Opening Urban Mirror Worlds: Possibilities for Participation in Digital Urban Dataspaces

Oliver Dawkins

The Bartlett Centre for Advanced Spatial Analysis, UCL

oliver.dawkins.13@ucl.ac.uk

Developments in dynamic urban mapping over the past 20 years have closely followed the emergence of the 'real-time city', a concept enabled in practice through successive innovations in mobile telephony, ubiquitous computing, location based services, and urban sensing via the Internet of Things (Graham, 1997; Townsend, 2000; Calbrese & Ratti, 2006; Kloeckl et al, 2012; Kitchin, 2014). More recently a new form of 'three-dimensional urbanism' has been posited which, while implicated with the increased privatisation and 'interiorisation' of urban space (Picon, 2015), also recognises growing concern and contestation over the 'vertical' dimension of cities (Graham, 2016). The combined demand these trends generate for the creation of dynamic, three-dimensional, data-driven maps has motivated a renewed interest in 'Mirror Worlds': computer generated models in which 'the *whole city* shows up on your screen, in a single dense, live, pulsing, swarming, moving, changing picture' (Gelernter, 1991 p. 30). While affording users the ability to 'dive deeper' their value comes from the provision of 'topsight', the ability to see the 'big picture' or 'image of the whole' (ibid.).

In his critical appraisal of the smart city Townsend (2013) compares Gelernter's Mirror Worlds to the technical and organizational form of the urban control room. Taking IBM's *Centro De Operacoes* in Rio De Janeiro as his example, Townsend provides that while form can succeed in providing an objectified view of what is happening in the city at any given time, it crucially fails through its inability to tell us why. This, he argues, is because it lacks the subjective dimension provided by the situated experience of people on the ground. In 'A Tale of Two Models' Townsend juxtaposes the top-down, data-driven, and objectifying efforts of Rio's city officials with those of the Pereirão favela's *Projeto Morrinho* in which local boys use a self-built model of the favela, constructed from cinder blocks, mud and LEGO, to reenact scenes of their own daily lives. The latter he suggests is crucial to telling us the why. Similarly Shannon Mattern criticises the objectifying 'data-fication' of modern urban interactions (Mattern, 2013), advocating for a more multisensory and subjectively informed 'deep mapping' of the city as a response to more top-down and data-driven forms of urbanism (Mattern, 2015).

In this paper we challenge Townsend's straightforward equivalence between the form of the control room and Gelernter's Mirror Worlds in order to maintain a space for the emergence of new forms of digitally mediated of agency. We do this by considering the wider potentials of emerging technologies that offer creative means of addressing a more varied range of needs, demands and expectations than Townsend's apparent dismissal allows. While particularly sympathetic to Townsend and Gelernter's own concerns over mirror worlds concerning certain aspects of technological dependency, we contest the usefulness of the sharp dichotomy created by Townsend's tale of two models, too readily aligning the physical and analogue with bottom-up autonomy, and the digital with the imposition of top-down control. The dualist position implied by Townsend's rhetorical gesture runs counter to the spirit of much of his own work by dismissing

the possibility that a particular type of digital technology might yet provide access to new ways of seeing the world and new forms of personal and collective agency.

Many existing digital platforms and applications for engaging with three-dimensional environments are specifically built for professional users in the fields of architecture, engineering and urban planning. We contend however that it is increasingly viable for interested individuals and communities to experiment with the creation of their own mirror-world-like environments. The growing availability of free to use tools like Unity and the Unreal Engine for the creation of computer games reduce barriers to participation by combine a powerful suite of tools for content creation with increasingly user friendly interfaces that remove the need for advanced programming skills. Our proposal is that engagement with these tools can activate young people's interest in and desire to create their own digital worlds. In this way such tools provide ideal environments for furthering digital literacy through experimentation. By considering emerging trends in three-dimensional mapping and 3D content creation we hope to suggest the potential value of the space between Townsend's two models. We do this by considering work undertaken at The Bartlett Centre for Advanced Spatial Analysis (CASA) to develop the interactive urban data visualisation platform ViLo (Figure 1).

Figure 1 - ViLo: The Virtual London Platform by CASA

ViLo builds on earlier research at CASA into the creation of a comprehensive three-dimensional model of London's built environment (Batty & Hudson-Smith, 2005). The current model supplements static spatial data about the cities' built environment and infrastructure with dynamic elements representing different kinds of events as they occur in real-time. Buses, tubes and trains can be seen moving across the city while more abstract visualisations show the locations and availability of different services like bikes at local bike-share stations. Sensors transmitting data about environmental factors can also be accessed to show changes in natural phenomena ranging from variations in local microclimate to the patterns in behaviour of particular wildlife species. Public interactions with social media can also be incorporated to provide social context. In this way each dataset contributes to the overall view of the city.

