

**Architecture for Cyborgs:
Laptops and Spatial Use at MIT**

by

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B.A., Anthropology
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Submitted to the Department of Urban Studies and Planning
in Partial Fulfillment of the Requirements for the Degree of

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ABSTRACT

Individuals have a particular set of tasks they need to accomplish or what might be called a “life pattern.” These tasks must be accomplished within a particular set of places or “life spaces.” What is the role of the laptop in defining these life spaces and patterns and how does it either enable or constrain an individual from acting out their life pattern within a particular life space? This study uses a variety of quantitative and qualitative analytical methods for understanding the adaptation of student behavior to new technologies on MIT campus with a focus on the Sloan School of Management.

Laptops will only enable spatial flexibility if the nature of one’s work (“life pattern”) affords it (Norman, 1999), “mobility” or “flexibility” is perceived to be advantageous, and there are suitable behavior settings (Barker, 1989; Schoggen, 1989) within their “life space.” Most students are *not* creating “a new office” (Duffy, 1997) or choosing “special places” (Mitchell, 2003) to work. They mostly choose to use a very limited range of locations, often similar to office-type spaces.

Only an exceptional minority of most techno-enabled are becoming free roaming “neo-nomads” (Abbas, 2005). Rather than being more “mobile,” most people are now more “connected” wherever they go (Castells, 2006). Instead, they might rather be labeled technologically enhanced cyborgs (Mitchell, 2003, Picon, 2000).

Our relationship to the physical surrounding environment changes depending on the degree to which we require our technological enhancements and how much our cyborg selves are supported by that environment.

Thesis Supervisor: William Porter

Title: Emeritus Professor of Architecture

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INTRODUCTION

Since the invention of the telegraph in the 19th century, forecasters have heralded the immanent “death of distance.” Someday, they dreamt, if only the technology got good enough, we would all be “freed” from the shackles of space, unbound to any particular workplace location.

Cities from San Francisco to Seoul are becoming ubiquitously WiFi. Infrastructural capabilities are improving rapidly. Access to Information Communication Technologies (ICTs) is becoming more widespread. Has the technology finally become “good enough?” Will all this change the way we use physical spaces?

THE NEW OFFICE?

Frank Duffy’s work on the future of the office suggests that with new forms of technology, the work environment will be shifting its pattern of spatial organization. He claimed in 1997 that the typical office consisted of a pattern of high numbers of “hives” of cubicles, coupled with a medium number of shared office “dens,” a small number private office “cells,” and trace numbers of highly interactive “clubs” for highly autonomous work. The “new office” would (and perhaps even should) consist of a large diminishing of “hives” with subsequent small increase in cells, large increase in dens, and “huge increase” in clubs (Duffy, 1997:6).

If Bill Mitchell is right and “special places, with particularly desirable qualities, become powerful attractors when traditional person-to-workplace linkages are loosened” (2004:154), then we would expect to see people with laptops using “non-traditional” spaces more than non-laptop users. If Duffy is right about the shifting types of workspace needs then we might anticipate those new spaces to be “clubs” and “dens.” In what situations are these empirically valid claims? What could we learn from an in-depth ethnographic analysis of the behavior of a specific user demographic using laptops?

We can think of each individual as having a particular “life pattern” composed of their various obligations, social networking practices, and other daily tasks. This life pattern must be played out within the spaces that are accessible and usable to that individual or what we might term one’s “life space.” What role does a laptop play in first defining either the life space or life pattern and, second, in enabling or constraining one from acting out a particular life pattern within one’s life space? Framing the question in this way enables us to look beyond technological or spatial determinism and more seriously consider the complex relationship between person, space, work, and object as suggested by Horgen, Joroff, Porter, and Schön (1999).

Access to a particular space or technology does not necessarily lead to any particular behavior change. Instead, the combination of a number of elements can allow for the possibility of performing certain tasks in certain places. The laptop will enable more when used by individuals with the need and desire to learn adaptive capacities while using resource rich spaces.

Yet, rather than analyzing “spaces” we should look at “behavior settings.” Behavior setting is defined here using Roger Barker’s definition of “entities (things) that impose patterns upon their components, including their human inhabitants (media)” (Barker, 1989:355) or the “stable extra-individual units with great coercive power over the behavior that occurs within them” (Schoggen, 1989:20). They suggest that there is a “synomorphy” in which the setting is viewed as something that “fits” the behavior. For instance, a baseball diamond with a dugout for the players and stands for the audience creates a synomorphous behavior setting in which the design of each spatial element suggests a particular type of behavior for each user type. However, it may also be possible to view behavior settings as the socio-physical context that can be adapted in given instances to fit the perceived advantage of the users.

