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# Shared Ethnography of Shared Cities

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*This paper aims to foreground issues for design ethnographers working in urban contexts within the smart-city discourse. It highlights ethnography's role in a shared urban future by exploring how ethnographers might pave the way for envisioning digital infrastructure at the core of Smart City programs. This paper begins by asking whether urban development practitioners can design for inclusive interaction with Smart Urban Infrastructure. The research suggests how ethnographers can work with 'cities' to rapidly develop diagnostic tools and capture insights that inform design processes with both utility and inclusive interaction as their key values. This involves rethinking how we consider places where space and information intersect. This work led to developing rapid means to assay a site and sensitize to contextual issues by tapping into heuristic expertise innate in city dwellers. This means doing ethnography in parallel with publics as opposed to performing ethnography 'on' them. Hence we discuss a fresh ethnographic perspective that can be especially useful in this context; shared ethnography.*

## MOTIVATIONS & METHODS

Framing the development of Smart Cities in terms of inclusion acts as a potent stimulus to re-think Urban HCI. Through this paper, we identify gaps and harness opportunities to make meaningful interactions and warn against the grave implications of inaction. By beginning to fuse ethnographic practice's rich history of engagement with cities, with burgeoning developments in smart technological infrastructure, the research aims to provoke and inure the urban development, human computer interaction and ethnographic communities to think carefully about *the* Smart City, and then look beyond it.

In this paper, we argue that a crucial maneuver is necessary; by adapting heuristic methods developed to evaluate digital environments to diagnose physical sites. This affords thinking of an urban site as a user interface and prepares the ground for the appropriate application of digital infrastructure that can enhance and include, becoming a sustainable part of the urban fabric. The resultant general method can be used as an adaptable system for evaluating a city along with its *users*, drawing on their innate expertise; lived experience. Rather than attempting to erase the difference between physical and digital user environments, it suggests acknowledging their co-presence and interdependence with respect to enabling the utility of a city for users/inhabitants.

Inspired by Kevin Lynch's seminal approach to urban studies (1960a) and borrowing from Jacob Neilson's (1992) heuristic user evaluation for this purpose, the researchers devised ways of rapidly capturing insights about a place by tapping into the perceptual images of users. Lynch privileged the meanings that inhabitants ascribed to their

environment and his work attempted to make user perceptions a central stimulus for planning spaces, he aimed to capture perceptual images of a city and identify their common patterns. These two perspectives are a surprising fit and form an incredibly productive way of thinking about information layers of a city, its *smartness*. Coincidentally, these principles are sympathetic to third paradigm HCI thinking (Harrison, Tatar, and Sengers 2007).

Rather than suggest guidelines, too inflexible for designers and too general for broad application, this paper suggests first shifting our stance on how we regard cities. It finds that such reframing can reveal novel ways of harnessing innate expertise dormant in inhabitants. This strategy is also effective in engaging those that sit outside the present gamut of users. Seemingly, the savvy core that, ironically, are the creative technical class that design systems will find it inherently difficult to design for inclusion, our research suggests alternative strategies. This indicates an issue of epistemic injustice, where either prejudice de-privileges the credibility of a person's insights or there is a gap in collective interpretive resources that puts someone at an unfair disadvantage when it comes to making sense of their social experiences (Fricker 2007). The research findings suggest that; people's interpretive ability, especially concerning their environment can be very strong. Also, that this gap can be bridged effectively by facilitating capture of situated insights and contends that ethnography should give weight to these collective interpretations, especially when this group is the user.

Design for inclusion is not only responsible, it is a political and in some cases a legal mandate. Inclusion is a fundamental consideration to ensure the resilience and sustainability of Smart City programs, as soon as they are regarded as complex product services systems (PSS). It makes sense to frame the city as a user interface when we recognize it as knot of nested services. Manzini et al discuss the need for a framework to understand the new types of stakeholder relationships and/or partnerships that are producing new convergences of economic interests, and their potential concomitant systemic resource optimization (2003). Designed to understand the situated usability issues of an urban site, to underpin attempts to foster livable and sustainable conditions, as such this study might be regarded as a Design Orienting Scenario (DOS) by Manzini (2007). Space and computation are increasingly interconnected as fungible components of a blended whole. As we face a seismic upheaval in how information and space intersect, considering issues of inclusion is both prescient and pressing.

## The Urban Future

Cities are sites of tremendous innovation, living labs for experimentation. The question presents twofold; how can ethnography reshape how we envision future urban interactions and how can ethnography harness innovation capability dormant in urban dwellers or 'users' to inform Smart City design?

Cities already generate 80% of global GDP (BIS 2013). Therefore, research and governance need to take a lead in removing barriers to inclusion and facilitating collaborative innovation between multiple diverse actors through civic engagement. Importantly, cities are also attractors for less privileged. Between 2000 to 2010 nearly half the world's urban population growth can be ascribed to rural to urban migration (Tacoli, McGranahan, and Satterthwaite 2015). Added to this, global populations are ageing, surprisingly in nearly all nations, not just developed ones. The number of older persons (over 60) is projected to double by 2050. After the sea change that came in 2004 when humanity for the first time

became predominantly urban, by 2047 the number of older persons will exceed children for the first time (UN 2014).

