Underground Aesthetics: Rethinking Urban Computing

An ethnographic study and a design proposal for a situated music-exchange application suggest how explicitly foregrounding the experiential qualities of urban life can help rethink urban computing design.

R ecent interest in urban computing grows not least out of a longer-term interest in mobile computing and its applications for urban navigation, discovery, and interaction. This legacy affects how applications are conceived. At present, many urban applications focus on solving perceived problems of disconnection, disruption, and dislocation. However, a growing movement points toward the value of considering a less instrumental account of city life. Ethnographic studies of existing relationships between urban mobility and technology offer an alternate formulation for applications development—one based on the experiences of urban dwellers relating to one another and to their city.

We conducted an ethnographic study of an existing urban mobility site—namely, London's Underground—to explore a specific aspect of urban life and its relation to technology. This study highlighted riders' diverse, often contradictory, aesthetic experiences of the Underground. In parallel with the study, we designed a music-exchange application, *undersound*,[1] based on explicitly foregrounding these experiential qualities.

In this article, through reflection on the ethnographic study results and the undersound design, we explore how an aesthetic account of urban life might be the basis of designs that support not only an individual but also a collective experience of the city.

Mobile technology and urban contexts

We begin by examining past and emerging relationships between mobility and technology in urban contexts.

First-generation applications: Solving problems

We divide first-generation urban and mobile applications into three categories.

First are systems that frame mobility as a *disconnection* from stable working situations. These applications try to overcome this disconnection either by providing remote mobile access to static information resources or by trying to reproduce static application contexts. For example, the Satchel system sought to give travelers easy access to electronic documents, as well as the ability to share and exchange them, by developing mobile digital tokens that could be used to manipulate documents stored centrally.[2] Researchers at the University of Glasgow investigated forms of "co-visiting" cities in which static and mobile participants interacted around the same physical resources.[3] In attempting to provide "anytime, anywhere" information access,[4] these applications frame urban mobility as a problem to be overcome or eliminated.

A second category of urban applications frames mobility as a *dislocation* problem. These applications focus on finding your way or locating resources. GPS navigation systems are one obvious example. So are guides to help people traverse unfamiliar environments, such as tourist sites,[5] museums,[6] and university campuses.[7] Similarly, applications that help people find resources as they move through an environment—whether interesting restaurants or nearby friends[8]—also reflect the idea that urban mobility often involves being "out of place" or lost.

A third category focuses on *disruption*—the ways in which a mobile technology might behave

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inappropriately in urban settings. These context-sensitive applications include, for instance, a mobile telephone setting itself automatically to vibrate mode in a theater or filtering out low-importance calls at dinner.[9] Beyond mobile devices, context-sensitivity also appears in public displays that respond to movement patterns in public spaces.[10] These systems respond to a sense of rupture between the technology and the urban setting in which it's deployed. Although social systems might be able to effect a contextually appropriate response, traditional technologies can't recognize and respond to the wide variety of contextual cues that a city presents. The problem, then, is to make the technology sensitive to them.

Emerging applications: Interaction opportunities

By contrast, an emerging generation of applications is viewing mobility not as a problem to overcome but as a way to create interactive experiences that rely on or exploit movement and space. For instance, the UK's Equator consortium has produced a series of mobile games that blend physical and virtual worlds. Among them, Can You See Me Now,[11] a game played on Sheffield streets, creates a novel hybrid space where virtual players interact with players physically in the urban space. Another application, Yoshi,[12] explores the "seams" in digital infrastructures—for example, the boundaries between telephone cells or Wi-Fi hotspots—on an urban scale, making them visible as interactive elements. Projects such as Sonic City[13] or tunA[14] explore the ways in which movement through space can create personal or collective audio experiences, giving an aural form to movement. Finally, several projects use GPS movement traces to literally draw images on maps or photographs.[15–17] These applications provoke new ways of thinking about movement and spatial practice in technology-mediated contexts.

This second generation of applications is establishing a body of research that begins to frame urban mobility as an everyday fact and a new opportunity. These applications present a less instrumental account of urban living by looking for inspiration not only in the available technologies but also in the broader experiences of urban life.

