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Exploring Urban Data Visualization and Public Participation in Planning

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ABSTRACT *Regulations in urban governance stipulate that large amounts of urban data be made available to the public with the intention of informing and enhancing decision making by businesses and citizens. Yet, the Planning and Building Permit Archive for the City of Oslo as one such source of data, only enables pinhole access by the public, denying public dissemination of planning and urban development issues beyond individual building and planning cases. Based on a set of experiments by the designer Even Westvang in a project called* SeePlan*, the article discusses how visualizing data from the Planning and Building Permit Archive may extend the available repertoire for the public to participate in urban planning.*

KEYWORDS *urban data; planning; archives; participation; visualization*

Introduction

The city is continuously reshaped and rebuilt through political and administrative decisions as well as through the actions of individuals and private businesses. This activity leaves traces that constitute an archive of the city, both of its physical form but also of the processes, negotiations, and controversies that produced it. One such example is the Planning and Building Permit Archive of the Agency for Planning and Building Services in Oslo where records are kept of the decisions and processes that lie behind all physical amendments to the city. This ranges from the smallest renovation of private apartments to large urban development plans, which may have direct consequences for individuals as well as local communities. The archive is made openly accessible as a result of national policies of transparency in public governance; however, in its current presentation the archive cannot play any part in informing the public on urban development beyond providing access to individual cases.[1]

In urban planning, public participation has been part of an evolving continuous discourse since the 1950s. In the research, we report here—part of a larger project into social media and the city called YOUrban—we probe the still under-explored relationship between issues of participation in planning and existing and emerging—locative, mobile, interactive, social, and pervasive—digital media. These are tools and processes that open up to forms of engagement and

Correspondence Address: Peter Hemmersam, Oslo School of Architecture and Design, Pb 6768 St. Olavs plass 0130 Oslo, Norway. Email: peter.hemmersam@aho.no

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participation that differ from the prevailing notions of institutionalized participatory processes and methods-based urban planning. In particular, we find that there is little literature on the interaction between the use and application of digital visualization techniques and the impact on public participation *with* urban planning.

In contrast, from outside urban planning research there is a burgeoning body of interdisciplinary research concerning locative media and participation. In Web 2.0 (O'Reilly, 2005), or types of social software, we encounter networking sites and applications that are designed to work in social, collective, and participatory ways. This trend has become even more significant with the advent of smartphones and corresponding new forms of locative and place sensitive software. All such developments make for richer forms of user participation, dynamic content production, processing of metadata and the like (Gartner, 2009). As such, one can talk about the development of a "new age of participatory culture" (Verhoeff, 2012: 42), or what the media scholar Henry Jenkins (2006) has coined "convergence culture."

This article incorporates elements of a study of a particular set of visualization designs, but otherwise takes the form of a design-heuristic enquiry. The main research questions we address are: What types of urban data and combinations of them can be visualized? How can visualization techniques be employed as a means of generating public agency? and What types of knowledge and insights of planning processes might these visualizations lead to? Further, we ask: How can the visualization of urban data contribute to the de-institutionalization of public participation in urban planning?

The study was carried out in the context of widened concepts of the networked city. This is a city that is infused with distributed contextual and mediated knowledge and urban data through which characteristics of the city are increasingly realized (e.g., Shepard, 2011; Morrison et al., 2013). To begin, we briefly locate our enquiry into urban data visualization in relation to the wider field of "Urban Informatics"—the use of information and communications technologies (ICT) and visualization in urban planning—and the emergence of Open Data and its relationship to visualization and public participation in planning. We then move on to describe and critically unpack the *SeePlan*[2] series of experiments. Finally, after discussing outcomes, we draw a number of conclusions with regards to the potential of urban data to inform public discourse and facilitate alternative opportunities for public participation with processes of decision-making in urban planning.

Computing the Networked City

This article looks at the relationship between urban data and the city. In the networked city and in a context of digital technologies, the boundaries between urban data and the physical city are in many ways blurred. Mobile technology emerges as a new "lens" through which to read urban space and becomes implicated in the production of urban experience (Dourish and Bell, 2011). Virtual data become important alongside physical buildings in reading the city (Ratti and Berry, 2007; Salim, 2012), and play a key role in the socio-technical co-creation of place (Forlano, 2013). Thus, from this view, urban environments are not composed of smooth layers of social, digital, and spatial information but are

rather constituted of interdependent interactions and relations between people, technologies, and places. Various kinds of data relevant to the perception and planning of the city are produced by governments and businesses, but also increasingly produced through real-time sensing, crowd sourcing, and social networks—as "by-product[s] of everyday transactions" (Savage et al., 2010: 13).

"Urban Informatics" is a term that describes the design and research field of mediating (real-time) urban data (Graham, 2004; Foth, 2009), drawing on classic informatics, but also social sciences, urbanism, architecture, and design. According to Anthony Townsend (2009: xxiii), urban informatics pertains to the "collection, classification, storage, retrieval, and dissemination of recorded knowledge of, relating to, characteristic of, or constituting the city," as well as to "the collection, classification, storage, retrieval, and dissemination of recorded knowledge *in* a city." Digital technologies have become important tools that enable citizens to reformulate urban space (Unsworth et al., 2014). Empowerment of city residents through the collection and dissemination of data through digital tools is a key theme in urban informatics, and notions of, for instance, "participatory urbanism" discuss ways in which ubiquitous technologies can facilitate "citizen action by allowing open measuring, sharing, and remixing of elements of urban living marked by, requiring, or involving participation, especially affording the opportunity for individual citizen participation, sharing, and voice" (Paulos et al., 2009: 420).