Internet penetration grew from just over 6 per cent of the world's population in 2000 to 43 per cent in 2015 (UN 2015). Yet, the International Telecommunication Union (ITU) secretary-general Hamadoun Touré has stated that access signifies a 'tipping' point for global economic development. Forming a key point in the now expired 2015 UN Millennium development goals; access to information remains a key challenge. Touré frames access to communication as a human right; A right to participate in the knowledge society and the dawning digital economy, not to mention the 650 million people worldwide living with a disability of some kind (WCIT 2012).

Globally, every other person has access to basic Internet. In an older, poorer, differently abled and yet more urbane future the social value of inclusive access to technology is obvious, and so is the market opportunity. Paradoxically, those urban dwellers outside of the present smart city purview are in fact crucibles of process innovation perfectly adapted to the contingent mores of urban life. Finding ways to engage and include these sectors in meaningful interactions is an important strategy to enable social mobility and cohesion.

Ethnographic practice is especially germane to contend with these issues. By retooling industry ethnographers with useful perspective to quickly generate insights about an urban site is an important precursor stage in determining what digital services might bring greatest utility to a particular site. The ultimate aim is to beat the bounds for better urban fabric augmented with computation.

## Smart City Critique

A growing critical perception of Smart City visions is that they 'construct the resident as someone without agency; merely a passive consumer of municipal services - at best, perhaps, a generator of data that can later be aggregated, mined for relevant inference, and acted upon, a brutally reductive conception of civic life'. Greenfield claims that Smart City rhetoric intertwines innovation and efficiency with exploitation and control (Greenfield 2013). This is a reality antithetic to inclusive, livable cities.

A fundamental conceptual problem is the distinction between physical and information spaces. For technologically savvy groups, the utility of smart systems is self evident, for others, this can be a source of anxiety and confusion. For the excluded, ubiquitous information signifies an anxious uncoupling or de-situating of information and space. Traditional sites of access for common services; libraries, banks and post become dislocated from visible, permanent sites and becoming ephemeral, always available but mediated through some kind of interface that may appear counter-intuitive or at worst may remain unavailable entirely.

## Situating Urban HCI

Computation is becoming predominantly mobile. In early 2014, mobile device use exceeded static devices for the first time (Gens 2014). The present device-based ecology will steadily be displaced by growth in pervasive and ubiquitous computing. Furthermore, the underlying trope is toward computation that it will also become a less visible, more integrated feature of spaces. This signifies a megatrend that is already underway (Vidyasekar 2013).

Often used interchangeably, for clarity, Ubiquitous computing is best thought of as the underlying frameworks or infrastructures that allow people to interface with information. Pervasive computing represents a vision of the blending of the physical components of our lives with computation, in other words the distributed networks of tools within an environment, through which we access information. Presently, an ecology of devices acts as interface to these systems, however looking forward, systems are likely to be increasingly embedded and shared resources (Kostakos 2005). In other research, we have explored how ethnography can anticipate future developments before they arrive (Lindley, Sharma & Potts 2014).

Mark Weiser envisioned computing as an integral, invisible part of the way people live their lives. As Weiser's vision portents 'the most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it' (Weiser 1991). Usefully, Weiser gives the example of reading a street sign, we absorb its information without consciously performing the act of reading, this phenomena suggests in essence, that only when things disappear in this way are we freed to use them without thinking and can focus beyond them onto new goals. Weiser envisions computing performing this role, extending reach, silently. In terms of Urban HCI, this means removing barriers to interaction and drawing from these effortless, situated interactions as a stimulus. This capacity can act as bridges across groups who may be unfamiliar with or unable to access present technology.

There is an underpinning 'machinery of interaction' that reinforces this apparent deftness in reading the road sign, so, can this deeply innate interaction become a gold standard stimulus for HCI? As Crabtree et al argue, uncovering this is ethnography's prize. Finding it is what doing ethnography as we know it is all about. Arguing, it isn't especially difficult to do but it does require that we pay careful attention to that which we would ordinarily let pass us by (Crabtree, Rouncefield, and Tolmie 2012).

Steve Harrison and Paul Dourish famously brought interaction with space and place within the auspices of HCI. Space for them refers to a context's physical configuration. Place refers to the way we are framed by social conventions and experience. Their view emphasises the ways in which we generate spatial forms and articulate spatial experiences. More importantly, it is vital to see both space and place as critical aspects and products of the circumstances of interaction (Harrison and Dourish 1996). In Harrison and Dourish's words, 'Place-making however reflects the *conscious arrangement* of elements to create a space that accommodates activity, and (here is the hard part) the interplay of reflective design and happenstance to give expression to the values of the occupants and their wider community'. In other words, as we have observed, a space can only be made a place by its occupants. The best that the designers can do is to put the tools into their hands (Dourish 2006). Here ethnographers should take issue with what we actually observe in the street to operationalize this vision.

The interpretation of the study reveals the enormous impact from mobile devices, already extant, on the way society interacts with information. We notice the central importance of interaction with these systems and their potential to facilitate shared interaction, however the way users interact presently is still mainly very individually focused. Change in the way we utilize and share information is necessarily shifting the form of interactions from individual behaviors to shared ones. Notionally, inclusive systems are best conceptualized as shared ones because this enables people to share what they know and

include new users in their experiences, this employs a social learning theory, where legitimate peripheral participation leads to membership of a community of practice (Brown 2002).

