 2007. "Navigational Map Reading: Predicting Performance and Identifying Relative Influence of Map-Related Abilities." *Annals of the Association of American Geographers* 97 (1): 64–85. doi:10.1111/j.1467-8306.2007.00524.x.

Loon, Joost Van. 2007. *Media Technology*. 1 edition. Maidenhead; New York: Open University Press.

Mac, Ryan. 2016. "The Inside Story Of 'Pokémon GO's' Evolution From Google Castoff To Global Phenomenon." *Forbes*. August 23. http://www.forbes.com/sites/ryanmac/2016/07/26/monster-game/.

MacEachren, Alan M. 1994. "Visualization in Modern Cartography." In *Visualization in Modern Cartography*, edited by Alan M. MacEachren and D. R. Fraser Taylor, 1–12. Oxford, UK; New York: Pergamon.

———. 1995. How Maps Work: Representation, Visualization, and Design. New York: The Guilford Press.

MacEachren, Alan M. 1998. "Visualization-Cartography for the 21st Century." In *Proceedings of the Polish Spatial Information Association Conference,* Warsaw, Poland.

MacEachren, Alan M. 2000. "Cartography and GIS: Facilitating Collaboration." *Progress in Human Geography* 24 (3): 445–456.

MacEachren, Alan M., and Menno-Jan Kraak. 2001. "Research Challenges in Geovisualization." *Cartography and Geographic Information Science* 28 (1): 3–12. doi:10.1559/152304001782173970.

Madrigal, Alexis C. 2013. "The Machine Zone: This Is Where You Go When You Just Can't Stop Looking at Pictures on Facebook." *The Atlantic*. July 31. http://www.theatlantic.com/technology/archive/2013/07/the-machine-zone-this-is-where-you-go-when-you-just-cant-stop-looking-at-pictures-on-facebook/278185/.

Maffei, Lucia. 2016. "Pokémon Go Is Doing a Lot of Good, Here Are 3 Surprising Ways." *TechCrunch*. July 22. http://social.techcrunch.com/2016/07/22/pokemon-go-actually-does-something-worthwhile/.

Mainemelis, Charalampos, and Sarah Ronson. 2006. "Ideas Are Born in Fields of Play: Towards a Theory of Play and Creativity in Organizational Settings." *Research in Organizational Behavior*, Research in Organizational Behavior An Annual Series of Analytical Essays and Critical Reviews, 27: 81–131. doi:10.1016/S0191-3085(06)27003-5.

Malaby, Thomas M. 2003. *Gambling Life: Dealing in Contingency in a Greek City*. Champaign: University of Illinois Press.

———. 2007. "Beyond Play." *Games and Culture* 2 (2): 95–113. doi:10.1177/1555412007299434.

———. 2009. *Making Virtual Worlds: Linden Lab and Second Life*. 1 edition. Ithaca, NY: Cornell University Press.

Maltby, Richard. 1983. Harmless Entertainment: Hollywood and the Ideology of Consensus. Metuchen, NJ: Scarecrow Pr.

Mann, Lane. 2016. "Audiences as Subscribers and Netflix's Notions of Success." *Flow - A Critical Forum on Television and Media Culture*. July. http://www.flowjournal.org/2016/07/audiences-as-subscribers-netflix/.

Manovich, Lev. 2002. *The Language of New Media*. New Ed edition. Cambridge, MA: MIT Press.

———. 2006. "The Poetics of Augmented Space." *Visual Communication* 5 (2): 219–40. doi:10.1177/1470357206065527.

———. 2013. *Software Takes Command*. INT edition. New York; London: Bloomsbury Academic.

Markham, Annette. 2012. "Fabrication as Ethical Practice." *Information, Communication & Society* 15 (3): 334–53. doi:10.1080/1369118X.2011.641993.

Marquardt, Stanford. 2015. "Google Earth Pro Is Now Free." *Google Lat Long*. January 30. http://google-latlong.blogspot.com/2015/01/google-earth-pro-is-now-free.html.

Martin, Robert Cecil. 2003. *Agile Software Development: Principles, Patterns, and Practices*. Upper Saddle River, NJ,: Prentice Hall PTR.

Mattern, Shannon. 2013. "Methodolatry and the Art of Measure." *Places Journal*, November. https://placesjournal.org/article/methodolatry-and-the-art-of-measure/.

———. 2015. "History of the Urban Dashboard." *Places Journal*, March. https://placesjournal.org/article/mission-control-a-history-of-the-urban-dashboard/.

McGonigal, Jane. 2011. Reality Is Broken: Why Games Make Us Better and How They Can Change the World. New York: Penguin Press.

McLuhan, Marhall. 1995. *Understanding Media*. Cambridge, MA: MIT press.

Merry, Sally Engle. 2016. The Seductions of Quantification: Measuring Human Rights, Gender Violence, and Sex Trafficking. Chicago: University of Chicago Press.

Michael, David, and Sandra Chen. 2005. *Serious Games: Games That Educate, Train, and Inform*. Illustrated edition. Boston, MA: Course Technology Inc.

Miller, Greg. 2014. "Autonomous Cars Will Require a Totally New Kind of Map." *WIRED*. December 15. http://www.wired.com/2014/12/nokia-here-autonomous-car-maps/.

Mirani, Leo. 2013. "Why the New Google Maps Is the Most Honest Form of Cartography." *The Atlantic*. May 16. http://www.theatlantic.com/technology/archive/2013/05/why-the-new-google-maps-is-the-most-honest-form-of-cartography/275947/.

Mol, Annemarie. 2010. "Actor-Network Theory: Sensitive Terms and Enduring Tensions." *Kölner Zeitschrift Für Soziologie Und Sozialpsychologie. Sonderheft* 50: 253–69.

