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My neighbourhood: Studying perceptions of urban space and neighbourhood with moblogging

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ABSTRACT

We describe a novel methodology that examines perceptions of urban space, and present a study using this methodology that explores people's perceptions of their neighbourhood. Previous studies of spatial cues have involved a variety of tasks such as pointing and sketching to externalise participants' internal spatial maps. Our methodology extends these approaches by introducing mobile technologies alongside traditional materials and tasks. Participants use mobile phones to carry out self-guided neighbourhood tours. We collected rich qualitative data from 15 participants during two workshops and a self-directed neighbourhood tour. Our study highlights the use of public and private landmarks, differences in spatial maps of rural versus urban dwellers, and individual variance in orientation strategies. These themes suggest guidelines for the design of technologies with personalised spatial profiles.

1. Introduction

The Cityware project was an interdisciplinary research project with a goal of developing theory, principles, tools and techniques for the design, implementation and evaluation of pervasive systems as integral facets of the urban landscape. Within the project, a combination of computer scientists, psychologists, architects and urban designers explored pervasive and mobile technology use and implementation within the urban environment. We developed and deployed new tools and techniques for studying people's interactions with the city using a combination of methods including space syntax analysis [1] and Bluetooth monitoring [2]. Here, we report on a study carried out within the project that focused on people's perception of space; in particular their local environment. In the following section we introduce "moblogging" as part of a methodology for exploring people's perceptions of space. We present some background on conceptions of neighbourhood and the use of landmarks. We then describe traditional methods used to study people's spatial relationships with their environment. Finally, we present our study of neighbourhoods using mobile user-generated content, and describe what we have learned about the relationship between local spaces and technologies.

1.1. Previous studies of local space

There is a wealth of literature relating to how people use landmarks within their environment [3,4] and how these aid in the development of people's internal spatial maps of their environment [5,6]. Most of these studies take a fairly traditional

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view of landmarks as "key characteristics that make them recognizable and memorable in the environment" [7]. Within a neighbourhood there have been distinctions made in the literature between traditional landmarks such as a parish church, in comparison to what are termed "neighbourhood hubs" (which might include schools, nurseries and post offices) [8].

Presson and Montello [6] draw a distinction between symbolic known landmarks (such as the Eiffel Tower) and spatial reference points (such as signposting and common features designed to support navigation). They define landmarks as features that represent singularity and prominence. However, they state that there is also a category of local landmarks which are peculiar to long term residents. Sorrows and Hirtle [9] define this distinction further by proposing three types of landmark: visual, cognitive and structural, suggesting that the cognitive category may be a more personal type of landmark. Understanding the use of landmarks and the importance of particular locations could be crucial when developing systems that will thrive on tailored and useful personalisation in order to be of individual use and thus ensure take-up.

Previous research has debated the precise constitution of the concept of neighbourhood. Some authors define neighbourhood in terms of physical and geographical boundaries whereas others try to integrate social aspects with the ecological, aiming to account for people's relationships within, as well as with the space; however it is argued that most definitions do not capture important aspects of the local residential environment (see [10] for an overview). One problem that remains unsolved is clearly but meaningfully to bound urban neighbourhoods. Some authors [11] have proposed a multi-level spatial view of neighbourhood which consists of levels ranging from the area in which you would allow your children to be unsupervised, through to locality, and finally entire sections of the city. It is strongly argued that the concept of neighbourhood needs to be viewed as a dynamic entity [10] and thus it is important to explore perceptions over time to provide a realistic portrayal [8]. Kearns and Parkinson emphasise the scale of variation because "People function in different social networks, at different scales, across different times and spaces" [11].

A neighbourhood can be very much a part of one's social and personal identity; for example, "People over 70 know twice as many of their neighbours as people under 30" [8]. In relation to the personal aspect of neighbourhood, Burdett (ibid.) also states that the issue of beauty is important to cultivate in a neighbourhood. Research by Kim and Penn [12] found that perceptions of neighbourhood extend related to the degree of 'intelligibility' of the spatial environment. Using space syntax metrics to measure intelligibility as the degree of correlation between local and global properties of the spatial network, they revealed that individual map drawing exercises produced a significantly reduced spatial scale and memory for named features in neighbourhoods with low intelligibility compared to those with higher intelligibility. The frequency of citation of local features, such as specific streets, depended directly upon the spatial accessibility of these features. More recently these results have been extended by Dalton [13] who worked with surveys of local residents to elicit their perceptions of the boundary of their neighbourhood. He developed a measure of the consensus boundary for a local population, which he found to be related to measures of local intelligibility. This research suggests that when designing pervasive systems on a city-wide basis it is important to tap into people's perceptions of their space in order to tailor technologies to enable people to be provided with information that is of value to them.

1.2. Moblogging

Mobile blogging or "moblogging" involves using a mobile device, which increasingly means a phone, to record a variety of media that is then uploaded to the web in the form of a diary or document of a pattern of events. Moblogging may be viewed as an example of situated or context aware computing. Dey and Abowd [14] proposed three main categories of context aware services: presentation of information and services to a user; automatic execution of a service driven by context; tagging of captured data with relevant contextual information. This last category has a strong relation with moblogging as used in the studies reported here.

While authors have reported experiences of moblogging on a range of activities including youth inclusion [15], sharing of photos [16] and new directions in recording and sharing one's life experiences [17], we present moblogging as part of a methodology to obtain data about people's perception of their environments. We suggest that this approach provides a novel take on previous methodologies for examining spatial relationships, because moblogging is used in a variety of ways. For example, moblogging can be used to capture data, as a tool for reflection, and as an aid to indicate how we might implement future designs within the environment, by taking account of features of importance to individuals as they move around these spaces. It enables a direct method of data collection that can be used alongside traditional methods of sketching maps and diary documentation in order to provide a new perspective on spatial relationships.