These adaptations might be usefully understood as a user’s relationship to the perceived affordances of an object or space. An affordance is defined here using Don Norman’s definition in which cultural, logical and physical constraints suggest how to interact with an object (1999). Here it is being interpreted to physical space as well as to physical object. The idea is that both will be used based on the user’s physical

capabilities as well as their prior experience, goals, ambitions and expectations for that space or object.

With these two concepts in mind, we should view laptops as one component of a complex set of relationships. Individuals will likely behave by balancing a number of considerations, not just one.

First, the characteristics of a place will have an influence on an individual's choice to use it. Based upon prior experience, an individual will develop a set of associations and meanings with a space. They will recognize the types and exercises of control as well as their legitimacy and accessibility to use the space. Now they might also come to perceive a layer of features relevant to the laptop such as WiFi speed, cost, signal strength, etc.

Second, an individual will need to evaluate the nature of the task at hand and the requirements necessary to complete it. They may also consider the total domain of all tasks that they may need to complete. These tasks may be more or less flexible in terms of their time, concentration, space, and additional participant requirements.

Finally, these tasks will be enabled and constrained by the field of support within which they must be carried out. For instance, a task might require lab work that may need to be run in a particular space or time or it might require gaining access to information that may or may not be possible to attain on the laptop. Some of these tasks will be more effectively enabled by increasingly powerful computational capacity, while others will remain largely unaffected or perhaps even be constrained.

The laptop would seem to open up the largest range of possibilities for an individual since they are reasonably unconstrained by their spatial choice. In individual work, one is much more able to determine the locus and setting in which one might want to perform a given task. This does not mean that any setting might be chosen for any task or context but that there would be a greater degree of flexibility in independent work. Group work has its own set of constraints- various schedules, spatial preferences, power dynamics, etc. must be negotiated which makes for a more complex algorithm to determine how a space might be chosen.

The laptop enables the potential of greater connectivity, a broader range of communication options, mobility, and ubiquitous access to many important work tools.

All of this might translate to shifts in the meaning and use of various behavior settings rather than new mobilities or new uses of spaces per se. In other words, it may look like “same old same old” in various spaces, but old spaces may be being retooled in rather different ways creating a different ecology of campus space.

New technology does not deterministically “impact” behavior like a billiard ball hitting another nor is it simply an outgrowth of existing “culture.” Instead, I take a user-oriented social constructivist perspective in which it is assumed that users—albeit constrained by socio-cultural conditions—manipulate technology to their own purposes. In many ways the technology also conform to the user, not just the user conforming to the technology. The technology becomes a tool *and* a structural constraint as it becomes a pervasive necessity (Fischer, 1992:17-19).

Drawing on ethnographic studies of laptop use by students at MIT, I argue that no matter how “good” the technology, we will still favor particular physical places. Rather than becoming more “mobile,” we are becoming increasingly dependent upon constant connectivity to a broader network.

ORGANIZATION

This paper is written in four sections. This introduction deals with laying out a framework of hypotheses to try to explain how spaces are assumed to be used as a basis to understand the effect of laptops. The second section discusses the findings of a quantitative mobility journal tracking the use of campus by randomly selected MIT students. The third section focuses on an in-depth study of MBA students at the MIT Sloan school of management based on structured and participant observations, surveys of student use of common areas, an interview with the director of capital projects in charge of the construction and design of the new building a Sloan. In the conclusion, the results of the empirical research are then brought back to the hypotheses and theories to see which seem to best explain the observed data.

MIT

MIT is a good model university campus since it is one of the most ubiquitously wireless campuses in the world (see map in appendix A). Unlike most urban contexts, we have a demographic that is generally technologically savvy, uses a computer for many of their daily activities, has access to a laptop and virtually seamless wireless internet connectivity. From this extreme demographic we cannot generalize to the future or even to the rest of society at large, but we can compare extreme users to some of the current hypotheses. If even the most fringe users are not behaving in ways we would expect, it calls into question our hypotheses.

Figure 1: WiFi Coverage at MIT



MOBILITY JOURNAL

In the first study, we used a quantitative survey tool (see Appendices A and B) to track the movement of a sample of all students on MIT campus (Dal Fiore, Goldman, and Hwang, 2006). 400 students were emailed based on a stratified random sample and asked to report where they went and where they used their laptops during the week of May 1-7, 2006. After two follow up emails, 49 agreed to complete the journal, for which they were paid \$40. Students were randomly distributed among program groups and between graduate and undergraduates. We collected baseline demographic information as well as information on computer usage, communication