What's more developments in ubiquitous and pervasive computing systems signify the perfusion of computation into physical spaces or as Weiser (1991) suggests tend to disappear entirely. In practical terms, this means these embedded services drop below the line of visibility. This coincides with the emergence of a third paradigm of HCI, named by Harrison *Situated Perspectives*. This perspective treats interaction as a form of shared meaning making in which the artifact and its context are mutually defining and subject to multiple interpretations. In this view system interactions should amplify and embody situated perspectives (Harrison, Tatar, and Sengers 2007). It is important then to develop a situated perspective on urban HCI, to shape meaningful shared interaction with the city as a user interface. There is a closing window to shape the utility and value of situated information systems before they 'disappear'.

This means refocusing onto embodiment and shared use from a single user / single device view, foregrounds collaboration and communication through shared artifacts and spaces. This means a shift to situated usage within a shared context. In an era of *infospherization* (Fattahi and Kobayashi 2009) exploring implications and evaluating the impact of emergent digital layers and how people *image* their surroundings becomes an invaluable role for design ethnographers.

Throughout the course of our observations we were forced to ask, how do we capture these situated *shared perspectives*? How can ethnography be tooled to examine concrescences of interaction that have both a digital and spatial character with both physical and mental components, that can be both personal and shared experiences. This entails crossing a difficult etic - emic threshold about how inhabitant users experience and interact with cities. We searched for an effective means to do this quickly, with integrity. We resolved to engage the public in ethnographic capture, to acknowledge their expertise by making inclusive tools to understand our site; an ethnography in parallel.

Indicatively, Fischer & Hornecker employ the term *Urban HCI* to denote situations that are composed of the built environment, the interface and any associated computer system, and the social context. They build on the concept of *Shared Encounters* which bridge existing research in architecture, urbanism, social sciences, anthropology and computer science. They adapt the concept of the shared encounter from Goffman's "Behaviour in Public Places". A Shared Encounter here is defined as "an ephemeral form of communication and interaction augmented by technology" (Fischer and Hornecker 2011). Their work focuses on the specific interaction patterns with media facades, this research advocates taking a more general view. Where Smart infrastructure is a vision rather than a reality, it is important to begin with a precursor stage; to understand how a city is used as an interface. This ethnographic work is essential as a stimulus to inform the design of appropriate services and interactions for Urban HCI.

## The Study

The study approaches these issues by starting simple. Observing an urban site with a view to understanding how people interact with information is problematic; this was the stimulation to regard it as an interface. Cities are certainly crucibles of shared interaction and interminably subject to diverse interpretations from their inhabitants, we sought to peer into this process. As Coyne intimates at our core we are interpreting (hermeneutical) beings. Our

whole world is imbued with this imperative to interpret (Coyne 2005). This insight gave license to engage ordinary people in the interpretive work usually ascribed to ethnographers and to entrust this interpretive expertise to the public as a user group. This is the self same capacity that allows such seemingly effortless interactions with common features of a city where people live e.g. traffic lights, signs, paths. The tool was designed to activate this invaluable faculty that we came to characterize as innate interpretive expertise. The interaction logic of ethnographic tools needs to be designed with inclusion as its first principle. This meant producing a tool that had extremely low barriers to access and effectively agnostic to the ability to use or access technology.

We developed an open evaluation tool system based on the following twofold logic; (i) color (ii) positive and negative value. The underlying assumption was that two orders of complexity remain generally interpretable but allow for enough complexity to generate rich responses. We chose the traffic light color value system because it binds onto a universally recognized visual code, is inherently connected to motion and mobility in urban areas and because it was easier to communicate the following 6 values to our research participants:

**Red = Stop +/ −** **Green = Go +/ −** **Orange = Attention +/ −**

Figure 1: **Heuristic tagging tool**

The binary value system (+ or −) was chosen because it is universally representative of positive and negative values. It is coherent with affirmation and negation in decision-making and again, the widely held connotation of positive and negative allows for simple choices to be made quickly. For example, a Red − (*stopped negatively*) would indicate feeling obstructed whereas a Red+ (*stopped positively*) would mean that someone made a conscious decision to stop.

Each evaluator was briefed loosely to connect 6 key locations in the city surrounding a central starting point. We asked participants to identify the 'best' routes between these locations, giving as little direction as possible. We standardized an introduction to using the tool and produced two versions; one reliant on using a GPS enabled smart phone and camera, the other using physical materials. We offered a free choice for which to select and designed the capture tool such that both data sets could be entered into the same space for analysis. We provided each participant with a set of six tags to represent each of possible choices.

The tags were deliberately developed to be reminiscent of place-markers used in digital cartography. This was a deliberate strategy that itself resulted in a key insight to pre-sensitize users who feel less comfortable with technology, whilst drawing upon what they do intuitively. In this sense, enabling participants to harness their expertise in interacting with common urban situations. The emplacement of artificial signifiers in the physical world and vice versa points to an approach to designing situated HCI with inclusivity as a key organizing concept. This became a conceptual maneuver to nudge interaction behavior positively (Thaler and Sunstein 2012). Overlaying iconography from digital environments in

physical contexts is a phenomenon that is already underway and itself became a principle insight from the study. The tool was also designed to encourage our participants to employing their evaluative faculties whilst making judgments about what they observed in situ. The tool was designed to elicit both analytic and synthetic insights from participants – a *walk aloud* method equivalent to think aloud protocols (Van Someren, Barnard, and Sandberg 1994) commonly used in evaluating the usability of digital systems.