From an informatics perspective, planning and associated public deliberation has been an arena for applying ICT tools including methods for data visualization. In this lies the potential for developing a "*neo-planning paradigm* in which urban planning is carried out through active civic engagement aided by Web 2.0 and new media" (Foth et al., 2009: 97). It is presumed that strategies of combining data sources in new ways, via real-time collection of urban data and new forms of interactivity, can make for alternative views and understandings of the city (Moere and Hill, 2012). Ubiquitous computing promises that data handling, sorting, and displaying will no longer be restricted to technical spaces, but disappear into the "fabric of everyday life" (Weiser, 1991) and thus release the pressure of potential information overload by making interaction with data more available to ordinary people. Urban computing takes this one step further and suggests a composite gathering, sharing, and dissemination of real-time data in socially relevant urban contexts in terms of "the urbanization of the Internet, and the digitization of the city" (Robinson et al., 2012), enabled by ubiquitous systems of communication and computation (Greenfield and Shepard, 2007). This would result in the instrumentation of "the human experience of public space with digital information" (Moere and Hill, 2012).

Urban informatics is not without its critics who argue that "the urban" is often somewhat superficially translated to "uncritically favor users who are mobile, young, affluent, cosmopolitan, and technologically savvy" (Williams et al., 2009: 4), that technological determinism should be avoided (Pitkin, 2001, 2006), and that ICT tools to function as "sources of social power" (Gurstein, 2007:) should enable community interaction beyond enabling "shopping, meeting up, advertising, casual social interaction, and so on" (Gurstein, 2010). It is this perceived gap between participation, empowerment, and the urban in urban informatics and urban planning that this article investigates by focusing on the potential role of data visualizations in this process.

Our own approach to this is to conceive of urban informatics, urban data, and the networked city in terms of cultural mapping (Hemmersam et al., 2014). By cultural mapping we refer to creative and experimental practices that make extensive use of the digital networked city's affordances (such as mixed media annotation, social sharing, local awareness, etc.). Our ambition is to deploy such affordances in ways that make mapping practices distinctly more cultural when it comes to approaches, methods, contents, and interpretation. This again reflects an understanding (within so-called, second-wave cultural studies) that culture is increasingly becoming an ingrained feature of everyday life and communication (Lash, 2010: 153).

ICT in Urban Planning

Today, Geographic Information Systems (GIS) are the primary digital technologies applied in urban planning. Even though GIS data and maps have been made public in many cities and have been used in interesting ways in experiments with public participation through the use of the Internet, so-called *public participation GIS* (PPGIS) remains an expert system and thus bounded within the institution of urban planning and within the confines of employed expertise. Examples of such systems include "Argumentation Maps" (Rinner, 2001), which attempt to facilitate map-based public deliberation on urban planning.

Visualizing the future spatial outcome of planning is commonly employed to enhance public participation, and several experiments in real-time visualization and map-based deliberations have been carried out, for instance The Luminous Table (MIT) (Ben-Joseph et al., 2001), The MR Tent (Wagner et al., 2009), and The Harbor Game[3] (Delman et al., 2003). All these projects use mixed reality technologies ("game tables" and big screens) and most often employ game-like features as means of visually simulating the outcomes of planning decisions. All of which have proven to be technically demanding and expert led.

In more recent times, experiments in participatory methods have focused on new developments in mobile technology such as Augmented Reality applications for personal handheld devices (Foth et al., 2009) that seem to promise a lower use threshold and hold the potential to unleash greater opportunity for public agency. Or, massive multi-player online role-playing games have been investigated as arenas for e-participation and e-democracy (Foth, 2009) that allow for more specific virtual worlds, such as Second Life, that simulate urban developments and allow users to engage in dialogue and non-verbal deliberation (Gordon and Koo, 2008; Foth et al., 2009; Gordon and Manosevitch, 2011).

While these ICT tools are widely in use in urban planning and as experimentation with different forms of simulation and visualization have resulted in important lessons on their use, the number of digital techniques and systems for public participation that empower citizens outside of institutionalized contexts or arenas of high expertise is currently very limited.

Open Data

Urban computing, as well as urban planning, relies on data from different sources. Such data may be generated in real time by sensors; crowd sourced from individuals or organizations; or obtained from government databases such as those of urban planning authorities. Government data have become more available not

only because that data can be easily disseminated over the Internet, but because of the prevailing ideologies of openness in government and public administration.

"Open Government" is traditionally associated with the idea of accountability. With the advent of the Internet and the possibility of sharing large amounts of data, the meaning has to some extent shifted towards the idea of making information available to government bodies, or when produced by government bodies, available to businesses and the public on the Internet as machine readable "open data." In many instances journalists, activists, and interest groups have made extensive use of such open data sources in planning.

The notion of Open Data is linked to discussions of Open Source, Open Access, and Creative Commons that derive from the information-sharing potential of the Internet. The adaptation of open data policies began in the mid-1990s[4] and the first open databases[5] made information available in bulk, providing access only through designed interfaces—"pinholes."

However, making data available may in itself not always result in greater openness. In fact, achieving increased accountability through open data is often confused with the technology of open data; there is no guarantee that open data itself leads to increased transparency of government (Yu and Robinson, 2012). Open government can be achieved without open data and open data can exist in contexts of low accountability.

Over the last decade, local and national governments in many countries have adopted open data legislation covering wide areas of government, as reflected in the EU directive on the Re-use of Public Sector Information (2003). Policies for the dissemination of open public-sector information are reflected in services such as the *US Data.gov* and the *British Data.gov.uk*, both launched in 2009 in order to facilitate access to data.[6] These efforts mirror a development where governments have followed individuals and organizations[7] that were quick to "scrape" or extract data from government databases, in order to make it available in a raw format to be queried in any number of ways through Application Programming Interfaces (APIs) (Yu and Robinson, 2012). The relative public availability of urban data seems to promise an increased possibility for the public to both read and understand their cities, but that availability also promises to affect the projections and policies that guide the future development of those cities.

