Framing resilience: social uncertainty in designing urban climate resilience

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Abstract

Building urban resilience to climate change and other challenges will be essential for maintaining thriving cities into the future. Resilience has become very popular in both research on and practice of climate adaptation. However, people have different interpretations of what it means: what resilience-building contributes to, what the problems, causes and solutions are, and what trade-offs, side-effects and other normative choices are acceptable. These different ways of 'framing' climate resilience are hidden in the positive, but sometimes fairly vague, language used to promote it.

Based on the current urban resilience literature, I will describe divergent ways of framing resilient urban climate adaptation and will explore their implications. Two important frames of urban resilience include the 'system resilience' frame, which focuses on maintaining urban functions and processes, and the 'community resilience' frame, which emphasises urban life, and community capacity & self-sufficiency. Other important (contrasting) frames include 'static resilience', dealing with quick return to equilibrium, and 'dynamic resilience', dealing with adaptability and co-evolving with trends.

The frames used by scientists, policymakers, and stakeholders reflect social uncertainties in climate adaptation, related to values, preferences, and goals. They entail different visions on the urban future, leading to different potential realisations of climate change adaptation. Leaving them implicit can result in a 'dialogue of the deaf', potentially leading to adaptation failure.

Urban decision-makers and stakeholders will need to investigate and develop a clear vision on what they mean by urban resilience: what are the goals, and who's or what's resilience are we talking about? Explicit exploration of the current and potential frames will help to cultivate meaningful discussion on the choices and trade-offs to be made in developing climate-resilient urban futures.

1. Introduction

The majority of the world's population is currently living in cities and the urban population is expected to increase from 3.9 billion in 2014 to 6.4 billion in 2050, rising from 54% to 66% of the total population (UN, 2014). In Europe, it will rise from 73% to 80% (UN, 2014). Europe is –and its future will be– increasingly urban.

At the same time, cities face numerous challenges. While we've come a long way from the days of the Industrial Revolution, with its polluted air and water, poor living and working conditions, and disease, cities are now increasingly faced by more pervasive issues that play over long periods of time and cannot easily be solved at the local level. Examples include the aging population, refugees, (socio-)economic challenges, transboundary pollution, security risks, emerging technologies, and climate change. Such issues are inherently complex and uncertain, and decision-makers will need to find ways to deal with ignorance and surprise. While a 'predict & prevent' approach was appropriate for the 'easy' problems of the old days, that approach is not always suitable for dealing with today's grand challenges. In these situations of high uncertainty and surprise, one may still have enough knowledge to find ways to strengthen the resilience of the impacted system (e.g. a city, region, or society in general) (Dessai & Van der Sluijs, 2007; Wardekker, 2011)[1]. In recent years, resilience has indeed become a prominent topic in urban research and policy.

Climate change is one of these serious, but complex urban challenges, particularly in low-lying deltas. It impacts water management (e.g. flooding, drought, freshwater supply), critical infrastructures (energy, ICT, transportation), health (heat, air quality) and various other sectors. Its effects are both highly uncertain and interact in complex ways with the systems they impact and numerous other issues and trends, such as increasing populations, shift of populations towards urban areas, and other environmental, economic, technological, and societal trends. Climate change provides a complex and highly interdisciplinary issue that cities and regions will need to adapt to. Enhancing the resilience of cities is urgently needed to make the rapidly urbanizing world less vulnerable to disturbances and surprises, to enable quick and flexible responses to crises and long term issues, and to maintain a thriving city into the future (Wardekker et al., 2010).

2. Urban (climate) resilience: some background

Resilience is a concept that emerged in ecology in the 1960s. It was an explanatory concept, highlighting the various processes in dynamic complex systems that produce the high degree of stability and adaptability that we observe in natural ecosystems in the face of a wide range of external perturbations and abiotic conditions. It has since been applied by numerous disciplines, ranging from engineering to psychology to disaster risk management. Similarly, the concept has gained much popularity in various policy fields. For example, the OECD (2014) recently indicated resilience as an important aspect of coping with critical risks, and the UN's (2015) Sustainable Development Goals (UN, 2015) and Habitat III New Urban Agenda (UN, forthcoming) use the term in relation to various specific threats and goals as well.