The study took the form of a research through design process in three iterative phases (Gaver 2012). We located our study in Lancaster, UK; the university town of Lancaster in the North of England. Lancaster has a vibrant merchant culture and an active city council that seemingly is determined but uncertain of how best to implement and capture the value of digital strategy for infrastructure and services. The University itself is engaged with the city with a growing number of collaborative research projects and also provides the city with a diverse international student population. Lancaster has aspirations to enrich its heritage with sustainable innovation.

The research began with a series of semi-structured ethnographic observations of the site, taking the form of static observations and free walking observation by the research team. This was followed by a series of workshops to gauge requirements and frame a problem space with multiple stakeholders and members of the public. Way-finding was deemed to be a key problem in the site, Lancaster was thought of as holding rich heritage and social capital assets but felt disconnected both socially and spatially.

Throughout we used a card sorting method borrowing from (Moore and Benbasat 1991) and (Nielsen 1995a) to develop a method to thematize insights for feeding back into a design research process. Although not statistically rigorous, this method allowed the researchers to derive conceptual constructs from our observations and we brought some internal validity to the data by spreading the analysis amongst our research team and calling upon a wide variety of interpretations around a common problem from broad user groups.

A pilot study with 7 pair teams engaged in tagging the city, researchers passively observed some of these studies and short debrief interviews were conducted after each session. This allowed the honing of the tool design through user feedback. The first participants were all tracked using a commercial GPS application, to trace their movements. This allowed the development of a study strategy and captured 500 data points and associated semantic data of incidents of attention. Finally, a public research intervention trialed the tool with the general public; 35 pair teams comprised of members of the public, resident and nonresident. Their raw data, necessarily, was more uneven, however the qualitative responses formed a rich perceptual image. The sessions lasted around 90 minutes on average, although a timeframe was deliberately not stipulated. The task instruction urged participants to build the activity into their planned movements and was designed to be similarly replicable for each team.

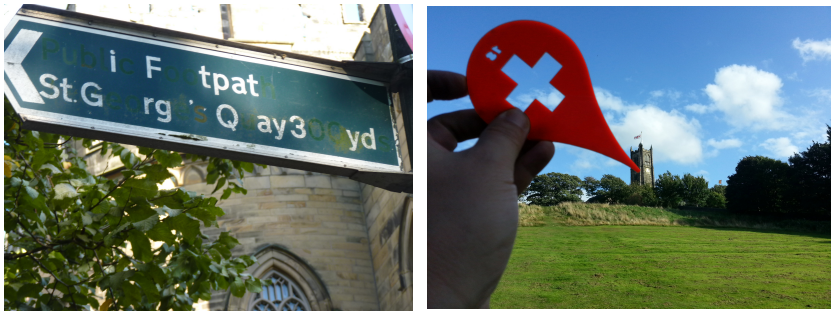

Figure 2

Participants were briefed to attend to moments that drew their attention and assign one of the six tags provided, marking the time, location and direction. Participants were asked to evaluate which of the tags pertained to the incident. They were instructed to use the tag to point out the issue, using the tag held at arms length and take a point of view picture. The tag was thus in the field of the photograph, giving context. Using an open tagging system allowed for a quick way to capture perceptions and allowed participants to evaluate which incidents were worthy of mention and to ascribe their own meaning to each.

Each photograph was GPS tagged and time stamped. For participants who preferred to use a paper map we asked them to mark the appropriate symbol by hand. We encouraged both groups to make extensive notes and drawings to supplement each tagged incident. Each team tagged on average 60 incidents resulting in circa 2000 separate tagged incidents. This data was assembled into a database for pattern spotting and the data was loaded into a digital model of the city showing location data and user choices. This allowed for a rapid unraveling of the perceptual usability issues in urban contexts, the tool mediated a way to capture shared perceptual images (Lynch 1960b) of research participants of the city in parallel and then assemble these into a shared artifact. Deploying this data into a digital environment was extremely useful for further interpretive work and pattern spotting, drawing on the pattern language work of Alexander, Ishikawa, and Silverstein (1977)

Nielson's heuristic evaluation matrices show the success of evaluators in finding usability problems. This heuristic evaluation principle relies on parallel evaluations of user environments to collectively identify a broader gamut of usability problems than experts can (Nielsen 1995b).

## Discussion of Insights

The outcomes of this study are useful for both urban planners and system engineers but also to a third class of activity that blends the two practices.

The ambiguous boundary between information and space afforded by technological mediation suggest a growing sense that place is experienced as a blended space (Turner 1998) where physical and symbolic features are reciprocally projected onto one another. Fixed systems are unlikely to remain useful in public contexts, as users will have flexible interpretations of the worth of a system and how to use it.

It may also be of interest for researchers interested in innovative research methodologies. Although the study was quite specific, the underpinning aim was more general. The tool itself was not designed as a research method (although it proved useful as one).