Girardin et al. [18] argue for the complementarity of more traditional data collection methods and more novel methods that draw on user generated content enabled by pervasive and mobile technologies. In contrast to our approach here, they focus on the analysis of large datasets that have not been generated explicitly for the purposes of the analysis, such as cell phone network data and georeferenced photo databases, noting that methods "that require people to carry a separate GPS-enabled device not only remind users that their movements are being followed … but also generate fatigue effects". It is also possible that the explicit generation of data through moblogging may affect the very concepts that are the object of research, a point we take up in Section 3.2. Notwithstanding these *caveats*, we suggest that the first person, real-time perspective provided by moblogging can enable different forms of reflection on features of the environment that emphasise personal significance. It can therefore be a useful complement both to more traditional research methods and to other more recent technology-based methods that exploit data generated by users but for purposes other than the research.

We analysed the data collected through our participants' moblogging in order to gain a holistic view of what people represented and to investigate if moblogging provided additional insight into their spatial and personal relationships with the environment around them. Our study had the secondary purpose of refining our methodology to be able to repeat the procedure over time and in different areas of the city in order to build up a dynamic and complex picture of people's relationships with their local environment that could be used in the design of pervasive and mobile applications.

1.3. Gathering data on spatial relationships in the environment

In the past there have been a variety of methods employed to gather information about how people use landmarks, which landmarks are of importance in the environment, and to explore people's ability to spatially represent their environment [19]. Methodologies have included:

(1) Experimental pointing, where an experimenter asks a participant to point to different aspects of their environment that cannot be seen from their current position in order to gain an understanding of the spatial accuracy of one's internal map of the environment [19]. While accurate, this method is difficult to use in isolation to gain an overview of an area, as it only produces a limited number of data points.
(2) A variety of map drawing activities ranging from drawing a free-hand sketch map of a particular area, being provided with a few key landmarks and drawing a map in relation to these to mark key places of significance on an outline map [19]. One argument against map drawing tasks is the level of spatial ability required to convert an internal spatial representation into a map-based drawing, which is in effect two steps removed from the original space as people translate the representation they have built in their mind back on to paper [19].
(3) Asking people to "think aloud" or reflect at the end of a route as they explore a map, a real environment, or in some cases more recently a virtual environment [7]. However what people say they do is often very different to what they actually do in practice, causing difficulties with the relevance of the information.

Often more than one of these methods are used and data is triangulated across them. One more recent technique for coherently integrating spatial data has been to employ technologies in developing and researching spatial relationships with our environment. For example, beyond the use of physical maps and compasses, more recently virtual environments [19] and mobile applications [7] have been used to explore landmarks and spatial maps. Some of these recent changes have influenced the way the "cognitive map" or internal representation of space has been reconsidered as a cognitive "collage" to take account of multimedia and multiple frames of reference [8].

During the last decade, the spatial mapping literature has drawn strongly on Virtual Environments (VEs) as a new medium within which to explore spatial relationships. VEs could accurately model the real environment and enable people to move through them independently from an egocentric viewpoint taking away some of the difficulties associated with drawn maps, while also allowing the experimenter some control over the environment they were exploring, for example the manipulation of landmarks [19]. With the advent of in-car satellite navigation systems and mapping facilities on one's mobile devices, new ways of enabling people to interact and reflect on their environment emerge [20,21]. Moblogging takes this a step forward enabling people to document their experience with the real environment in real time and from an egocentric viewpoint, synchronously using a variety of media including time-stamped photos, video, GPS trails plotting the route they explored and audio recordings.

1.4. Research questions and research design

The studies reported in this paper were motivated by a set of related research questions. The first research question was: are there differentiable conceptions of neighbourhood? We considered factors that might contribute to different conceptions of neighbourhood, such as geography (e.g. village boundaries), social factors and familiarity.

The second research question we explored was: are there differences in conceptions of neighbourhood between urban- and rural-dwellers? Previous research has suggested that rural-dwellers' conceptions of neighbourhood tend to be based on geography while urban-dwellers' conceptions are principally based on social factors. Nation et al. [22], Forrest and Kearns [23], and Freeman [24] talk about changing neighbourhood statuses and dynamics. They all suggest that neighbourhoods are changing such that they are increasingly fluid, dynamic and personalised for a given resident. This process may be accelerated in urban environments as a result of the vastly larger set of opportunities for residents in terms of potential social contacts.

Finally, our third — methodological — research question was: does moblogging give the researcher access to mental representations of space that are not accessible to alternative, more traditional, research methods? In the terms expressed by Hagen et al. [25], the moblogging tour in our studies constitutes a form of "mediated data collection", where mobile technologies mediate data collection from and about participants in natural settings. Our moblogging data collection was unguided, so reducing influence from the researcher. This, in combination with the fact that data collection took place in the same space as that under investigation, gives this research method an immediacy that is not possible with traditional methods. There are fewer barriers between participants' perceptions of the environment and participants' ability to record those perceptions. Such barriers in alternative methods include environmental effects, e.g. data collection takes place outside

of the environment to be investigated and so inhibits a participant's recall, and experimenter effects, where the presence of a researcher inhibits or alters a participant's response to questions about their personal life and perceptions. One area where we expected to gain increased detail of data was the effect of social factors on participants' conceptions of neighbourhood.

The design of our research flowed from our interest in answering this set of research questions. Our studies, described below, used a combination of traditional methods (map-sketch, boundary-marking) with moblogging. A significant portion of the analysis will focus on similarities and differences between the perceptions of neighbourhood revealed by these different means of data collection. Part of this involves comparisons of the size and shape of neighbourhood but we also investigate meaning attached to aspects of neighbourhood such as locations noted as landmarks, and reasons for inclusion or exclusion of areas within the neighbourhood boundary. As noted above, we expect the moblogging activity to reveal some of these aspects of meaning-making that may be inaccessible to alternative methods.

