Living for the Global City: Mobile Kits, Urban Interfaces, and Ubicomp

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Abstract. Using ethnographic methods, 28 young professionals across the global cities of London, Los Angeles, and Tokyo were studied to understand in some detail what items they carried with them (their mobile kits) and how they used these items to access people, places, and services (through various urban interfaces). The findings are analyzed in terms of these cities as existing sites of ubiquitous information and communication technology (ICT) use. More specifically, findings are considered with respect to the prospects in these cities for ubicomp as a paradigm of trusted, environmentally embedded computing, as opposed to a wearable computing paradigm of individual self-sufficiency. Overall, at least for the young professional class studied, practices of urban interfacing were remarkably similar across all three cities studied, suggesting that ubicomp systems might be developed to address the range of urban concerns and to unburden and empower urbanites.

1 Introduction

The term *ubiquitous computing* can be understood in a variety of ways. Loosely, it can refer to a state of affairs in which information and communication technology (ICT) is everywhere, used by everyone, for many purposes in many contexts, most often taken for granted, unseen, part of daily life. From this point of view, ubiquitous computing is already a reality in the most developed parts of the world, particularly in "global cities." These are culturally, economically, and politically prominent world metropolises like London, Los Angeles (L.A.), and Tokyo, primary nodes in the interconnected, increasingly information-based global economy [e.g., see 8, 30]. And though it is clearly overstating the situation to claim that *everyone* in these cities is using ICTs, if taken to mean personal ownership and use of devices like personal computers and mobile phones; it is not an overstatement if ICT use is viewed more broadly to include, for example, buying a subway ticket from a vending machine or placing a call to a mobile phone.

This paper reports on an exploratory ethnographic study of ubiquitous computing in this sense as practiced and encountered in London, L.A., and Tokyo. The sheer size of these places (see table 1) necessitated narrowing the focus of the study to a

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tractable scale. We chose to look at young professionals, many in fairly freelance or autonomous employment situations, as they went about their lives in the city, staying mostly clear of the time they spent at home or at work to focus instead on their travels and use of non-home, non-work, "third places" [23]. We sought to approach ubicomp not as a theoretical possibility, but as a set of existing practices from which we could learn and infer opportunities for future value, either in reducing barriers and costs or increasing benefit. We also sought, with some skepticism, to assess the notion that places like London, L.A., and Tokyo actually form a coherent category – that they are essentially a single, distributed place, despite their apparent differences. Was ubicomp realized fundamentally differently in these three places, with different implications for future direction, or could one usefully design ubicomp for "the city"?

Table 1. Population and density of the three global cities studied

	London	Los Angeles	Tokyo
Urban Region	Greater London (City & 32 boroughs)	L.A. County (L.A. & 87 other cities)	Tokyo Metropolis (Tokyo & 26 other cities)
Population (2004)	7.6 million	10.1 million	12.4 million
Area	1580 km^2 610 mi^2	10518 km^2 4061 mi^2	2187 km^2 844 mi^2
Density	4810 per km^2 12459 per mi^2	960 per km^2 2487 per mi^2	5670 per km^2 14692 per mi^2
Transit Ridership	34% (see note 1)	7% (see note 2)	63% (see note 3)

1. Daily travel in Greater London, 2003. Excludes walk/bicycle trips at 23%. http://www.tfl.gov.uk/tfl/ltr2003/market-share.shtml

2. Journey to work data, LA county, 2000. Excludes walk/other trips at 4.5%. http://www.publicpurpose.com/ut-jtw2000la.htm

3. Annual passenger journeys, Tokyo-Yokohama metro area, 2000. http://www.publicpurpose.com/ut-tokmkt.htm

A stricter reading of ubiquitous computing contrasts with the notion of wearable computing. The wearable paradigm involves empowering the individual through augmenting the body with ICTs such as cameras and microphones, heads-up displays, eyes-free input devices, and personal databases and automated agents. The individual bears the burden (in bulky, battery-laden near-term implementations, quite literally) of this technology, but also exercises control and autonomy, and in the extreme is self-sufficient despite whatever resources the environment does or does not provide. In contrast, the ubicomp paradigm involves augmenting the environment with networked sensors, displays, and services in an unobtrusive but empowering way. The individual is freed from having to carry, maintain, and manage ICTs, which instead plentifully stand ready as needed to adapt themselves to the individual and his or her

context. Rather than being dependent upon what they carry, individuals in this paradigm become dependent upon their environment, into which they place their trust and from which they consent to be sensed and adapted to.