Participation and Planning

Simply releasing data in the name of openness may be what Sherry Arnstein would have called "tokenism." While early efforts to involve citizens in government decision making largely took the form of information surveys and consultations (essentially "non-participation") (Arnstein, 1969), participation and empowerment surfaced with the anti-authoritarian cultural streak of the 1960s and 1970s (Arnstein, 1969; Gordon and Manosevitch, 2011). In the 1980s and 1990s, theories of participatory planning based on notions of communicative planning became foregrounded (Forester, 1989; Healey, 1996), and in current planning regimes, public consultations are carried out routinely, while other forms of community-based involvement is continually being tested (Shipley and Utz, 2012).

Innes and Booher argue that the importance of participation in planning lies in discovering peoples' preferences, in the incorporation of local knowledge in planning, in the advancement of fairness and justice, but importantly also in the

legitimizing of government decisions and in the fulfilling of legal requirements (Innes, 1995; Booher and Innes, 2002). The potential outcomes of participation include higher quality decisions, lower costs, fewer delays, increased consensus and agreement, easier implementation, and enhanced credibility and legitimacy. It is also seen as a means of avoiding "worst case confrontations," a way to anticipate and respond to public concerns, and finally a way of building social capital and a strong sense of civil society (Creighton, 2005).

There has been broad consensus that participation is a good (Arnstein, 1969), but there has also been general skepticism in the planning literature to the way participation has been practiced (Innes and Booher, 2004), and a fear that current participative methods, tools, and processes may be counterproductive as they raise false expectations among citizens (Forester, 1989) or cause fatigue due to continued demands for involvement (Shipley and Utz, 2012).

The application of net-based ICT tools, social media, and crowd sourcing are potential avenues of expanding public participation in planning into popular social discourse where the use of digital tools seem to promise a more immediate relationship between the individual or local communities with wider questions of urban planning. This widening of participatory contexts and discourse is illustrated through emerging terminology such as "participatory urbanism" (Paulos et al., 2009), which deals with participation with urbanization issues, without the boundary of traditional participatory methods within institutionalized planning contexts.

Visualization and Participation

Informing citizens to enable them to make empowered decisions is a requirement for democratic planning practice (Forester, 1989, 1999). Releasing data, however, is not in itself sufficient. The data have to be useable and easily accessible to various social groups and organizations (Barndt, 1998). Visualizing the data is a way of making public information accessible. The use of different kinds of computer-based visualization techniques in various social settings is one way to go about enabling citizen participation (Gordon and Manosevitch, 2011).

Traditionally, visualization in urban planning and urban design takes the form of images of existing and possible future physical structures and spaces. As the planning paradigms of the twentieth century shifted from an emphasis on esthetic and representational aspects of built environments to a modernist approach, close relations between urban mapping and surveying arose, and the design and formation of the city became important and common (Aspen, 2010). This was related to the development of social statistics and foundational work in information and data visualization such as Otto Neurath's System of Typographic Picture Education (ISOTYPE) (Vossoughian, 2008). Since then, data visualization has developed with the advent of computers, real-time data, and various sorts of open data. However, until now, this development has only had limited effect on existing regimes of information visualization in urban planning.

Today's tools for data dissemination, analysis, and visualization have been democratized and have become available to a much wider range of people than just professionals involved in planning (Moere and Hill, 2012).[8] At the same time, computer and net technologies provide access to previously unimaginable amounts of data. This has also led to data or information visualization design research, such as that of the *InfoVis* series of conferences[9] that is concerned with

data sets, contexts, and technologies of externalizing "big data" (e.g., Segaran and Hemmerbacher, 2009; Schraefel, 2010; Yau, 2013) and massive archives (e.g., Shadbolt et al., 2012; Mayer-Schönberger & Cukier, 2013). This work also extends to the domain of visual analytics (e.g., González-Torres et al., 2013). This body of diverse attention to the visual and to data is in contrast to approaches that are occupied with mediation and communicability of visual representations and creative visualization or so-called "information aesthetics" (Manovich, 2001; Lau and Moere, 2007; cf. Steele and Ilinsky, 2010). Similarly, we see growth in the popularization in the media of "info graphics" and research that acknowledges that archives and their visualizations are dynamic performative entities (Bacon, 2013). In short they are discursive and mediational as much as technical constructs (Morrison, 2010). Laura Kurgan (2013: 35) even argues that the term "data visualization" is redundant as all data are already structured by intent and agency, and since there is no presentation without representation, data are in a sense "already visualizations."

Situated visualization of urban data and active displays on screens and billboards in urban space allow inhabitants to acquire meaningful "insights beyond the retrieval of facts (e.g., events, routes, time schedules)" (Moere and Hill, 2012: 41). Such forms of visualization may become part of direct feedback loops between citizens and city administrators, in which for instance, user- or sensor-generated data are displayed or combined with other types of data sources, creating new dynamics between observers and the actual displays.

These and other strategies for the visualization of urban data may be seen as critical studies into the potential for ICT and Internet-based tools to engage creatively with the city and urban data through new platforms for dialogue, visualizations of future spaces, and accessibility of information.

SeePlan

Inspired by the *SeePlan* series of experiments, conducted by the interaction design developer and digital media scholar Even Westvang (http://vis.bengler.no/projects/seeplan), we have looked into how the planning and building permit archive of Oslo could be reprocessed via visualization for the purposes of dissemination of planning issues and suggested ways in which data visualization may overlay or extend the efforts of participation in planning.

