Games as Strong Concepts for City-Making

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Abstract Cities are becoming increasingly complex, both in terms of their social and cultural context, and in the technological solutions that are necessary to make them function. In parallel, we are observing a growing attention toward the public dimension of design, addressing societal challenges and opportunities at an urban scale. Conceptualizing, ideating, and framing design problems at a larger scale may still prove challenging, even as cities are becoming more and more relevant for all branches of design. In this chapter, we address the use of game mechanics to produce strong concepts for better understanding complex problems in city-making and communal participation, capitalizing on the necessity to shift the attention from smart cities to smart citizens. Through several examples we will show that games and play have a special quality of social bonding, providing context and motivational aspects that can be used to improve the dynamics and solutions within city-making.

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A. Nijholt (ed.), *Playable Cities*, Gaming Media and Social Effects,
DOI 10.1007/978-981-10-1962-3_2

1 Introduction

There are a growing number of applied games and playful interventions in an urban context, as a way to involve citizens and urbanites with their urban environment in the broadest possible sense, across spatial, social, and mental levels. These playful applications range from (1) Involving urbanites in the actual planning process of the city (Tan and Portugali 2012), (2) Engaging them in collective urban issues like air pollution, vacancy (de Lange 2014), (3) Engaging them with fellow citizens as a way to create more playful interactions and build trust between strangers (e.g., Kars Alfrink's Koppelkiek; 99 tiny games in UK), (4) Creating meaningful memories via playful poetic experiences (Rieser 2012), or (5) Play as critical tool, e.g., procedural rhetoric that allow people to reflect on future of their cities, or play/games as ways to imagine possible alternatives (Flanagan 2009).

This has spurred further interest in the research and design community, pushing an agenda of "playable cities", e.g., Bristol's Watershed, "playful cities" (Schouten 2015), and a more general interest in conceiving the city as a playground and urban ludic culture (Stevens 2007). Direly needed however are more in-depth reports on how these playful or gameful interventions actually "work" across the full gamut of research, conceptual, and design considerations; prototyping and testing; evaluation; portability and scaling up.

Indeed, there seems to be a disconnection between the current state of knowledge in models and visions for public services required for sustainable urban development and the implementation of this knowledge into the planning, management, and delivery of services. The development of new ways of active participation and co-creation within the optimal use of open data can help address urban challenges and bridge the implementation gap.

This chapter is organized as follows. In the next section, we will first present a concise state of the art on the need for more citizen-centered approaches to address complex urban contexts, and for processes in city-making that include different stakeholders. We will then turn to "game-making" as a resource for design research to make urban complexity more undersdable and tractable: following Stolterman and Wiberg (2010) and Höök and Löwgren (2012), we will point at game mechanics as strong concepts. We will then present data collected during the Hackable City project (Buiksloterham, Amsterdam), showing a series of three ad hoc games developed as an integral part of the inquiry process. We complement our analysis of the games with a designer interview, and we make the case for game-making effectively contributing to a more dynamic and situated understanding of complex urban scenarios.

2 Design and the Publics

Cities are becoming increasingly complex, both in terms of their social and cultural context, and of the technological solutions that are necessary to make them function. Numerous urban areas in Europe have seen a significant change in the structure and organization of public service provision (European Commission 2015). Cities are the main drivers of change in economic development and growth, knowledge production, innovation, and overall livability, recent economic, social, and environmental trends intensify the necessity to rethink traditional urban models. Different responses (from peer-to-peer informal networks, to the "sharing economy", to the "circular economy") have been recently explored to answer urban challenges, and the development of new ways of active participation and co-creation is at the center of these new models.

These design solutions are driven by a number of trends on which we elaborate: (1) a shift from smart cities to smart citizens, a focus on the end user in relation to the enabling technology, (2) open innovation focusing on process rather the simple solution making, and (3) the necessity to scale up the initial solutions to stronger concepts that can be reused and generalized.

2.1 Smart Cities and Smart Citizens

Advances in technologies such as the Internet of Things, networked sensors, and pervasive/ubiquitous computing have made digital mediations much more common in urban environments, opening new dialogues between citizens, urban planners, and design researchers in HCI, game design, interaction design, and user experience. Since the early 2000s, the term "Smart City" has been broadly adopted as a popular label to identify and cluster technology-driven approaches to urban development and renewal. Bowerman et al. (2000) characterize smart cities through their "use of advanced, integrated materials, sensors, electronics, and networks which are interfaced with computerized systems comprised of databases, tracking, and decision-making algorithms." The discourse about smart cities has been also criticized (e.g., Hollands 2008; Townsend 2013; de Lange and de Waal 2013) for a tendency to frame urban-scale design processes as top-down interventions, often technology-pushed and industry-driven, instead of bottom-up and participatory. Urban environments are characterized by social relations and by the emergence of a variety of practices. As Teli et al. (2015) have recently exemplified, designing for such complex socio-technical contexts requires taking into account the interaction between people, technologies, and places/spaces (Foth et al. 2011; Harrison and Dourish 2006).

Indeed, focusing on "smart citizens"—the inhabitants of smart cities—may prove effective in providing a more bottom-up, human-centered approach to these design spaces. "Third wave" HCI design (Bødker 2006), "design in the wild" (Dittrich et al. 2002; Rogers 2011; Chamberlain et al. 2012), as well as participatory design

(Bødker et al. 1993; Spinuzzi 2005) productively resonate with this objective. DiSalvo et al. (2014) recently provided an effective synthesis of these positions as they argue for a public orientation in design: a more public-oriented approach in design is nonsolutionist, and aims at articulating issues and giving form to problematic situations. "From this orientation, the basis for […] judgment is not whether an issue or situation resolved through design [and rather] whether we now have a better recognition and understanding of the contours of the issue or situation" (DiSalvo et al. 2014).