It was a good fit to repurpose usability heuristics because the underlying premise of heuristics is that with an increase in evaluators engaged in using a system there would be a

commensurate increase in the proportion of usability problems that can be identified. All that was required was to frame the type of problems to be identified and then facilitate the capture of incidents flagged up by users whilst interacting with the system. In a traditional HCI context, the user can be observed or the interactions recorded. In the context of a city, a tool was needed that would facilitate this. Determining that this tool should itself be assembled from common heuristics and call upon heuristic capacity, in the true sense, meaning designating or relating to decision-making that is performed through intuition or common sense, was a vital design strategy. Heuristics can be thought of as methods that place participants as far as possible in the mindset of the discoverer (OED). In psychology, heuristics pertains to simple, efficient rules, learned by experience that have been proposed to explain how people make decisions, come to judgments, and solve problems typically when facing complex problems or incomplete information (Sternberg 2011). Heuristics tap into innate cognitive ability; they explain our ability to deal effectively with contingent events, by using situated insight to inform onward progress. This could be characterized as an *abductive* approach (Peirce 1901). As such, abductive reasoning lends daily decision making the kind of deftness to do the best with the information at hand, which often is incomplete. This resembles the mode of thought a trained ethnographer assumes to understand a context. The professional relationship between design ethnography and user experience design ensured this connection would be commensurate and mutually intelligible.

Taking an abductive approach to decision-making allows for rapid flexible thinking and recognizes the value of intuition (or *nous)* to work with effectively in contingent situations where no optimal situation exists. Herbert Simon identifies that engagement with complex research contexts requires *satisificing* as in these situations, single optimum solution exists (Simon 1996). As this research engages with a lived context, it must proceed via satisficing, proceeding by finding the best available interim step towards a goal. Essentially, establishing a continuum of informed guesses, this seems to harken the mode of thinking people rely on whilst navigating an environment. Generally, people are innately very good at this. The resultant strategy meant borrowing from this insight to ensure the methods were fit for purpose in unstable contexts, but also calling upon this faculty in our participants to unravel usability problems in the site. This meant that our epistemological stance was a good fit for what we observe in the field.

The core principles of heuristic evaluation were found to be good match for identifying usability problems in an urban context. This would seemingly work equally well in sites that have little or no digital infrastructure and sites with extensive Smart infrastructure. Having said this, we advise that ethnographers working in Urban HCI contexts begin this work in earnest to determine what smart layers could bring to the civics of a city, rather than refigure a system after the fact. In this way, ethnographers have an enormous part to play in a global Smart City market projected to have cumulative value $1.565 trillion USD by 2020 (Vidyasekar 2013).

Harrison & Dourish give weight to the reasoning that reinforcing the loop between way-finding in physical environments with equivalent digital systems should be indispensible: "We live in a three-dimensional world, the structure of the space around us shapes and guides our actions and interactions. With years of experience, we are all highly skilled at structuring and interpreting space for our individual or interactive purposes" (Harrison and Dourish 1996). By acknowledging this tacit spatial and interpretive expertise that humans bring, developed through the course of their daily lives, our ability to produce meaningful

systems is greatly amplified, a view strongly mirrored in the work of (Suchman 1987) and (Orlikowski 2009). This is the same machinery of interaction spoken about by (Sacks 1984) and later (Crabtree, Rouncefield, and Tolmie 2012).

Exclusion will always result from a user's inability to find utility in a service; this seems to result from a failure to make meaning from an interaction. In lieu of finding validity in an interaction system a person will resort to orientating themselves with reference to physical features, this strong instinct to return to embodied experience is evidence of an innate spatial expertise. We see this as a source of insight for the design of emerging systems. Our tool was ridiculously simple but enormously productive as a mode of thinking through the site as ethnographers, furthermore, it facilitated the participant group to reflect on the usability of the site. As such simple interventions like this can act as enormous resources for learning quickly about a city. Drawing on Lynch's methodology, our data acted to form an inter-subjective perceptual image of the city. We present the product of our data analysis and what this leads us to understand about design for inclusion in Urban HCI.

We recognize this as a resource for intelligent design of situated HCI. Way-finding was deemed to be a key problem in the site. A shared perceptual image emerged, representing Lancaster as rich in environmental, social and economic assets but a sense of dislocation. An overarching political climate of funding cuts to public services, a national scale transition towards self-organizing public services to replace legacy government funded ones feeds into the megatrend of transitioning traditional built space into spaces of situated information. There is little digital infrastructure presently in Lancaster, but a sense that the existing information environment was not able to adapt or signify the life of the city. Insight about life in the city is held by inhabitants and exchanged somewhat tacitly (Polanyi 1966). Accessing knowledge that lies in networks of people, using co-creative strategies to harness value is an increasingly important role for design ethnographers (Ramaswamy and Ozcan 2014).

We found that for each physical characteristic, there was a counterpart that would tell us something about the role information played in informing decision-making. What we observe is a growing evidence for linguistic and interactional structures born of e-culture finding their way into public space. We see great desire in our participants to feel oriented and connected to the history and social dimension of the city. The engagement pattern in our study was asymmetric, just as engagement in digital infrastructure would likely be. The study gave us a keen sense of how the city is used as an interface and delivered rich insight into quickly deploying effective diagnostic tools in neighborhoods, streets and city centers.

We found a skew in our participation rate towards families with young children, visitors to the city and persons with factors limiting their mobility. The common thread between engaging groups was a sense of disorientation, difficulty in connecting social and spatial experiences and a vested interest raising conviviality through place-making. This is likely because the study was phrased as an activity, a way of engaging with the city and finding more about it, more importantly, these groups unanimously expressed a sense that the city was disconnected and badly provisioned with orienting information and services.

