

Tool Criticism

From Digital Methods to Digital Methodology

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ABSTRACT

While the use of tools is not new for the sciences, the, traditionally, qualitative research methods driven humanities were using tools scarcely. The increasing use of computer-aided methods within the humanities has been summarized as 'computational turn' [36], digital humanities [4, 7], eResearch [25] and/or eHumanities [41]. In the Humanities, scholars are in the unique position to actively question the relatively new role and influence of tools on research. Such reflection, however, need not be limited to the Humanities, but holds value for both scholars and scientists. Digital tools and data have changed the production of knowledge [22, 26, 34]. Although there has been attention to biases in digital tools, discussions have been scattered not only across monographs, articles and book chapters lacking a proper label, but also tend to remain in their respective academic bubbles. Different methods have emerged, each embedded in their own fields. In this paper we reflect on the novel practices of digital methods and data analysis in the humanities and discuss the epistemic impact of knowledge technology, more generally. Consequently, this paper argues for the development of a rigorous inquiry into the tools used for research to be an essential element of the overall research process. We dub this enquiry 'tool criticism'. Tool criticism paves the way to move from digital methods [32, 33] to 'digital methodology'.

CCS CONCEPTS

• **Human-centered computing** → **Collaborative and social computing design and evaluation methods**; • **General and reference** → *Reliability*;

KEYWORDS

Digital tools, tool criticism, digital methodology.

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1 INTRODUCTION

Similar to the sciences in the 19th century, the humanities now experience the emergence of tools for research within their respective disciplines. Most of these tools are software applications that support or accelerate research practices, from mining large textual corpora [27], to the analysis of (moving) images [12, 21] or networks [3, 38]. Not only are scholars users of tools, they also develop these tools themselves. Pioneered by Richard Rogers, the approach to digital methods goes hand in hand with developing applications which collect and/or analyse data from web platforms [33]. As many platforms provide access to data through application programming interfaces (APIs), and as a growing number of tools are available for harvesting and analysing these data, a critical inquiry of the tools used for research is needed to develop an understanding for their epistemic impact.

With this relatively new reliance and use of tools, digital humanities scholars find themselves in the position of having to consider their relation to these tools. As Van Es & Schäfer [36] note elsewhere "[m]edia scholars in particular are well equipped to scrutinize processes of mediatisation and as such have much to offer into the critical inquiry into knowledge technologies". The unique position of humanities scholars as new tool users, coupled with their traditional of critical engagement with media practices, afford insights relevant to disciplines within and outside of the humanities: for scholars and scientists alike.

In this paper we first trace the ideas from Digital Humanities, Digital Methods Initiative and Software Studies Initiative about the neutrality of tools. It highlights a interest for how research tools affect knowledge production, but lacking in common language around which to connect these ideas. We then put 'tool criticism' forward as focal point providing our own take on what this entails. Finally, we show how tool criticism can enhance research practice.

2 ON THE 'NEUTRALITY' OF TOOLS

As mentioned, we are hardly not the first to question the non-neutrality of tools. Rieder and Röhle, for instance, reflect on "the larger ramifications of digital research in the field of the humanities and social sciences" [30, 31]. This contribution similarly (largely) departs from a humanities viewpoint, but the 'larger ramifications' of working with tools can be extended to all disciplines and fields on a more general level.

In the following, we briefly touch on ideas from the Digital Humanities, Digital Methods Initiative, and Software Studies Initiative (interested in an area of cultural analytics) about the 'neutrality' of tools. Here, then, these ideas and works serve as a vehicle to touch upon more general considerations of working with tools as

a scholar or scientist. To emphasize, the idea that media and technologies are biased as a general point of departure is not new and has been studied for several decades within, amongst others, New Media Studies. However, this contribution aims to underline, yet again, the importance of reflecting on the tools one uses, and to extend a call to action to our colleagues to engage in such critical reflexivity.