Montola, Markus. 2011. "The Painful Art of Extreme Role-Playing." *Journal of Gaming & Virtual Worlds* 3 (3): 219–37. doi:10.1386/jgvw.3.3.219_1.

Morozov, Evgeny. 2013. "My Map or Yours?" *Slate*, May 28. http://www.slate.com/articles/technology/future_tense/2013/05/google_maps_personalization_will_hurt_public_space_and_engagement.html.

Muehlenhaus, Ian. 2014. "Going Viral: The Look of Online Persuasive Maps." *Cartographica: The International Journal for Geographic Information and Geovisualization* 49 (1): 18–34. doi:10.3138/carto.49.1.1830.

Muehrcke, Phillip C. 1990. "Cartography and Geographic Information Systems." *Cartography and Geographic Information Systems* 17 (1): 7–15. doi:10.1559/152304090784005778.

Mukherjee, Souvik. 2015. "The Playing Fields of Empire: Empire and Spatiality in Video Games." *Journal of Gaming & Virtual Worlds* 7 (3): 299–315.

Nagy, Peter, and Gina Neff. 2015. "Imagined Affordance: Reconstructing a Keyword for Communication Theory." *Social Media + Society* 1 (2): 2056305115603385. doi:10.1177/2056305115603385.

Nahon, Karine. 2015. "Where There Is Social Media, There Is Politics." In *The Routledge Companion to Social Media and Politics*, edited by Axel Bruns, Gunn Enli, Eli Skogerbo, Anders Olof Larsson, and Christian Christensen, 39–55. New York: Routledge.

Nakamura, Jeanne, and Mihaly Csikszentmihalyi. 2001. "Flow Theory and Research." In *Handbook of Positive Psychology.*, edited by C.R. Snyder, Erik Wright, and Shane J Lopez. Oxford: Oxford University Press.

Nelson, Robin. 1997. *TV Drama in Transition*. London: Palgrave Macmillan UK. http://link.springer.com/10.1007/978-1-349-25623-5.

Newell, Bryce Clayton. 2014. "Crossing Lenses: Policing's New Visibility and the Role of Smartphone Journalism as a Form of Freedom-Preserving Reciprocal Surveillance." *University of Illinois Journal of Law, Technology & Policy* 2014: 59.

Nieborg, David B. 2015. "Crushing Candy: The Free-to-Play Game in Its Connective Commodity Form." *Social Media+ Society* 1 (2): 2056305115621932.

Nielsen, Jacob. 2012. "How Many Test Users in a Usability Study?" June 4. https://www.nngroup.com/articles/how-many-test-users/.

Nielsen, Jakob. 1994. "Heuristic Evaluation." In *Usability Inspection Methods*, edited by Jakob Nielsen and Robert L. Mack, 25–62. New York: John Wiley & Sons, Inc. http://dl.acm.org/citation.cfm?id=189200.189209.

Nielsen, Jakob, and Rolf Molich. 1990. "Heuristic Evaluation of User Interfaces." In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 249–256. CHI '90. New York, NY, USA: ACM. doi:10.1145/97243.97281.

Norman, Donald A. 1988. *The Psychology of Everyday Things*. New York: Basic Books.

———. 2002. *The Design of Everyday Things*. New York: Basic Books.

November, Valérie, Eduardo Camacho-Hübner, and Bruno Latour. 2010. "Entering a Risky Territory: Space in the Age of Digital Navigation." *Environment and Planning D: Society and Space* 28 (4): 581 – 599. doi:10.1068/d10409.

O'Brien, Oliver. 2016. "Putting Cartography Back on the Map – Google Maps Getting Prettier | Suprageography." *Suprageography*. July 26. http://oobrien.com/2016/07/putting-cartography-back-on-the-map-google-maps-getting-prettier/.

O'Donnell, Casey. 2012. "This Is Not a Software Industry." In *The Video Game Industry: Formation, Present State, and Future*, edited by Peter Zackariasson and Timothy Wilson, 17–33. New York: Routledge.

Olanoff, Drew. 2015. "Deep Dive With The New Google Maps For Desktop With Google Earth Integration, It's More Than Just A Utility." *TechCrunch*. Accessed January 9. http://techcrunch.com/2013/05/15/deep-dive-with-the-new-google-maps-for-desktop-with-google-earth-integration-its-more-than-just-a-utility/.

Orlikowski, Wanda J. 2000. "Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations." *Organization Science* 11 (4): 404–28. doi:10.1287/orsc.11.4.404.14600.

Parikka, Jussi. 2010. *Insect Media: An Archaeology of Animals and Technology*. Minneapolis: Univ Of Minnesota Press.

Parks, Lisa. 2005. *Cultures in Orbit: Satellites and the Televisual*. Durham: Duke University Press Books.

———. 2009. "Digging into Google Earth: An Analysis of 'Crisis in Darfur.'" *Geoforum*, Themed Issue: The "view from nowhere"? Spatial politics and cultural significance of high-resolution satellite imagery, 40 (4): 535–45. doi:10.1016/j.geoforum.2009.04.004.

Parush, Avi, Yonit Shwarts, Avy Shtub, and M. Jeya Chandra. 2005. "The Impact of Visual Layout Factors on Performance in Web Pages: A Cross-Language Study." *Human Factors: The Journal of the Human Factors and Ergonomics Society* 47 (1): 141–57. doi:10.1518/0018720053653785.

Perkins, Chris. 2004. "Cartography - Cultures of Mapping: Power in Practice." *Progress in Human Geography* 28 (3): 381–91. doi:10.1191/0309132504ph504pr.

———. 2008. "Cultures of Map Use." *The Cartographic Journal* 45 (2): 150–58. doi:10.1179/174327708X305076.

———. 2009a. "Mapping Agencies." In *International Encyclopedia of Human Geography*, edited by Nigel Thrift, 344–50. Oxford: Elsevier. http://www.sciencedirect.com/science/article/pii/B9780080449104000468.