Urban life has features of both paradigms. Urbanites typically carry a large array of objects (many of them technological) with them in their bags, purses, wallets, and pockets. These containers are private domains over which they exercise control, and their contents provide a measure of self-sufficiency and reassurance, particularly when they are confronted with the unexpected, challenging, or threatening. But urbanites also live in heavily technologically augmented environments offering all manner of amenities, public and proprietary, free and commercial. Much of what they carry with them are interface tokens required to gain access to, conduct transactions with, and use and enjoy their chosen slice of the urban environment. These tokens have co-evolved with the environment itself, such that the contents of a wallet can be considered a microcosm of the world its bearer inhabits. And sometimes these tokens can be dispensed with partially or entirely, as when one sets out for a night on the town, carrying just the bare essentials, trusting that fun will be had.

In investigating everyday life in London, L.A., and Tokyo, we sought to understand how these two paradigms balanced and interacted in the lives of our study participants. We paid close attention to what they carried with them, how, when, and why it was used, and how it reflected who they were and wanted to be, as well as how it reflected the character, realities, and potential of the encompassing city. We observed the environments through which our participants traveled, shopped, worked, and recreated, and analyzed our participants' attitudes toward them, whether of fear, trust, engagement, disengagement, resignation, delight, or some combination. In short, by understanding in detail how some residents of each of the three cities practiced ubicomp in the loose sense, we aimed to better understand ubicomp in the stricter, paradigmatic sense, with its associated issues of trust and the practical co-design of the personal and the environmental.

2 Related Work

Our overall approach is one of lightweight ethnography [10, 18, 19], in which methods from anthropology are adapted for more rapid turn-around and applicability to issues of technology use and design, while seeking to remain true to the core ethnographic concern of understanding everyday practice and experience from the perspective of another culture. Our approach is related to what Marcus [17] has called multi-sited ethnography, in which the traditional ethnographic focus on a single field site is shifted to encompass multiple global sites and their interrelationships, though it is less self-reflexive and open-ended, and does not explicitly explore interconnections *between* London, L.A., and Tokyo.

A number of studies in the computer-human interaction (CHI) and computer-supported cooperative work (CSCW) literatures have looked at what people in cities carry with them and why. Much of this has been in the context of understanding mobile work and workers [e.g., 14, 26, 31]. Our study seeks to extend this beyond the work domain, into everyday urban routines [see also 13, 34]. The emerging field

of urban computing [24, 25] shares these interests, seeking to apply technologies of ubicomp and mobile computing to enhance social spaces in cities, beyond utilitarian concerns of efficiency and commerce.

An important set of studies and analyses have illuminated the profound impact of widespread mobile phone adoption across many social domains, from political organization to adolescent development [e.g., see 2, 11, 12, 29]. For the people and places we studied, mobile phones were a fundamental infrastructure underlying much of what we observed. Given this large existing literature, we focused not so much on mobile phone usage per se and the varieties of social interaction it affords (and blocks), but on the larger mobile kits, of which mobile phones were an important part, and the wider set of everyday transactions they support.

We have been strongly influenced by the work of sociologist Christena Nippert-Eng, who has studied how people use objects, spaces, and routines to manage boundaries between home and work in their lives [21]. In more recent research on Chicago-area professionals' conceptions of privacy, Nippert-Eng and her associate Jay Melican used wallets and their contents as an entry point for conversations with their participants on boundaries between public and private, disclosure and concealment [Nippert-Eng and Melican, personal communication]. Though we did not have our participants sort their wallet contents into "private" and "public" piles, we did adapt their methodology to leverage wallets (and more generally, whatever was being carried) as conversational resources as well as data in itself.

Cooper and colleagues [5] also looked in depth as wallets, using semi-structured interviews about the contents of 55 UK adults' wallets to inform the design of e-wallets as wearable technology. Their findings regarding wallets are generally consistent with ours, though based on a broader, larger, and older sample; and as might be expected, there were some discrepancies as well (e.g., they reported more emotional attachment to the wallet and variability in its contents than we found). We have reported on implications of our study for the notion of e-wallets elsewhere [15].

In her multi-year and ongoing Portable Effects project [33], Rachael Strickland has documented the "nomadic design practices" of many people through inventories of what and how they carry (many of these collected as part of interactive museum exhibits in the San Francisco Bay Area). Like her, we see our participants as vernacular designers of their mobile kits, creatively balancing personal, cultural, and infrastructural constraints. As predicted by this point of view, we found participants' practices and materials to be idiosyncratic and expressive of their identities, but also exhibiting important regularities and identifiable genres.

At a macroscopic level, London, L.A., and Tokyo are major topics of study in their own right, generating multiple histories, economic, cultural, political analyses, not to mention tourist guides, blogs (see [28]), and commentary [e.g., 9]. L.A., in particular, has captured the imagination of a group of urban theorists, resulting in an emerging field of "Los Angeles Studies" [20]. Furthermore, their comparison and interrelationships as embodied in the "global city" concept continues to attract attention, following from the seminal work of Sassen [30]. Though much of this work is clearly beyond the scope of ubicomp, scholarship is increasingly recognizing the crucial role of ICTs in the past, present, and future of these world cities. We found this macro-level work valuable in providing a background for our mainly micro-level investigations of every-day ICT use in context.