2.2 A Process, Involving Stakeholders

Examples of large-scale design challenges range from widespread "sharing economy" platforms (such as Uber and AirBnB for ride-sharing and apartment-sharing), to more local initiatives. For instance, about 90[1] bottom-up platforms, local digital media platforms were operating in Amsterdam in 2016, including FarmingtheCity.net, an online tool to support the creation of a local food system, or Peerby, a mobile phone app that allows people to borrow things they need from others in their vicinity. What binds these examples together is that they are part of an underlying shift in the organization of our societies, a shift we could call "the rise of the platform society" (de Waal 2014). This platform society may empower on the one hand the citizen to organize themselves around issues, bringing about a sharing economy, a participation society or civic economy. On the other hand, it forces designers to face issues of increasing complexity in terms of stakeholder diversity, pervasive technologies, and interlocking economic causes and effects.

As public-oriented design for urban spaces, the commons, and other city-scale interventions is gaining relevance, a number of design research methodologies have been leveraged to address it. Engaging such complex contexts may call for a situated approach, conceptualizing design "not as the creation of discrete, intrinsically meaningful objects, but the cultural production of new forms of practice" (Suchman et al. 1999). Participatory design (Bødker et al. 1993; Spinuzzi 2005) ideally complements situated design by actively involving people—citizens, in this specific case—in the process of ideating and creating products or services. Although participatory processes have been framed and defined in multiple ways over the years, and Vines et al. (2013) synthesize them as follows: "people are resourceful and skillful, and researchers should establish ways for this knowledge to be shared, communicated and embodied in technology design. By cooperating and forming boundary objects we provide spaces for knowledge and skills to be shared and inspire preferable future states" (Vines et al. 2013). But when it comes to articulating those opportunity spaces proposed by Vines et al. (2013), working at an urban scale pose an additional problem. Complexity increases exponentially, and so does the number of stakeholders, their needs, aspirations, and competences—as Dalsgaard (2010) shows.

[1] https://goo.gl/wycec6.

Framing a city-sized design problem may become an almost intractable. An interdisciplinary dialogue with social sciences and urban planning has provided design research with useful tools—as Shklovski and Chang (2006) have argued "we are not calling for technology designers to become urban planners and social scientists, but we do suggest that there is a wealth of research in these areas that needs to be taken into account when designing new technologies" (Shklovski and Chang 2006). For example, Angus et al. (2008) leveraged an "evaluative map technique" to collect personal stories related to specific places, Resch et al. (2014) triangulated biometric data collected through smart wristbands with GPS location sensors and emotions expressed on Twitter, and Stals et al. (2014) leverage a "walking and talking" method to probe urban experiences. These, and other similarly integrated methodologies, may be used in conjunction with more traditional (non) participant ethnographic observations plus other contextual and interview methods such as panels, collective mind-mapping, or card sorting exercises. For a small selection of possible outcomes of these methodologies in urban spaces, we may point—among others—at Bentley et al. (2012), Jetter et al. (2014), Greenbaum (2010), or Lindsay et al. (2012).

2.3 Urban-Scale Challenges

The complexity of the issues at hand (problem space and solution space) constitutes a possible hindering factor in many of these examples, as well as the large community of stakeholders involved—from city council, citizens, institutions, and organizations. This hinders the scaling up of these solutions as well as the development of theories and models: many solutions are only valid in a particular context and lack generalizability. Although there clearly is already a new generation of young designers, architects, activists employing digital platforms to revitalize public spaces, we are still lacking concepts and methodologies for effectively framing design issues at an urban scale. Methods for probing complex issues and making them visible, sharable, and debatable could yield more complete design insights. More engaging participatory methods could bring designers and stakeholders together, facilitating a better understanding of urban issues.

As a contribution in this sense, in this chapter we point at the strategic use of games as lenses to understand stakeholder dynamics and as a way of rapidly exploring urban issues in cooperation with stakeholders, thus producing design knowledge that can be leveraged and that can be transferred to other domains. This use of play fits into a broader approach that understands the urban public sphere not so much as a predetermined spatial site, but as a potential event space, which has recently also been embraced by city governments as a strategy to increase the quality and functionality of public spaces, a development that the UK government for science has called "vibrant cities" (Calzada 2016).

3 Game Mechanics as Strong Concepts for Urban-Scale Challenges

Given the difficulty of framing urban-scale issues in ways that are easy to grasp and generative for design/codesign insights, we turn to game-making to identify urban problems, discuss them, and ultimately understand them better together with stakeholders. Our emphasis here is on both *making* and *playing* games, as we propose that the whole process of researching, ideating, prototyping, and testing a game about urban issues may bring more clarity to how these urban issues may actually be understood and communicated. In other words, we point at games not as solutions in themselves (Morozov 2014), but at game-making as a support for design research in urban-scale issues.

The contribution we are aiming at is methodological and conceptual: we situate a *making* practice (in our specific case, making games) as an exploratory part of a much broader urban-scale design process, and we reconceptualize games neither as readymade solutions nor as final deliverables of a research project but as "thinking by doing". Making games about complex systems (e.g., urban environments) requires exploration and reflection, which in turn allows for a better understanding of the problem space. In what follows, we present and unpack our reasoning: we first look into making, hacking, and design it yourself (DIY) as forms of inquiry, then we address game design as a reflective practice, and finally we tie everything together by framing situated game-making in Stolterman and Wiberg's (2010) and Höök and Löwgren's (2012) "intermediate knowledge".