———. 2009b. "Playing with Maps." In *Rethinking Maps: New Frontiers in Cartographic Theory*, edited by Martin Dodge, Rob Kitchin, and Chris Perkins, 28:167–88. London and New York: Routledge.

———. 2011. "Researching Mapping: Methods, Modes and Moments in the (Im) Mutability of OpenStreetMap." *Global Media Journal: Australian Edition* 5 (2).
———. 2015. "Tesla Is Mapping out Every Lane on Earth to Guide Self-Driving Cars." *Mashable*, October 15. http://mashable.com/2015/10/14/tesla-high-precision-digital-maps/.
Perkins, Chris, and Martin Dodge. 2008. "The Potential of User-Generated Cartography: A Case Study of the OpenStreetMap Project and Mapchester Mapping Party." *North West Geography* 8 (1): 19–32.
Pickles, John, ed. 1994. Ground Truth: The Social Implications of Geographic Information Systems. 1st edition. New York: The Guilford Press.
———. 2004. A History of Spaces: Cartographic Reason, Mapping and the Geo-Coded World. London, New York: Routledge.
Pile, Steve, and Nigel Thrift. 1995. "Mapping the Subject." In *Mapping the Subject: Geographies of Cultural Transformation*, edited by Steve Pile and Nigel Thrift, 13–51. London: Psychology Press.
Pine, B. Joseph, and James H. Gilmore. 1998. "Welcome to the Experience Economy." *Harvard Business Review* 76: 97–105.
———. 2011. *The Experience Economy, Updated Edition*. Boston: Harvard Business Review Press.
Poster, Mark. 2004. "Digitally Local Communications: Technologies and Space." In proceedings of *The Global and the Local in Mobile Communication: Places, Images, People, Connections* conderence.. Budapest. http://www. locative. net/tcmreader/index. php.
Pruitt, John, and Tamara Adlin. 2010. *The Persona Lifecycle: Keeping People in Mind Throughout Product Design*. Burlington, MA: Morgan Kaufmann.
Puijk, Roel. 2008. "Ethnographic Media Production Research in Digital Environment." In *Making Online News: The Ethnography of New Media Production*, edited by Chris A. Paterson and David Domingo, 29–42. New York: Peter Lang.
Pura, Minna. 2005. "Linking Perceived Value and Loyalty in Location-based Mobile Services." *Managing Service Quality: An International Journal* 15 (6): 509–38. doi:10.1108/09604520510634005.
Raessens, Joost. 2006. "Playful Identities, or the Ludification of Culture." *Games and Culture* 1 (1): 52–57. doi:10.1177/1555412005281779.
———. 2012. *Homo Ludens 2.0 The Ludic Turn in Media Theory*. Inaugural Address. Delivered on November 19, 2010 on the occasion of accepting the Chair of Media Theory at Utrecht University. Utrecht: Utrecht University. http://igitur-archive.library.uu.nl/oratie/2012-0918-200528/UUindex.html.
Rankin, William J. 2011. "After the Map: Cartography, Navigation, and the Transformation of Territory in the Twentieth Century." Cambridge, MA: Harvard.
Richardson, Douglas B., Nora D. Volkow, Mei-Po Kwan, Robert M. Kaplan, Michael F. Goodchild, and Robert T. Croyle. 2013. "Spatial Turn in Health Research." *Science (New York, N.Y.)* 339 (6126): 1390–92. doi:10.1126/science.1232257.
Richardson, Laurel. 2000. "Evaluating Ethnography." *Qualitative Inquiry* 6 (2): 253–55. doi:10.1177/107780040000600207.
Richmond, Shane. 2010. "How Google Crossed the Creepy Line." *The Telegraph*. October 25. http://www.telegraph.co.uk/technology/google/8086191/How-Google-crossed-the-creepy-line.html.
Rogers, Richard. 2009. "Post-Democraphic Machines." In *Walled Garden.*, edited by Annet Dekker and Annette Wolfsberger. Amsterdam: Virtueel Platform.
Rogers, Simon. 2012. "Data Are or Data Is?" *The Guardian*, July 8, News section. http://www.theguardian.com/news/datablog/2010/jul/16/data-plural-singular.