Our current more micro-level work is also in many respects a continuation of our previous exploratory work on the various meanings that ubiquitous infrastructures can have for the people enmeshed in (or reacting against) them, and their implications for the design, adoption, and appropriation of ubicomp systems [16]. We sought both to enlarge the scope of this work beyond a U.S. and home life focus to more global and mobile contexts, as well to zero in on the details of interacting with ubiquitous infrastructures in everyday life.

3 Study Design and Methods

The study was designed to address the following questions regarding the notion of global cities as sites of ubiquitous computing:

- Mobile kits. What do people carry with them? How is the carrying (multiple items, multiple choices) managed? How are these items perceived or valued?
- Urban interfaces. How do people use the city and the environments and services it offers? In what situations are items from the mobile kit involved, and how are they used?
- Global differences. In terms of mobile kits, urban interfaces, and their interaction, what differences (if any) between global cities matter? To what degree is it warranted to talk of "the global city" or "urban computing" as if they were unitary domains?

As is common in ethnographic work, we selected participants for theoretical interest and for trust relationships with the researchers rather than to serve as a statistical sample. As we were primarily interested in learning about differences between the different cities to be studied and had limited resources to cover any particular city, we decided to focus on a particular life stage and social class of participants: young professionals, aged 22 to 32, without children, transitioning into the workforce after completing their higher education. We expected (and found) this group to be tech savvy, mobile, and confronted with novel challenges as they adapted to a new life stage. They were also of theoretical interest as a group that it seemed could in principle choose to purchase and carry a wide variety and quantity of stuff if they so desired, but also a group that could choose to carry very little and rely on resources in the urban environment that was in many ways designed for and friendly to them. (Thus we might expect substantial variability of mobile kits based on personal preference and circumstances of employment, relative to other groups who might be more constrained in terms of what they were expected and able to carry.) At a more practical level, we also had relatively easy and trusted access to them through our academic and professional contacts in the study cities, many of them former students or classmates of our contacts. Thus, many of our participants were graduates of elite universities, notably: the Royal College of Art (London), USC (University of Southern California, in L.A.), and Keio University SFC (Shonan Fujisawa Campus, near Tokyo). And many were in the design and media industries; freelancers were relatively over-represented.

It is worth noting that by focusing on this particular lifestage, class, and to some degree occupational milieu across the three cities studied, we may have biased the

study away from finding differences between the cities. For example, it may well be that the lifestyles of elderly residents, immigrant groups, or children vary considerably more across our study sites than do those of elite young professionals. We do not wish to suggest that other groups merit any less attention from the ubicomp community, and indeed may merit more. Nevertheless, we believe our study design was a reasonable initial approach to the research questions at hand, and that it is not a priori apparent that this group would have limited variability. Furthermore, our goal was not a comprehensive survey of ICT use across all people in all cities, but an interesting first pass through the "global city" looking at an influential group of urbanites with similar needs and concerns which *could* in principle be met in different ways in different urban contexts. We welcome and look forward to additional cross-cultural comparisons of ubicomp practices.

In addition to selecting individual participants, designing this study also involved selecting cities to "participate" in the research. Whereas individual participants were selected to form a fairly homogeneous sample, London, L.A., and Tokyo were chosen for diversity within the category "major world city." According to the Loughborough Globalization and World Cities (GaWC) rankings [1], each of these is one of the 10 "alpha" world cities, and London and Tokyo (along with New York and Paris) are in the first tier of these. Although similar in these terms, there are fairly obvious differences between them – widely dispersed on different continents and economic communities, different cultural origins, different levels of multiculturalism, different transportation infrastructures, and population densities (see Table 1). Of these, we were particularly influenced by differences in common modes of transportation, as we expected this would have a large influence on everyday urban practices. For this reason, we chose L.A. and its famous (or infamous) automobile culture over first-tier New York as the U.S. city in our sample.

A total of 28 individuals participated, 12 in London, 10 in Los Angeles, and 6 in Tokyo. Participants took part in a four different activities:

1. An initial interview, including a survey of their "mobile kit", i.e., everything they were carrying with them – in their car, pockets, bags, wallets, hands, etc.
2. One or two days of diary keeping, focused on use of any of the aforementioned items. Various methods were experimented with, including notebooks, voice recorders, and GPS-enabled camera phones (see [22]).
3. A "shadowing" session in which a researcher accompanied them on a shopping, commuting, or other trip through the city.
4. A final interview, including a review of their diary, and a discussion of positive and negative images of future technology.

Interviews took place for the most part in public places such as restaurants and cafes; we had limited access to homes and workplaces. Participants were thanked for their participation with cash gifts, and promised that their data would be treated confidentially.