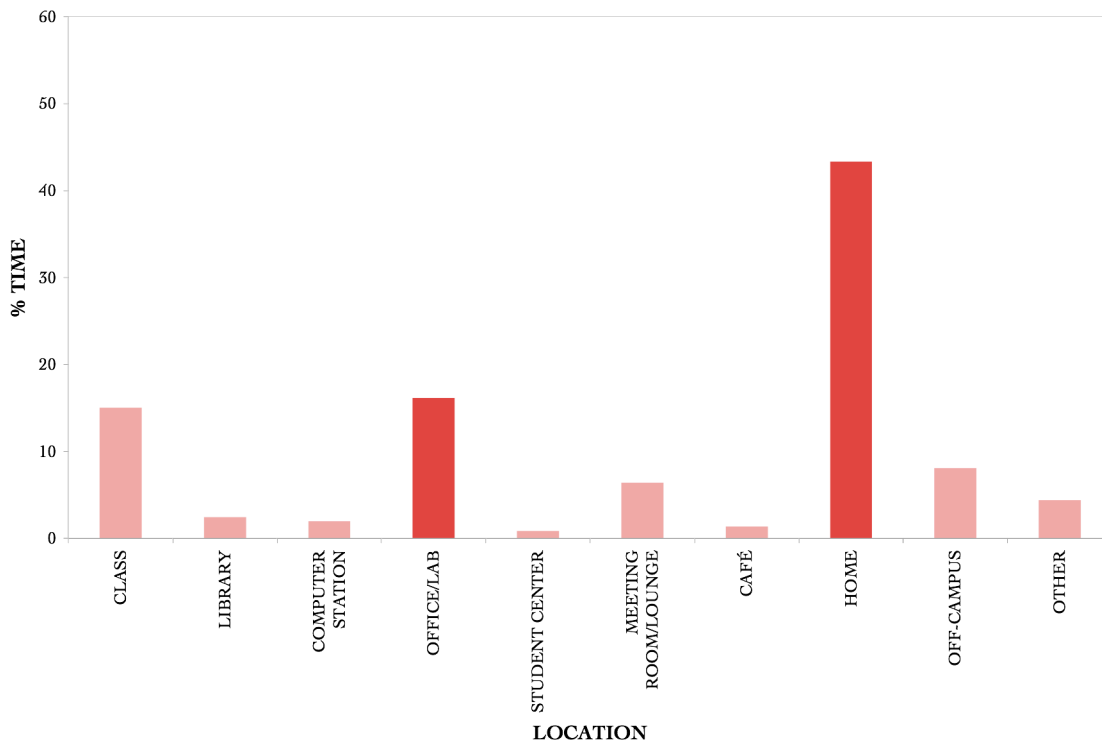
patterns, and course load. While it is difficult to surmise statistically significant correlation given the small sample, a myriad of interesting patterns have been discerned thus far that can translate to testable hypotheses.

MIT FINDINGS

Where are students spending their time? Despite ubiquitous WiFi coverage and high laptop use, most students still spent most of their time in a narrow range of

Figure 2: Weekday Spatial Use by All MIT Students

N=49



places. 74% of all students' time was spent between home (43%), classrooms (15%), and offices (16%) with only 18% of total time being spent in all other spaces on campus combined (see Figure 2 below).¹ No one claimed to use a "meeting room or

¹ 8% is of time is spent "off-campus." Spatial categorization was done by those filling in the journals and then organized by the research team afterwards. Room numbers also exist for most entries on the original documents.

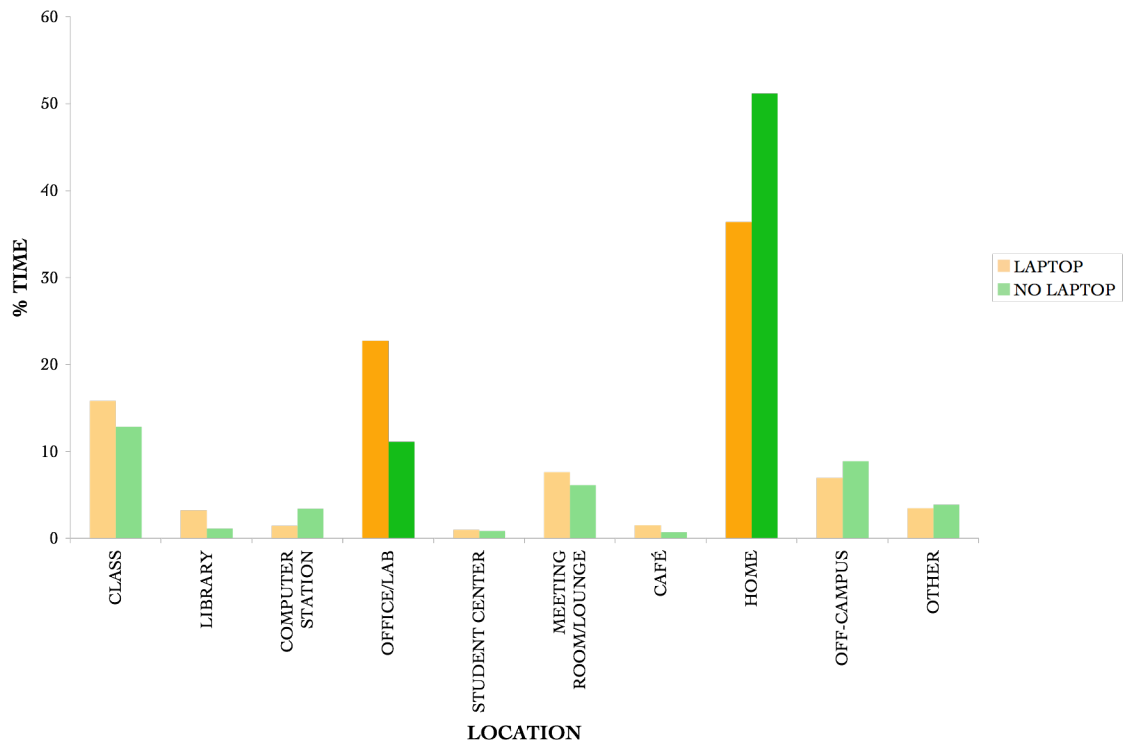
lounge” as a primary workspace. Those who have offices tended to claim their office as a primary workspace. Those who did not, tended to claim their home as a primary workspace. Nearly a third of the user group claimed “multiple” primary workspaces.