2. Study: Map sketching and moblogging

2.1. Method

2.1.1. Participants

We engaged a cohort of participants to work with us throughout the Cityware project [26]. We advertised within the Bath area for interested parties to engage in technology development in the project. From several hundred volunteers, we recruited 30 people from around the area with varying levels of technical skill. They were aged between 13 and 83 and had a variety of backgrounds, including a potter, a pilot and a magician. The sample was not intended to be representative but rather to provide a mix of participants with differing knowledge and skills who live within the area.

For this study, the cohort were invited to attend two workshops and to carry out an activity in the period between the two meetings. We collected 15 full sets of data from 10 males and 5 females of the 22 participants who took part. Here, only those sets of data that are complete are reported because some of the cohort could not attend both workshops and some participants had problems using the mobile phone based software for saving the trails of where they had visited.

2.1.2. Materials, design and procedure

The study took place over two weeks. Participants were unaware of the task before they arrived at the first workshop. At this workshop they were asked to complete a hand-drawn sketch map of their neighbourhood and were given unlimited time to carry out this task. Most people took around 20 to 30 min to complete the map. Neither the term 'neighbourhood' nor the type of content expected on participants' maps were defined, although participants were asked to mark points of interest.

In the time that elapsed between the first workshop and the second workshop, participants were asked to carry out an independent activity. They were asked to complete a moblogging tour of their neighbourhood in the week following the first workshop, as close to 10:00 am on Sunday as possible. The brief was to take a tour of their neighbourhood as if showing somebody around who was new to the area.

The cohort all had a Nokia N70 and SIM that was provided for their use as part of the project and with which they were familiar. For this moblogging tour of their neighbourhood they were asked to use several functions on their phone in order to document their tour. They were asked specifically to use the camera for taking pictures and video where they felt appropriate and use the text note and audio recording facilities as they felt they were required. As we were interested in tracking where they had been on their tours we also asked participants to carry a Qstarz GPS unit (the N70 does not have built-in GPS) and to make sure they had a satellite fix before starting their tour. A flashing blue light indicated the GPS was working. There was no other feedback provided by the unit. They were asked to open an application on their phone called GEtrack and to start recording and to save it under their name at the end of the tour. GEtrack is a third-party application, written in Java to run on mobile phones, designed to record trails of co-ordinates generated by a GPS device. While using GEtrack they could open all other applications on their phone in order to document the tour.

The cohort was then invited back to another workshop the following week where they were asked to provide the moblogging records of their tours. We then asked them to carry out a number of tasks in the second workshop. First, they repeated the map drawing task in which they were given an A4 blank sheet and asked to draw a sketch map of their neighbourhood. They then carried out a second activity in which they were asked to draw a line representing the edge or boundary of their neighbourhood on a pre-printed map of the wider area. They were also asked to mark and label landmarks within the boundary that they had drawn. Finally they were asked to complete a questionnaire asking them questions about their tour, including listing 10 landmarks within their neighbourhood and any comments about these landmarks, and to reflect on any differences between their tour and hand-drawn maps. Two researchers carried out a qualitative analysis of these data sets, reported below.

2.2. Analysis

The data was correlated; comparing the data that was collected in a more traditional form (the map drawings and questionnaires) with data collected during the mobile tours. During the neighbourhood tour, participants carried out the activity independently from an egocentric point of view and were free to document as they wished.

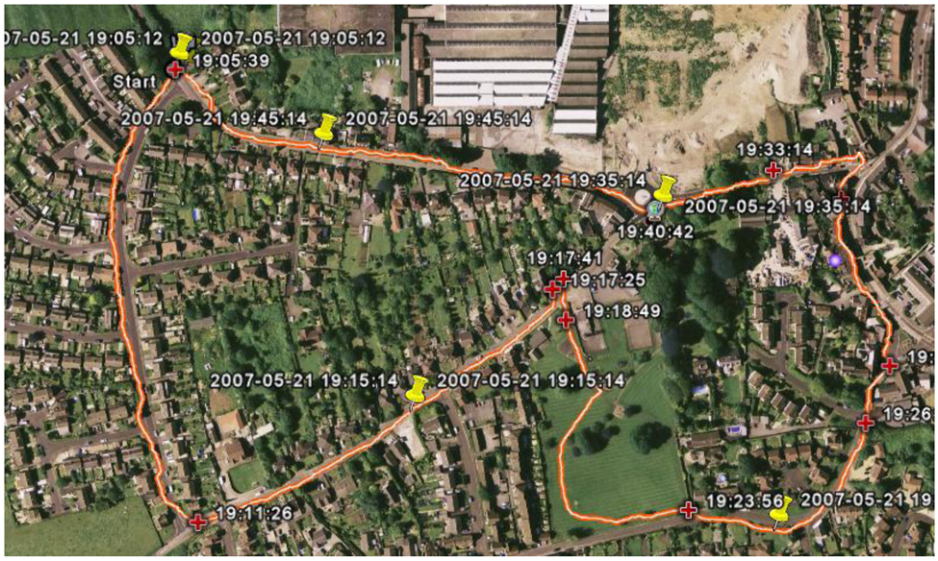

Fig. 1. Google Earth mash-up of neighbourhood moblogging tour.

A thematic analysis revealed the following issues: the use of public and private landmarks; differences in spatial maps of rural versus urban dwellers; and individual variance in orientation.

2.2.1. Public and private landmarks (and non-landmarks)

People who live in clearly defined residential areas, villages in particular, tended to portray what we may term "traditional" landmarks, e.g. church, pub and village hall. Within both the rural areas and the city people illustrated a lot of signposts. While there were more of a mix of landmarks from those who lived within the city centre, often these included shops or particular landmarks such as a war memorial or playing fields. However many of the participants highlighted very personal landmarks, for example "best tree in Bath" and a plot where a pub used to be. The participant was relieved when this pub was demolished as it used to cause noise and disturbance in the area. One woman notes a particular pub and then says she would never use this as a landmark because she had an awful meal there. Lots of people used very personal services and locations e.g. a hairdresser, as a landmark. Equally, many of the cohort decided to use images showing views as the anchor points around their tour. People wanted to portray the "beauty" of particular areas of their neighbourhood. Additionally, pictures of animals and their relationship with the environment (e.g. horses, taking dogs for a walk, new lambs) were a prominent feature. This practice was not observed on any of the sketch maps. During the tour many participants used their own nicknames for particular areas, e.g. "frisky park" where one participant's dog always got frisky when they went on a walk there; "the spooky house" by another participant.