4 Three Global Urbanites

In this section, we present brief sketches of one participant from each of the cities we studied, not because one individual can represent the range of themes and issues we encountered even in our small sample, but only to give some sense for the concrete cases we encountered. In the subsequent section, we turn to more general findings.

Fig. 1. Some study participants and their mobile kits. Alex running an errand near Covent Garden, London (left); Jenna's silvery mobile kit (minus iPod), Los Angeles (center); Sumi umbrella shopping in a Ginza department store, Tokyo (right)

4.1 London

Alex, 23, grew up in the U.S. and Australia and moved to London four years ago thinking that he would get a job in theatre, one of his passions. That has never quite happened, and he now finds he can only attend the theatre two or three times a year due to the expense. He commutes by bike (unless the weather gets really nasty) 20 minutes from his apartment in South London to his job providing technical support in media production; it's actually faster than the Tube (the London subway), doesn't go on strike several times a year (though he feels penalized when his colleagues use this as an excuse not to show up for work), and most importantly lets him breathe much better air. Recently he's also been working part-time as a personal assistant for a New York "VIP" (a Very Important Person he declined to name), looking after a luxury apartment being leased for a year to facilitate the VIP's frequent trips to London. The apartment serves as a very handy central "base," where Alex can drop off his bike and bag on his way back home and go out, unencumbered, on foot.

Alex's mobile kit consists of a wallet, an iPod ("the newest model since I'm a geek"), and a Sony Ericsson Bluetooth-enabled mobile phone, all of which are kept in his pockets so he can easily check that he has them whenever he leaves a place. A small shoulder bag holds two key rings (one for his bike, his apartment, and his notebook computer which he keeps chained to his bed in case of burglary; the other for the VIP's apartment), gridded paper notebook and pen (for capturing ideas for his blog), food (an apple and a "superfood" bar), sunscreen lotion, and a book for leisure reading. (He was also carrying two CD cases for Broadway musicals. Although he had ripped the CDs themselves to his iPod, he needed the cases for their booklets so

he could read the lyrics while listening.) In his hand was usually a water bottle (see Fig. 1, left).

Sleek, minimalist style is important to Alex. He goes so far as to hide his iPod ear bud cord under his shirt so that it emerges discretely from his collar. He hates having things in his pockets, but does so for security, as mentioned. Stylish techno gadgets are a source of pride, as well as having a central role in his daily activities. To connect to his phone he bought a Bluetooth adapter for his computer at work, so that he can send SMS (Short Message Service) messages with the computer keyboard. The iPod is sometimes the focus of his attention, as when he spent an afternoon in a large, hidden park near his flat listening to his Broadway CDs, but more often is set to random play to provide the "soundtrack to my commute" and other travels.

4.2 Los Angeles

Jenna is in her mid-20's and lives near the beach in Santa Monica. She works for a prestigious non-profit media company, which requires frequent travel – she had just returned from New York City before we interviewed her. When she's not away, each workday she drives her Honda sedan 16 miles inland to her office near Hollywood, where she spends much of her day emailing and phoning clients. Her mobile kit, which she carries in a small shoulder bag, consists of a Calvin Klein wallet, a Palm Tungsten PDA in a metallic case, an iPod, an LG clamshell mobile phone, and a key ring (6 keys, wireless key fob for her Honda, and an ornament bearing the logo of her employer). Each of these is entirely or at least partially silver – her fashion statement (see Figure 1, center).

Jenna loves her work and respects her employer, but feels that it's only realistic to prepare for the possibility that she could lose her job (and access to her online work files) with short or no notice. She makes it a point to keep her client database, painstakingly acquired over time, separate from the data on her work (employer's) PC; it resides only on her PDA, which she never leaves at work for fear that someone might gain access. In the event she loses her current job, she will still have her client database – a valuable resource for her next job. (The PDA is also used more publicly to display photos, often to people she meets during her business trips.)

Data loss is also a concern regarding her mobile phone. The current one is a recent replacement for one she had lost, along with many phone numbers stored on it. Because of this, she has resolved to store fewer numbers on her phone – "only people who really matter to me". Thus, her work PC, PDA, and cell phone are all compartmentalized domains that she goes to some length to keep separate, and which represent in some sense varying (increasing) levels of intimacy.

Jenna's use of her car was also noteworthy for its different zones. In addition to being a mechanism for her commute, it serves in some way as an extension of her apartment. The trunk serves as a laundry hamper (holding plastic bags of dirty laundry and laundry soap at the time of our surprise inspection, on their way, eventually, to a Laundromat), recycling center (collecting empty water bottles waiting for a trip to a recycling drop-off point – she does not have curbside recycling service), and pantry or refrigerator (holding cases of full water bottles; these move to the front seat

or her bag for use, and then make their way to the floor of the back seat where they collect before being transferred to the recycling bin in the trunk).