The archive was chosen because of its relevance to urban planning and because it represents a sufficiently dense set of geo-referenced data. It not only reflects recent historic developments but also the future city in the making (in the form of planning and building applications and related case work), making it attractive as an object of study for urban researchers and immediately relevant to the urban public.

The archive was accessed through a searchable web site and the data were "scraped" by systematically querying case numbers, a process that took several weeks. Correspondence numbering 1,898,193 items were identified and covered a period of ten years. These data related to roughly 100,000 individual planning or building permit cases. A major challenge was to identify the individual actors represented: case officers, citizens, architectural offices, entrepreneurs, etc. because misspellings were widespread.

Once the data were scraped and streamlined, the task was to ask how visualizing the data would open insights into the planning discourse. The

SeePlan experiment has three subsequent components that engage in three distinct modes of remediating the data from the archive. These are modes that enable a range of relations to data—from the very intuitive (*PlanAR*) to the structural (*Planimator*) to the analytical (*DynaPlan*). The three representations are not experiments in visualization techniques or esthetics per se, but rather experiments in how data can be re-mediated to reveal hidden "truths."

In this sense, they relate in different ways to the complexity of the archive by centering on different mediations and configurations of the data. In our communicative and informational view on cultural mapping, this is a matter of making data visible via a variety of semiotic and esthetic techniques (Morrison, 2010). The affordances of the archive data are reflected in the choice of visualizations: location being one. These choices are not merely stylings of representations; they carry communicative meaning in their visually and digitally meditated spatializations of the data to offer variation and to present potential ways of approaching such designs. The selected visualization modes we present below also make it possible to conceive of an "engaged" agency of the archive in public participation with planning process in a number of ways:

(1) *PlanAR*—maps the archive *back* into the city using AR technology. It provides a non-expert system with immediate access to "relevant" urban data on planning and building cases in Oslo.
(2) *Planimator*—looks *into* the archive by showing all of the cases in day-by-day temporal snapshots illustrating the scale and velocity of transformation usually made invisible by the relative scales of real-world human temporal attention. It visualizes the "big" and "small" case sizes of the archive and reveals both the mega-trends and smaller, typically invisible, transformations inherent in city development.
(3) *DynaPlan—reveals* structural forces of urban development. Through techniques of "spatialized" visual analysis, it promises to enable "public oversight" of the interactions between institutional and private actors in urban development.

PlanAR—Locating Data in Space

PlanAR is a developed layer in the augmented reality smartphone browser Layar. The cases identified in the database are geo-referenced[10], and spatially located visual indicators provide links to the particular cases in the database.

The *PlanAR* application enables data from the database to be reassembled and mobilized through "locative filtering." Relevant data are mediated and made available for users on the move and on-site. Through augmentation technologies, administrative planning processes are visually mapped on the physical city as one moves through it. Thus, encountering a construction site in the city one can access relevant information via *PlanAR*, including documentation of future plans and links to all of the official case documentation. This demonstrates a shift from the existing data format, the "pinhole" public access, to a more open user interface with a much higher degree of immediate relevance. In this way, AR visualization removes planning data from its institutional context, enabling local residents an opportunity to *in-situ* identify and respond to ongoing or proposed change in a community or neighborhood. (See Figure 1.)

PlanAR actively facilitates access to building and planning data (such as building applications) and also to administrative and political decisions. By

Figure 1: PlanAR—Mapping the archive on the city through augmented reality. Case title and a sampled case file illustration emerges when a marker is centred, providing a direct link to the case file. The size of the markers reflects distance.

easing access to administrative workings via locative technology, the app potentially enables a degree of public oversight and points to the fact that transparency via "open data" is not just about releasing data but about facilitating targeted readings for critical inquiries. In this sense, *PlanAR* is an experiment towards governmental transparency based on enabling immediate relevance between the individual and local neighborhood not possible without wide use of GPS-enabled smart phones.

Layar, the augmented reality application for personal hand-held devices, belongs to the low-threshold technology that potentially unleashes greater opportunity for public agency (Foth et al., 2009). Our experiments in the use of *PlanAR* points to an immediate physical and sensorial relationship to the city through the AR tool. This de-institutionalization of planning information mediated via AR technology locates *PlanAR* within the "participatory urbanism" framework, which "promotes new styles and methods for individual citizens to become proactive in their involvement with their city, neighborhood, and urban self-reflexivity" (Paulos et al., 2009: 420).

Although we argue *PlanAR* to be a successful prototype instrumentation of "the human experience of public space with digital information" (Moere and Hill, 2012: 29) and "the collection, classification, storage, retrieval, and dissemination of recorded knowledge *in* a city" (Townsend, 2009: xxiii), the shortcomings of the current AR technology includes glitchy, slow, and not entirely accurate performance. These issues could potentially be overcome with better design, including more inclusion of "query" and "communicative" functionality, which in its current state can only be made in an intuitive and limited way. While these glitches may be seen to distract from the overall participative outcomes as the technological downsides can override the user's experience of interacting with

the planning issue itself, the idea that they should be smoothed out also reveals an underlying technological determinism that tends to accompany the application of ICT tools in social processes, including participation.

Planimator—Tracking Development History and Organizational Life

This experiment visualizes the totality of the archive over time.[11] A time-lapse sequence shows urban development, day by day, over the 10-year period covered by archive data. The visualization dynamically renders individual cases three-dimensionally on top of a city map. A sphere represents each building case, the spheres are sized according to the amount of case correspondence data embedded in the archive and are colored by case type. The amount of case processing time is animated via the dynamic, vertical movement of the spheres. The totality of emerging and disappearing cases represents the continuous and entire transformation of the city: the big, the small, the fast, and the slow; the city as seen from a structural perspective (See Figure 2).