Landmarks on the map were often different to those selected on the tour. Some participants provided very different landmarks dependent on the format — map, tour or questionnaire. It appears that the methodology used is integral in scoping what people decide to report.

2.2.2. Rural versus urban dwellers

Rural inhabitants used a similar scale for all of their maps, representing a similar area of their neighbourhood on both map sketches, the boundary marking activity and the moblogging tour.

A female participant lives in a rural village outside Bath and her boundary drawing, both of her sketch maps and her tour were all very similar in terms of content, scale and landmarks indicated (see Figs. 1–3).

The participant stated that the boundary exercise was an easy one for her and that she did not have to hesitate at all before drawing her line. "…village has a clearly defined centre at the moment — though planned expansion will undoubtedly change that in the relatively near future — where most of the amenities are situated. So the obvious neighbourhood for me is the area between my house and the village centre in which I shop, walk the dog and go to the pub. Outside of my area, on the other side of the village, are ***** social club, a garage and hospital, all of which I have visited, but rarely, so I don't consider them to be neighbourhood".

She continued, "The areas I have shaded as those I don't normally go are residential areas — largely cul-de-sacs — where I have no reason to walk. I know no-one who lives there and they are not routes which lead to anywhere I wish to access. However, I do still consider them as part of the neighbourhood — the people who live there I am likely to see regularly because of their proximity, and it is much more likely that I would become friendly with them (and therefore possibly visit their homes) than that I would become friendly with someone who lives at the other end of the village (outside of my neighbourhood)".

Fig. 2. Participant's sketch of the boundary of their neighbourhood.[1]

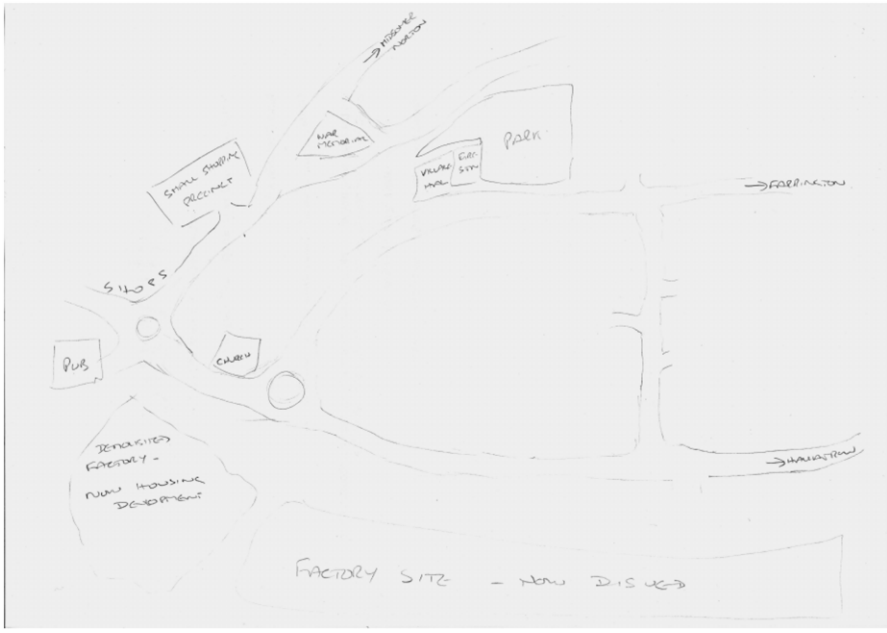

Fig. 3. Hand drawn map post tour.

This is one of four examples of data from rural areas that we collected — in all these rural cases, participants maintained a similar scale and landmarks across all their maps, sketches and tours.

In a number of cases, the cohort's second hand-drawn map and the boundary map completed after carrying out their moblogging tour portrayed a much larger area than that drawn on the first map. This was primarily the case when people lived within the city itself. For example one female participant drew a larger scale map after having completed the tour (see Figs. 4 and 5). Her tour data covers a larger area than her original map of her neighbourhood (see Fig. 6) and her boundary includes a slightly larger area again towards the north (Fig. 7). In the follow up questionnaire, this participant stated that

[1] Please note that this and all subsequent hand-drawn images have been anonymised to remove features which might be used to identify participants (e.g. home locations).

Fig. 4. Pre-tour hand drawn sketch map.

Fig. 5. Post-tour hand drawn sketch map.

the area that she chose to be "my neighbourhood" is the area which she goes out and about in regularly. She stated that this "extends west as far as the church. Any further west of this is a school (which I don't use and residential properties which I don't visit as I have no friends there). To the East ****** I have included ***** Road as part of my neighbourhood as that is a very busy and popular shopping street which I visit at least once a week. It has banks and most sorts of shops which the High Street doesn't have. Also I have several friends in this area so am often over there. North of ******* is a useful footbridge over the river. It accesses the cycle path to ***** and is a favourite haunt of mine. It also leads on to ***** Road which is another good local shopping street and has the closest free cash point to my house. The shaded areas on my map are just residential and which I have no reason to visit. I guess I would still class them as in my neighbourhood purely because they are in such close proximity to my house".

This example illustrates our finding that participants living in urban and semi-urban areas hold multiple parallel conceptions of what constitutes their neighbourhood. Another example from one of the participants is provided below.

This participant's sketch-map illustrates a relatively small area. The map covers an area approximately 3–4 min walk from the house (see Fig. 8).

The boundary marked on the pre-printed map extends to include frequently used shops and services. While the house is still at the centre of the neighbourhood, the shape of the boundary is much larger and more irregular in shape, encompassing a loop to the north, in order to include a gym, and a loop to the south, to include a favorite walk to a local pub (Fig. 9).