4.3 Tokyo

Sumi, 23, recently graduated from Keio SFC and moved to Tokyo, renting an apartment with a roommate and joining a venture company as a part-time clerical administrator. Though paid part-time, she works full-time as a means of advancing in her career. Indeed, this strategy just paid off and she has accepted a full-time position at a major multinational bank beginning the next year. She currently has about a 30 minute commute to work (10 minutes walking, 20 minute on the train), but her life is played out in many ways beyond this (temporary) home/work axis. Although serious about developing a career, rather than focusing on her workplace relationships, she values and spends much time cultivating face-to-face her close network of (mostly female) friends from college – and indeed relies upon them, more than libraries and professional courses, to support her continuing business education. Relationships with friends often bring her to outlying cities like Shonandai and Yokohama, though she stays connected continuously through email on her *k-tai* (mobile phone). (Like many of our Japanese participants, Sumi uses her k-tai mostly for email, although she sometimes downloads coupons to it from the i-mode Gurunavi restaurant search engine, or emails them to it after finding them from her PC. She continually checks her k-tai to see if she's gotten mail.)

Sumi's mobile kit is carried in one of seven bags she switches between based on fashion, supplemented by (on the day we interviewed her) a paper shopping bag with with a little-known logo on it re-purposed to hold a newspaper, her day planner, and a CD player she's had since sophomore year in high school. (This reused shopping bag greatly surprised our Japanese colleagues, as it seemed very out of place with Sumi's overwise *ojyousama* [upper class young woman] persona; it may be a new trend.) The main bag holds her wallet, k-tai (accessorized with a strap she got several years ago by being stopped on the street in Yokohama to appear on *Piiko's Fashion Check* TV show), key case (parent's house in Kobe, apartment, company van, office desk), tissues, make-up (usually a pouch, but the day's bag was too small for this so she only had lip gloss), and a book.

Sumi shifts between her upscale *ojyousama* upbringing and a more practical role as a *shakaijin* (working adult). For example, in her shadowing session in Tokyo's glitzy Ginza district she went umbrella shopping in a number of department stores with truly astonishing assortments of umbrella styles on display (see Figure 1, right); finding none to her liking, she moved on to browse in Prada and Barney's New York. But ultimately she ended up purchasing a new day planner in a quite ordinary Sony Plaza store in the subway station. Sumi works to construct her new identity in conjunction with her social network of like-minded women; often they turn outside of Japan for role models, following with great interest American television shows like *Ally McBeal* and *Sex and the City* (available in Japan on DVD and on pay TV services).

5 Overall Themes

5.1 Mobile Kits

What people carried with them was, overall, remarkably similar across all three cities. Wallet (with cash, credit card, debit card, ATM card, ID, transit pass or license), mobile phone, keys, and a bag to carry stuff in were universal. A work-related scheduling device – be it a traditional paper day planner (most common), PDA, or occasionally data downloaded to an iPod – were nearly universal, though their forms were more variable. Other common categories included:

Body items. Tissue, lip balm, eye drops, glasses or sunglasses (even in famously cloudy London!), and for women, a make-up kit.

Cocooning items. By this we mean items that allow escape from one's current environment through creating a kind of "bubble" in which outside distractions are shut out. These include music players like the nearly ubiquitous iPod and its earlier incarnations (see [3, 4]), but also books, magazines, mobile phone email and games, "anything to avoid staring at stranger's shoes on the Tube" as one London participant put it. But cocooning could also be seen as unfortunate and anti-social; in particular, images of friends or children sharing the same space but not paying attention to each other were often selected as representing fears of future technology.

Experience-capture items. Less common, but highly valued by their users, were notebooks, sketchbooks, stand-alone cameras, and cell-phone cameras. Sometimes these were in service of an explicit activity, like journal keeping or blogging, but often they were for informal sharing with friends (camera phone photography was often deemed nonserious in this sense).

Professional tools. This could include work-related books, files, and especially notebook computers; often they were simply shuttling between home and work, but sometimes they were being taken into the field to a client site, etc., or carried about in case a client was encountered. Because of their importance to the bearer's livelihood, these items were often closely guarded and worried about – theft or damage were seen as serious dangers.

Emergency items. Rarely these were actual weapons like pepper spray; more often these included battery chargers (sometimes the emergency of running out of power could be anticipated, but often these were carried "just in case") and emergency food rations. We did not encounter supplies for medical emergencies in our sample.

Junk. A large and diverse category, including actual trash waiting for an opportunity to be thrown out; but also receipts (some but by no means all of which were being purposely saved for reimbursement or reconciliation with monthly statements), left-over transit or phone cards with small amounts of money on them, and sometimes items that surprised and embarrassed their bearers as their purpose had been forgotten.