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[1] Resilience is one among several approaches to adaptation under uncertainty (Dessai & Van der Sluijs, 2007; Wardekker, 2011). See e.g. Thissen et al. (in press) for a comparison of robustness, exploratory modelling and resilience approaches applied to a single case study.

Walker et al (2004) define resilience of 'social-ecological systems', which includes cities, as: "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks". Definitions for urban resilience specifically include: "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience." (Rockefeller Foundation, 2016), or "the ability of an urban system - and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales - to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity" (Meerow et al., 2016).

Resilience has recently gained popularity in the field of climate change adaptation as well, particularly in relation to flood risk management and urban planning. For instance, resilient development has become a central concept in IPCC's Fifth Assessment Report (IPCC, 2014). At the local level, the ICLEI Local Governments for Sustainability network has been promoting resilience and organising 'Resilient Cities' congresses since 2010 (ICLEI, 2016), and the 100 Resilient Cities network has been "Helping cities around the world become more resilient to the physical, social, and economic challenges that are a growing part of the 21st century" (Rockefeller Foundation, 2016), for instance by stimulating the appointment of Chief Resilience Officers in cities and by providing tools and support. Weather-related disasters and disaster recovery efforts in urbanised regions, such as hurricane Katrina in New Orleans, hurricane Sandy in New York, or the 2003 European Heat Wave, further highlights the importance of improving urban climate resilience.

3. Framing urban climate resilience: Resilient future of who or what, exactly?

The notion of 'strengthening urban resilience' provides a distinctly positive way to discuss urban climate adaptation and other urban policy agenda's (McEvoy et al., 2013). It is also relatively open to interpretation and tailoring; in itself it does not prescribe any specific way to measure or evaluate resilience or specific type of policy options that would enhance resilience. This has both advantages and disadvantages. On the one hand, it helps gather and inspire a wide variety of stakeholders with diverse interests and goals, and allows decision-makers to tailor the implementation of urban resilience to specific local problems and requirements. On the other hand, stakeholders run a serious risk of talking past each other, as they may have very different ideas on what urban resilience really means in practical terms, and how their respective interests fit into that picture.

The conceptual malleability of urban resilience means that different people will paint different pictures of what a 'resilient urban future' will look like. In other words, people will have different ways of *framing* urban resilience. Framing means that people "select some aspects of a perceived reality and make them more salient… in such a way as to promote a particular *problem definition*, *causal interpretation*, *moral evaluation*, and/or *treatment recommendation* for the item described" (Entman, 1993). Often, this happens subconsciously, in a taken-for-granted way.

This is not simply a matter of semantics, as the specific framing highlights certain problem aspects, policy options, relevant decision tools & information, and appropriate governance approaches, while obscuring others (De Boer et al., 2010; Wardekker et al., 2009a). Different frames entail different goals, boundary conditions, and trade-offs.

Consequently, in designing and building resilient urban futures are we will need to be explicit: The resilient futures of who or what, exactly? What are our goals in building resilience, and who can contribute in what way?

Below, I will discuss in-depth two such frames that are prevalent in urban resilience thinking. Both seem 'natural' ways of thinking about resilience, but they have different views on the problems, causes, values, and solutions. A summary is displayed in Figure 1.

Framing: What's the:	System resilience	Community resilience
Problem	Threat to functioning of urban system	Threat to urban life & social cohesion
Causes	Disruption of resource flows and activities	Societal disruption, hampering daily life
Moral judgements	Prioritise subsystems & infrastructures according to city goals	Social equity, public participation, vulnerable groups
Remedies	Engineer ways to deal with this, enhance buffers	Improve social support networks, skills & education

Figure 1. Comparing system and community frames for urban resilience.

4. A System Resilience frame: Climate change as a challenge to urban functioning

Resilience thinking developed in a literature that was oriented on systems analysis, particularly ecology and system dynamics. Many approaches to urban resilience are consequently also rooted in this literature. Urban resilience is, e.g. "the ability of the city to maintain the functions that support the well-being of its citizens" (Da Silva et al., 2012), conceptualizing cities as systems with components, functions, and flows of e.g. resources, materials, and people (e.g. Wardekker et al., 2010; Meerow et al., 2016). This framing of urban resilience is analytically focused and primarily outcome-oriented. Larger stakeholders and authorities are often natural/key players, particularly when the analysis is performed at the city level.