3.1 Critical Making and Game Design as a Reflective Practice

To make more tractable and understandable the complexity of urban-scale issues, we point at critical making (Ratto 2011; Ratto and Boler 2014) for an alternative way of producing and sharing design insights for/about/with a variety of stakeholders. Here we use the term "making" in the broad sense of "producing ad hoc artifacts", similarly to the related practices of hacking and DIY. Ratto (2011), who coined the term, describes critical making as "a mode of materially productive engagement that is intended to bridge the gap between creative physical and conceptual exploration." As Grimme et al. (2014) synthesize, Ratto specifically emphasizes the process of making (as opposed to the product) and material production as integral to his understanding of what critical making could be (Ratto 2011). Therefore, he presents critical making as an activity or process that seeks to reveal some sociocultural characteristics and assumptions by means of constructing ad hoc artifacts. Elaborating upon this definition, we looked at activities and artifacts that may capture complex systems and that may be easily experienced by a broad range of participants.

Flanagan (2009) has already discussed the idea of some games supporting "critical play", that is a specific way of using playful interactions to carefully examine "social, cultural, political, or even personal themes that function as alternates to popular play spaces" (2009). Our approach draws equally from critical making and from critical play. Following Flanagan, we propose playful interactions as tools to carefully examine social issues—situated, in our case, in urban spaces—and hopefully understand them better. However, we differ from Flanagan, as she points at reflective understanding as a specific effect of gameplay whereas we also draw from Ratto's proposal of inquiry through making. In sum, we are pointing at an opportunity space where (1) designing and making a game, and (2) iteratively testing it with a variety of stakeholders contribute equally to a better understanding of complex issues, such as urban-scale ones.

3.2 Toward Game Mechanics as Strong Concepts

Extracting actionable and generalizable design knowledge that connects concrete instances to abstract theories has been already discussed in design research. In a Research through Design process (Zimmerman et al. 2007), Stolterman and Wiberg (2010) point at "conceptual constructs" as midway entities that comprise the research methods applied (that is, the process of interaction design research) as well as the prototypes (that is, the products constructed according to a certain concept). The DynaBook (Kay 1972), from the early 1970s, is an example that they use in their well-known paper. The DynaBook was a concept that inspired the design of the modern laptop computer but at the time of its creation was not technologically possible to build. The original concept was to design new interaction forms, interface solutions, technology, and software for children. The DynaBook concept foresaw a low-powered flat screen that did not exist at that time. The attempts to implement the DynaBook as a prototype led to results that were too expensive, clumsy, slow, and in most ways useless. The DynaBook concept pointed in the direction of a future development toward partly digital, book-size computers. Today, we can still see the strength of this concept in, for example, Apple's naming of their laptop computer, a MacBook.

Along the same lines, Höök and Löwgren note how "design-oriented research practices create opportunities for constructing knowledge that is more abstract than particular instances, yet does not aspire to the generality of a theory" (2012), an intermediate level that contains evaluative or generative elements such as guidelines, criticism, design patterns, annotated portfolios, and strong concepts. As an example of this, we may point at citizen-led urban sensing experiments, such as the "Making Sense" project,[2] as fitting examples to these intermediate positions, in the middle

[2]https://www.waag.org/nl/project/making-sense. Carried out by a consortium consisting of Waag Society (Lead partner—Netherlands), University of Dundee (UK), Peer Educators Network and Science for Change (Kosovo), Institute for Advanced Architecture of Catalonia—IAAC (Spain), and the EU Joint Research Centre (Belgium).

between specific artifacts and broader theories. In this project they use the concept of citizen science, to provide the citizen with tools to change urban policies for instance in air pollution problems: Ispex (www.ispex.nl) for instance is a simple smartphone used in combination with an add-on device to measure the amount of fine dust in the air. While they are very successful in their particular application domain, it is still a big question if these initiatives and concept will lead to general practice and theory for empowering citizens in general and in other application domains.

As our specific contribution with this chapter, we argue for adding game mechanics—the algorithmic rules governing gameplay (Hunicke et al. 2004)—to Höök and Löwgren's intermediate level of design knowledge to guide the process to develop strong concepts from instances or particular problems. Games and game design have a way of producing knowledge that is clearly different from more systematized forms of design research. Games allow emphasis on sense-making in context, for ill-defined complex problems (Lombardi 2007); games are context machines that allow users to join (online) communities, so-called affinity spaces (Gee 2005; Shaffer 2006; Schouten 2015), where they can share knowledge and skills pertaining to their interest. For instance, in the various websites devoted to the game Civilization, for example, players organize themselves around the shared goal of developing expertise in the game and the skills, habits, and understandings required to successfully grow an empire—one of the victory conditions of the game.

Here, we propose that making/playing games may be useful as it transparently connects specific, concrete artifacts and issues (e.g., how rainfall and excess water is dealt with in a specific neighborhood) to much larger theoretical arguments and problems (e.g., empowerment and ownership over specific issues). Moreover, thinking and designing interactions in urban spaces has supported broader conceptualizations that are more general than a specific instance, but have not yet (or programmatically do not aim for) the breadth of a full-fledged theory.

It is important to state, that a set of game rules may be, first of all, an operational model that simplifies and represents a portion of reality from a certain point of view. It is a story or a procedure to discuss and persuade, as Bogost (2007) frames it. In the process of making a game, those rules tentatively model the general theoretical understanding of a given issue (e.g., urban empowerment) and connect it to a concrete representation (e.g., what takes place in the game). Complementarily, during play, involved stakeholders may consider the concrete elements symbolized in the game and, through strategic trial and error, explore what the game rules allow, what they forbid, which are the winning strategies (if any), thus forming a clearer mental image of the general theory behind the game. Like strong concepts and intermediate knowledge, we understand these kinds of games to have a degree of generality and not being tied to a single, specific context, thus allowing insights to emerge and be transferred also to other domains.