Management of all these ensembles of containers, devices, certificates, and objects was an ongoing concern. Different styles could be discerned, for example, whether the wallet had defined compartments with a place for everything and everything in its place (more common than not) or was a haphazard amalgamation of items to be

sorted through at time of use. (In either case, there is an opportunity here for technological augmentation, so long as it is not seen as insulting the abilities of the wallet keeper.) Often style itself was the point, as with participants who had multiple bags and wallets to suit different fashion contexts or personal moods, or even for single-bag owners who often invested considerable time and trial-and-error over years to find the "right bag for me."

The importance of the body in the management, perception, and valuing of urban kits is difficult to over-estimate. The category of "body-related" items was alluded to above, but this could be extended to include the fit of wallets and other items in pockets (avoiding uncomfortable and unsightly bulk sometimes gave rise to secondary or tertiary wallets annexed to the carried bag), the way bags are worn while walking or placed while sitting, the importance of bodily contact providing reassurance that critical items are safe in one's possession, and the positioning of cell phones and transit passes to be ready-at-hand, to name but a few. There was a general delight in being unburdened and unencumbered, whether that meant stashing items away in one's car (or VIP apartment one is tending, in Alex's case), or positioning an RFID (radio frequency identification) transit card in one's pocket so that it can be read by a subway wicket without breaking one's stride, or leaving everything behind but your keys and some cash to run out to the corner store.

The question of how people value and perceive the items they carry is complex and often idiosyncratic and contradictory. For example, Nippert-Eng and Melican [personal communication] found that cash was seen both as public (not something I'm attached to, something meant to be traded away in the public realm) *and* private (posing personal risk to me should I lose it, and in general none of anyone else's business) by their informants. Mobile kits were not *so* private that our participants balked at showing them to us in considerable detail and discussing them rather openly. Only a few rushed past certain areas in their wallets or compartments in their bag that were clearly not open to inquiry. Of course, we gave participants advance warning that we were researching what they carried and why, so they could adjust what they brought to the interviews if necessary. The car inspections in L.A. were the exception to this rule, and generated somewhat higher levels of discomfort, particularly when this involved looking into trunks and glove compartments – closed furniture, in effect. And many items had a "cash like" quality of being meant for public (or at least semi-public) transaction, in Nippert-Eng and Melican's sense.

Nevertheless, mobile kits are valued in part because they *are* private, related to one's identity, and one's very body. Often our participants would say that either their day planners or their mobile phones were the most private things they were carrying, not because these held what was perceived to be sensitive information that could be clearly damaging should it fall into the wrong hands (unlike, say, the credit cards and identity cards in their wallets), but because these items embodied their personal histories, who they knew, how they spent their time – who they *were*, in some sense. And in crowded urban environments, privacy can be a precious commodity indeed, and valued as an end in itself. Just as elements of mobile kits were used to cocoon, the mobile kit itself formed a personal space which one could control and put effort into managing.

5.2 Urban Interfaces

Perhaps the primary urban interface, not surprisingly, is money. Our participants used the city to earn money, to spend it, and sometimes to invest it (as in some cases of spending money on the alcohol required to socialize with ones work colleagues, who could provide future returns). Much urban infrastructure is designed around these economic activities. We have reported elsewhere on implications of our study for e-wallets and opportunities for technology to address issues such as receipt management, self-monitoring and self-control over temptation, and automated payment [15]. The intersection of ubicomp and money, like the intersection of ubicomp and cities, is a large topic for a fuller investigation in its own right, and compared to urban computing, is surprising by its absence from the agendas of the ubicomp research community. Here we just reiterate its global importance, and the high stakes it introduces: when it is not just one's notebook computer on which one's livelihood depends, but one's interactions with embedded sensors, displays, and disembodied processes running behind the scenes, the demand of robustness and trustworthiness placed by users on such systems will be high indeed. From such a perspective, which is indeed a bit paranoia-inducing, the appeal of the wearable as opposed to the ubicomp paradigm is not hard to imagine. It is likely to be an uphill battle to get mission-critical functions out of users' mobile kits and into the environment itself, unless this can be demonstrated to increase safety, cost-effectiveness, and user control.

But urban interfaces are certainly not *just* about money – even when they are (even mostly) about money. Looking at how our participants made use of their cities, a number of important classes of activity are worth calling out, though this is by no means a comprehensive list.

Traveling. Like money, not surprisingly a major and universal concern, particularly in densely populated areas where other people are often as much obstacle as resource. Our participants optimized their commutes, being able to tell us in detail how long it took (or could take), and what they did along the way. In transit-oriented cities, this often involved making use of amenities at major transfer stations, as well as the stations at which the commute began and ended; these transfer stations are logical nodes for the deployment of ubicomp technologies, as is already happening in Tokyo with JR East's experiments with Suica smart card transactions within its stations. In the car-oriented culture of L.A., along the way meant in one's car – which is also an excellent candidate for early deployment of ubicomp technologies, and a particularly nice one given the essentially captive audience and the ability of the platform to generate its own power. Travel obviously extends beyond commuting, becoming a precondition for a huge variety of urban interactions that city makes possible – if you can make your way to them! These include both place-based and people-based interactions, which despite the ubiquity of ICTs in these cities, are still primarily embodied experiences, ICTs being used primarily to coordinate rendezvousing in space rather than replacing it.