Both the sketch-map and the boundary-marking task were introduced as having reference to the neighbourhood. Therefore, the difference in the area covered in each depiction of neighbourhood is significant. The participant's tour of her neighbourhood (see Fig. 10) sheds some light on the disparity between the sketch-map and the boundary marking activities.

Fig. 6. Google Earth neighbourhood mashup also reveals a larger scale than the hand drawn map.

Fig. 7. Boundary map larger scale than hand drawn sketch map.

The route taken for the tour includes the loop to the south, taking in a favorite walk. In one audio note, she says that she considers the southern end of this loop to be part of her neighbourhood as it is a location she often visits. However, on her return journey, back to her house, she makes another audio note, saying, "Now we're coming back into my neighbourhood".

The use of these three data sets demonstrates that in both the above examples there seem to be at least two categories that form participants' perception of their neighbourhood. There is a neighbourhood defined by distance from home and a

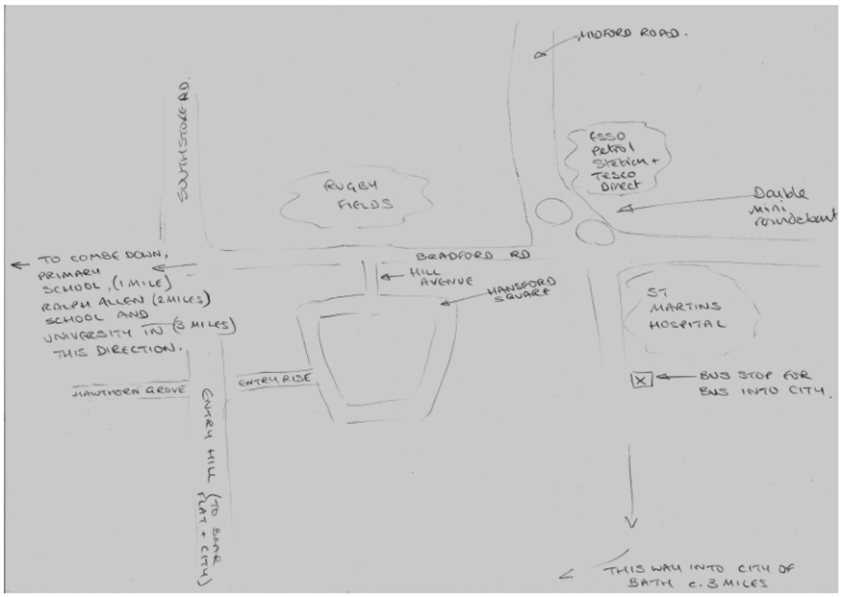

Fig. 8. Sketch map of neighbourhood.

neighbourhood defined by use. The multiple sources of data available thus draw out aspects of perception of neighbourhood that would otherwise be inaccessible.

In the same vein, the only participant who actually drew a smaller map the second time justified this by commenting that the main criteria he used in drawing the boundaries was to include the areas that he visited on a regular basis, daily in many cases either on foot or by car. (This participant had mobility problems while walking at the time of the study.) He claimed that he could have been even more restrictive and just included the area in which he lived as his neighbourhood and the expanded area as his local community. So while he was the only participant to show a smaller scale map, he also defined two categories of neighbourhood.

When asked about the reasons for any differences in the maps in the questionnaires many participants commented directly on their change of scale. Comments included:

"Revised ideas about neighbourhood — first map about where I live — second map about the area I move around by foot";

"I think, having done the exercise once, I did the immediate neighbourhood from my memory of last time and felt comfortable extending my range";

"Second map covered larger area, which I attempted to illustrate in my neighbourhood tour. I was unable to accurately draw a map of a larger area and although familiar with the location could not mentally reproduce a map to draw";

"Took longer journey on the neighbourhood tour, so included more on map".

2.2.3. Orientation

A third theme to arise from the data analysis was the way in which people had drawn their sketch maps. All of the male participants except one aligned their maps north–south while only one of the females did so. (Her house faces north so it is hard to tell if this was purposeful as most participants marked their houses on the map first and then worked from this position.) Of the other 4 females, 3 of their maps were aligned 180 degrees out (i.e. South–North) and one was almost arbitrary in terms of scale and geographical areas in relation to one another (see Figs. 3–5 and 8). A number of males marked North, East, South, West on their map whereas none of the females did. See Fig. 11 for an example of an aligned map with compass points incorporated. Fig. 12 is the only map by a male that was not aligned North–South and can be compared with his boundary map in Fig. 13. While these alignment factors were noted when comparing the sketch maps to the boundary maps during analysis, they bear no relationship to the detail included within the map or types of landmarks included.

3. Discussion

In the development of a number of tools during the Cityware project, it became evident that we needed to pursue a deeper understanding of people's individual spatial and cognitive relationships with their environment. As we had a cohort of participants working closely with the research team we examined their relationship with their environment through an intensive paper and technology based intervention. We identified key themes coming out of our data comparing people's hand-drawn sketch maps with their boundary maps and independent mobile tours. We are beginning to build up a picture of how city areas differ from rural areas in how people perceive their neighbourhood.

Fig. 9. Sketching the boundary of a neighbourhood.

3.1. Conceptions of neighbourhood

We have evidence for different conceptions of neighbourhood, in that our different data collection activities (map-sketching, boundary-marking, moblogging) revealed different definitions of neighbourhood, at least for urban-dwellers. Kearns and Parkinson [11] talk about different kinds of neighbourhood according to the social or functional framework that a person is currently working within. We argue that the different tasks (map-sketching, moblog touring, boundary-marking) promoted or activated participants' working with different social or functional frameworks, and thereby revealed different pictures or conceptions of neighbourhood. Map-sketching revealed a conception of neighbourhood informed by physical factors – usually an area within approximately 5 min' walk from a participant's home. Moblogging and boundary marking revealed a neighbourhood informed by social factors, irregularly shaped in order to encompass shops, services used by a participant, and activities taken part in (dog walking, school run etc.).