In other studies, strong concepts are described along four general axes: as a response to a particular use situation; triangulation between empirical, analytical, and theoretical results; horizontal grounding focusing on similarities and differences in different application domains, connecting instances and theories; and vertical

grounding informing theoretical development on a more general level by broadening the context of use and usability (Höök and Löwgren 2012). While recognizing the importance of all these strands, in this work we foreground particularly the role of game mechanics in relation to horizontal and vertical grounding. More specifically, here we explore how an experienced game designer turned to a toolbox composed by a variety of mechanics to better understand a complex, urban-scale design problem. We make the case that semi-abstract game mechanics exists in the intermediate space identified by Stolterman and Wiberg (2010) and Höök and Löwgren (2012), and can be effectively leveraged to (1) abstract and model complex issues, (2) play with variables, outcomes, causes, and effects, (3) support specific "styles" of play, thus spurring reflection and discussion with stakeholders, (4) finally, grounding the issue horizontally and vertically, thus situating it in a broader context.

4 Game Mechanics for Hackable Cities

To support our argument, we present a design critique (Löwgren 2009; Chatting et al. 2015) of game-based discussion tools/probes that were developed in 2015/16 as part of the Hackable City project, in Amsterdam. In what follows, we first provide an overview of Hackable City study, of the urban context it is situated in, and of the issues it explores. Then, we outline our methodology for data collection, analysis, and interpretation. Finally, we introduce three games (Buiksloterham Matrix, the Neighborhood, The Water must Flow), we "think through" them by teasing out their game mechanics, and we triangulate our reading with a design interview with their author.

4.1 Introducing Hackable City

The Hackable City[3] is a research by design project that explores the potential for new modes of collaborative city-making in a network society. A team of academics and designers,[4] an architecture office, and societal partners explore the opportunities as well as challenges of the rise of new media technologies for an open, democratic process of collaborative city-making, which we conceptualize as the process in which citizens, designers, and institutions give shape to physical, infrastructural, legal, and social aspects of urban life (Ahlers et al. 2016; Ampatzidou et al. 2014). The Hackable City project addresses how can citizens, design professionals, local government institutions, and others employ digital media platforms in collaborative processes of urban planning, management and social organization, to contribute to

[3] www.thehackablecity.nl.

[4] Including the authors of this chapter.

Fig. 1 Buiksloterham, a neighborhood of Amsterdam as a field lab for circular economy (2015)

a liveable and resilient city, with a strong social fabric? The area of Buiksloterham in Amsterdam's northern part of the city (Fig. 1) is our primary case study. This is a former industrial and production area that is slated to grow from 300 to about 10,000 inhabitants in a few years. The area was given the status of an urban lab where experiments with circularity and new forms of sustainable city-making can take place, with less restrictive rules.

As making, DIY and bottom-up participative processes emerge as central topic in design research, we observe a striking parallel between the original hackers and current city makers. Like the first hackers were computer hobbyists who wrote their own software and shared it with the world, some city makers similarly contribute innovations for the existing city. Like hackers, city makers can repurpose, circumvent, or newly kickstart a range of urban infrastructures, systems, and services using fairly simple off-the-shelf digital tools. Some examples of this new sharing economy have already been mentioned under section 2 and include collaborative measuring of air quality, cooperative working spaces, collectivizing insurances and other services, producing and sharing energy, food, and other resources. To study this hacker approach to city-making, we propose to adopt a research method that is equally grounded in making. Although the Hackable City is a complex project, here we focus specifically on the part where specific games were developed as a form of design inquiry. As we will show, we adopted the practice of game-making as an alternative way of gaining insights into the complex processes of city-making. In what follows, we will present an account of how thinking through the process of game-making enabled us to obtain new perspectives. To do so, we will point at specific game mechanics as strong concepts: generative ideas that exist across domains (city, games, society, etc.) and enable us to make complex systems more tractable.

Fig. 2 The mechanics from Carcassonne (Wrede 2000) was taken to the existing situation of Buiksloterham, where future infrastructure was discussed amongst different stakeholders (citizens, city council, architects, etc.), organizing the water ecosystem of Buiksloterham, combining recreational and environmental efforts

4.2 Study Methodology

To tease out how some game mechanics operated as strong concepts in three of the Hackable City games, we turn to a mixed-method qualitative approach. We present a design critique and analysis through procedural criticism (Bogost 2006; Chatting et al. 2015) of three playable artifacts designed as part of the Hackable Cities project (Buiksloterham Matrix, the Neighborhood, The Water Must Flow), and a close reading of design interviews with their author. Other secondary materials (development diaries, sketches, playtest reports, etc.) were also considered. After a first pass of analysis, further conclusive interviews ("respondent interview") were conducted to make sure that our understanding is coherent with the designer's own interpretation of his work. The artifact-centered part of our analysis was conducted on the "finished" games, as they were demonstrated to the participants of the Hackable City project, even though these research-oriented playable artifacts are expressly fluid and often rapidly iterated upon. We produced a qualitative analysis of the three games by teasing out the game mechanics from their systems of rules, and by applying ludological categories (Aarseth 2010; Hunicke et al. 2004; Järvinen 2007) and interpreting them through procedural criticism (Bogost 2006, 2007), a design-oriented methodology for examining the relationship between the interactive, experiential, and playful qualities of an artifact and its sociocultural context (Fig. 2).