Rossiter, Ned. 2015. "Coded Vanilla: Logistical Media and the Determination of Action." *South Atlantic Quarterly* 114 (1): 135–52. doi:10.1215/00382876-2831334.
Rundle, Michael. 2012. "10 Funniest Fails In Apple's iOS Maps App." *The Huffington Post UK*. September 20. http://www.huffingtonpost.co.uk/2012/09/20/apples-ios-6-maps-app-fails_n_1899603.html.
Salen, Katie, and Eric Zimmerman. 2004. *Rules of Play: Game Design Fundamentals*. Cambridge, MA: MIT Press.
Sampson, Tony D. 2016. "Understanding Neurocapitalism: Gramsci Does HumanComputerInteraction." *VIRALITY*. April 15. https://viralcontagion.wordpress.com/2016/04/15/understanding-neurocapitalism-gramsci-does-humancomputerinteraction/.
Sandvig, Christian. 2014. "Corrupt Personalization." *Social Media Collective*. June 26. http://socialmediacollective.org/2014/06/26/corrupt-personalization/.
Saukko, Paula. 2003. Doing Research in Cultural Studies: An Introduction to Classical and New Methodological Approaches. Gateshead: Sage.
Sayes, Edwin. 2014. "Actor–Network Theory and Methodology: Just What Does It Mean to Say That Nonhumans Have Agency?" *Social Studies of Science* 44 (1): 134–49. doi:10.1177/0306312713511867.
Schäfer, Mirko Tobias. 2011. *Bastard Culture! How User Participation Transforms Cultural Production*. Amsterdam: Amsterdam University Press. http://mtschaefer.net/media/uploads/docs/Schaefer_Bastard-Culture_2011.pdf.
Scholz, Trebor. 2008. "Market Ideology and the Myths of Web 2.0." *First Monday* 13 (3): 3.
Schramm, Wilbur. 1954. "How Communication Works." In *The Process and Effects of Mass Communication*, edited by Wilbur Schtamm. Urbana, IL:University of Illinois Press, 3–26.
Schüll, Natasha Dow. 2005. "Digital Gambling: The Coincidence of Desire and Design." *The ANNALS of the American Academy of Political and Social Science* 597 (1): 65–81. doi:10.1177/0002716204270435.
———. 2014. *Addiction by Design: Machine Gambling in Las Vegas*. Reprint edition. Princeton University Press.
Schulz, Winfried. 2004. "Reconstructing Mediatization as an Analytical Concept." *European Journal of Communication* 19 (1): 87–101. doi:10.1177/0267323104040696.
Selwyn, Neil. 2003. "Apart from Technology: Understanding People's Non-Use of Information and Communication Technologies in Everyday Life." *Technology in Society* 25 (1): 99–116. doi:10.1016/S0160-791X(02)00062-3.
———. 2004. "Reconsidering Political and Popular Understandings of the Digital Divide." *New Media & Society* 6 (3): 341–62. doi:10.1177/1461444804042519.
Shannon, Claude. 1948. "A Mathematical Theory of Communication." *Bell System Technical Journal* 27 (July and October): 379–423, 623–56.
Shapin, Steven, and Simon Schaffer. 1989. *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*. Princeton: Princeton University Press.
Sicart, Miguel. 2011. "Against Procedurality." *Game Studies* 11 (3): NA.
———. 2014. *Play Matters*. Cambridge, MA: The MIT Press.
Silverstone, Roger. 1999. *Why Study the Media?* 1st edition. London ; Thousand Oaks, CA: SAGE Publications Ltd.
Simondon, Gilbert. 1992. "The Genesis of the Individual." In *Incorporations*, edited by Jonathan Crary and Sanford Kwinter. Zone 6. New York: Zone Books.
Smith, Catherine Delano. 1987. "Prehistoric Maps and the History of Cartography." In *The History of Cartography Volume 1: Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean*,

edited by J. B. Harley and David Woodward, 1:45–49. Chicago: University of Chicago Press. http://ww.chicagomanualofstyle.com/books/HOC/HOC_V1/HOC_VOLUME1_chapter2.pdf.

Standing, Guy. 2014. *The Precariat: The New Dangerous Class*. London, UK; New York, NY: Bloomsbury Academic.

Stanfill, Mel. 2014. "The Interface as Discourse: The Production of Norms through Web Design." *New Media & Society*, February, 1461444814520873. doi:10.1177/1461444814520873.

Stevenson, Michael. 2013. "The Web as Exception: The Rise of New Media Publishing Cultures." Amstedam: University of Amsterdm. http://dare.uva.nl/record/1/394557.

Stiegler, Bernard. 2010a. *Taking Care of Youth and the Generations*. Stanford, CA: Stanford University Press. https://books.google.nl/books?hl=en&lr=&id=uNvIzG_WBf8C&oi=fnd&pg=PA8&dq=stiegler+attention+economy&ots=4e3p4kNo_g&sig=kSjGJ1Xd-NmpB_RRmJMiqUk5x7Y.

———. 2010b. *Taking Care of Youth and the Generations*. Stanford, CA: Stanford University Press.

Sugden, Robert. 2009. "On Nudging: A Review of Nudge: Improving Decisions About Health, Wealth and Happiness by Richard H. Thaler and Cass R. Sunstein." *International Journal of the Economics of Business* 16 (3): 365–73. doi:10.1080/13571510903227064.

Terranova, Tiziana. 2000. "Free Labor: Producing Culture for the Digital Economy." *Social Text* 18 (2): 33–58.

———. 2012. "Attention, Economy and the Brain." *Culture Machine* 13 (1).

Thaler, Richard H., and Cass R. Sunstein. 2009. *Nudge: Improving Decisions About Health, Wealth, and Happiness*. Revised & Expanded edition. New York: Penguin Books.

Thatcher, Jim. 2014. "Living on Fumes: Digital Footprints, Data Fumes, and the Limitations of Spatial Big Data." *International Journal of Communication* 8 (0): 1765–83.

Thrift, Nigel. 2008. *Non-Representational Theory: Space, Politics, Affect*. Milton Park, Abingdon, Oxon; New York, NY: Routledge.

Tobler, Waldo R. 1970. "A Computer Movie Simulating Urban Growth in the Detroit Region." *Economic Geography* 46 (sup1): 234–40. doi:10.2307/143141.

———. 1976. "Analytical Cartography." *The American Cartographer* 3 (1): 21–31.

———. 2004. "On the First Law of Geography: A Reply." *Annals of the Association of American Geographers* 94 (2): 304–10. doi:10.1111/j.1467-8306.2004.09402009.x.

Tofel, Kevin C. 2012. "Users Are Indeed Trying and Ditching Apple Maps." *BusinessWeek: Technology*, October 3. http://www.businessweek.com/articles/2012-10-03/users-are-indeed-trying-and-ditching-apple-maps#r=lr-fs.

Tolman, Edward C. 1948. "Cognitive Maps in Rats and Men." *Psychological Review* 55 (4): 189–208. doi:10.1037/h0061626.

Tozzi, John. 2012. "At Least Someone's Happy About Apple Maps." *BusinessWeek: Small_business*, September 28. http://www.businessweek.com/articles/2012-09-28/at-least-someones-happy-about-apple-maps#r=lr-fs.