Noninstrumental aspects of London's Underground

The London Underground represents an iconic space of urban mobility. It has shaped, and been shaped by, the city's development. Used by over three million people every day, the Underground (which Londoners call "the Tube") is a primary means of city transportation. Furthermore, it's a complex system that mediates people's perception of the city itself, of other inhabitants, and of the urban experience. The Tube is a single infrastructure but it supports many experiences, highlighting the heterogeneity of urban life.[18] Its history is well documented, and it's been the setting for many stories in books and films. It's also the subject of several Transport for London studies, including a recent one regarding the impact of advertisements (www.thelondoncommuter.com).

However, there are no contemporary ethnographic studies describing the experience of riding the Tube. Over the summer of 2006, we conducted such a study to enrich our understanding of the experience's aesthetic components that would complement the undersound application design process.[19] This study included photographic documentation, written observations, and semistructured interviews with 19 riders. We focused on both the individual and collective Underground experience. We looked at all the mediating technologies used within the Tube, including nondigital technologies such as newspapers, books, and tickets. We also

examined how riders interacted with one another and with the space itself, which sometimes occurred via these technologies.

Traveling the Underground is a nuanced experience. For example, many participants in our study recognized "societal rules" about the proper social distance between strangers, which Janey Levine and her colleagues observed in an earlier study of several American subways.[20] For example, *civil inattention* is such a convention, which acknowledges another's presence in an initial show of respect and then avoids undue, and therefore threatening, attention.[21] One participant described the conflict between maintaining civil inattention while giving up a seat to a fellow passenger:

> I find it quite embarrassing to speak in London. You can't speak to anybody. You don't speak to anybody, you know. And so, it is quite embarrassing to say, "Excuse me." That is the hardest bit, touching them. I usually just get up and they go, "Oh, thank you," and then they sit down. I find that easier.

The complex negotiation of simultaneously seeming to be unaware of other passengers and yet still participating in the unspoken seat exchange is an important facet of riding the Tube. Various media and technologies—from newspapers to music players—can help balance this tension. For example, music players—apart from augmenting people's moods and perceptions of their surroundings—can also serve as a social defense. In fact, all technologies can contribute to the air of civil inattention, helping users who want to discourage social interaction with nearby people. In these situations, "users appear to achieve, at least subjectively, a sense of public invisibility."[22] Our interviewees confirmed that they often kept themselves demonstratively engaged with technologies to avoid (or appear to avoid) looking at other people:

[Without a book, it's] a bit more boring. I just end up reading the ads or looking around. You are trying not to stare at someone and you are looking like a psycho.

Yet at the same time people can become curious about one another and engage in subtle communication:

Sometimes you might have contact with somebody or you might catch somebody looking at them and you do that whole kind of flirtation thing, but it never really comes through…. I think a lot of the time it is curiosity. It is people looking at each other, and you accept that someone has been looking at you as long as they are not holding their gaze.

Many of our participants told us about taking these small moments a bit further. Becoming curious about people around you and going a bit out of your way to observe a stranger are far from rare activities in the Tube:

[I will go out of my way], probably only one stop extra or something like that, or I will just walk a bit slower. Mmm. This makes me sound incredibly shallow. But it's fun and it's something to do. Ohh. You sit there and think, "You're cute." I'll sort of walk behind you until the entrance, and we will go our separate ways and I will fall in love again when I get back on the Tube. And there will be another small romance later on. [Sighs]. God, traveling into town I must fall in love about 20 times.

In the next example, something as simple as noticing the writing on another passenger's book cover can drastically alter the course of a day's activity or simply give a window into another passenger's reading taste.

[The train was closing and] I was aware the girl sitting opposite wasn't moving, and everybody else got off the train and she obviously hadn't picked up what was going on. She was from Thailand, and she was reading a guidebook, and you could
tell from the writing on the front that it was from Thailand…. I actually went back inside and stopped and said, "You have to get off," and she looked surprised and got off. And I said, "Can I help you? Where are you going?" And she said she wanted to go to Harrod's, which seemed a bit depressing, so I tried to explain [that] to her and ... I actually ended up going to Harrod's [with her] and getting my picture taken.