Planimator demonstrates how the archive could reveal the entirety of the data while preserving an experience of the spatial and the temporal. We have become accustomed to recognizing transformation in real time through seeing physical, often vertical, densification. *Planimator* plays on this real-life visual cue by animating the spheres, representing the passing of case processing time, through vertical, spatial movement—regardless if the actual case is visible in the real world or not. Thus, through visualizing case processing times, *Planimator* highlights the past through to the present transformation of the city, revealing dynamic patterns of

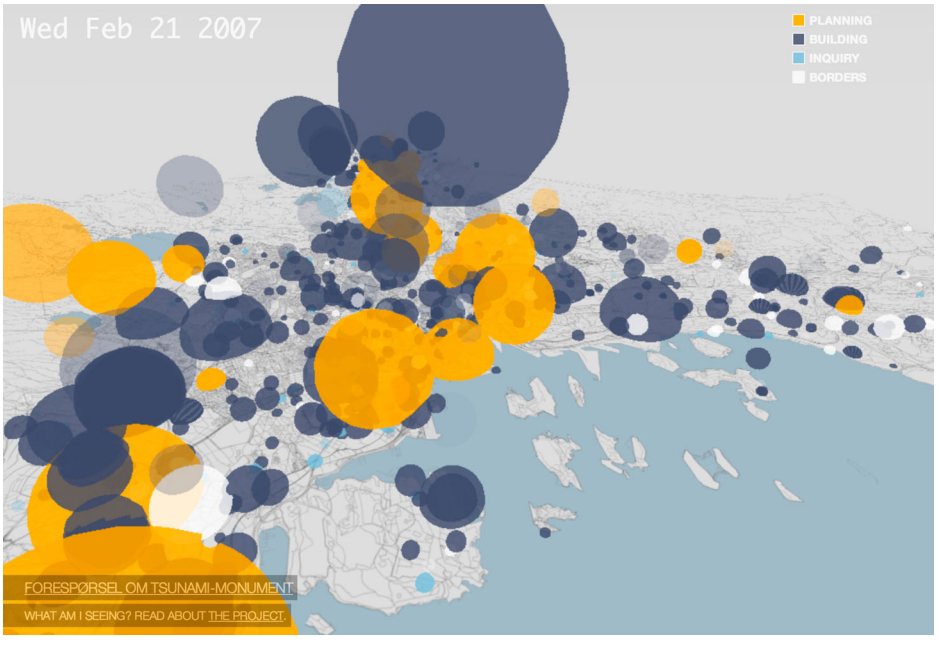

Figure 2: Planimator—Tracking urban planning over time. Bubble sizes reflect the amount of case corespondance and vertical movement reflects time. Planning cases (yellow) are fewer than building permit cases (blue). Also visible are land severances and mergers (light blue) and boundry adjustments (white). When clicking on a bubble, the case title emerges with a direct link to the archive case file. The animation loops the ten-year span of the archive.

areas of intense development versus corridors of small changes. This rendering of the invisible and visible construction of the city through animation of data and through the thickening and spatialization of time enables one to see the entirety of city development in a manner usually inaccessible at the human temporal scale; it reveals a hitherto unseen totality of urban development.

Although *Planimator* is engaging through its playful presentation of the archive data, in this primitive stage improvements could be made to the generic visualization mode. For example, development of more sophisticated modes of user navigation, including variable speed, would no doubt improve the communicative and analytical potential of *Planimator* and enhance the power of the visualization in terms of the agency of the public to create their own mappings. This could potentially relate to what Manovich (2002: 3) describes as the

> new politics of mapping of computer culture. Who has the power to decide what kind of mapping to use; what dimensions are selected; what kind of interface is provided for the user – these new questions about data mapping are now as important as more traditional questions about the politics of media representation . . .

The employed generic visualization technique also reveals bias. Since the size of the spheres are based upon the amount of correspondence associated with the case, once construction has commenced and the role of the planning authority diminishes, the spheres naturally decrease in size. Although communicatively this can be considered biased, a "mistruth," we argue that this is the nature of using intangible means to "see" the tangible environment; that this "qualculation" of *Planimator*, where "the use of numbers is inevitably partial, performative, distributed, and often integrated into other activities rather than understood as a discrete activity carried out for itself" (Thrift, 2004: 14), actually lifts the duality of the built environment; that it is always a product of bias—of tension between the material and non-material processes (See Figure 3).

DynaPlan—Participants and Networks

In this sub-project, participants and actors in two urban development areas in Oslo—individuals, developers, consultants, interest groups, and public agencies—and their involvement over time were mapped. Through visualizing the accumulative correspondence between the planning authority and the various actors involved in Tjuvholmen and Bjørvika, *DynaPlan* unveils the vastly different organizational structures, often discussed as power structures, of the planning processes in question—one being largely spearheaded by a singular developer, while the organizational structure of the other is relatively flat.