There also seemed to be division amongst social groups in the city, a rupture between different social worlds using the city in parallel but without interaction. This was typified by a group of disenfranchised local people who did not engage with the study, but watched intently throughout. They used the central space outside the town hall to conduct

their social interactions with a sense of ownership of the space, ignoring and being ignored with some anxiety by the wider populous.

***Engagement -*** Our initial, more conventional attempts at ethnographic observations and interacting with people proved to be extremely difficult and did not seem to permit 'participation' of any kind. In response to this however, a research through design process was useful to rapidly develop tools to engage participants resulting in a more 'emic' view, akin to the perceptual images sought after by Lynch. The tool and the activity together in some ways performed as a shared boundary object (Star and Griesemer 1989). The tool was open enough to sustain a degree of interpretive flexibility, becoming a way to express different meanings and agendas through a common framework. The activity in itself stimulated independent dialogue around the theme and begin to raise the issue into public awareness. The assemblage of the people, the tool and the activity itself in its various different configurations allows us to frame interaction within a wider activity system (Engeström, Kajamaa, and Lahtinen 2015) that could be usefully deployed in cities, the challenge remains to develop shared experiences that are more than fleeting moments and become and integral part of the shaping of urban interaction. As such, ongoing, shared ways to contribute to civic planning and contextualizing appropriate Urban HCI would mean establishing and sustaining boundary objects in use (Barrett and Oborn 2010).

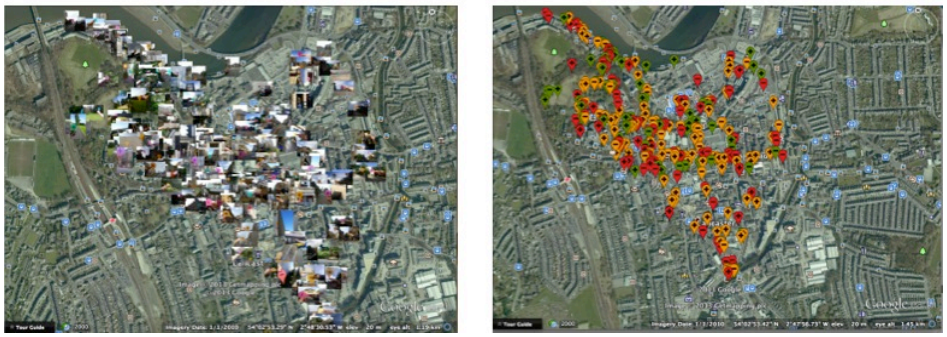

Figure 3: Heuristic **data visualization maps – with photographs (left), with tags (right)**

The data visualization compiled from the tagged incidents was also incredibly effective to delineate the perceptual boundaries of Lancaster and the clustering of perceptual usability. Participants tagged certain areas of the city as being of value to them and our further investigation in the form of debrief interviews revealed patterns of interaction, blockages in flow and areas of convivial interaction (Ilich 1979). Multiple mobility and access challenges to certain parts of the city and these were tied into the physical and information features of the landscape and there was a reciprocal relationship between these features. For instance, signage performed similar obstructing or facilitating roles, one was able to ameliorate the affect of the other. In some cases, concrescences of failures to orient and afford appropriate utility caused clusters of tags indicating where a place was failing to support the people's intuitive interaction, conversely, where information and territory intersected and afforded flowing interaction, a place emerged. There were alternate routes that the city dwellers were most likely to know, these were indicative of a wider expertise shared amongst inhabitants that was able to circumvent problem areas. This information was

rich enough to begin delineating how local knowledge had begun to form informal districts that provided particular services well and other areas that seemingly failed to orient users and give them a sense of place. The data patterns shown together present a powerful way of understanding these failures or successes and provide insight to hack these spaces, borrowing from the success of one to recondition another.

This emergent pattern would be incredibly useful for planning the fundamental dimensions of urban flow; signage, tourist movement and commerce. This also gave rich sematic issue of how embedded digital services could raise public awareness of these patterns that could assist both in better in situ and long-term decision-making. In the long term usability of particular patches of space could be associated with their perception of success and utility value to city users. It would be a fundamental step to make informal contribution to a public perceptual picture an ongoing process and make this public intellectual property. This could act as a de facto shared boundary object (Star 2010) in public ownership and accessible to all. This data could function as both an online artifact or as physical part of the city, ideally the two would be entangled. This would be a potent means of participatory planning and a useful stimulus to determine capabilities capture for inclusive Urban HCI systems.

***Semblant Interaction –*** This point of synthesis indicates the utility of affording semblance between digital experiences and physical ones, thus situating HCI. The research data presented the potential of drawing upon innate experience to inform inclusive design choices in HCI. A common reported situation for older participants was attaching anxiety to using online services or mobile technology (to interact with services like banks, online shopping or even navigation). As some sectors become increasingly used to performing interactions with these services, for others the situation is becoming increasingly exclusive, and frankly, mystifying. Participants found that the conventional architecture of information in the street; signage, access to postal, shopping or banking services was in decay and in some cases gave entirely erroneous information. This presents an opportunity for meaningful, smart design interventions. Investment in shiny smart services often means decay in functional physical services that are relied upon. As those with access become more comfortable with digital cultures and services we see lots of evidence of digital language and iconography becoming present in cities and becoming part of how we understand space. For others this becomes a barrier to use and interpretation.