We first approached the analyses of these playable artifacts adopting a grounded theory perspective, carefully describing their mechanics and the dynamics (Hunicke et al. 2004) they supported. This was performed on a dataset composed by collected game rules, by the props and artifacts used for playing, and by coded observations from demonstrations and playtests. Furthermore, the designer expressly mentions being inspired in his creative work by game mechanics from other existing artifacts, which were adapted to address the specific issues of the Hackable City. For this reason, we include as secondary data

also the other "off-the-shelf" artifacts that provided inspiration to the designer, that we consider for a comparison with the games developed for the Hackable City.

4.3 Procedural/Ludological Description of the Games

In discussing the three games that we designed (Buiksloterham Matrix, the Neighborhood, The Water Must Flow), we first outline their general structure, and then we tease out how existing game mechanics were adopted and reappropriated as a way to make the Buiksloterham context more understandable in its complexity. In other words, we present an account of how game mechanics were used as strong concepts, as a generative tool for thinking across domains (city-making, game-making, making games as design research, etc.). As strong concepts are inherently transdisciplinary and cross-media, in our description we highlight how game mechanics are reused and reappropriated from existing artifacts (from domain 1: entertainment games, to domain 2: research games), and how they illuminate and clarify specific parts of the city-making processes (from domain 2: research games, to domain 3: city-making).

Our analysis follows the chronological order in which the games were developed as part of the Hackable City research. We present (1) an experimental game to probe and reveal existing assumptions, and conceptualizations (Buiksloterham Matrix), (2) a playful experience leveraging cooperative storytelling and map-drawing to make tangible different values and related expectations (The Neighborhood), and finally (3) game mechanics for concretely demonstrating the different values and roles which could be attached to urban-scale resources (The Water Must Flow).

Buiksloterham Matrix is a tabletop game that casts players into roles that span from homeowners, local builders, public officials, and foreign investors. Gameplay is moderated by an umpire, and takes place on a large-scale printed map of the Buiksloterham neighborhood, with small tokens to show where specific actions take place. Players are assigned resources to manage, and specific goals. The overall objective is to reach one's goal within 12 turns, each of them simulating 2 months. At every turn, players declare an action to attempt and present an argument to the umpire describing why it would succeed, for example, "I am going to coordinate with my neighbors to build a small garden to reduce rainwater runoff, and I think it will easily succeed because this is a small tight-knit community where similar initiatives worked well in the past." The quality of the claims made by players are assessed by the game mediator, also with the support of a precompiled matrix with a number of variables, and turned into judgments over the likelihood that a specific event might actually take place. After this, random numbers are generated using dices, and the actions proposed by players take place (or not) according to the probabilities assigned by the umpire. Finally, the game state is updated, and the players may begin a next round by making new claims and arguments.

Buiksloterham Matrix adopts and reappropriates game mechanics from an open framework called Matrix Game System (Engle 1988), a tool for producing referee-

mediated strategic games with an emphasis not on quantitative mechanics but on qualitative and rhetorical arguments. There is, however, a significant difference between Buiksloterham Matrix and the original ruleset. The standard Matrix system uses a predetermined set of labels (for example, productivity, size of the territory, diplomatic relations, etc.) in the tables helping the umpire moderating the players' claims. Buiksloterham Matrix uses a similar solution, but with a crucial difference: the variables are much more open, and players and umpire must invent the relevant categories as the game is played. If we compare the original system with this modified version, we might point at its potential usefulness as a research tool. Indeed, this game enabled designers and researchers to tease out how stakeholders conceptualized the urban environment. Observations collected during the Hackable City playtests show a slightly modified game mechanic (the matrix does not have labeled variables) generating different dynamics (Hunicke et al. 2004), prompting open conversations about the urban environment that enabled the gathering of design insights toward the following games.

For Buiksloterham Matrix, we point at "Refereed Arguments" as an emerging strong concept that is at work both in the original Matrix system and in the modified version, and that highlights a quality of bottom-up city-making. Like players have to construct their argumentations to have an impact on the game world, real-life stakeholders engage in a communal political debate at a local level, a series of bottom-up, network-like discussions with the objective of building a consensus around proposed initiatives. The strong concept of "refereed arguments" emphasizes the dialogical, social, emergent, and sometimes messy nature of this kind of processes.

The Neighborhood is the second game in this series. It is a game based on storytelling and collaborative map-drawing, and aims at generating and discussing ideas about the future of public spaces. Play is moderated by an umpire, and makes use of markers, tokens, and a large sheet of paper for cooperative drawing. Each player develops a persona that considers desirable values (e.g., sustainability, sociality, or aesthetic qualities) and problematic neighborhood issues (from noise level, to personal appropriation of communal facilities). Then, the moderator guides different rounds in which players randomly pick "event cards" and react to them by telling a story from the perspective of their persona, and by drawing on the map the locations in which it takes place. Cards contain prompts such as "Torrential rain causes the flooding of a main street", or "An exceptionally dry summer makes it difficult to water the public gardens". Similarly to an improvisational narrative exercise, the players are not allowed to directly contradict what others say, but need to co-construct a story that is coherent from a narrative point of view. All the stories are set in the same area and, as the game and the narration progress, a map of the neighborhood is collectively constructed. As they talk, players mark the map with tokens signifying problematic situations or desirable values according to their characters' description. Tokens may also be removed or replaced when specific narrative situations are resolved.

Let us now return to a comparative approach. The Neighborhood reinterprets the key game mechanics used by the narrative role-playing game The Quiet Year (2013)

by Avery Mcdaldno. Differently from the artifact we are analyzing, A Quiet Year is set in a fantastic postapocalyptic world, and tasks players with describing the everyday activities of a small community of survivors. The mechanics of collaborative narration and map-drawing remain quite similar, although the overall theme of the event cards is clearly different. The value-related tokens are, instead, a significant addition that was not present in A Quiet Year. This seemingly minor change in-game mechanics has a profound impact on its emergent dynamics. By asking players to make explicit which elements are desirable and undesirable in their public spaces, The Neighborhood teases out how different values are understood and conceptualized. Also in this case, we observe an existing game mechanic being reappropriated to make visible not only the unspoken assumptions of various stakeholders but also their interplay and how they may be collectively negotiated over time.