Networking. This includes creating, collecting, and maintaining personal contacts, often for one's work – but as in Sumi's case, work networking and networking among close friends can be closely related. Often networking is deliberate and self-conscious, with certain places affording match-making and relationship building, but sometimes it is quite serendipitous if not downright unlikely – on multiple occasions

in our shadowing of participants, they unexpectedly "ran into" people they knew well. Through practices of self-selection of places and routes, even these largest of world cities can sometimes resemble to their inhabitants small towns. This has interesting positive and negative consequences, as place-based social-networking systems like Dodgeball [7] demonstrate; chance (or half-chance) encounters can be wanted or unwanted, and often both at once depending on whose perspective is taken. None of our participants had used such services, relying instead of personal networks of email and phone calls; the key artifact for networking, besides the cell phone, was the business card, which surprisingly has tenaciously resisted being replaced by some digital version. (The closest phenomenon we encountered to this was the appearance QR codes [27] – barcode-like glyphs – intended to be read by cell phone cameras which had begun to appear on avant-garde business cards in Tokyo.)

Mapping. This often takes the form of literal map use, as the complexities of navigating these cities is more than anyone but a highly trained taxi-driver could do from memory (see [32]). Nearly all Londoners in our sample carried their *A to Z Street Atlases*, focused on pedestrian and Tube navigation, just as nearly all Los Angelinos had their more car-oriented *Thomas Guides*. Personal atlases were far less common in Tokyo, where they had been incorporated into more of a ubicomp than a wearable paradigm: maps they were embedded everywhere in the environment, at subway entrances (nicely rotated such that straight ahead was always up), in print advertising, on store business cards, and increasingly on k-tai screens. But by mapping we want also to include practices of collecting places, often in the form of store business cards or loyalty cards, sometimes in the form on annotations on the *A toZ* or equivalent. We found this to be a widespread way of personalizing and making sense of the city, the place-holders often being sources of considerable pride, demonstrating the bearer's mastery of the environment.

Tracking. This was more of a latent than an often realized practice. Our study methodology, which included both self-monitoring and diary/blog keeping as well as being "shadowed" by a trusted stranger, prompted our participants to consider various future possibilities for tracking their own or others behavior. The reaction was surprisingly positive, despite the obvious privacy concerns; most participants could see at least some circumstances where automated tracking might have more benefit than risk. These often included business-related cases such as receipt tracking, but monitoring one's own spending was often entertained to be potentially useful, as was (particularly in Tokyo) the idea of learning the wise habits and skillful actions of an admired other.

Cocooning. As mentioned in the discussion of mobile kits above, disconnecting from the city and finding private space for oneself was a widespread if problematic activity, often technologically mediated. However, it often involved some measure of using the city itself, not just an interaction between one and one's mobile kit. For example, Alex's bike riding and the bike paths being actively promoted by the London government are a form, for him, of escape from the city; the random shuffling of the iPod enhances the experience, but it is not primary to it – the (relatively) fresh air and sense of speed and freedom seem more fundamental. Related to this, London has embarked on an ambitious and controversial plan to reduce traffic in its central areas through "congestion charging" enforced by mobile CCTV (closed-circuit television) checkpoints and automated billing of violators through the mail [6]. For better or

worse, this is very much along the lines of the ubicomp paradigm (in a rather communitarian/authoritarian form) rather than any sort libertarian wearable scheme; and it appears to be working surprisingly well. It can be regarded as a ubicomp deployment to create a kind of giant cocoon within central London itself, creating an escape, at least partially, from the noise and pollution of the less regulated city.

Browsing. Finally, there is a mode of interfacing with the city that (at least at first approximation) requires neither money nor ones urban kit – if one disregards transit costs and infrastructural maintenance and support. This is the cheap thrill of simply walking (or driving or "cruising", in L.A.) around and browsing the myriad of sensory, social, and informational experiences the city has to offer. In Japanese, there is a term *tachiyomi* meaning "to read while standing in a shop, not buying" – a popular activity across all three cities, at least for our target population. Much of the delight of cities is *tachiyomi* generalized to all sorts of experiences, with a somewhat subversive sense of having gotten something for nothing as a finishing touch. Of course there is a danger that too much *tachiyomi* that does not ultimately lead to enough buying will put bookshops out of business. Ubicomp has the potential to ruin *tachiyomi* experiences by monitoring behavior, regulating spaces, and charging for access; but it also has the potential to deliver wonderful new forms of urban experiences through shared displays and public interactive systems that don't require everyone to pay in order to play.