The attitude of shared ethnography and rapidly iterated contextually sensitive tools can help to uncover these otherwise hard to articulate issues and help to diagnose solutions appropriate to users (inhabitants and visitors). Finding ways to make the online interaction experiences resemble familiar interactions that occur without a second thought i.e. reading a sign, using a post office, bank etc. is a potent way to both inure excluded groups to feel comfortable with online interactions and to design situated information systems that afford a similar level of usability. This reciprocal bridging of insight is the core concept of this paper. This also instantiates the directive that if an excluded group, for instance the elderly struggle to interact with an HCI environment equivalent to a service they use with ease when in a physical site, it should be evaluated as poorly designed.

Where there exist complex interactions that these same users find to be second nature, this is a potent place to inform better design interactions. This raises an important issue of equivalence of access and inclusion. Rethinking a cities' ecology of services in terms

of equivalence would cast in a stark light the success of changes in city environments and the relative success of technocratic attempts to provide smart services. This argues the case for aligning experience expectations across services. For instance, simple changes like introducing the user interaction steps from logic of logging in to online banking service, subtly into face to face banking interactions would be an important behavior change strategy for inclusion. Allowing features of each user experience to bleed into the other, removing complexity resulting in interaction patterns that are common to physical and digital interactions is an important inclusive strategy. Finally, emplacing equivalent services interactions in the street in a hybrid form, capturing the effortless utility of traditional services with the expanded capability of digital services, points to efficacious ways that smart city services could become a sustainable part of urban life.

## Conclusions

This paper's contributions are four-fold. Firstly, it discusses how smart-cities should not only be seen as enabling environments as they can potentially be extremely exclusive for someone with limited digital skills such as the elderly, migrant workers from rural settings etc. Secondly, it argues that a city is an informative environment that is constantly lived, understood and interpreted by its dwellers. Therefore, a city's *users* should be seen as an invaluable resource possessing innate interpretive expertise that needs to be captured and harnessed in order to uncover the 'perceptual' (Lynch 1960a), as opposed to the three-dimensional image of a city prior its *smartening up*. Thirdly, this paper presents ways of augmenting urban ethnography with modes of gathering rich insights by developing boundary objects that afford doing ethnographies *with* a city's users (in parallel) rather than *on* them (in series). And finally, this paper proposes a novel approach to mitigating anxiety induced by technology in less technologically savvy city-users by fostering *semblant* physical experiences that map and replicate a user-journey in the digital world. This points towards the potential of new standards for Urban HCI interfaces with inclusive values at their core. This implies a barrier free HCI that has been so far elusive, we suggest that this would best draw upon effortless interactions we already see urban users perform with extant urban systems. It also implies the need to afford interpretive flexibility, defined as the capacity of a specific technology to sustain divergent opinions (Doherty and Coombs 2006). In other words, open systems that allow multiple users to ascribe their own meanings and utility to them. Above all, this positions ethnographers to enact connections between theoretical and situated perspectives, between plans and situated actions (Suchman 1987) in the development of integrated Urban systems.

As such, the research asks pertinent, lasting questions to rally the ethnographic community around redefining how we engage in Urban HCI contexts. If our interactions with urban HCI should be based around the values of absolute utility and inclusion, do they resemble present systems? This short paper is a footnote for urban ethnographers concerned with inclusion in Urban HCI. It connects ethnographic practice and user experience to fundamental commercial and technological developments just over the horizon. It bridges a number of disciplines with the potential pitfalls and opportunities of smart city developments that are already underway at mass scale and often failing to deliver meaningful interaction, supporting conviviality and livability. It shapes thinking on how system development and HCI can be effectively guided by experience design agencies and the ethnographic community directly. These soft principles for inclusion are thinking tools for

better situations and situated technologies. In discussing the issue of Physical > Digital > Hybrid bleed, we can outline a blended space that remains mutable as new technologies appear. This means using ethnography to shape a soft HCI made up of shared interactions that are mutually semblant with existing deeply embedded practices opening up new possibilities for urban spaces.

The problem is clear; 'The technologies deployed in the process of smartening up our cities will succeed if they are embraced and integrated into the modalities people chose to live their cities and they will fail if their deployment is seen as the end of a process instead of a beginning' (Roche et al. 2012). Let's make the shared city truly "#epic".

## REFERENCES CITED


Alexander, C, S Ishikawa, and M Silverstein
1977 A Pattern Language: Towns, Buildings, Construction (Center for Environmental Structure Series).

Barrett, M, and E Oborn
2010 Boundary Object Use in Cross-Cultural Software Development Teams. Human Relations 63(8): 1199–1221.

Department for Business Information & Skills (BIS)
2013 The Smart City Market: Opportunities for the UK BIS RESEARCH PAPER NO. 136. gov.uk.

Brown, John Seely
2002 The Social Life of Learning: How Can Continuing Education Be Reconfigured in the Future? Continuing Higher Education Review 66. NUCEA CHEREVIEW: 50–69.

Coyne, Richard
2005 Wicked Problems Revisited. Design Studies 26(1): 5–17.

Crabtree, Andrew, Mark Rouncefield, and Peter Tolmie
2012 Doing Design Ethnography. London: Springer Science & Business Media.