Indeed, the objects that people carry act not only as gateways for imagination but also as potential interaction points. Before the Underground introduced the Oyster Card, an RFID-based ticketing system, it operated solely on paper tickets. Both the Oyster Card and paper tickets offer many different travel options, but the day-travel card, which allows for unlimited journeys on a given day, gave rise to a particular behavior in its paper form:

We were just standing there looking at this huge line. I think it was at Liverpool station. We noticed in this big line-up there were all these people waiting to get a ticket, and we saw this one guy who was leaving the station. Without exchanging words or anything, he gave his ticket to this woman who was kind of near the back of the line. It was just procedural. She just kind of looked at him and took it, and she left the line and just went in.

This study participant was new to London and was surprised by this unspoken exchange. Many people used to pass along their paper day-travel cards when they completed their day's journeys because they no longer needed the cards. However, the Oyster Card is a personal, reusable ticket, so this exchange practice is no longer feasible.

It's also common, even expected, in the Tube for people to leave behind copies of the free daily newspapers when
they've finished reading them. This subtle social gesture acts as a channel for unspoken exchange through which riders can acknowledge current and future passengers. Indeed, more than one interviewee told us that they often intentionally left behind their copies of *The Guardian*, a for-purchase newspaper, to encourage other riders to read it because they believed it to be more enriching than the free dailies.

Technology mediates collective experience, but it can also change the way individuals interact with their surroundings. People are exposed to or avail themselves of a multitude of media (for example, see figure 1). Gigantic posters are plastered across seemingly every wall; personal technologies, on the other hand, seem to provide people with more control of the media content they're accessing. People use mobile phones similarly to music players, carving a bit of personal space and keeping their eyes from wandering around the carriage. Because phones don't yet receive signal coverage in the Underground, people are demonstratively engaged with them in playing games, reading through and deleting old text messages, or listening to music. Indeed, sometimes interacting with technology can be so engaging that riders miss their station, as many of our participants confessed. These experiences all contribute to the mnemonic narratives that each passenger develops in relation to their Underground experience.[23] Indeed, for commuters who regularly use music players, these narratives can become intertwined with the memories triggered by music. One of our interviewees explained how, upon hearing a particular song from her iPod, she

Figure 2. Undersound is a music-sharing application designed to explore riders' individual and collective experience of the Tube.

was instantly reminded of her train pulling into the station nearby her workplace. Because she listened to the same album every day for many months on her way to work, this song came to symbolize the moment of her arrival.

Finally, the Underground's aesthetics, such as the cohesive look of every line and the individual characteristics of each station, together with its visual representations, such as the Tube map, affect the human experience of both the Tube and the city. The Underground superimposes—or better, underimposes—a geography that constitutes an "interface between the chaotic city and its user, presenting and structuring the points of access and possibilities for interaction within the urban space…, [an] essential technology that mediates between the city and its users."[24] Places with Underground stations become more meaningful both by the individual mnemonic narratives they trigger and by their representations on maps.[25] For example, one of our participants remembered a panic attack in the Underground not only by going back to a particular station but also by seeing its representation on the map.

Among other things, our ethnography showed that technology's uses aren't solely instrumental, like entering the transit system or finding a station, but also

experiential. People can explore their curiosity about fellow passengers and engage in unspoken exchanges with them. They can also engage technology to preserve their social isolation. Finally, the specific technologies each rider carries and the station aesthetics and maps available to all can contribute to the richness of personal mnemonic narratives that make the Tube experience meaningful.

Undersound: An alternate technology design approach

In parallel with our study, we engaged in a design exercise intended to help us frame our ethnographic results in technological terms. By undertaking the ethnographic study at the same time we embarked on the design process, we were able to critically engage with many themes surfacing in the ethnographic work. The result is a form of technological engagement with ethnography that's as much an ethnographic product as a design proposal—and not simply a new set of "implications for design."

The proposed design, undersound, is a music application comprising three parts:[1]

• A mobile phone client lets both emerging musicians and audiophiles wirelessly upload their tracks at upload points inside the Underground station ticket halls.

• This same phone application lets users download tracks from download points on the train platforms as well as from other users in proximity (see figure 2).