The Neighborhood, like The Quiet Year, leverages a strong concept that we may call "Shared Narratives". The two games prompt player to cooperatively construct a story around their community and the spaces they inhabit: this mechanic points at the importance of building a shared discourse as a step toward a common identity, and at the negotiations that are necessary to do so. It also underlines the close relationship between common narratives and physical spaces, how they support and shape each other. Like in the two games, similar processes are at work also in city-making, with the social relationships between citizens producing a common discourse around specific places, which in turn give form to how they are lived, planned, and built.

Finally, The Water Must Flow is a strategic game of resource management about using water in the commons and in private areas of a neighborhood: it tasks players with managing plots of lands in relation to rainwater, flooding, draught, and other similarly water-related issues. At the beginning of the game, each player receives a stakeholder/character to role-play, with particular needs and special abilities. The main game mechanics include managing water, creating/harvesting resources (beauty, fun, livability, produce), and developing plots of land. Water, in particular, is a key component of these game mechanics. Every turn, a casual amount of rain falls upon the land plots. Each of them produces a certain amount of resources based upon how much water it receives, but only up to a limit. When water reaches the limit for a specific plot, it either overflows to an adjacent one, or it creates damage. Players need to strategically place their plots in a way that optimizes the distribution of rainwater, maximizing irrigation, and minimizing flooding.

Like the previous examples, also The Water Must Flow builds upon specific mechanics from existing games, and reinterprets them to better understand the urban context. The tile-laying mechanics, together with aesthetics qualities about building a coherent landscape with the tiles, are borrowed from Carcassonne (Wrede 2000). It is a tabletop game in which players compete for strategically arranging tiles, which generate points and benefits, and at the same time represent a rural scenario. The mechanics that deal with resource generation and allocation are adapted from Agricola (Rosenberg 2007) and Lords of Waterdeep (Lee and Thompson 2012), whose rules look at the placements of specific cards to procedurally calculate production

and upkeep costs. The Water Must Flow indeed serves a twofold purpose: on one hand it elicits a playful engagement of stakeholders, but it also constitutes a conversation piece on the double role of water in neighborhood-scale planning.

For The Water Must Flow, we point at a strong concept that we may call the "Duality of Resources". Both in the existing games (Agricola, Carcassonne, Lords of Waterdeep) and in this ad hoc version, some in-game resources may play a positive and a negative role depending on how players construct their strategy. Specifically, The Water Must Flow conceptualizes rain both as a fundamental asset and as a potentially catastrophic element. Likewise, the game teases out a similar conceptualization in city-making practices, thus illuminating another way in which citizens may understand their relation to natural elements and plan their neighborhood accordingly.

As The Water Must Flow constitutes a (temporary) conclusion of our "Research through Game Making" process, it draws upon insights gathered throughout the whole series, synthesizes them, and expresses a possible overall argument. The following topics, recorded in the design diary kept during the creative process, were brought into focus through the making and testing of The Water Must Flow, and constitute its practical takeaway. Rainwater can be a threat, but also a resource in the commons, and the game system should represent this double nature. Collaboration is often an ad hoc process, not carefully planned beforehand, both in games and in urban environments. Cooperative processes are tentative, and must allow space for failure and reflection: making mistakes, stopping and starting over happens in urban practices as well as in games.

Through our practical process of game-making and playtesting with stakeholder, we were able to reflectively identify three strong concepts, which are equally at work in existing games, in the ones we designed, and in some city-making practices observed through the Hackable City research. The strong concept of "Refereed Arguments" refers to the dialogical and collective nature of designing urban spaces together, and points at the need for collective argumentations. "Shared Narratives" exemplify the construction of common identities that is frequently observed in bottom-up participatory processes, and underlines the effect that collective storytelling has on how places are conceptualized and collectively reimagined. Finally, the "Duality of Resources" highlights the complex nature of the elements of city-making: what can bring positive effects in some cases, may also cause damages in others, and citizens and planners need to be aware of this duality. We point at these observations, although not necessarily groundbreaking in the field of urban design, to exemplify how a research process based on game-making may not only bring together a variety of stakeholders, but also yield relevant insights. To complement this artifact-centered description, we now turn to a designer interview.

4.4 Designer Interview

We now present a selection of quotes from a "respondent validation debrief" conducted with Karel Millenaar,[5] one of the authors of this chapter as well as a game designer, responsible for the Hackable City games. By integrating them with theoretical insights, we support our proposal of game-making as an effective ad hoc form of inquiry into complex contexts such as urban-scale issues. Millenaar was tasked with creating applied games dealing with bottom-up urban practices, thus facing a complex, multidimensional context with no evident solution and with incomplete information. In his own words: "*I wanted to do the best job I could do, and do justice to the subject, and I wanted a deep understanding. But this would be an arrogant statement, because now I understand that [urban-scale issues] are very difficult to grasp, and not something that one person can solve. I now have a much deeper respect for the people who work on this, their professionalism, their qualities, and they're doing something so difficult.*" Through a close examination of the designer interviews and of the secondary material, we identify a pattern emerging in Millenaar's "research through game making" work. It is an ad hoc process resonating with Ratto's Critical Making (2011) and with Stolterman and Wiberg's (2010) and Höök and Löwgren's (2012) strong concepts and intermediate knowledge. We will outline here a two-pronged design strategy that is visible in our dataset. The first design tactic consists in developing and deploying games to delimit and identify the problem space, and we observe Millenaar adopting a pragmatic approach to identify where it is more productive to intervene. Second, we observe the reuse and reappropriation of game mechanics from existing off-the-shelf designs as a way for the designer to invite specific types of play and, by doing so, to situate stakeholders in significant contexts. This way, the designer argued that he was able to make the problem space more tractable and understandable. Referring to Höök and Löwgren's (2012) intermediate level of design knowledge to the ad hoc practice of game-making, we will now present extracts from the designer interview illustrating how (1) Millenaar tapped into a "toolbox" of existing game mechanics as a leverage to better frame the urban-scale context he was facing, (2) through a deliberate use of those mechanics, the three games that Millenaar developed oriented stakeholders in a more holistic understanding of the problem space, (3) ultimately Millenaar reflected back on his design process and was able to significantly reframe the problem space.