Tuchman, Gaye. 2002. "The Production of News." In *A Handbook of Media and Communication Research. Qualitative and Quantitative Methodologies*, edited by Klaus Bruhn Jensen, 78–91. London; New York: Routledge. https://books.google.nl/books?hl=nl&lr=&id=_WJvR_kccUsC&oi=fnd&pg=PA78&dq=tuchman+the+production+of+news&ots=H-B4eBw8-L&sig=fgXfmLoMFw7NiPt_30bnW3dAI2Q.

Tufte, Edward R. 1990. *Envisioning Information*. Cheshire, Connecticut: Graphics Press.

———. 1997. Visual Explanations: Images and Quantities, Evidence and Narrative. Cheshire, CT: Graphics Press.

Tversky, Amos, and Daniel Kahneman. 1973. "Availability: A Heuristic for Judging Frequency and Probability." *Cognitive Psychology* 5 (2): 207–32. doi:10.1016/0010-0285(73)90033-9.

Van den Boomen, Marianne V. T. 2014. *Transcoding the Digital : How Metaphors Matter in New Media*. Vol. 14. Theory on Demand. Amsterdam: Institute of Network Cultures. http://dspace.library.uu.nl/handle/1874/289883.

Van Elzakker, Corne P. J. M., Ioannis Delikostidis, and Peter J. M. van Oosterom. 2008. "Field-Based Usability Evaluation Methodology for Mobile Geo-Applications." *Cartographic Journal, The* 45 (2): 139–49. doi:10.1179/174327708X305139.

Vasiliev, I., S. Freundschuh, D. M. Mark, G. D. Theisen, and J. McAvoy. 1990. "What Is a Map?" *The Cartographic Journal* 27 (2): 119–23. doi:10.1179/000870490787858685.

Verhoeff, Nanna. 2012. *Mobile Screens: The Visual Regime of Navigation*. Amsterdam: Amsterdam University Press.

Virilio, Paul, and Benjamin H. Bratton. 2006. *Speed and Politics*. Translated by Mark Polizzotti. Los Angeles, CA: Semiotext.

Wachowski, Andy, and Lana Wachowski. 1999. *The Matrix*. Action, Sci-Fi.

Weaver, Warren, and Claude Elwood Shannon. 1963. *The Mathematical Theory of Communication*. Chicago, Univ. of Illinois Press. http://books.google.com/?id=dk0n_eGcqsUC&pg=PP1&dq=inauthor:shannon inauthor:weaver.

Wen, Wen, Toru Ishikawa, and Takao Sato. 2013. "Individual Differences in the Encoding Processes of Egocentric and Allocentric Survey Knowledge." *Cognitive Science* 37 (1): 176–92. doi:10.1111/cogs.12005.

Westlund, Oscar. 2013. "Mobile News." *Digital Journalism* 1 (1): 6–26. doi:10.1080/21670811.2012.740273.

Whitson, Jennifer R. 2011. "La Révolution Des Jeux Sociaux." In *Socialisation et Communication Dans Les Jeux Vidéo.*, edited by Charles Perraton, Magda Fusaro, and Maude Bonenfant, translated by N. Roy, 41–64. Montréal, QC: University of Montreal Press.

Whittlesea, Bruce W. A, Larry L Jacoby, and Krista Girard. 1990. "Illusions of Immediate Memory: Evidence of an Attributional Basis for Feelings of Familiarity and Perceptual Quality." *Journal of Memory and Language* 29 (6): 716–32. doi:10.1016/0749-596X(90)90045-2.

Wikipedia. 2015. "iPhone." *Wikipedia, the Free Encyclopedia*. http://en.wikipedia.org/w/index.php?title=IPhone&oldid=640532775.

Wood, Denis. 2003. "Cartography Is Dead (Thank God!)." *Cartographic Perspectives*, no. 45: 4–7.

———. 2010. *Rethinking the Power of Maps*. 1st edition. New York, London: The Guilford Press.

Wood, Denis, and John Fels. 2008. *The Natures of Maps: Cartographic Constructions of the Natural World*. Chicago: University of Chicago Press.

Woolgar, Steve. 1990. "Configuring the User: The Case of Usability Trials." *The Sociological Review* 38 (S1): 58–99. doi:10.1111/j.1467-954X.1990.tb03349.x.

———. 1991. "Configuring the User: The Case of Usability Trials." In *A Sociology of Monsters: Essays on Power, Technology, and Domination*, edited by John Law, 58–99. London: Routledge.

Wyly, Elvin. 2014. "The New Quantitative Revolution." *Dialogues in Human Geography* 4 (1): 26–38. doi:10.1177/2043820614525732.

Yee, Nick. 2006. "The Labor of Fun: How Video Games Blur the Boundaries of Work and Play." *Games and Culture* 1 (1): 68–71.

Zagal, José P., Staffan Björk, and Chris Lewis. 2013. "Dark Patterns in the Design of Games." In Foundations of Digital Games 2013 conference. Chania, Crete, Greece. http://soda.swedish-ict.se/5588/.

Zajonc, Robert B. 1968. "Attitudinal Effects of Mere Exposure." *Journal of Personality and Social Psychology* 9 (2, Pt.2): 1–27. doi:10.1037/h0025848.

———. 1980. "Feeling and Thinking: Preferences Need No Inferences." *American Psychologist* 35 (2): 151–75. doi:10.1037/0003-066X.35.2.151.

Zickuhr, Kathryn. 2013. "Location-Based Services." *Pew Research Center: Internet, Science & Tech*. September 12. http://www.pewinternet.org/2013/09/12/location-based-services/.

Zittrain, Jonathan. 2008. *The Future of the Internet - And How to Stop It*. 1st edition. Harrisonburg, VA: Yale University Press.

Zoomers, Annelies, Alex Gekker, and Mirko Tobias Schäfer. 2016. "Between Two Hypes: Will 'big Data' Help Unravel Blind Spots in Understanding the 'global Land Rush?'" *Geoforum* 69 (February): 147–59. doi:10.1016/j.geoforum.2015.11.017.