The problem(s): System resilience is a framing that seems common in discussions on urban resources, infrastructure and services. Climate-related disturbances, such as extreme weather events (short-term shocks) or sea level rise (long-term stresses), threaten the flow of goods or traffic, continued delivery of urban services, and fulfilling urban functions and needs. For example, flooding may close roads, prolonged heat and drought may threaten the cooling water supply of a power plant, and rising water tables may result in areas becoming unsuitable for housing. Salient problems include particularly those that hamper the smooth functioning of the urban system. A potential blind spot is that relatively short or (at city level) minor disturbances could be overlooked, while they may have disproportionate impacts on specific subsystems or (vulnerable) subpopulations.

The causes: Climate change will have large impacts on urban systems that lack the ability to plan/prepare for, absorb, recover, and/or adapt to climate change-related disturbances (and their combined effects with other trends that also influence urban vulnerability or resilience). Such weaknesses may lie in, for instance, the governance structure, for instance if it is inflexible or lacks the ability to look and plan ahead or adapt, spatial planning, physical infrastructure, the specific sources of resources and routes to obtain these, and/or the actors involved. For instance, if electricity is brought into the system via a single power line, that system cannot absorb the impact of a section of this line going down.

Moral judgements: While this framing rarely focuses explicitly on moral and value aspects, these are certainly present. A particularly prominent one is in setting priorities. In assessing the level of impact that disturbances have on specific urban functions, processes, and actors, one will need to establish whether or not that level of impact is acceptable or not. Implementing measures to reduce the impacts will cost money and effort (which could be spent elsewhere), and any option to increase the resilience for one subsystem, sector, neighborhood or population would decrease the resources available for –and may even physically reduce resilience of– others. Actions have pros and cons, and sometimes unintended consequences. A similar evaluation is whether resilience-improvement should focus on the current population or on future populations/generations.

Suggested remedies: Key adaptation strategies and options could focus on enhancing the capacity of (sub)systems, sectors and actors to absorb and recover from disturbances, e.g. by enhancing redundancy, omnivory, or buffer capacity. Reaction to disturbances could be improved by fast mobilization of resources ('high flux'), feedback mechanisms ('homeostasis'), or by avoiding overly hierarchical or bureaucratic decision-making ('flatness'). Similarly, disaster preparedness can be improved by investing in monitoring, foresight, and local practical knowledge development. Adaptability can be enhanced by increasing flexibility, resourcefulness, and learning capacity. For discussion of such 'resilience principles', see e.g. (Wardekker et al., 2010; Da Silva et al., 2012).

5. A Community Resilience frame: Climate change as a challenge to urban life & self-sufficiency

Community resilience is "a process linking a network of adaptive capacities (resources with dynamic attributes) to adaptation after a disturbance or adversity" (Norris et al., 2008). It entails "ongoing and developing capacity of the community to account for its vulnerabilities and develop capabilities that aid the community in… (1) preventing, withstanding, and mitigating… (2) recovering… (3) using knowledge from a past response" (Chandra et al., 2010). This framing of urban resilience is fairly process-oriented; the outcomes are important, but the quality and fairness of the process matter much as well. It focuses on the way communities are impacted by disturbances, but also places the ball for dealing with these in their court. Citizens and small stakeholders are natural/key players.

The problem(s): Community resilience seems to be discussed particularly in the context of disaster preparedness and psychology, discussing how disturbances impact a community, the relations in that community, and the ways in which communities deal with and learn from disturbances. Climate change would in this frame lead to disasters and other disturbances that cause societal disruption, e.g. break up social networks or hamper daily urban life, and decrease physical, financial, and mental wellness. Salient problems include particularly those that directly impact communities, such as

flooding and health impacts. A potential blind spot is that it may focus primarily on shock-resilience (i.e. disasters; short-term events), and neglect slower, creeping stresses.

The causes: Climate change may have the severest impacts on communities that have weak community ties, that have low adaptive capacities, including low economic development, social capital, information & communication, and community competence (cf. Norris et al., 2008). These can be low if the social bonds are weak, the community has little access to resources (e.g. financial, informational) which are essential for self-sufficiency and adaptability, low education, and/or its adaptive capacity is already hollowed out by other problems.