Media and culture studies have persistently raised questions concerning the objectivity of scientific images, computer simulations, and data visualisations have [5, 8]. Regarding visualizations, Drucker argues that, "We should ask the same basic questions we use to study any artifact: Who made it, how, when, where, and with what assumptions?" [10] But Drucker also points to a need to understanding the statistical models of the image of data. She warns for the "reification of misinformation" which refers to confusing the display for the source. To clarify this point she discusses the use of Ngram as example:

once someone makes an Ngram, they present it as if it were the actual phenomena. "See, the term god is popular in this period and not in that." Instead, they should say "The Google corpus indexed by their search algorithms shows this or that statistical increase in the sample set." (n.p.)

Without labelling it *tool criticism*, she here clearly reflects on the impact of digital tools on knowledge production.

Within the specific context of historical research, and what is known as Digital Humanities research, this has equally been a subject of concern. In the Netherlands, members of the national project CLARIAH, a digital infrastructure for linking and making data searchable, have identified the need to go beyond source criticism and organized workshops around "digital tool criticism" [18]. They added the question of how does the tool function, to the questions who, what, when and why (standard questions in source criticism). Here they engage with the work done at the Luxembourg Centre for Contemporary and Digital History on Digital Hermeneutics. Koolen, Van Gorp and Ossenbruggen make a plea for "reflection-in-action" [18], meaning that reflection becomes an integrative practice in research and it seeks to think about the limitations of data and tools.

Noortje Marres (2017), affiliated with the Digital Methods Initiative (DMI), recognizes how studies that make use of digital methods or data face the issue of digital bias. She explains, "once we start analysing online materials and data, researchers may easily find themselves studying not the social phenomenon they set out to investigate, but rather the peculiarities of digital platforms and digital practices themselves" ([23]). The ambiguity in this type of research centers on the question: Are we researching society or technology? Related directly to this question [37] have offered an article in which they discuss eight practical precautions to deal with the conflation between medium and message in using digital methods. Bernhard Rieder and Theo Röhle, also connected to DMI, zoom in on the type of knowledge needed by researchers: "Reflective practice requires much more than a critical attitude, it requires deeper involvement with the associated knowledge spaces to make sense of possibilities and limitations" [30]. Thus, they claim that digital tools mobilize concepts and techniques which are not

always sufficiently understood to assess their impact on research output. Gephi, for instance, gives a large audience the ability to produce network diagrams without understanding the "layers of mediation" involved in its production. To understand these layers requires, what they call interrogating a concept by David Berry, *Digital Bildung* [4].

There is also a wave of research centered around *cultural analytics*. Lev Manovich introduced the term in 2005 to reference the use of computational and visualization techniques to analyze cultural data sets and flows. Two years later he established the Software Studies Initiative to work on these types of research projects. Aside from these practical projects the lab is also concerned with "the theoretical analysis of how software systems (including apps, algorithms, machine learning and big data analytics) shape contemporary cultural and social life." This work has resulted in prominent publications such as *Software Takes Command* [22] and the MIT Press Software Studies book series. As a field, software studies is closely linked to theoretical approaches such as interface studies, platform studies and more recently algorithm and code studies.

Both DMI and the Software Studies Initiative are part of the academic discipline known as New Media Studies, which inquires the qualities and the use of new technologies and their social impact [20]. The critical inquiry into the politics of artefacts [40], the psychology of design [28], and scientific tools and their epistemic impact [17, 19] is an essential aspect of Science and Technology Studies and has been informative for New Media Studies. The conceptual origins of New Media Studies can be traced to the work of Harold Innis and Marshall McLuhan, who focused on how the medium (rather than the message) shapes society [13, 24]. In light of this theoretical grounding it is not surprising that readily in 2008, media scholars such as Bernhard Rieder, Theo Röhle, Felix Stalder, Richard Rogers critically inquired how search algorithms affect knowledge (in [2]), and media scholar José van Dijck wrote about how search engines like Google Scholar produce academic knowledge through their ranking and profiling systems [35]. Tool criticism cannot be considered a new domain. However, what makes present-day digital tools hard to unravel are — as Drucker, and Rieder and Röhle have identified — the concepts and methods (often imported from other disciplines) they put to use.