11. Appendix 1: Test Scenario for Nowforce

Dispatcher General Usability Testing

24/7/14

Alex Gekker & Menachem Shafran

9.1. Overview

We aim to conduct a basic usability test for operating the Lite Dispatcher (new dispatcher) with its current set of capabilities. The purpose is to find common mistakes in operating the system - i.e. actions that the participant are trying to perform and are not available and actions they are having difficulties performing.

9.2. Methodology

The test will have two parts:

- First the participant will get no instruction about the system and will be asked to log-in and perform several basic action such as open a new incident, find the nearest responder.
- In the second part the participant will be given a short instruction about how to use the system and then will be asked to answer a 911 call and operate the system accordingly

Before the start each participant will be given a short explanation about dispatch systems, and the company but not about the product.

The participant will be instructed to "Think out loud" so we can catch some of the way he is feeling while trying to operate the system. During part 1 they will be asked state when they move to the next task.

The participants will be instructed to move to the next task if they don't know how to continue or feel frustrated with it.

The entire test will be recorded both screen recording and audio recording of the participant while in the same time the test observer will take notes.

After the test is finished the participant will be asked to answer a short questionnaire about the system and the testing will be analyzed.

The test will be conducted on 3 different users:

- A dispatcher from Hatzala who havn't worked with the system but is a trained dispatcher
- A GIS expert who is not a CAD expert but has knowledge in complex GIS systems
- A common guy with no related background

9.3.Analysis

in order to evaluate the performance of the users, a combined quantitative/ qualitative methods will be used. The following measurements will be tracked:

- Time per task (extracted from the screen capture video)
- Approximate number of mouse clicks per user, to gage difference in skill level (counted manually, extracted from the external video).?
- Audio account of the tasks at hand, collected via the audio record function of CamStudio and notes taken during the test.
- Post-research semi structured interview (see appendix C below) - we opted not to carry out a closed questionnaire with ranking, due to the small amount of participants that allows more in-depth exploration. Thus, instead of asking to rank interface consistency on a scale of 1-to-7, we ask "We saw you had trouble performing task 5 despite acing task 4, what changed for you in between the two?"

9.4. Technical info

we've set up a demo org with a small amount if users/groups/roles/incidents as to give a reasonable environment to the participants who is not too complicated.

server: lb.nowforce.com

orgID: 2009

mike 1234582817

police1 1234582836

ambulance2 1234582835

ambulance1 1234582834

alex 1234582833

the participant username is: [REMOVED FOR CONFEDENTIALITY]

9.5.Appendix 1-A: Transcripts.

Test1 tasks:

- Take 3 minutes just to explore the system
- Open an incident at Doresh Tov Street 8, Jerusalem of type “Heart Attack” which requires a “Paramedic”
- Dispatch the best available responder to it and make sure he’s on the way
- Find the earliest “Fire” incident in the system and close it
- Find the closest responder with a ”medical kit” to the “Nayot St, Jerusalem” and send him some message

Test2:

phone call script based on

EMD: Paramedics

Reporting Party One: Yea, we have someone here hyperventilating and we don’t know

what to do with her. (RP one has very slurred speech.)

EMD: What’s the address there?

Reporting Party One: 6545...

EMD: Yes

Reporting Party One: ...we don’t want an ambulance, we just need to know how to treat it.

EMD: Ok, well what you need to do is call an emergency room if you’re just looking for

treatment. All I can do is send you an ambulance, sir.

Reporting Party One: Ok...

EMD: What is she doing?

Reporting Party One: ...we're not paying for an ambulance.

EMD: Well, what is she doing right now?

Reporting Party One: She's hyperventilating.

EMD: Why?

Reporting Party One: I don't know why.

EMD: Can I speak with her?

Reporting Party One: Sure.

BACKGROUND- The following calls were received from an area of town having many college

student housing complexes. Several calls were placed for this incident in a short time span.

Day of week: Sunday

Time of day: 01:00

45

Reporting Party Two: Excuse me, ma'am. (RP Two also has slurred speech.)

EMD: Yes.

Reporting Party Two: Ok, we have a person that's... ah... hyperventilating and but yet she has been drinking a lot and mass quantities. She fell and hit her head, possible concussion.

EMD: Ok.

Reporting Party Two: But...

EMD: So she's having difficulty breathing?

Reporting Party Two: She will not...she will not stop breathing hard and it's like when you're ah...

271

EMD: How old is she?

Reporting Party Two: bent over and you're cramping.

EMD: How old is she, sir?

Reporting Party Two: She's twenty-two...and I don't know how to treat her. I've had CPR, but I've never had this.

EMD: Ok, she doesn't need CPR if she's breathing.

Reporting Party Two: Yea, but she's...

EMD: Is she conscious?

Reporting Party Two: Yea, well ah barely... would it be better if she wasn't?

EMD: No, not at all, what's your address there?

Reporting Party Two: Ah...Gail what's your address? I just...we're visiting so... I just need the treatment.

EMD: Yes, I need your address, sir, she needs medical attention.

Reporting Party One: Hey listen, I've been through butting you medical people before...

EMD: Sir, she needs medical attention.

Reporting Party One: Well, apparently so, but I've been screwed by it before and I'm not willing to pay unless it's a life-threatening thing. She really does need help right now.

46

EMD: Sir, you'll be getting help, I just need you to verify your address.

Reporting Party One: It's 6545 Montezuma Road.

EMD: Apartment number what?

Reporting Party One: Seventeen...

EMD: Ok.

Reporting Party One: ...but I'm not going to pay for this s_ _ t if you're going to screw

me around again.

EMD: Ok, the girl needs help, ok?

Reporting Party One: Well, I know she does.