DynaPlan shows that the city *is* a complex relational mixture of contestations and agreements between various commercial, political, public, and administrative actors in planning, shedding light on the conflicts and negotiations that precede physical form to a level of detail not before seen. In this sense, *DynaPlan* is a reworking of the classical participative planning paradigm (Shipley and Utz, 2012) that discusses a supposed actor-relational hierarchy that is often hidden from the public. While *DynaPlan*'s visualizations do not in themselves directly engage publics in decision-making, displaying the processes that lie behind or are involved in physical amendments to the city—whether completed, ongoing,

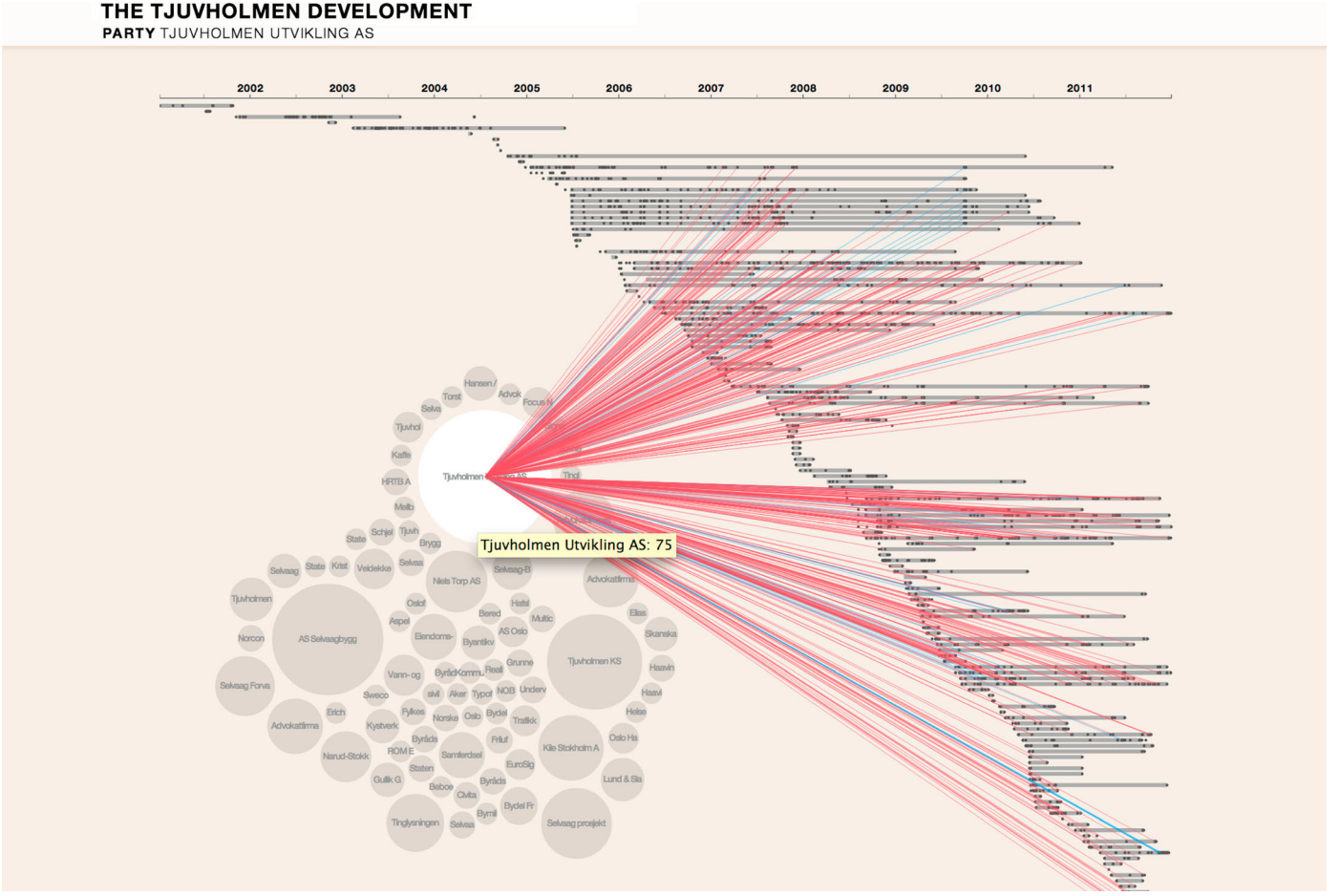

Figure 3: DynaPlan—Participants in the Tjuvholmen urban development are mapped, and the size of bubbles reveal the total amount of corespondance for each actor. Clicking an actor reveals their involvement over time by highlighting correspondence in relation to all cases (planning cases, building permit applications, etc.) on the right. The private development corporations (Tjuvholmen Utvikling AS and KS Tjuvholmen) and the main owner of these (AS Selvaagbygg) are dominant actors.