Doherty, N F, and C R Coombs
2006 A Re-Conceptualization of the Interpretive Flexibility of Information Technologies: Redressing the Balance Between the Social and the Technical. European Journal of … 15(6): 569–582.

Dourish, Paul
2006 Re-Space-Ing Place: "Place" and "Space" Ten Years on. *In*. ACM Request Permissions.

Engeström, Y, A Kajamaa, and P Lahtinen
2015 Toward a Grammar of Collaboration. Mind.

Fattahi, Kaveh, and Hidetsugu Kobayashi
2009 City Imaging After Kevin Lynch. *In* Pp. 283–287. IEEE.

Fischer, Patrick Tobias, and Eva Hornecker
2011 Urban HCI: Interaction Patterns in the Built Environment. British Computer Society: 531–534.

Fricker, Miranda
2007 Epistemic Injustice. Oxford University Press.

Gaver, William
2012 What Should We Expect From Research Through Design?

Gens, Frank
2014 IDC Predictions 2015. IDC.

Greenfield, A.
2013 Against the Smart City, Verso.

Harrison, S, D Tatar, and P Sengers
2007 The Three Paradigms of Human-Computer Interaction. Proceedings of the 25th ACM Conference.

Harrison, Steve, and Paul Dourish
1996 Re-Place-Ing Space: the Roles of Place and Space in Collaborative Systems. ACM: 67–76.

Ilich, Ivan
1979 Tools for Conviviality. Published by Marion Boyars

Kostakos, Vassilis
2005 A Design Framework for Pervasive Computing Systems.

Lindley, J, D Sharma, and R Potts
2014 Anticipatory Ethnography: Design Fiction as an Input to Design Ethnography. Affiliate Organizations.

Lynch, Kevin
1960 The Image of the City, vol.11. the MIT Press.

Manzini, E, and C Vezzoli
2003 A Strategic Design Approach to Develop Sustainable Product Service Systems:
Journal of Cleaner Production 11(8): 851–857.

Manzini, Ezio
2007 Design Research for Sustainable Social Innovation. Design Research Now(Chapter 14).
Basel: Birkhäuser Basel: 233–245.

Moore, Gary C, and Izak Benbasat
1991 Development of an Instrument to Measure the Perceptions of Adopting an Information Technology
Innovation. Information Systems Research 2(3): 192–222.

Nielsen, Jakob
1992 Finding Usability Problems Through Heuristic Evaluation. ACM: 373–380.

Nielsen, Jakob
1995a Card Sorting to Discover the Users' Model of the Information Space. Obtained From:
www.useit. com/papers/sun/cardsort.html.

Nielsen, Jakob 1995b
Heuristic Evaluation: How-to: Article by Jakob Nielsen. Accessed from nngroup.com.
www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/, accessed September 11, 2015b.

Orlikowski, Wanda J
2009 Knowing in Practice: Enacting a Collective Capability in Distributed Organizing 13(3): 249–273.
http://www.tandfonline.com/r/aom-2-1.

Peirce, Charles Sanders
1901 On the Logic of Drawing History From Ancient Documents, Especially From Testimonies. The
Essential Peirce: Selected Philosophical Writings,(1893–1913). Edited by the Peirce Edition Project.
Volume 2: 75–114.

Polanyi, Michael
1966 The Tacit Dimension. Doubleday

Ramaswamy, Venkat, and Kerimcan Ozcan
2014 The Co-Creation Paradigm. Stanford University Press.

Roche, S, N Nabian, K Kloeckl, and C Ratti
2012 Are "Smart Cities" Smart Enough. Global Geospatial Conference.

Sacks, Harvey
1984 Notes on Methodology. Structures of Social Action: Studies in Conversation Analysis: 21–27.

Simon, Herbert A
1996 The Sciences of the Artificial. MIT Press (MA).

Star, S L
2010 This Is Not a Boundary Object: Reflections on the Origin of a Concept. Science.

Star, Susan Leigh, and James R Griesemer
1989 Institutional Ecology, Translations and Boundary Objects : Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology , 1907-39. Museum 19(3). JSTOR: 387–420.

Sternberg, Robert
2011 Cognitive Psychology. Cengage Learning.

Suchman, Lucille Alice
1987 Plans and Situated Actions. Cambridge University Press.

Tacoli, Cecilia, Gordon McGranahan, and David Satterthwaite
2015 Urbanisation, Rural–Urban Migration and Urban Poverty. http://pubs.iied.org/pdfs/10725IIED.pdf.

Thaler, Richard H, and Cass R Sunstein
2012 Nudge. Penguin UK.

Touré, H.
2012. First Plenary of World Conference on International Telecommunications (WCIT 2012)

Turner, Mark
1998 The Literary Mind: the Origins of Thought and Language. Oxford University Press.

United Nations
2014 World Population Ageing, 2013. United Nations Publications.

United Nations
2015 The Millennium Development Goals Report 2015. United Nations Publications UNIDIR. www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf.

Van Someren, Maarten W, Yvonne F Barnard, and Jacobijn AC Sandberg
1994 The Think Aloud Method: a Practical Guide to Modelling Cognitive Processes. Academic Press London.

Vidyasekar, Archana Devi
2013 Strategic Opportunity Analysis of the Global Smart City Market. UVW12372USEN. Public.Dhe.Ibm.com.

Weiser, M
1991 The Computer for the 21st Century. Scientific American.