We also found evidence for differences in neighbourhood conception between rural-dwellers and urban-dwellers. This links to Nation et al. [22], who discuss different interactions and networks amongst neighbours in urban, suburban and rural neighbourhoods. There is also a link with Freeman [24]; although Freeman is talking about children, she details changing patterns of physical and social relationships within neighbourhoods. This reflects the pictures of urban neighbourhoods

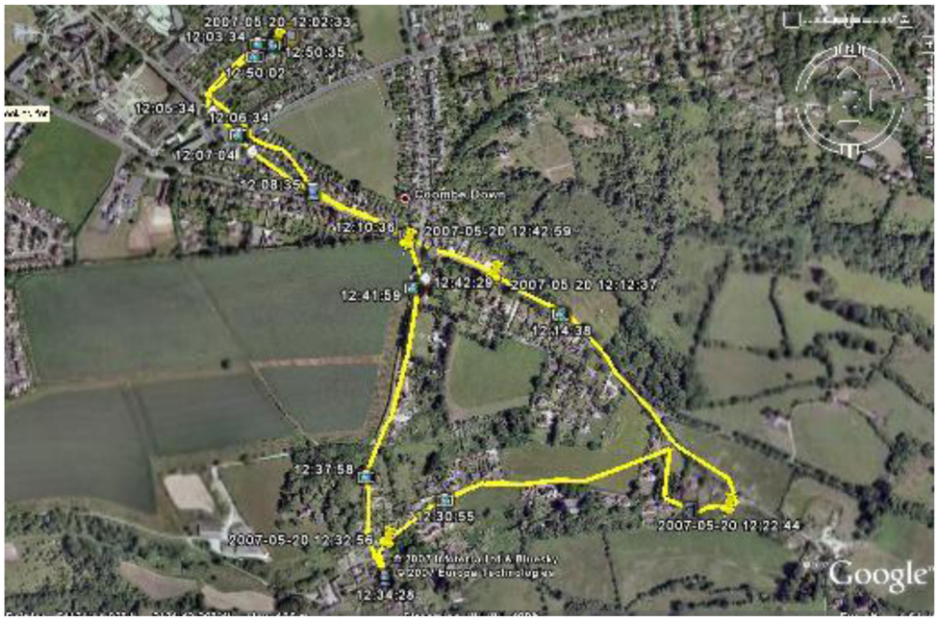

Fig. 10. Google Earth mashup of a neighbourhood tour.

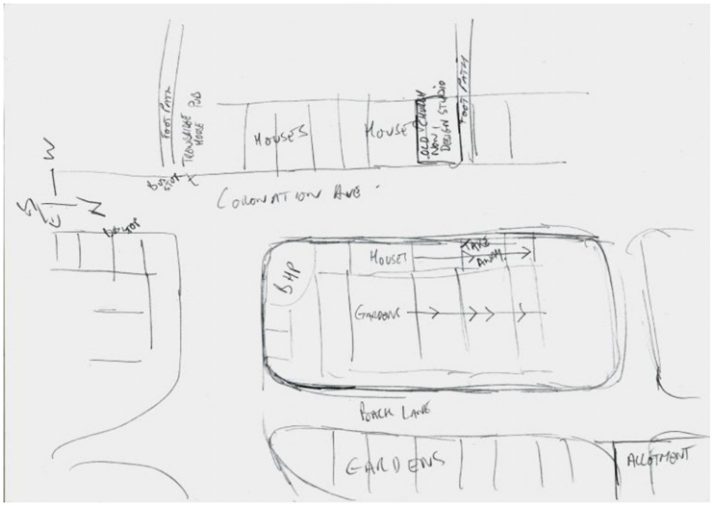

Fig. 11. Aligned map; the participant has marked NSEW (see top left of map).

revealed in our study, whereby participants' conceptions of urban neighbourhoods are representative of 'the emergence of a more fluid, individualised style of life' [23, p. 2120].

All three of the methods we used reveal very similar neighbourhood conceptions for rural-dwellers. Differences between the three representations can be seen for most urban-dwellers. This may be linked to the size of the conurbation in which participants reside — the city is just too big for participants to represent or think of as "neighbourhood" all at once. This has important implications for design: designers need to understand that people function according to a "neighbourhood" conception that is likely to be qualitatively different to their "city" conception. While the "neighbourhood" conception is concrete and practically-oriented, the "city" conception is likely to be more abstract and idealistic.

We found that in suburban and urban environments people have several categories of neighbourhood, one based upon direct proximity from their house — whether they visit these areas or not — and at least a second category based upon places they frequent which may be some distance away. This seems to be consonant with past research that has identified different categories of neighbourhood [11]. We must remember here that we have presented a snapshot of neighbourhood and these are likely to be dynamic and in recent data that we have collected from the same participants we should gain some understanding of how these categories change dependent on factors raised in the study such as use, changes in environmental structure and mobility.