LAPTOP USERS

How many people are bringing their laptop? Overall, 40% of those surveyed claimed to bring laptops daily, 27% sometimes bring their laptops and 33% never bring

Figure 3: Spatial Use Comparing Laptop Users and Non-Laptop Users

N=39



laptops. In other words, two-thirds bring their laptops either every day or some days of the week. Those who regularly bring the laptop to school tended use it more than three hours per day.

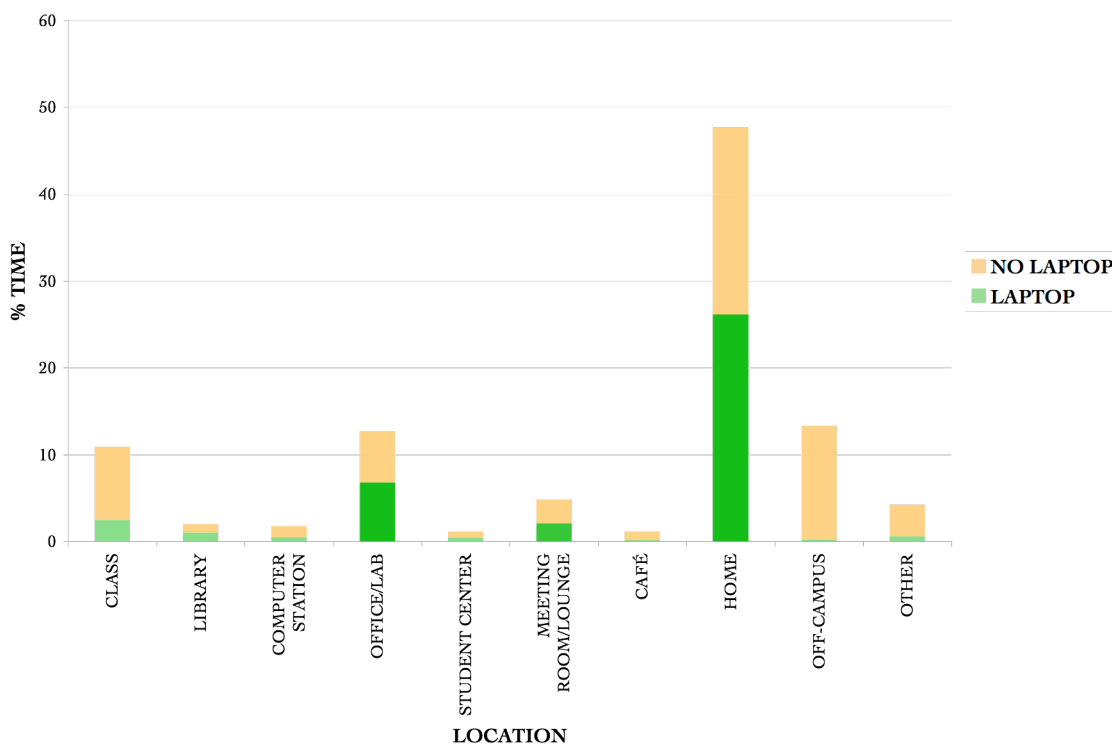
Is there a difference in the way people who bring laptops use space compared with non-laptop users? The chart in Figure 3 above shows differences between the spatial use of daily laptop users and those who never bring laptops. Notice how those

who bring their laptops to school daily tended to spend more time in the office and less time at home compared with those who never bring their laptops.