EMD: All right, we're going to get help out there for her. Right now, I want you to encourage

her to slow her breathing down.

Reporting Party One: Well, we're trying.

EMD: All right and we'll be out there in a couple of minutes.

Reporting Party One: Ok.

EMD: All right, good bye.

כתובת -רמב"ן 22 ירושלים

סוג משימה - הרעלת אלכוהול

נערה בת 22 עם נשימת יתר, בהכרה בעקבות שתיית אלכוהול מרובה

סקריפט

מוקדן: הלו

מדווח: כן, אאמ, יש לנו פו מישהי והיא אמם מתנשפת בכבדות. אנחנו לא יודעים מה לעשות איתה.

מוקדן: מה הכתובת?

מדווח: אאמ, רחוב רמב"ן אממ..

מוקדן: כן

מדווח: אנחנו לא רוצים אמבולנס אנחנו רק רוצים לדעת מה לעשות איתה..

מוקדן: אם אתה רוצה רק לקבל טיפול אתה צריך לפנות לטיפול נמרץ, כל מה שאני יכול לעשות הוא לשלוח אמבולנס.

מדווח: אוקיי

מוקדן: מה היא עושה כרגע?

מדווח: היא מתנשפת. כאילו ממש.

מוקדן: למה?

מדווח: אנחנו לא משלמים על אמבולנס

מוקדן: אוקיי, ומה היא עושה עכשיו?

מדווח: היא מתנשפת, אמרתי לך!

מוקדן: למה?

מדווח: אני לא יודע למה?!?

מוקדן: אפשר לדבר איתה?

מדווח: כן

מדווח 2: הלו

מוקדן: כן

מדווח 2: יש לנו פה מישהי ש.. אאמ, היא מתנשמת בכבדות. היא שתתה מלא, ממש. היא נפלה וקיבלה מכה בראש. אולי יש לה זעזוע מוח.

מוקדן: אוקיי

מדווח2: אבל

מוקדן: אז היא נושמת?

מדווח2: היא לא.. כאילו היא לא מפסיקה לנשום. ממש חזק, כאילו

מוקדן: בת כמה היא?

מדווח2: היא בת 22, אני לא יודע מה לעשות איתה. אני למדתי החייאה אבל אף פעם לא עשיתי.

מוקדן: היא לא צריכה החייאה אם היא נושמת.

מדווח2: כן, אבל היא

מוקדן: היא בהכרה?

מדווח2: כן, כאילו בערך. היה עדיף שהיא לא תהיה?

מוקדן: לא, לא. מה הכתובת?

מדווח2: אהה, גיל מה הכתובת פה? אני רק מבקר. אני רק צריך שתגיד לי מה לעשות.

מוקדן: טוב, אני צריך אבל את הכתובת, היא צריכה השגחה רפואית

מדווח1: היי, תקשיב, אני מכיר איך זה עובד איתכם

מוקדן: אדוני, היא צריכה טיפול רפואי

מדווח1: טוב, אולי, אבל אני כבר נדפקתי איתכם בעבר ואני לא מוכן לשלם אם זה לא סכנת חיים. למרות שהיא ממש צריכה עזרה

מוקדן: אדוני, אנחנו נעזור לה, אני רק צריך את הכתובת

מדווח1: אוקיי, זה רמב"ן 22 ירושלים. זה ברחביה.

מוקדן: איזה דירה?

מדווח1: 17 דירה 17

מוקדן: אוקיי

הסבר למוקדן - חייבים לשלוח מישהו לטפל בכל מקרה חירום. דבר ראשון לוקחים את הטלפון והכתובת ע"מ שהיה אפשר לחזור אליהם/לשלוח מישהו במידת הצורך. יש צורך להבין מה המקרה ולהרגיע את המדווח על מנת שנוכל לטפל טיפול יעיל.

9.6.Appendix 1-B: User Guidance (in Hebrew)

ברוך הבא לניסוי השימושיות של מערכת Nowforce Lite Dispatcher

משך הניסוי כ-45 דקות.

אנא קרא את ההוראות בעיון.

המערכת מיועדת למוקדני חירום, כמו משטרה ואמבולנסים, אך גם לניהול משימות שוטפות בסביבות עבודה שדורשות ניוד סוכנים מנקודה אל נקודה, למשל סוכנויות רכב חלופי.המערכת נמצאת עתה בגרסא חדשה. עם זאת, חלק מהפונקציות עדיין קיימות רק בגרסא הקודמת, ועל כן ייתכן ופעולות מסוימות יפתחו טאב חדש עם ממשק ישן.

הניסוי שלפניך מחולק לשני שלבים. בשלב הראשן תתבקש לבצע מספר משימות מתוך דף הוראות כתובות. בשלב השני תתבקש להאזין להוראות בעל פה ולפעול על פיהם בתוך המערכת. בתחילת השלב הראשון יינתן לך זמן להיכרות ראשונית עם המערכת. אנא קרא את ההוראות לשלב א' כעת, אך אל תמלא אותן עדיין ולאחר מכן המשך לקרוא.

1. קח לך מספר דקות להיכרות עם המערכת.

2. פתח קריאה ברחוב דורש טוב 8, ירושלים, מסוג "heart attack" הדורשת טיפול של פרמדיק.

3. שלח את איש השטח המתאים ביותר לתקרית ווודא כי הוא/היא בדרך.

4. מצא במערכת את האירוע המוקדם ביותר מסוג 'fire' וסגור אותו.

5. מצא את המגיב הקרוב ביותר עם 'medical kit' לרחוב נאות בירושלים, ושלח לו הודעה כלשהי לבחירתך.

במידה ויש לך שאלות הנוגעות להוראות, אנא שאל את הבודקים כעת. במהלך הבדיקה נסה להמנע מפנייה לבודקים, ונסה לפתור את הבעיות העולות בעצמך.