Millenaar reflects: "*My initial understanding was very vague and I didn't see any real 'issue to solve', in a sense there was a problem and in other senses there was not.*" This indeed exemplifies how urban-scale challenges may seem intractable at first, with a vague perception of some kind of underlying issue that nevertheless

[5]Karel Millenaar is a practicing game designer and educator based in the Netherlands. He was involved with Hackable City throughout the whole process, and provided his expertise in making, testing, and discussing the ad hoc games produced as part of the inquiry. He did not have previous experiences of academic research in the field of urban studies and urban planning, thus making his "clean-slate" approach to this problem space qualitatively representative. The designer interview presented in this paragraph was conducted by the other authors of this chapter.

proves elusive to get a grip on. Facing the difficulty of framing the context abstractly, he turns to local stakeholders as a way into the problem space. He continues: "*I was looking at how I could use the gameplay as a sort of leverage, to tell me how [people] understood their own situation, but not through talking which is always biased, and I actually wanted to know how they understood someone else's stuff - because most of the time the people dealing with these kind of projects, it's always about the interaction, not everyone is on the same page, different goals, opinions, scales ways of doing things*".

This led to Buiksloterham Matrix, the first of the three games, which was developed to probe and tease out how stakeholders/players conceptualize the social dynamics at work in the neighborhood. We have evidence of the designer accessing his own repertoire of existing game mechanics, and choosing one that he deems promising: "*[I wanted to] figure out their understanding of the subject matter, and the matrix game makes it very easy to create these groups that are competing for something - not necessarily symmetrically.[…] I was looking at gameplay that allows people to express their understanding, and the matrix games are perfect for that. It's very simple, mechanics are not heavy, and it's not really strategic in the strictest sense.*" We start seeing horizontal and vertical grounding at work here, especially with the designer selecting game-related concepts (asymmetrical competition and negotiation) and using them as a way to "think through" urban complexity. And, indeed, grounding is a fundamental component of Höök and Löwgren's strong concepts (2012). In his words: "*Not being deterministic system was important because I wanted to take the strategy away from the board, I don't want to have players focusing on playing the game successfully, I want to invite them to express the ideas they have.*"

Also in the reflection on the second game, The Neighborhood, we document Millenaar picking up mechanics from other games and adapting them to foster specific effects during gameplay. "*I stumbled upon [A Quiet Year], an alternative roleplaying game with mechanics based on drawing and telling stories. […] I wanted to figure out a way for [stakeholders] to express their own [expectations] in a meaningful manner to someone else, talking about their expectations on the place they want to build a house.*" And, again, we have evidence of the designer turning to his game competence to horizontally ground his understanding and have a clearer idea of the urban process: "*I brought it back to something I could understand. I delved deeper in [this process] and I realized that not every stakeholder has a plan. It's a pretty* ad hoc *process. But how can I capture this through play and learn about who everyone is? […] The Neighborhood is an experiment about creating mini-stories, mini-scenarios about a specific real location, and based on very short bursts of creativity. And for this reason I looked at A Quiet Year for an elegant and simple way to imagine a story.*"

All this led to the third design, The Water Must Flow, which in a way constitutes a temporary conclusion for Millenaar's process. He reflects: "*I'm used to figure out systems that give birth to problems, I know how can I act on systems. But in this case I began to understand that water was not the actual issue, but the problem arose from something else.*" Millenaar talks about a twofold approach to conceptualizing

water: "*Water is a threat and, at the same time, a resource. [I aimed at having players] develop the commons and use it to create the environment that is best suited to their own fictional character, which have very different values and aspirations – for example beauty, or comfort, or luxury, or sociality…*" And another evidence of horizontal grounding through reappropriated game mechanics: "*The trick is that water is transient, it's in the commons. So I've decided to develop a standard 'upkeep' game mechanic: you need to maintain it or it's going to be destroyed, for the good or for the bad. If enough damage is done, water will fade away, an opportunity to build something new, but also an issue if you happen to need water. It's a fluid way to look into common spaces: water management can be valuable and can be expensive.*"

In conclusion, Millenaar reflects on how his own understanding the games he was making evolved throughout the process: "*I did two things: I mulled over the context, and I looked into different tabletop game mechanics. I wanted to make a game that worked as engines to get people together and sorts of interfaces to look into complexity. I wanted to put a filter over reality to make complexity easier to cope with, and make explicit the implicit. A tool that connects, deepens understanding and also transforms, all that by doing, not so much by planning. I wanted something that was meaningful to people stepping into it: how to use different mechanics to express themselves.*"

5 Discussion and Conclusion

In the same vein of practices such as critical making (Ratto 2011), in this chapter we have pointed at game-making as an ad hoc form of inquiry that can support design researchers in addressing and untangling urban-scale issues. Paraphrasing Shklovski and Chang (2006), we are not calling for technology designers, urban planners, and social scientists to become game designers, but we suggest that "thinking through" game mechanics may be particularly useful in making complex scenarios visible, understandable, and tractable.