Among those who do bring their laptops on a daily basis, where do they primarily use their computer? Figure 4 suggests that laptops are mainly used at home and in offices and virtually nowhere else except a bit in meeting room/lounge areas. Note that cafés are *not* being used by laptop carriers – even less than Athena clusters. If we should get rid of Athena clusters now because they are “unused,” we should get rid of cafés and libraries too.

Figure 4: Location of MIT Laptop Users

N=23



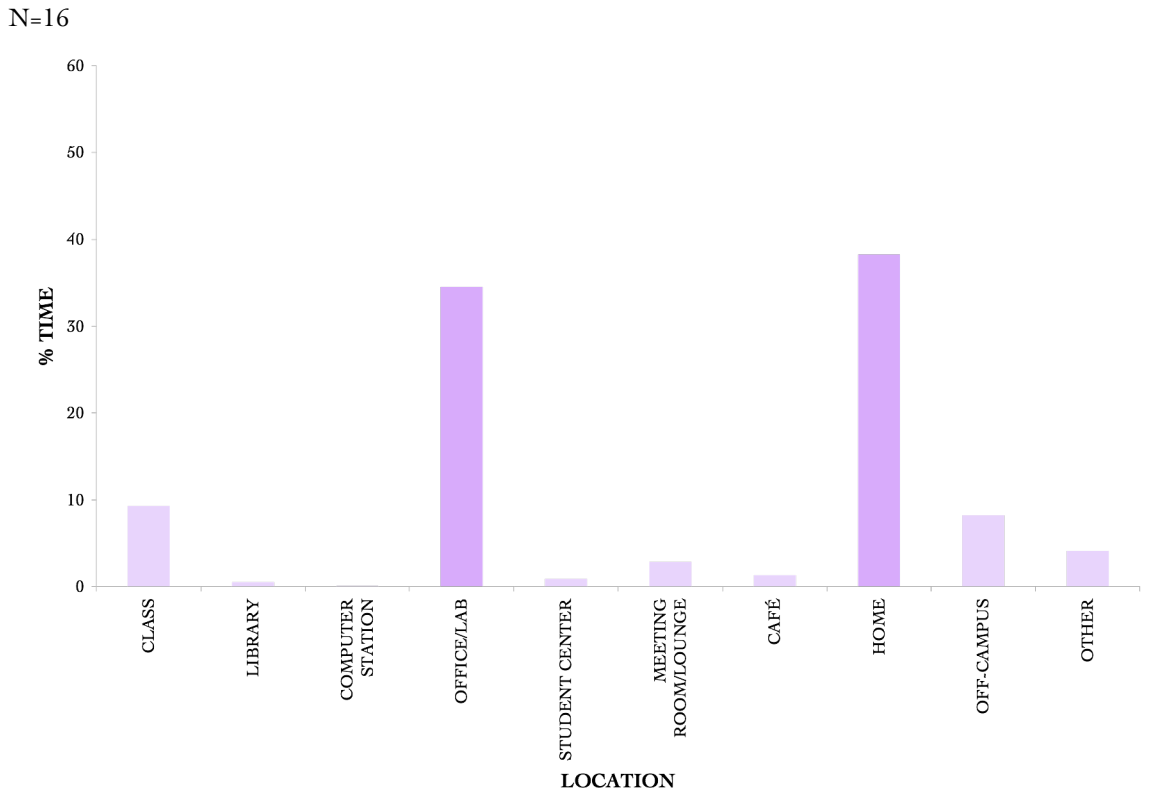
It should be noted that these data could be skewed in terms of the amount of time reported “using a laptop” in a space. Students wrote only how long they used a space and whether they used their laptops there, not how long out of the total time in a space that they used their laptops. Therefore, these data are more accurate in terms of clearly showing *where* people were and were not using their laptops and the *maximum* amount of time they could be spending using their laptops in various spaces. Yet something important seems to be happening in office and lab spaces.

OFFICE USERS

What type of office access do people have and how is that related to what we are observing? Use of an office or lab as a primary work site appears to be related to laptop usage. A third of those surveyed primarily use an office or lab,² nearly all of which are shared spaces. 94% of these students are graduate students (particularly PhDs). 88% of those with offices bring their laptop daily.

Despite having a laptop, students with offices primarily spend time in their offices (see Figure 5). Why do they not use other spaces? Perhaps “Athena” clusters

Figure 5: Spatial Use by Office/Lab Holders



are not underutilized because shared computers or desktops are not useful. Instead, these people might not use them because they are low status (considered to be for BS/MS) or because they prefer to use their own space once they have “earned” it. If it

² “Office” means students who reported either “shared office/lab/studio” or “private office” as their primary workspace.

were the case that they don't use Athena clusters because they prefer to use a laptop, then why wouldn't they substitute that time in a Library, Café or other common space? Many of these people may also have to remain more or less "stationed" to observe lab experiments that are running throughout the day or supervise underclassmen.