• The phone application stores metadata from each music exchange, which the upload and download access points throughout the undersound network collect and use to drive large visualizations in the ticket halls, which reflect the music's movement through the network.

Currently in the implementation phase, we've designed undersound to run on a localized peer-to-peer communication network called Bionets (www.bionets.org). We'll deploy and evaluate the system over the coming year. Here, we'll consider this application, like the ethnographic work, as a lens through which to examine and reimagine how technology can influence and contribute to the urban experience. By exploring the ways undersound might be used, we can see how explicitly foregrounding urban life's experiential qualities can help rethink the overall approach to technology design for cities.

Music sharing scenario

Matt is a filmmaker in his mid-20s who uses the Tube every weekday to get to work. Tonight, he's traveling from Soho to Angel to meet friends for drinks.

To get there, he plans to take the Victoria Line to Euston, where he'll change to the Northern Line toward Angel. This is his first chance to try out the undersound application he just installed on his mobile phone.

In the Oxford Circus station ticket hall, he notices three girls with musical instruments who are gathered around the undersound upload point. Ellen, Carolina, and Alice are students and play in a band called Zot. They're using undersound to get some free publicity. At the station's entrance, Ellen browses their music on her phone. They can only upload each track once, so she chooses their best song for this station, one of the Underground's busiest. Alice suggests that they add the date of their next gig as a note to the track.

While waiting for the train, a message pops up on Matt's phone, asking if he wants to download the latest track from the station. He assumes that the girls probably uploaded the song, and he accepts the download. Once in the carriage, he starts listening to the song, but it's a bit too punky for him. So, he checks other application features and discovers that he can browse the playlists of people in proximity and download their undersound songs.

"It's good I have something to play with," Matt thinks. "Otherwise, I'd get bored on my way to Angel because I forgot my book." He checks people's profiles and their songs, and notices one person has a different kind of icon by their name. He checks him out and realizes they have the same track.

Curiosity about others is a fact of both urban and digital life. This scenario shows digital and spatial networks intertwined in new ways to satisfy this curiosity. Like the guidebook cover we mentioned earlier, digital content can act as a window into another person's identity. Additionally, the digital content itself can generate interest in another person. This adds another dimension to the social-defense aspect of mobile phone applications.

When people are engaged with a collectively used application, they might be isolated in one sense, but they're socially present in another.

Personal narratives

While Matt's thoughts are wandering, Stephanie, a woman in her early 50s, gets on the train. She's tired from work and looking at other people wondering who they are and where they're going. When she sees Matt she thinks, "That's the kind of guy that would be perfect for my daughter." She notices he's listening to music with his phone, so she opens undersound, which her daughter recently installed on her RAZR. She looks through the other users' profiles to see if she can guess which one is Matt. As she's browsing, she suddenly realizes one of the icons that she hadn't yet had a chance to look at has disappeared. She looks up around the carriage and is disappointed to see that Matt is gone.

In the meantime, Matt had become so engrossed in undersound that he missed his stop at Euston and only realized it at Finsbury Park. He feels a bit strange because he used to come to this stop all the time to see his ex-girlfriend, but he realizes he hasn't returned since their breakup last year. Suddenly, he sees a message on his mobile phone, alerting him that someone is downloading the song from Zot. He remembers how his ex always hated punk music. As the train approaches, he looks around as he makes sure the download is complete. He feels a part of the undersound community already.

Thinking about how people will use new situated digital technologies within a specific physical and social urban space lets us consider how different social practices might begin to emerge. The ethnographic work showed how someone might alter a course of action to get a better glimpse of someone on the Tube. Likewise, we can consider how a mobile urban application might afford a new

channel for a similar behavior. Furthermore, an urban application that's incorporated within the surrounding environment can trigger memories that intertwine media and place in new ways. Finally, there's a social cost to actions in both the physical and digital space. You can't pick up a newspaper without other people noticing. In undersound's case, you can't exchange a track in secret. So, it's useful to think about the relationships that arise between these two forms of accountability—a certain action in the digital world can have consequences in the physical one, and vice versa.