We have reported on part of a research project entitled Hackable City, addressing some structural similarities between the "hacking" practices of early computer enthusiasts and the some innovative bottom-up city-making activities. As we faced the complexity and heterogeneity of the urban practices we were approaching, it became clear that we needed tools to make it more tractable and understandable, not only to us but also to the stakeholders themselves. By making ad hoc games, we pursued a twofold objective: on one hand, we tapped into an experienced game designer's practice to select and isolate existing game mechanics as lenses for research, and on the other one we notice how these game mechanics tease out significant parts of city-making. In other words, we argue that the mechanics we isolated act as strong concepts.

Three game mechanics/strong concepts were isolated: Refereed Arguments, Shared Narratives, and Duality of Resources. Refereed Arguments points equally

at mechanics asking players to make persuasive argumentations on why a certain in-game action would have a positive outcome (as exemplified in our Buiksloterham Matrix, and in all other Matrix games), but also at the negotiations that inevitably take place in informal groups of citizens dealing with city-making processes. As game mechanics, Shared Narratives refer to collaborative storytelling by players shaping in-game elements (an element demonstrated in The Neighborhood and The Quiet Year), and also to the social process of building local identities in urban areas. Finally, games like The Water Must Flow leverage the Duality of Resources as game mechanics to simulate how certain element may have both positive and negative effects on gameplay, referring also to similar potentialities in city-making (e.g., water may pose serious problems for a city infrastructure, but may also be a significant resource). In relationship to intermediate knowledge and strong concepts (Stolterman and Wiberg 2010; Höök and Löwgren 2012), we focus specifically on reappropriation and reuse of game mechanics to make sense of urban phenomena by grounding them horizontally and (in part) vertically. Höök and Löwgren describe horizontal grounding as the conceptual connection between similar ideas in different domains, and the vertical one as a link between concrete instances and theories. Through the description of three games developed for the Hackable City project, and through a reflective designer interview, we have given evidence for the use of game mechanics as horizontal connectors between domains (from entertainment games to research games, and from research games to city-making), and as vertical connectors between different levels of abstraction (from the complex, multiform practices of city-making to the simplified versions enacted through games). More generally, we argue that this integrated approach can enable designers and researchers to model, simplify and communicate complex contextual elements. Clearly, urban-scale issues are not the only situations in which a similar approach may be used. More generally, we consider experimental game-making as a promising mode of inquiry for several complex application domains, as testified for example by the relative abundance of ludic simulations about (among others) economy, international policy, and geopolitics.

For most research projects in this field, the involvement of game experts has been so far principally "solutionist" (Morozov 2014)—aiming at, in other words, communicating preferred solutions to well-defined problems, commonly at the end of the project itself. Instead, we have documented and presented an exploratory process that had the objective of making complex situations more understandable and accessible for researchers and stakeholders alike. In the Hackable City project, games were not simple "deliverables" but an integral part of the inquiry process. As city-wide design problems may risk becoming almost intractable, designers have been called to address the cultural production of new forms of practice (Suchman et al. 1999) instead of single artifacts: we see the iterative, open-ended practice of game-making clearly pushing this research agenda forward. Indeed, there are methodological implications for the use of games and play in design research, especially in the construction of strong concepts. First, we foreground how games are actionable artifacts that support thinking by doing (Schouten et al. 2010), which in turn produc-

tively resonates with research through design as a form of inquiry (Zimmerman et al. 2007). We emphasize the active nature of play, as an activity that connects data and knowledge through game mechanics and, if we want to use a slogan, we might suggest that gaming, as a verb, transforms data into knowledge. As we propose this, we refer not only to playing existing games but also (as exemplified by our observations on Hackable City) through the ad hoc practice of game-making. For this reason, we draw the design research community's attention toward co-creative practices like "game jams". Similar to hackathons, game jams are very intensive (generally 24–72 h long) creative sessions where teams ideate, co-create, prototype, and pitch experimental games. Like hackathons, they have been extensively applied in the domain of therapy, healthcare, education, and research in order to balance the problem space to the solution space, to scale between the complexity of the "big" solution and the simplification of the particular problem. Game jams have been organized as part of research events—for example, the "Game Jam: [4 Research]" at CHI (Deen et al. 2014)—and studied from the perspective of design inquiry (Goddard et al. 2014). As supported by our observations in the Hackable City project, we promote extending the use of game jam-like methodologies also in other research practices, integrating game-making with more traditional forms of design inquiry. This resonates with Shaffer's (2006) conceptualization of games as affinity machines that create situated understanding: "Videogames make it possible to participate in valued communities and develop the ways of thinking that organizes these practices" thus immersing players in a socially and culturally shared experience. We point at these "affinity spaces" as opportunities generated through game-making to collectively address and discuss research issues, and to conceptualized shared solutions. In many cases this situated understanding can be transferred to other contexts—a phenomenon called the transfer of games and described by Shaffer as "epistemic frames", mechanisms through which one can use experiences in videogames to deal with situations outside the game. In our chapter, we presented evidence of game mechanics from existing (entertainment) games transferred then in an applied context, translating the motivation and experiences into the new game to model an (apparently intractable) urban context.

We see more potential in this approach and, at the same time, there is clearly much work yet to be done. Grounding is not the only trait of strong concepts, which are described along four general axes (response to a particular use situation; triangulation between empirical, analytical, and theoretical results; vertical grounding connecting instances and theories; horizontal grounding connecting related instances). Future work in this direction will include the development of a repository of core game mechanics that can be used in several application domains, followed by further research into best practices on how to perform horizontal and vertical grounding using them.

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