Clearly, there is some value to the office or lab that has little to do with the laptop. For whatever reason, they clearly are not becoming spatially "liberated" by their laptops. Perhaps they should all have desktop computers in their offices to have better access to the tools and materials on their home computer so they do not need to carry their laptops so much. Perhaps Castells (2006) is right and it is *connectivity* not *mobility* that best explains why people carry their laptops. It might also be accessibility to tools in the case of the laptop.

GRADUATE STUDENTS

Is age or graduate/undergraduate status an important variable? Two thirds of undergraduates work primarily from home. One third of them carry their laptop either sometimes or daily. The remaining third of undergraduates claim multiple workspaces. Two thirds of these bring their laptops sometimes or daily. So most undergraduates work from home and do not carry a laptop. Some students work in multiple spaces and carry laptops.

By contrast, 70% of graduate students – most of which with offices or labs – carried a laptop daily versus just 21% of undergraduates. Daily laptop users are less likely to live in Cambridge and about 3.5 years older.³ The "tipping point" seemed to be somewhere around age 25, after which point– mostly regardless of course– students were more likely to bring their laptops. This means that they would be born in 1981, age 12 in 1993 when the Internet became public, they were age 19 in 1999 and began college between 1999-2003 when universities began installing WiFi. In other words, this is the first WiFi Internet generation. However, what is surprising is that it is those who are *older* (i.e., the last "pre-WiFi" generation) who reported using the laptops more

³ This number excludes a 49-year-old outlier.

than those who are younger. Perhaps this explains why they are using it in much the same way as they did when they had desktops.

Is age causing a shift in laptop use, or is it the type of work done in graduate work that makes a laptop more necessary or used in different ways? At any rate, the “WiFi generation” does not appear to be carrying their laptops much as of yet. It is also unclear whether these are “dying trends” or if they will continue with the next generation.

CONCLUSIONS

In general, graduate students carry laptops and work in their offices whereas most undergraduates do not carry laptops, do not have offices and work from home. About two thirds of students (both graduate and undergraduate) seem to work primarily in one space.

Can the different work patterns between the graduates and undergraduates be accounted for simply by access to certain types of available spaces? Are there differences between not only graduate students and undergraduates but also between different departments that are related to particular work needs?

SLOAN SCHOOL OF MANAGEMENT

While we now have a thumbnail understanding of which spaces might be used by what types of people, we need a better understanding of what people are actually *doing* in those spaces. This chapter focuses in on MBA students at the Sloan School of Management to better understand how laptops enable or constrain their ability to enact particular life patterns within their life space. Data from the mobility journal is compared with empirical observations and surveys to understand the use of several common areas at Sloan. These findings are then compared to the process and current design of the new Sloan building currently under construction.

MBA STUDENTS AND SLOAN

Looking over all of the students we surveyed, they seem to break into three clear categories: almost half (nearly all of which PhD students) claimed an office as a primary workstation. About a quarter claimed to work from home- these were MBAs and various undergraduates. Only about a quarter or so claimed to have “multiple” workspaces. These were essentially MCPs and an assortment of undergraduates. Given the relatively high percentage of MCPs in the sample (~10%), their actual percentage of students doing this campus-wide may be much lower. One way to better understand various categories is to break MIT students down into a simple chart:

Table 1: Laptop/Office Matrix

	Laptop	No Laptop
Office	Many Masters students and most PhDs	Very few
No Office	Few Undergraduates, <i>Most MBAs</i> , some MCPs	Most Undergraduates

It seems apparent that most students are *not* creating “a new office” but are rather more or less replicating the old office despite using “mobile” devices. If we want to understand the limitations and possible new affordances a laptop might enable, we should observe some “extreme” users (Kelly, 2001) who are most willing to adapt new

technologies into their life patterns and spaces. The extremes that people are willing to go to in order to adapt will shed insight into their mental models while showing us the limitations of both the device and the physical spaces to meet their needs. From this we might be able develop design insights that might be valuable to more typical users.

If we want to observe the few people creating “the new office,” who could we observe? Where do we have a relatively homogeneous demographic in a relatively encapsulated and readily observable physical space? Where do users carry laptops on a regular basis, but do not have offices? Where have design interventions been made particularly in their corridor spaces to encourage interactions? More specifically, to test Duffy’s hypothesis, where might we find “high level work carried out by talented independent individuals who need to work both collaboratively and individually” with “a variety of individual PCs on networks and widespread use of laptops” who are hypothesized to need “many rich and complex” work settings (Duffy, 1997:66)?