Moral judgements: A key moral issue in community resilience is the matter of social and resource equity. Often, those populations that are already less well-off or have significant gaps in terms of wealth, education, and/or health, are also the ones that are most vulnerable to disasters and disturbances in general. Another key value in community resilience relates to a perceived right to public access to information & resources, and public involvement in decision-making (and perhaps also in adaptation research and adaptation implementation). If the community is to be the problem owner, it will want a say in how it is analyzed and adapted.

Suggested remedies: Key adaptation strategies and options would focus on enhancing communities' capacity to cope with disturbances in a self-sufficient way. Community refers to citizens, as well as local businesses, NGO's, and policy actors. As a basis, improving basic living conditions, education, health, wellbeing, social support networks, and social participation in general would be helpful. More advanced strategies would focus engaging communities in research, decision-making, and implementation, by providing or helping them develop the tools and resources to do so. Recent trends such as citizen science, city labs, open data, and bottom-up citizen-led adaptation & sustainability initiatives are a key example of this. An important condition, is that some decision power will need to be distributed to the community –at the very least, their efforts will need to have a clear influence in the decision-making process.

6. Framing and contrasting frames highlight social uncertainty

The frames discussed above can be contrasted with another set of resilience frames that has received some attention in the literature: that of short-term versus long-term resilience (e.g. Davoudi, et al., 2013; Meerow et al., 2016). Short-term resilience is mainly focused on absorbing shocks and a quick return to equilibrium: maintaining the status quo. This relates to the classic notion of 'engineering' resilience (Folke, 2006), which lends itself well to relatively narrow (proximal) interpretations of the problems, causes, and solutions related to climate change adaptation (cf. De Boer et al., 2010). Long-term resilience deals with the inevitability of change in complex, dynamic systems, with transformation, adaptability & flexibility and co-evolving with trends. It relates to the classic notion of 'socio-ecological' resilience (Folke, 2006), which lends itself to relatively broad (distal) interpretations of problems, causes, and solutions (cf. De Boer et al., 2010). Davoudi et al. (2013) coin the term 'evolutionary' resilience, and 'dynamic' resilience might also be a good description.

Figure 2 presents the two sets of frames in a quadrant, describing them as four potential contrasting frames of urban climate resilience. Such diverging interpretations of what urban resilience means, also imply differences in preferences regarding how resilience can best be achieved (what is appropriate, effective, efficient, etc.), with which options and interventions, and how it can be evaluated using what metrics and tools. This is form of uncertainty (Petersen et al., 2013), specifically social uncertainty, in climate change adaptation: different assumptions underlying specific paths that resilient urban adaptation could (when viewed 'from the outside') our should (from the perspective of a specific urban actor) take. Different frames result from differences between people in interpretations of how the world works or should work – what matters and what not – similar to (and possibly related to or partly originating from) differences in worldviews that often colour debates on issues related to sustainability, climate change, and other societal matters (cf. Wardekker et al., 2009b). One can recognize that these differences exist, but not pinpoint which interpretation is more 'true' or 'likely. As such, framing can be seen as a type of scenario uncertainty (cf. Walker et al. 2003; Mathijssen et al., 2008), particularly related to value-ladenness, although there will be considerable (recognized and unrecognized) ignorance as well regarding how varied local actors frame and interpret resilience for the local situation more specifically.

Framing focus:	Short term	Long term
Urban system	Urban shock-proofing *E.g.: disaster engineering; urban economic resilience*	Resilience planning *E.g.: transformative, flexible planning & design; adaptive management*
Community	Community disaster resilience *E.g.: self-sufficiency; social aspects of disaster planning*	Community development *E.g.: human(itarian) development approaches; social innovations*

Figure 2. Four typical frames of urban resilience.

Conclusion

Building urban resilience to climate change and other urban challenges will be essential for maintaining thriving cities into the future. People have different interpretations of what that means, however. Two important overall frames of urban resilience include the 'system resilience', which focuses on maintaining functions and processes, and 'community resilience', which emphasises urban life and community capacity & self-sufficiency. In practice, there will likely be a wider variety of frames among stakeholders, citizens, and decision-makers in different cities. To prevent 'dialogues of the deaf', urban decision-makers and stakeholders will need to investigate and develop a clear vision on what they mean by resilient urban futures: what are the goals, and who's or what's resilience are we talking about? Explicit exploration of the current and potential frames will help to cultivate meaningful discussion on the choices and trade-offs to be made in developing resilient urban futures.

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