Before expanding on our take on tool criticism, it is important to briefly note our understanding also of what a tool is. We find a tendency to differentiate between digital source criticism, tool criticism, algorithmic criticism, and interface criticism, or focus only on one of these aspects. When we refer to tools and call for reflexivity, we find it necessary to consider the entire "technical stack" [16] which includes infrastructure, platform, software/algorithms, data and interface.

3 TOWARDS A PRACTICE OF TOOL CRITICISM AND DIGITAL METHODOLOGY

The various illustrations above all paint a slightly different picture, which is why we believe formulating a working definition for tool criticism can be helpful. In our practice we see tool criticism as a reflexive and critical engagement with tools. In this reflexive and critical practice, the limitations and presuppositions built into the tool and its output need to be put under scrutiny, as well as the

user's interaction with the tool. For this conception we draw from a variety of fields (e.g. STS, feminist theory, software studies and critical data studies, software studies) to come to terms with how the tools themselves are non-neutral, and afford particular kinds of use, and how output, such as visualisation, is always already imbued with particular conventions, and manipulations.

There are many scholars vouching for such reflection and we are not claiming that tool criticism is a new phenomenon. Instead, we advocate for an umbrella term for a wide variety of work which is already being done [10, 14, 15, 29]. What the term offers to scholarly conduct, is the unification of technical reflection of the tool [29, 35] and the critique of the research output [15]. Such tool criticism, which covers not merely the tool, but its influence on the research process and the results and their presentation, and the way in which the user interact with it, paves the way to move from digital methods [32, 33] to 'digital methodology'. It is worth connecting all the disparate reflections on the influence of digital tools under label "tool criticism," and to build on the foundation established these past decades in (new) media studies (which in affordance theory has already provoked us to think not about the tool alone, but the relationship between tool and user). In light of this we put forward the following working definition:

Tool criticism is the critical inquiry of knowledge technologies considered or used for various purposes. It reviews the qualities of the tool in light of, for instance, research activities and reflects on how the tool (e.g. its data source, working mechanisms, anticipated use, interface, and embedded assumptions) affects the user, research process and output.

There is a lot of similarity between our definition of *tool criticism* and the definition of *digital tool criticism* coined by Koolen, Van Gorp & Van Ossenbruggen [18]. However, our understanding diverges on several crucial points. First, we understand tool criticism as something that also incorporates reflection on the interaction between the researcher and the tool. Considerations of, for instance, the tool's complexity or intelligibility, or one's lack of skills, often prove to be reasons for opting for particular tools. To give but an example, programming skills are unfortunately still relatively rare among Digital Humanities scholars, which is why alternatives such as Gephi more often adopted for doing network analysis. There is a risk that the term tool criticism may be misleading as it seems to focus on how the tool, rather than the relation and interaction between researcher and tool, shapes research output. Second, tool criticism, for us, should be part of the academic ethos. As such, it extends beyond checklists and questions, which are helpful to kickstart this reflection process, but can never be the end point. Third, for us the distinction of tool builder and researcher is no longer defensible, as the two positions have collapsed. Finally, and in light of the previous point, we see tool criticism as something that can very much lead up to, and even invites, new and better tool development.

Tool criticism is at the heart of methodology, which describes the rationale for selecting a specific method for the research — and is therefore an integral reflexive practice situated at the heart of academic processes. A key issue is the difficulty of opening 'black boxes' of systems and understanding their technical details.

It has been proposed that critically engaging with these tools on a theoretical level can be accomplished by understanding the logics and principles of their functioning [6].