5.3 Global Differences

From this one modest study, it would be foolish to try to draw any definitive conclusions about such a philosophical question as whether London, L.A., and Tokyo are fundamentally similar or fundamentally different. And it is too easy, though probably true, to say that they are both. For the purposes of ubicomp, however, the question is a practical one – what differences matter, and are there useful similarities?

To take the latter question first, overall we generally more struck by the similarities between the practices and concerns of our participants regardless of city and culture rather than the differences, and feel that our data suggest some useful global opportunities for ubicomp. At least, this is a hypothesis we would like to advance, and look forward to other studies to confirm or reject it.

All of the major categories within mobile kits and urban interfaces discussed in the preceding sections appear to cut across all three cities, at least to a first order of approximation. Perhaps we should not have been surprised by this, given the population within each city that we targeted and the processes of globalization that urban theorists have pointed to rapidly at work shaping the, as the argument goes, convergent evolution of each megalopolis. Yet we were surprised – at the ubiquity of wallets bulging with receipts and unexplained clutter, the widespread acceptance of plastic money, the similar vision of social network based professionalism being striven for by young Japanese and young Americans, the similarity of problems faced by commuters stuck in traffic in L.A. and those stuck in the Tube under London. Similar forms and similar problems suggest the possibility of similar solutions.

That being said, there are important differences. Infrastructure is one of them. For example, car-based ubicomp is likely to look far different than pedestrian- or transit-

based ubicomp. Indeed, one could argue that car-based ubicomp isn't ubicomp strictly speaking at all, but rather a form of wearable computing, if one can imagine that one "wears" a car while driving or riding it in (not such a farfetched idea). In any case, car-based systems are probably easier to deploy and are already an area of great interest to the automotive industry.

The infrastructures underlying technology diffusion and deployment are also likely quite different across London, L.A., and Tokyo, though this matter of practical politics, of how innovation happens or is thwarted by particular communities, is beyond the scope of our investigation. But there is something at work that is producing real-world smartcard payment systems in Japan, congestion charging in London, and the relatively backward state (in terms of SMS, email, and internet services) of mobile phones in L.A.

It would also be foolhardy to disregard important cultural differences between the US, the UK, and Japan. Though these do not necessarily preclude the success of similar technological paradigms across all of them, they do almost guarantee that the meaning and connotations of these technologies will differ, and that they will be culturally constructed in interestingly different ways. We are only suggesting that the cultural construction could proceed from fairly similar starting points. For example, business cards are important artifacts of social networking in all three locales, but anyone who has observed the differences of respect and decorum involved in business card exchange in the East compared to the West can see that these cards *mean* something different in Tokyo than they do in L.A. or London. The same is bound to be true of ubicomp artifact (and indeed can already be seen in the case of the different mobile phone cultures in all three cities).

6 Summary

Globalization theorists may be on to something, in positing the emergence of global cities, co-dependent, convergently evolving, and interlinked through a worldwide information economy. This phenomenon is relevant to ubicomp because these world cities are major centers of ubiquitous computing (broadly conceived), among all the other things they are major centers of. Ubicomp is already a lived experience in these cities, and at least for a class of elite young professions, similar lived experience in interesting and perhaps surprising ways.

In exploring with a handful of study participants the detailed of this lived experience, we uncovered some general trends that appear to cut across cities as widely separated in space and culture as London, L.A., and Tokyo:

- People are skilled at using their bodies and mobile kits to connect their private identities to the public spaces and urban interfaces they navigate as part and parcel of daily life in these cities. Ubicomp design should seek to leverage these skills, allow for this flexibility. It should also seek to help people cocoon, creating spaces in the city of escape and rejuvenation. It should work along with wearable technologies (like wallets, or e-wallets should technologies like mobile phones and iPods move in that direction) to allow people to record, collect, and track their environments and their own behaviors.

- Responsive, display-rich, trustworthy environments are a source of delight, even at small scales. They can afford *tachiyomi* – browsing/experiencing/enjoying without pressure to buy. Ubicomp may be able to unburden people – of expanding mobile kits, and the physical, cognitive, and emotional burdens they can produce, such as the constant vigilance of people checking that they still have their wallet, keys, mobile phone. Ubicomp may be able to reduce fear, if it can be trusted.
- Cultural differences are important, but global cities share much in common that can be designed for – a shared baseline of expectations and experiences. The details may differ (for example in car- vs. pedestrian-based implementations), and the culturally constructed meanings certainly will, but there are useful commonalities that can be leveraged.

We present these hypotheses in the spirit of calling attention to some phenomena ripe for consideration and testing by the ubicomp community. In addition to the question of global cities and whether they constitute a coherent domain for design, we also hope that future research will look at the needs and experiences of other, less privileged populations in this cities; at urban environments left off the globalization grid; and at better methodologies for conducting this kind of research, to facilitate tracking and self reflection.

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