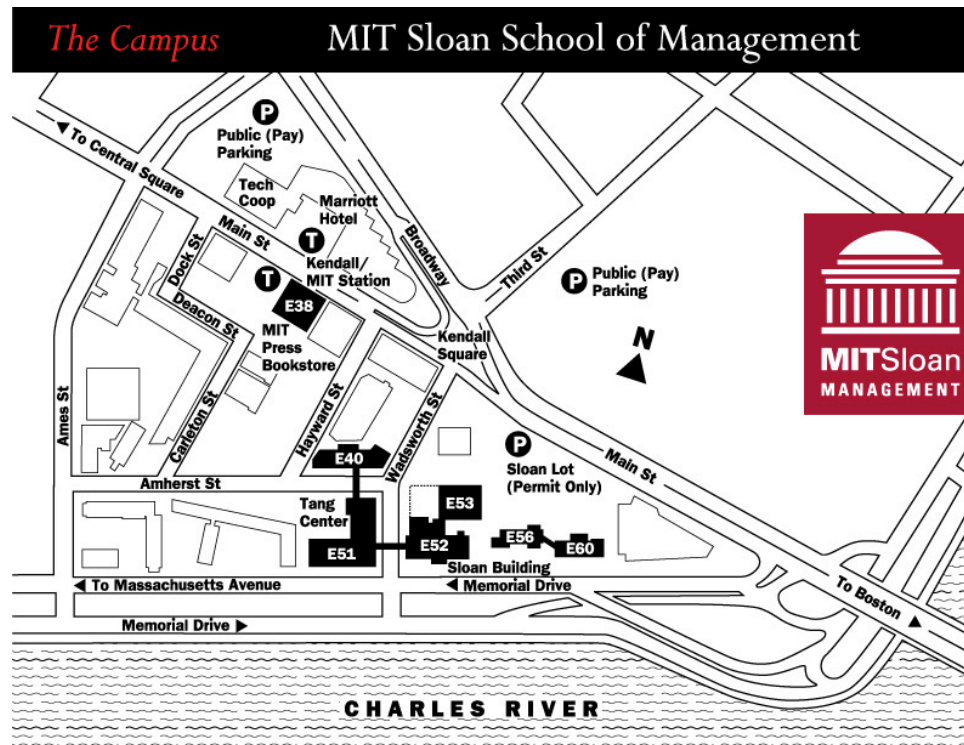
If anyone is leading MIT in both stimulating interaction and “the new office,” it is the business school. There are about 900 MBA students so the study would be relevant to nearly 10% percent of campus. The Sloan “campus” is relatively well defined and spatially segregated from the rest of MIT, minimizing confounding variables. MBA students’ schedules are very constrained with their program requirements and so much of their time is spent at Sloan itself. Virtually all of the students seem to carry and use their laptops on a daily basis and no one has an office. They have a clear need to create spaces that encourage interaction since much of business school is about networking. Casual conversation with students there has revealed that space is a major problem for them. Finally, Sloan is constructing a new building so any findings might be able to be incorporated into the programming decisions of that new building.

What is the nature of MBAs’ work? What is the nature of their spaces? How do they use laptops and how does that affect student behavior? Are their spatial needs similar to what Duffy predicts? Is their space optimized for Sloan student flextime use given their work needs and laptop use?

“Sloan” in this study consists of what is found on the Sloan website on a map labeled “Sloan Campus” (see Figure 6 below). This map shows only E38, E40, E51,

E52, E53, and E60. All of these buildings are next door to one another or close by and all are at the far east end of campus, bordering the Charles River and Broadway. Sloan campus consists of 117,329 total square feet and 654 rooms.