חשוב! החל מרגע זה תתבקש "לחשוב בקול רם", כלומר לקריין את פעולותיך תוך כדי עשייתם, על מנת לעזור לנו להבין את תהליכי העבודה שלך מול המערכת ולזהות פערים. נסה לדמיין כאילו ואתה מסביר את שימושך במערכת למישהו שאינו מכיר אותה כלל. לדוגמא, על מנת להסביר תהליך של בדיקת מזג אוויר לאינטרנט (בלי קשר ל-Nowforce) תבצע פעולות על המסך תוך שאתה אומר בקול רם משהו בסגנון של:

"אני לוחץ עם הכפתור השמאלי על האייקון של הדפדפן, מחכה עד שהוא ייפתח, ואז הולך לחלונית הימנית הקטנה יות, שהיא חלונית החיפוש, ומקיש שם 'מזג אוויר בירושלים' ולוחץ אנטר. עולות מספר תוצאות בדף של גוגל ואני מקיש על הראשונה מבינם, שהיא של השירות המטאורולוגי".

במהלך החלק השני אין צורך בחשביה בקול רם.

אנא חזור כעת למשימה הראשונה תוך שאתה מתחיל בתהליך החשיבה בקול רם.

9.7.Appendix 1-C: Post-testing interview.

1. אילו פעולות היה לך הכי קל לבצע? מדוע?

2. אילו פעולות היה לך הכי קשה לבצע? מדוע?

3. עד כמה קל או קשה היה לך להבין את תצוגת הממשק החדש? האם המפה הייתה ברורה? האם היחס בין החלוניות היה טוב?

Translation:

1. Which actions were the easiest to perform? Why?

2. Which actions were the hardest to perform? Why

3. How difficult was it to understand the interface for you? Was the map clear? Were the relation between the windows convenient?

12. **Appendix 2: Test results for NowForce**

	Beginner	Intermediate	Expert
Two screens	Started working with the left screen. Switched to the second screen once he needed to compare (responder location vs. incident location).	Worked with one screen (right) but appreciated the possibility of working with two. Issue of learned habits.	right screen at first, quickly switched to both.
Was the map pleasing, clear and aesthetic?	navigated it easily.	Google maps gives a familiar feeling.	
Was clustering clear?		No and yes. He just clicked and after the zoom-in he just saw the topemost icon. After seeing 7 different icons for the second time - he did.	
Interactive icons?	Started from the icons, not the map view.	Yes, attempting clicking on various maps icons and elements was an intuitive action.	used them when looking for incident of a certain type. Used icon and number as displayed on the map to shut it down.
Incident popup clear and engaging?	clicked while looking for a user, closed immediately.	Didn't have any immediate response, closed a second after clicking, without exploring. Didn't understand the icon of a draft incident	Liked the fact that the incident appears before the dispatch is done. Used appropriate icon to open up the event details and clo

		(allies have landed).	
Did he notice and utilized the global search?	Didn't notice and didn't use until the last task.	yes, he went almost immediately to examine the search. Not selecting from the drop down in the search (simply pressing 'enter') produces no results or feedback.	
Did he understand the selectors of the search?	Didn't notice and didn't use until the last task.	yes (surprisingly, unlike the others). However, at first he mixed up the scope and selectors functionality.	Not really. Clicked one by one and then went on. When the polygon window opened after the search, he went on.
Did he understand the search scope?		Yes.	Didn't understand. Said: I can't figure out how to look for people. 7:30
Icons in the panel?	Focused on columns with text. Used hover to understand the status. Tried to click on the status indicator.	Didn't see the difference between clickable and non-clickable elements. Focused on columns with text.	Went directly to the action icons in the last column.
Grid columns headers	Said they were too dense, didn't see immediate relevance to	Were clear, went one by one.	

	the task at hand.		
User Icon clear?		Didn't understand the status indicators (check mark and line under). He did notice the line but didn't understand how to reade it.	
User info popup		Only stalled on the street view tab, didn't see the relevance of other tabs to him.	Went briefly when looking for the user's role. Didn't see it. Went on.
CLI	Understood the icon intuitively.	Understood the concept	understood.
Arrange layout button		only the map was open, so nothing happened.	
Map sidebar	Went before the search, understood routing, didn't manage to use measurement because he tried to click and drag.	Didn't notice.	
Tried to dispatch from the user panel?	yes, by sending messages to him. Ori1- 09:16. couldn't do it in the end.	Yes, his first attempted to dispatch was outside of the new incident process window, went back to 'users' panel. Guy1 - 10:39	

Did he use group and sort incidents by type?	No, he just went one by one, trying to understand from the icons the type of incident and its status.	No, he grouped them by time and then looked at the icons to see what they mean.	No. used the map view to locate the earliest number of the icon type. only when prompted by us, went to tasks grid. There found the button to close easily. The automatic 'task closed successfully window' popped and he closed it without paying attention.
Locating a nearby responder	Clicked on responder location on one screen and searched for the place in global search on another.	first went to users grid, because he could easily see who owns proper equipment, but then couldn't get location.	
different grid views icons	started with them, going through right to left. Identical map icons on both sides confused him.	Got to them towards the end, after activating them from within the map	Started with them. Annoyed with the fact that pressing task button opens and closes the task panel, rather than creating new tasks.
Back' button on the browser.	Clicked when he lost the map view after not realizing his vhe didn't understand and go back to the previous view,	Clicked when he was lost, changed language to previously selected.	

	logged him out.		
Incidents grid clear?	Thought that the status of an incident was already closed because of the icon. Ori1 13:13		
New incident window	Used free text in incident selection and was pleased with auto-complete. Went directly to dispatch - the flow was clear. Understood 'new icident' as a final stage of authorizing his action.		Liked the map generated in the window and the free map.

13. **Index**