Originally intended as a tool for urban planners, ViLo has capabilities that could recommend it well to support certain forms of deep mapping (Mattern, 2015). In relation to the built environment and urban infrastructure it enables users to view models in context from any angle they choose, and zoom in and out at a range of scales. Images, videos and documents could be uploaded, made searchable, and replayed on a timeline. In this way it can provide views of the recent events or access to the more distant past. Live, real-time events can also be displayed such that buses, tubes and trains can be visualised moving across the landscape. In a similar fashion to Townsend's control room, ViLo achieves this by providing an interface to an underlying 'dataspace' (Thompson, 1993). This dataspace could be a centralised archive but it is often more useful to incorporate a range of heterogeneous datasets collected from different participating individuals, organization and institutions (Franklin et al., 2005). In distinction to the more highly structured, closed and centralised dataspace of a control room, typically characterised by privileged and restricted access arrangements, systems like ViLo can provide more loosely structured mashups of publicly accessible open data that can be stored locally or accessed remotely via an application programming interface (API).
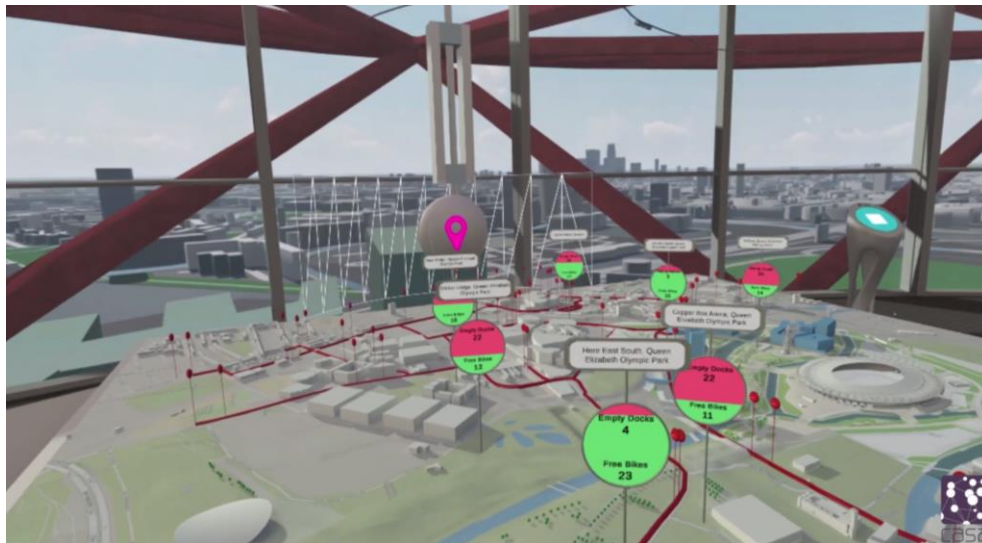

Figure 2 - ViLo: The Virtual London Platform by CASA in VR

ViLo has been built with Unity gaming engine that is free to use for non-commercial projects. This offer a great deal of flexibility by creating opportunities for non-specialists to access the underlying software and data structures if they are so inclined, but also as a means of exploring the novel types of interactions and differing contexts for use that such systems can provide. Integrated with virtual reality (VR) systems like ViLo can offer rich multisensory experiences with a heightened sense of presence that can engage not only the visual, but also the aural and haptic registers of user experience with the aid of appropriate hardware peripherals. New software like Google's Tilt Brush for painting or Blocks for 3D modeling are already demonstrating the medium's great potential for engaging new users and enabling them to create their own 3D digital content. Combined with computer networking such applications could also expose the medium's potential for enabling wider participation by providing the conditions for collaboration at a distance without the need for spatial colocation of participants.

Applications such as ViLo can also be distributed to users to run on their own devices. On a tablet ViLo can be used when out and about to obtain useful information about the surrounding

environment. However, enabling its use with augmented reality on the same device enables new opportunities for the discovery of and interaction with data and other digitally mediated aspects of the city. In particular augmented reality spatially references data in relation to the user's actual position in the city. Spatial relationships that seem abstract on a two-dimensional map become relatable with regard to the scale and orientation of the human body. And digital artefacts like data visualisations can be intuitively incorporated into their user's own spatial and sensory field of reference, their augmented field of view (Figure 3).

Figure 3 - ViLo: The Virtual London Platform by CASA on an iPad with ARKit

Townsend's tale of two cities powerfully highlights the constraints imposed by a very real digital divide experienced by inhabitants of cities across the world. It also demonstrates the enduring value of traditional and analogue means of participation and engagement. However, in creating such a strongly dualistic opposition between the analogue and the digital, and aligning this with the opposition between autonomy and control, Townsend's narrative tends to devalue a wide range of opportunities for engagement and participation that can only be enabled and negotiated digitally.

> 'One has to get away from the idea of agency and structure as a dualism, as two opposing conditions. […] Spatial agency implies that action to engage transformatively with structure is possible, but will only be effective if one is alert to the constraints and opportunities that the structure presents' (Awan et al., 2011 p. 31).

Within the context of smart cities, as our cities reliance on digital infrastructures grows, the exercise of individual agency will increasingly involve an engagement with the digital and data-driven aspects of the city. Whether considered in terms of Gelernter's Mirror Worlds or not, in the near future more open and accessible versions of systems like ViLo may come to provide the principle means for both organisations and individuals alike to exercise their own spatial agency

in processes like urban planning and daily navigation. Far from imposing top-down control, with a little support and instruction such systems could be pieced together from free-to-use and open source software by their users. In this way ViLo and systems like it point the way and contribute to the opening of a space of digital agency and participation between Townsend's two models. Capable of incorporating user generated content and providing rich multisensory experiences, they also provide the ability to view the city at different scales bestowing on their users the benefit of abstraction implied by Gelernter's 'topsight' or the view of the whole.

Acknowledgements

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