MOBILE COMPUTING AND COMMUNICATIONS:
NEW INTERACTIONS BETWEEN INFORMATION ARCHITECTURE AND INFRASTRUCTURE USE

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INTRODUCTION

Three technological trends are converging to strengthen and reinforce the link between databases, computation, and the day-to-day management of cities and urban infrastructure.

1. The expansion of terrestrial wireless communications networks for voice and data
2. The widespread use of geographic data and geographic information systems
3. Advances in positioning technologies such as the Global Positioning System

This essay argues that the rapid growth of mobile communications and computing[1] in the first decade of the 21st century will present a series of challenges and opportunities to urban planners and managers. These challenges will come in the form of changes in the location of human activities in urban areas, changes in the character of these activities, and most importantly changes in the way such activities are organized and coordinated. It then suggests some possible topics of a new research agenda in this area.

[1] Geographer Nigel Thrift has argued that the mobile revolution is actually the real technological breakthrough of the massive worldwide investment in information technology research of the1990s.

TECHNOLOGICAL TRENDS DRIVING THE MOBILE REVOLUTION

The new breed of mobile technologies are characterized by the integration powerful handheld or wearable computers with always-on, wireless, broadband data and voice telecommunications. In this scenario, mobile computing and communications will augment the user's ability to function in professional and social settings by providing supplemental information gathering, processing, and storage functions, which to a large extent will be cued to the user's geographic or locational context. While this vision is not yet a reality, three trends are working together to create this future:

Wireless growth. within cities, mobile technologies are quickly becoming more prevalent than the desktop Internet and the personal computer (PC). Furthermore, 490 million of the world's 1.3 billion telephones are now mobile. (ITU, 2000) Mobile terminals will overtake PCs as the most popular devices for Internet access by 2003. (IDC, 2000) Unlike the desktop Internet, voice-driven information portals can serve the billions who cannot read or write.[2] In short, the mobile handset is coming to define our global society in the way that television and the automobile defined earlier generations.

Growth of GIS and spatial databases. A mysteriously under-reported outgrowth of the 1990s revolution in information technology has been the explosion of computer-data that is spatially referenced. It has been estimated that 80 percent of the information on the web is or can easily be geographically encoded. (SRI, 1998) The worldwide market for GIS is estimated at several billion dollars, through the ultimate economic impact of the technology through efficiency gains is surely huge.

Advances in positioning technology. Regulatory initiatives aimed at improving emergency services responses (i.e. 911) to mobile telephone calls have pushed the development of positioning technologies for handsets. Additionally, the U.S. military, under executive order from President Clinton, stopped introducing errors into the Global Positioning System, which will greatly improve the accuracy of these signals in civilian positioning applications. Both developments are leading to miniaturization and reduction in power-consumption of positioning systems, making it practical to integrate them into an increasingly broad variety of devices.

These technologies are combining to create new information services that are *location-based*. That is, a wireless data link (tech #1) can be used to query a GIS (tech #2) for information that is relevant to the user's current position. (tech #3) The few demo applications emerging from computer science research labs offer hints at the types of uses these devices will ultimately be put to, such as posting virtual notes to places (Persson, et al, 2001) and searching for information (Youll, 2001)

[2] Services such as TellMe™ combine voice synthesis for the delivery of information on weather, traffic, and stocks via mobile telephone in response to spoken commands.

CHALLENGES

The rapid spread of mobile communications presents a number of challenges to urban planning and management with respect to the use of infrastructure. This essay does not specifically address the possibilities of using mobile technologies to manage infrastructure. Rather it focuses upon the strains that will be placed on static systems that must respond to an increasingly fickle population of computationally-enhanced cyborgs. These challenges fall into three main areas:

Changes in the location of human activities. Traditionally, urban scholars have addressed the issue of telecommunications from the perspective of its impact on economic geographies, land use, and travel patterns. (Graham and Marvin, 1996) Mobile communications, by freeing the need for many types of workers to remain at their desk, or check in periodically, is helping to move more work out into the field, where delivery persons, salespeople, and others can gain greater efficiency.

Changes in the character of activities. As Moss and Townsend (1999) and Mitchell (1999) note, it is not just the location but the character of urban activities that is changing through the use of new computing and telecommunications technologies. Public spaces in many European cities, once a venue for strolling, begging, or flirting are now primarily used as a place to talk on mobile phones. For those equipped with wearable computers, the parameter of place may become an important way to filter the vast variety of information available through computer networks like the World Wide Web. One can imagine a scenario in which people travel to certain places for the possibility of serendipitous encounters with interesting information, the way they travel now for the same types of chance encounters with people.

Changes in the way such activities are organized and coordinated. Most importantly, mobile technologies permit a new degree of freedom in both movement and scheduling that is unprecedented. Because information about status, ETA, etc. no longer flows from place to place, but from person to person, activities can be coordinated more loosely. Ling and Yttri (1999) call this phenomenon “hyper-coordination”, while Townsend (2000) has argued that such changes represent a fundamentally decentralizing and accelerating force in urban dynamics and urban metabolism. Other possibilities include hot-spotting in physical locations, much like happens with popular websites. (Townsend, 2001)

DEVELOPING A RESEARCH AGENDA

The evolution of mobile communications technologies have had a rich and fundamental connection to the shape and size of human settlements. There is a strong likelihood that the location-based services will continue and reinforce this connection between design and the built environment, yet will also extend this effect to the design of information architectures as well as that of physical infrastructure.

Crafting a research agenda at this early stage is fundamental to the future of urban planning and management. At present, it is clear that these mobile technologies will have a fundamental impact on the spatial organization of economic activities within metropolitan areas. However, while the effects of new technologies like the mobile telephone are beginning to be felt, we are still years or decades from the future city of ubiquitous computing. In the meantime, we have an opportunity to think about some of the opportunities and challenges outlined in this article.

Impacts on land use and travel. Where are mobile users? How do their usage patterns correlate with location, travel, and activity? We lack even sufficient *anecdotal* evidence to speculate in this area, let alone data to make reasonable generalizations. This is an area that needs to be explored in conjunction with the wireless carriers who have access to this kind of data. How do these technologies contribute to broad changes in settlement patterns, the location of economic activities, and land use?

Planning/Managing the real-time flexible city. How can long-range planning and construction of large, expensive, fixed infrastructure be effectively carried out in the flexible, and rapidly-changing urban environments that mobile communications and computing will support. However, as Humbad (2001) demonstrated, new masses of mobile users provide new opportunities for sensing and monitoring urban conditions in real-time.

Design and perception of urban landscape. Mobile technologies will act as intermediaries between users and environments, providing information about navigation, opportunities, etc. to urban dwellers. As such they will have significant impact on the *imageability* of cities. In turn, the need to provide supporting infrastructure for mobile users will have an impact on the design of buildings and neighborhoods. What location-based services and types of information can be developed to assist community and economic development in disadvantaged areas? As Abler (2000) notes, for the first time, these technologies will make it possible to assemble all the information about a place *in that place*.

Interactions between urban design and technological design. Mobile technologies will act as mediators between individuals, and between individuals and the built environment of cities. As primary points of distribution for information about places, localities, and transport networks, MCCTs can have dramatic impacts on the use of urban facilities and infrastructure. However, as illustrated by the backlash to the proliferation of mobile phone use in public places, the study of human environments has not been incorporated in the design and implementation of new mobile technologies and services. What are the interactions between the design of devices, interfaces, and built environment? How might changes in the design of one impact the design of others? How do information architectures for storing information about places impact the use and viability of neighborhoods and communities? How can open standards for geographically encoding information be tailored to reinforce the identity and importance of places and place-based communities?

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