4 HOW TOOL CRITICISM CAN ENHANCE RESEARCH PRACTICE

In the Table 1 below we highlight our first practical contributions to tool criticism. We show how tool criticism can feed back into the scholar's tool arsenal, for instance in the form of the Gephi 'field notes' plugin and thereby demonstrate how tool criticism can also provide scholars and scientists with a lens to investigate their own working process. As we argue elsewhere [39], it's "development can be seen situated within a larger trend of other projects such as Datasheets for Datasets [11], Principles for Accountable Algorithms [9], and the Data Ethics Decision Aid (Utrecht Data School 2018) that seek to make transparent and accountable the work that digital tools do".

While the Gephi Field Notes plugin is but one example, such practical interventions — rooted in tool criticism — can be extended to other tools as well. The logging of one's work process is not sufficient in itself to guarantee a reflexive attitude with regards to one's tools, but it can help kickstart such reflection. In such reflection, it is important to document what you have done (and in what order), why, and with what implications. As demonstrated, engaging with tool criticism can lead to a better, more conscious and informed, interaction with tools, by for instance paving the way for developing one's own (plugins for) tools. Tool criticism needs to go beyond ticking off boxes and working through checklists. In fact, the reflexivity precedes the tool use as well, as the rationale for choosing a particular tool for a certain job (e.g. proficiency of the researcher, open source, is compatible with hardware) influences the research process.

5 CONCLUSION

As our society becomes increasingly datafied, researchers have a plethora of empirical data to analyze. However, the tools that are developed for the collection, cleaning, processing and presenting of such data influence knowledge production. It is important that as academics we maintain a critical attitude towards how this affects our work and find ways of making our choices in relation to these tools accountable. While much concern has readily been raised, there is not yet a coherent framework of research and practical design considerations in relation to tools. We propose tool criticism as a point of convergence for the various disciplines engaged with these issues. Developing shared practices of tool criticism across various disciplines, would stimulate peer assessment of tools and methods, enable the verification of research results and cooperation in developing tools further or to create new ones.

As statistics, mathematical concepts, and many data science practices become increasingly implemented into the interface design of tools, there is a growing need for users to actually understand what the tools are doing and how. But in addition more is needed: as users of Gephi or other analysis tools, our understanding for graph theory, other mathematical theories and statistical concepts is limited to the end that we can verify the algorithm only empirically. Here, computer sciences, informatics and statistics can

Table 1: Gephi Field Notes**Gephi Field Notes**

Gephi [1] is a popular network visualization package, and used widely within scientific and scholarly research. As open source software, it is easy to access at no cost. A dynamic developer community contributes to the software with new features, updates and bug fixing. However, working with Gephi makes one realize the limitations of the software, some of which have not been addressed yet by the developers, and stimulates inquiry about the epistemic impact of the tool(s) one uses for research. Provoked by the tool, members of the Datafied Society have been developing, in collaboration with with the Digital Humanities Lab at Utrecht University, a Gephi 'field notes plugin' [39]. The plugin automatically logs selected choices and parameters to document how a network visualization is produced with Gephi. Its goal is to facilitate collaborative projects and it is a first step in making the "interpretive acts" [10] involved open to scrutiny by others. At the moment such registration is not possible in the software application and an undo button is noticeably absent.

The lack of documentation of the researchers actions in Gephi prevents from retracing one's own steps when necessary and makes it impossible for others to scrutinize and reproduce results. This opaqueness stands in stark contrast with traditional scholarly practices and codes of conduct. Nevertheless, the Field Notes plugin does not immediately lead to a better understanding of the algorithms/procedures used, but through its logging facilitates reflection on the variables and procedures used during the research process [39]. The plugin, as such, is deeply rooted in our tool criticism of Gephi. In the end it delivers more stability, and clarity in using the tool by documenting the research process to enable verification.

provide invaluable contributions (in collaboration with humanities scholars) by developing theory that conceptualizes novel data analysis practices as much as revisits algorithms and models embedded in research tools.

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