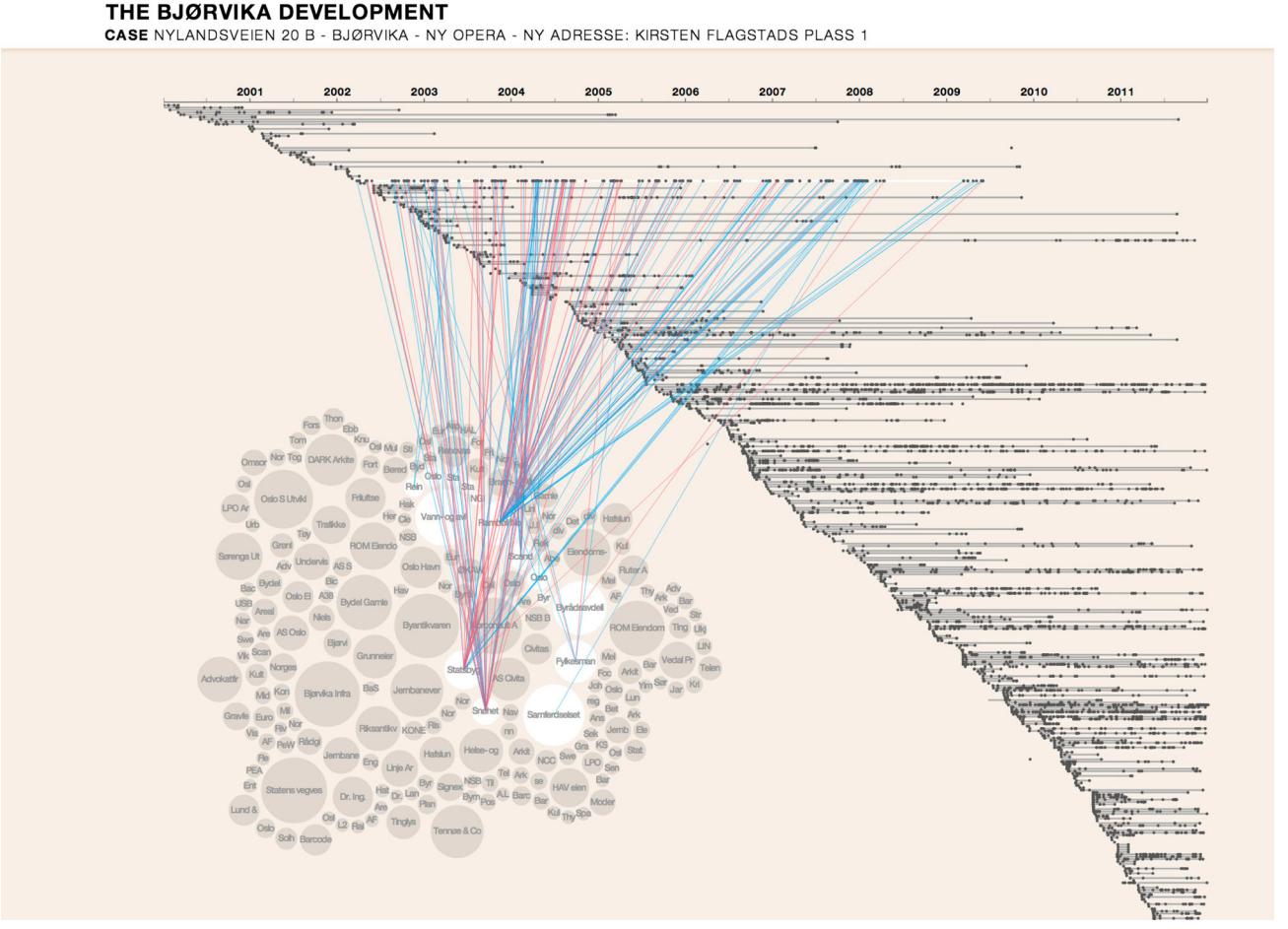

Figure 4: DynaPlan—In contrast to the Tjuvholmen case, the actor map for the Bjørvika urban development area is much more of a composite, revealing a different development logic. Holding the mouse over an individual case on the timeline highlights all involved actors and their correspondence over time.

or planned—can provide insights into how planning unfolds through negotiations of interests

The critical outcomes of *DynaPlan* can be outlined in two ways. First, its potential to provide an accessible overview of complex, contrasting, and often unknown, relationships of actors over time, thereby contributing to increasing the transparency of planning processes, prompting participation not as decision-making but as an aspect of critical public oversight. And second, one can also see how certain government agencies and quasi-autonomous, non-governmental organizations, whose role in planning may not be immediately obvious to the public, are in fact actively involved in planning processes. While not all influence on building permit processes and urban planning and development is immediately traceable in the archive, such an approach would assist the identification of special interest groups that may also operate through other channels (such as public debates, social and news media). Special interest or advocacy groups are, in practice, important players in public participation in urban planning, and while their actual influence may not always be obvious, *DynaPlan* demonstrates an approach that could potentially track their involvement over time and in larger urban development areas.

The preliminary visualizations of the Tjuvholmen and Bjørvika developments (See Figures 3 and 4) offer a model for ways in which researchers[12] and the public might see planning processes in a given urban district—or the actions of particular groups or individuals over the entire city—and over time. An interactive interface for automating queries into time-space-actor organizational hierarchies would have the potential to entice the public's curiosity in planning processes in the sense that it would invite the public to produce its own maps in a low-expertise and de-institutionalized context. In these maps, networks of actors and their relative influence or power in urban planning could potentially be exposed by anyone outside the traditional planning institutions—including the extent to which big developers, construction companies, and particular consultancies dominate the construction and development of certain areas of a city.

SeePlan, then, can be said to be a step towards the development of urban representations that make evident the social processes behind physical form. Such an approach would be valuable in urban research and could contribute to the development of ways "to automate the mapping" (Yaneva 2012: 100) of procedures and processes in planning.

Conclusions

In the context of the networked city, the digital re-mediation of urban data raises highly contingent issues of democracy, played out as engagement and potential for involvement in urban planning processes, performed under the participatory paradigm. Through experiments, we have asked what aspects of urban data sets might be relevant to this purpose, how visualization techniques can be applied, and what outcomes can be identified (either realized or potential). In our experiments, *SeePlan* has demonstrated the potential agency of the database—and of data visualization for engaging public participation with planning discourse.

Regarding data characteristics, the potential for geo-locating, the identification of actors, and the temporal aspect of the data have been important

attributes of the archive. The importance of geo-locating data relates to the potential of making it immediately relevant to the individual or local community ("proximity filtering") and to the possibility of associating individual cases to larger urban development areas or neighborhoods. The temporal aspect—enabling time-span visualizations—not just case by case, but over larger urban development areas or even at the scale of the city as a whole, renders urban development with a certain history or "depth," revealing trends spanning beyond individual temporal perception and exposing aspects of the complex negotiations and rationales behind the physical city as we see it and sometimes do not see it.