Shared interactions

Steve, who just downloaded the Zot song from Matt, is on his way home from work. Although already late for dinner, he can't resist the temptation to check if anyone has new undersound songs because he's really interested in being one of the top collectors and distributors. Upstairs, he checks the undersound public display to get an update on the music traffic and recent activity hotspots around the Tube. While checking the display, he notices a new message on his phone from an undersound buddy: "Hey, are you in the station too?" It's Clive, the friend he was supposed to meet for dinner. By chance, he happened to see Steve on undersound while he was exiting the station. It turns out they were both late.

When an application's use is situated in a social space, we can consider how to use digital technology's flexibility to afford a variety of behaviors at once. For example, you can use a technology that keeps you demonstratively engaged to intentionally display something about your identity. Similarly, you can use a channel of unspoken exchange as a means for explicit engagement.

Through undersound, we've seen how application design can engage the complexities of urban experience. When we

can reflect urban experiences in technology design, we can also find ways to transform the experience so that new behaviors can emerge.

Discussion

Let's consider how this reformulated view of the urban experience might provide a different approach to urban computing.

Situated understanding of the space

Traveling by Underground mediates people's perception of the city they inhabit. Undersound's design highlights new ways in which both individual and collective understandings of the Underground's physical, social, and technological space could emerge. The undersound network is enmeshed within the Tube, which in turn is part and parcel of London. Likewise, urban computing isn't simply about the city. It's also part of the city, and its meaning and consequences arise not simply as informational accounts of urban space (directories, maps, listings, and so on) but as sites for new sorts of individual and collective meaning-making. In a word, urban computing is situated rather than dislocated. Framing the city as a source of experience rather than a source of trouble raises the design question: how are information technologies implicated in the aesthetics of everyday practice?

Localized interpersonal interactions

We've described a tension that exists in the Underground between the interest in observing fellow passengers and the desire to maintain the collective air of civil inattention. Individuals already manage this tension daily in various ways. Portable music players act simultaneously as social shields and hints about personality. The continual exchange of newspapers acts as a behavioral code that you can conform to or leverage to make a political statement. With undersound, we're trying to account for this social ecology's complexity by creating a design that affords equal flexibility. Running the application on your phone comes at the social cost of opening your track list for others to peruse. Users must choose how, or if, they want to present themselves. Making decisions like these integral to the system experience creates the opportunity for reflection on the here-and-now of urban life. So, disruption isn't a problem but a design tactic, and the social negotiations that are the starting point of urban living become visible.

Emergent large-scale flows

Current advertisement posters we observed in the Underground, when taken as whole, seem to present a cohesive vision of a Londoner's lifestyle, often hiding the city's intrinsic contradictions. On the other hand, undersound attempts to speak to the contrast between media that's "pushed" onto people, sometimes exposing them to new content, and personal media, which arguably affords them a higher degree of control. In addition to this, while individuals might be motivated to interact with the system for various reasons (purely for music listening, to promote their band, to feed their curiosity about other travelers, and so on), all their actions still contribute to the formation of large phenomena.

Undersound reflects these phenomena through situated visualizations, driven by all the actions combined. Rather than viewing users as disconnected from resources, undersound explores the potential for alternative forms of social practice to arise through the use of information technology and mobile systems. Its design addresses and leverages the fact that content isn't always accessible anytime, anywhere. In contrast to accounts of technology as a means of spatial regulation and urban surveillance, our approach to urban life's aesthetics turns our attention toward open-ended systems design, where use and meaning are shaped in a complex dialogue among users and application sites.

A longside the creators of second-generation mobile applications, we're reexamining the urban experience and the ways technology can enrich it. We want to move away from framing urban mobility as a problem and toward recognizing it as an everyday fact that designers can leverage as a new opportunity. Additionally, by exploring not only how technology affects the relationship between the individual and the city but also the relationships of individuals with one another *through* the city, our work attempts to expand the scope of this emerging research area. ⏚
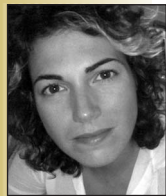
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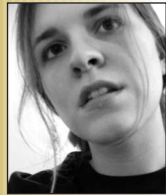
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