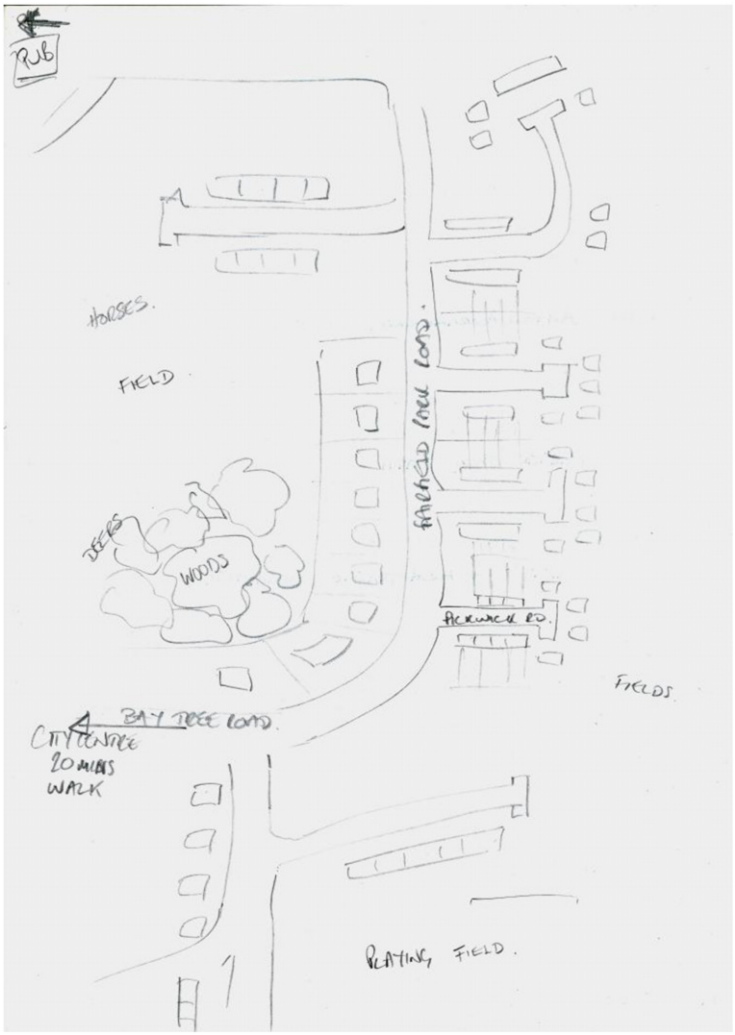

Fig. 12. A map which is not aligned North/South, it appears to be aligned around a route direction often walked by the participant.

We have shown that people have quite distinct "neighbourhood profiles", which may vary depending on the correlation between residential and spatial cohesion (where rural villages are highly spatially cohesive), but also vary according to the kind of technique used to articulate the neighbourhood itself. Thus, although designers may find in the simplest cases that rural locations afford some level of spatial segmentation for the purposes of identity, urban users of mobile and pervasive systems that draw on spatial cues for social context will need some flexibility to shape the system around their personal neighbourhood profiles.

Furthermore, the way in which such systems collect data with which to personalise their representations and uses of space will also need to consider clearly the ways in which users' perspectives have been collected, and in particular whether egocentric or allocentric demarcations of perceived spaces have been used. Furthermore, as mapping services increasingly bridge the digital rural divide between detailed urban services and sparse rural interactivity for non-residential purposes such as sports, nature watching and leisure pursuits, the different ways in which rural spaces are conceived by occupants will also require increasing consideration of spatial demarcation.

3.2. Moblogging based research methodology

We were interested in assessing our methodology in terms of the extent to which moblogging gives the researcher access to mental representations of space that are not accessible to alternative, more traditional, research methods. Some aspects of neighbourhood conceptions were revealed by moblogs and were not revealed by the other methods we deployed. These included differences in the kinds of landmarks included and described through the different methods. In Section 2.2.1, we saw that traditional methods were more likely to reveal use of traditional, public landmarks while the moblogging activity was more likely to reveal personal, private, landmarks. Two categories of landmark were of particular interest here — those

Fig. 13. A boundary map to indicate non alignment when compared with Fig. 12.

representing social and aesthetic factors. The moblogging activity, but not the map-sketch or boundary-marking activities, often revealed views from particular locations (representing the aesthetics of the neighbourhood), and community loci such as community centres, church meeting rooms and charity bases (representing the importance of social factors in determining neighbourhood conception).

A second major aspect of neighbourhood revealed by the moblogging activity, but not by other methods, related to some of the reasons for participants' particular conceptions of neighbourhood. The moblogging activity allowed participants to talk about, for example, the walk they did to and from school, or to walk the dog. These activities were explicitly given amongst reasons for the particular description and explanation of neighbourhood related by participants.

There are some important questions of methodological validity, centering on the fact that participation in the moblogging activity may itself be a catalyst for changes in neighbourhood conceptions. This issue relates to recent research that positions moblogging as a learning activity, e.g. [27–29]. We need to question what it is that participants' moblogs are telling us. Do they tell us about participants' pre-existing conceptions of their neighbourhoods? Or do they tell us about a transition between past and future conceptions. There is a need for the researcher to be somewhat sceptical in the interpretation of these data — and to consider them in the context of other data sources. This was our approach in the studies reported here, where we combined moblogging with other data collection methods, in this case map-sketching and boundary-marking. As an example of the possible interaction effects, we have some evidence from participants saying that the experience of the moblogging tour had an influence on the map they produced in the second map sketching session. An area for future research is to investigate the extent to which moblogging and other documenting activities affect conceptions of space and neighbourhood.

There are some issues of data management when using moblogging as a research method. The moblogging tours generate large amounts of data of varying structure and form. This has some advantages, one of the most significant being that the task can be loosely defined, allowing participants to provide information that researchers might not have expected. The disadvantage is that analysis can be very demanding and time-consuming.

Related to the issue of collecting large amounts of data, moblogging as a research method raises some ethical issues. Participants may be more likely to reveal information about their lives through this method than through alternative methods (e.g. private and non-landmarks, thoughts about neighbours). It may be argued that the researcher should take more care to debrief participants and allow participants to view, and possibly to censor, data after collection. This issue has been raised, but not dealt with fully, elsewhere: Christensen et al. [30] raise two sources of concern. The first is that large amounts of data regarding participants' private lives are collected. The second is that this kind of research might encourage tracking and surveillance of children that may not be in their best interests.

The main value of moblogging as a method may be in its ability to reveal aspects of conceptions of space in combination, or in comparison, with other methods. Would moblogging have been so informative to the researcher if it had been a stand-alone activity rather than being completed alongside map-sketches and boundary-marking?