The visualization techniques stem from a variety of sources. They were critically employed to play out these data characteristics, demonstrating ways in which visualization introduces urban data into public discourse, thereby sidestepping traditional modes of public participation in planning that are largely confined to institutionalized methods and processes. In this sense, *SeePlan* can be considered to extend the perimeter for a theory of participation that goes beyond the simple categorization of how the public can participate in planning processes as either institutionally governed "participatory decision making" or simple "public consultation of planning decisions." The experiments also demonstrated a potential shift in "voice" in which analysis and perspectives developed outside the planning institution. The experiments also revealed bias as a fundamental characteristic in any urban representation, and as such, the underlying duality of the city as both tangible and intangible.

The *SeePlan* series demonstrates how urban data can be visualized in a variety of ways and with a set of potential outcomes. Beyond the issue of participation, we would claim that the overall effect has been that the visualization of urban data made us "see" afresh both the underlying data archive and the contexts in which it can be put into use. Importantly, the "mapping" undertaken relates not only to one sphere, but spans from "information space (grasping patterns within vast quantities of data) to physical space (navigating the city, region, or globe) to social space (representing power relations within and between organizations, whether corporate, cultural, political or covert)" (Abrams and Hall, 2006: 12). The information space mapped refers to the strategies of unpacking the archive itself, through for instance strategies of geo-locating and mapping the data back onto the city or the re-assembling of data into formats for visualizing actor and network relations. The physical spaces mapped relate to all the ways in which the archive data are set to reveal conditions and relationships that affect and play themselves out in urban space. The social spaces include all the kinds of interrelations between actors involved that can be made and visualized—and thus represented—based on the basic data units of the archive.

New kinds of data and material for urban research emerged from these experiments in visualization. Savage et al. (2010: 11) talk about a striking "re-emergence of visualization as key to social analysis." Our design explorations support such a claim through the concrete making of an array of new kinds of visualizations that portray previously unseen social patterns and relations, and of specific mapping tools that create new kinds of uses. *SeePlan* illustrates that the use of digital technologies and strategies of design and visualization contained within them, have the "capacity to mobilize and materialize social and other relations" (Savage et al., 2010: 2). By demonstrating the potential of working with urban data and with regards to participation in urban planning, the highly social nature of data handling, digital technologies, and methods are highlighted. A logical next step

would be to attempt to unleash the social power of urban data by linking it to—and critically supplementing—the emerging realization that digital social media could potentially completely revolutionize the way participation in planning takes place (Evans-Cowley and Hollander 2010; Shipley and Utz 2012).

SeePlan has demonstrated that public participation in planning can be shifted from relying on pre-packaged information to facilitation of informed urban deliberation that is based on a much wider set of "voices" emerging from engagement with accessible urban data. In today's situation, where authority and power are increasingly fragmented as "information flows through networks" (Innes and Booher, 2004: 429), we claim that the procedures and practices of urban planning should be reconsidered. Planning will have to learn to respond to the constituencies of the networked city and its new and continuously evolving information, communication, and media technologies. Whether "real-time planning" should be considered a goal or not, this new situation makes for "a more dynamic and adaptive planning practice" (Ratti and Berry 2007: 143). Systems of urban computing could potentially compensate for the lack of social relevance in many contemporary participation processes. If such ambitious goals were to be achieved, though, one ought to look more closely into how urban data can be made both more available and relevant. Our perspective is that much of what is available as open public data requires further processing, mediation, and contextualization in order to gain importance and become more accessible for larger groups of the population. This again can be said to create conditions for more dynamic and informed urban deliberation in, for instance, urban politics, governance, and planning.

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Notes on Contributors

Peter Hemmersam is an associate professor at the Institute of Urbanism and Landscape at the Oslo School of Architecture and Design. He does research within urbanism and urban design and is associated with the YOUrban Project.

Nicole Martin is an architect and PhD fellow at the Institute of Urbanism and Landscape at the Oslo School of Architecture and Design and associated with the YOUrban Project.

Even Westvang is a scholar and media designer at Benglar (www.bengler.no) and associated with the YOUrban project.

Jonny Aspen is an associate professor at the Institute of Urbanism and Landscape at the Oslo School of Architecture and Design. His main research field is urban theory.

Andrew Morrison is a professor and head of the Centre for Design Research at the Oslo School of Architecture and Design. He also leads the YOUrban project.

Notes

1. At the time of writing, public access to the data was limited to "pinhole" targeted queries. Several meetings were held between the agency and the research and design team during the development of *SeePlan*. Feedback unveiled that the agency found unexpected ways of interfacing the archive material with the public sphere, and map-based access to the database has since been added to the public web page.
2. The *SeePlan* series can be found here: http://bengler.no/seeplan.
3. Havnespillet.
4. The 1994 California Public Records Act released legislative information online. California Public Records Act, Laws of California (1994).
5. Such as *Thomas* containing legislative information from the US Library of Congress (http://thomas.loc.gov/home/thomas.php).
6. In Norway, government bodies are required to make information available to businesses and the public (Lov 19. mai 2006 nr 16 om rett til innsyn i dokument i offentleg verksemd, 2006), including the data in the Oslo Planning and Building Archive.
7. E.g., OpenSecrets.org from 1998 and GovTrack.us from 2004.
8. E.g., IBM's Many Eyes (http://manyeyes.alphaworks.ibm.com/) and Google Fusion Tables (http://www.google.com/drive/start/apps.html#fusiontables).
9. See http://ieeevis.org/.
10. Most cases have unique lot numbers, many of which were geo-referenced using an automated reference to the public interface of the Norwegian Mapping and Cadaster Authority.
11. Inspired by the Chromaroma travel visualization game: http://www.chromaroma.com/
12. In his PhD work on the Tjuvholmen harbor front development area in Oslo, Halvor Weider Ellefsen, at The Institute of Urbanism and Landscape, Oslo School of Architecture and Design, has used *DynaPlan* as a tool for sketching out timelines of the various actors' involvement in the development process.

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