3.3. Design guidelines

Three findings are of direct relevance to the design of technologies with personalised spatial profiles. First, the act of hand-drawing a map from memory appears to be largely one of recreating and reflecting on the selective relationships with the local environment — this can be seen in the inconsistencies present in drawn maps and the way that participants appear to have tried to resolve these. Second, in exercises where the true geography of the area is given (eg. the neighbourhood boundary and moblogging) the reflection by the participant was shifted from the physical coordination of elements of the plan to other factors of importance. For example, the reasoning behind inclusion or exclusion of an area from one's neighbourhood, personal reasons for citing (or not citing) a 'landmark', personal memories associated with features in the landscape. Third, in the case of moblogging these reflections were extended into the immediate present. The photography of animals or taking pictures of particular views gives an example of a different form of engagement with one's environment. The participant's mode of engagement is shifted from that of a subconscious to a conscious reflective agent.

These findings suggest that a key factor in the design of technologies with personalised spatial profiles lies in the way that those technologies afford novel and differentiated kinds of engagement between the user and their environment — the way that they act to change the relationship between user and environment through affording a different perspective.

In view of this our findings suggest a number of guidelines for designers of technologies with personalised spatial profiles.

Guideline 1. *Flexibility is required for users of spatial technologies to personalise their neighbourhood profiles. Designers of technologies that draw on spatial measurement to demarcate behaviours or services will need to explore the resolution, overlap and spatial mappings that are being used to collect spatial profiles.*

The landmark data provided some innovative findings in terms of the types of landmarks people decided to select. Of course, the wording of the task may have enabled people more freedom in choosing their landmarks than if we had for example, asked them to direct someone unfamiliar with the area to their house. However our aim here was to gain perceptions of the environment and to leave people fairly free to express what they felt were key aspects to them in describing their environment. While we found a set of traditional landmarks that we might expect to see, we were surprised by the number of landmarks provided with very personal meaning to the participant. Many of these more personal landmarks correspond with Presson and Montello's [6] definition of local landmarks as more personal to the resident. Additionally, the number of views and beauty spots that were highlighted on the tour link back to Mulgan and Burdett's [8] views on beauty and may indicate that people wished to portray a particular image of their neighbourhood which is not revealed in the sketch maps or questionnaire. However, alongside the personal and aesthetic we also see a social use of landmarks emerging. It appears that landmarks can be more quirky, individual and personal in fact less obvious — in a neighbourhood environment.

Although further work is required to explore the reasons for this, we suggest that the community, regularity of practice and social communication which pervade the concept of neighbourhood allow for identifying features of space to be not just recognised between individuals, but to demonstrate and propagate membership of the neighbourhood to one another. To some extent, landmark selection is used as a social display of individuality — it conveys the personality of the director's relationship with the neighbourhood to the person being directed. Thus, although a personal landmark may be less easy to immediately identify and share, its eventual identification presents an opportunity to establish a social relationship through a shared understanding of neighbourhood.

Guideline 2. *Designers of spatial services will need to be aware of all types and categories of landmarks in order to make the service authentic. Our data particularly indicates that personal landmarks have a social and communicative role that should not be precluded by enforcing the most legible landmark forms available.*

The data clearly revealed that the females and males in this study had very different strategies when completing their hand-drawn maps, seemingly tying in with much of the literature on gender differences in spatial skills [31]. However when considering the neighbourhood tour and boundary sketches we find little disparity between males and females in how they represent their environments and there are many arguments suggesting that the orientation issue we have observed is due to explicit exposure to spatial mapping tasks predominant in male upbringing rather than intrinsic skill [31]. This is an argument that cannot be confirmed here but may be of interest to others for future research. For our purposes, gender differences in spatial understanding matter less for designing systems for the neighbourhood itself and more about their relationship with the space outside. Given that it appears females tend to retain relative spatial information whereas men tend to use more absolute mappings, we suggest that technology that integrates neighbourhood into more global spaces could consider these transition points. Our first pass of the data suggests we may need to consider the impact of changing spatial behaviours or practices beyond familiar neighbourhoods, in turn affecting design representations from simple north-up versus track-up egocentric choices through to off-screen neighbourhood orientation displays in unfamiliar spaces. If these types of application are to be used intensively it is crucial to consider the effects on the development of individual's cognitive spatial development of the spatial fit across points of transition between known and unknown areas.

Guideline 3. *The ability to individually tailor the orientation of spatial displays would seem crucial from a design perspective. Designers should consider the use of north-up versus track up displays backed up by the spatial mapping literature, but accounting for how a good design could ease distortions in spatial knowledge and enable the development of a good internal representation of different environments.*

4. Future work

Within the Cityware project we have developed a number of complementary tools and techniques to enable us to capture and explore people's interactions with their environment including for example space syntax, Bluetooth scanning as well as the moblogging tours documented here. We have recently conducted a follow-up study using the same procedure to explore how both residents and tourists represent the city. We will then use this data to decide on the most appropriate places for some of our technology implementations, for example, which places may need rejuvenation, which places are key landmarks to local people that could be enhanced with digital information, how could we direct people to parts of the city which are not visited often but have lots to offer. We are likely to have differing solutions for those who live in the city and those who are visiting the city.

New technology is constantly altering our perceptions. Our perceptions of space and landmarks are likely to be altering based upon new forms of viewing our environment such as Google maps, satellite navigation systems in cars, mobile guides on PDAs and mobile phones, multiscale map applications and new experiences of technical representations of space directly within these environments. Drawing on the specific benefits we have found using moblogging as a critical feature of a spatial study methodology, we suggest that the significant increase in "spatial" technologies should not just be viewed as an opportunity to correlate real and virtual spaces, but also present numerous opportunities for using the virtual to gain a more varied understanding of spatial practices in the world.

A significant conclusion of this research is that mobile and pervasive devices lead to both a greater degree of conscious engagement between users of a technology and an urban environment, and at the same time paradoxically, can decrease the degree to which those same users have to think about where they are in the world. Reliance on mobile navigation devices, for example, can lead users to create a kind of self-inflicted "fog" on their wider understanding of where they are at any moment, relying instead on information provided by the device, whilst moblogging as an activity appeared to encourage greater perceptions of the scale of a person's neighbourhood.

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