Figure 6: MIT Sloan Campus



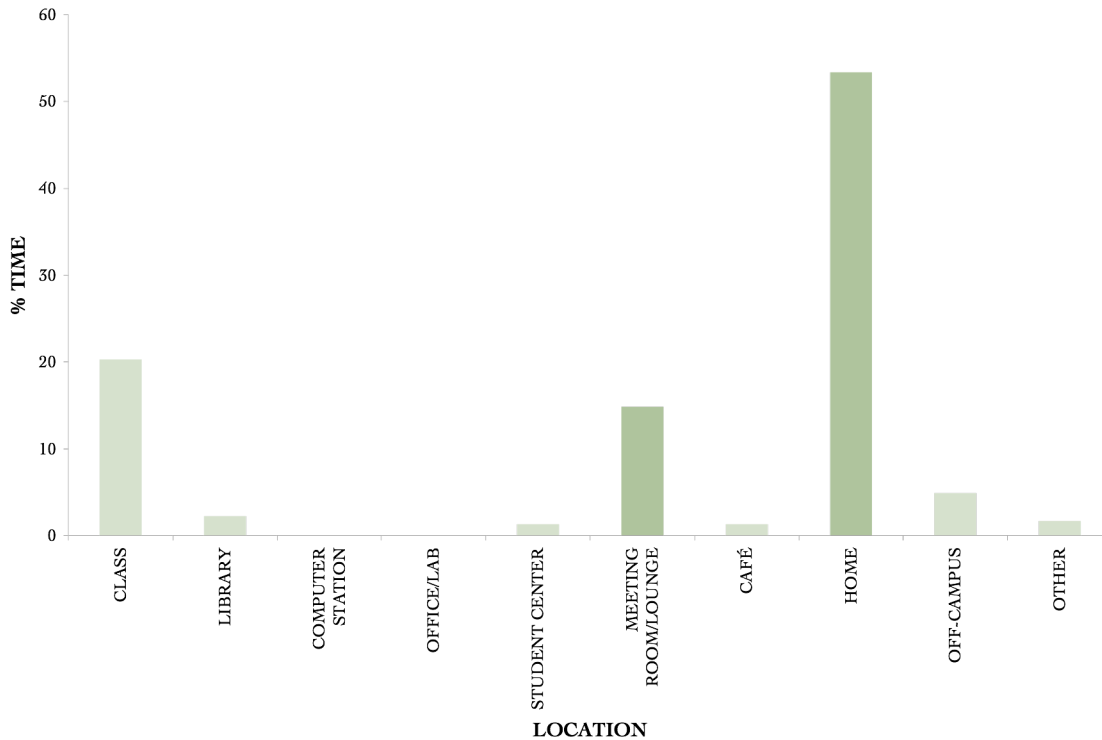
Over 90% of Sloan is office space for faculty, administration, PhDs and a handful of non-MBA Masters student departments. “Sloan” corridor space is equal to roughly 22,956 square feet. This amounts to about a third the size of its allotted assignable space. Sloan has only 19 classrooms (3% of total rooms) that take up 3,233 square feet (3% of total space). There are eight “study rooms” and two “general use” rooms which amount to only 7,443 square feet. This equates to a mere 1% of rooms or 6% of total square footage. In other words, MBAs would appear to be spending 15% of their time in 6% of their campus space. What are Sloanies doing in these spaces?

All of those in our study bring their laptops on a daily basis and none of them have offices. What do they do? The first most glaring thing is that they spend over 50% of their time at home and 15% of their time in meeting room/lounge areas. Other than classes (which seem to be relatively consistently 15-20% of all students’ time all over campus) they don’t really spend their time anywhere else. Despite being one of

the most “mobile,” a full 73% of their time is spent either at home or in classes. And, despite being able to work “anywhere,” they seem to spend their flextime on campus sitting in the common areas and meeting rooms. In other words, they are spending 88% of their time in three types of spaces.

Figure 7: Sloan MBA Space Use

N=4



OBSERVATIONS

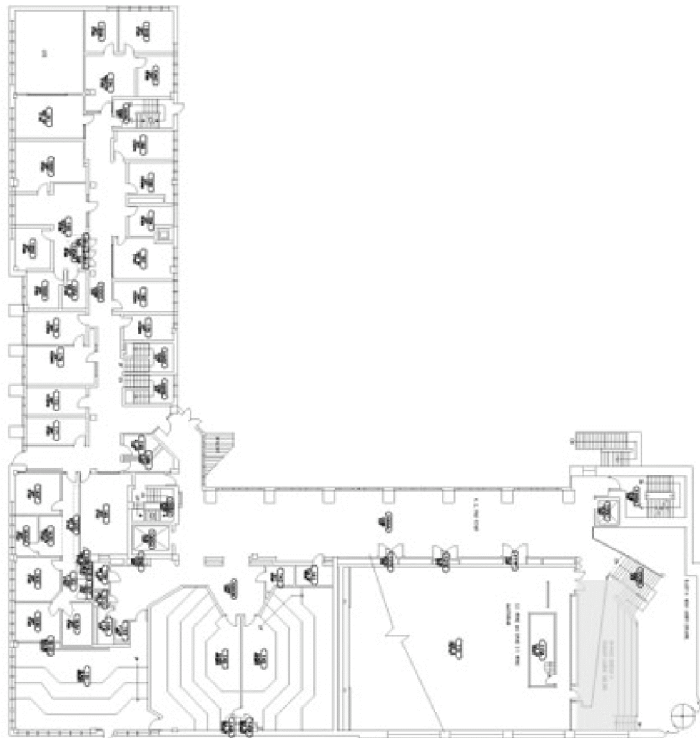
As part of the process of choosing a case study, we⁴ began investigating several locations on campus that we hypothesized might be heavily used by laptop and non-laptop users alike based on personal experience and knowledge of the campus.

Each space was observed for one and a half hours in five-minute blocks at fifteen-minute intervals. During each time block, we would note onto trace paper

⁴ Emily Hwang and Melati Kaye helped conduct observations in November and December, 2006.

where we were as well as the locations of all users of a particular space. For each user we would note gender, laptop use, reading, writing, eating or drinking, conversing (and with whom), cell use, and music (headphones). This was then translated into an excel file where all the data could be compared.

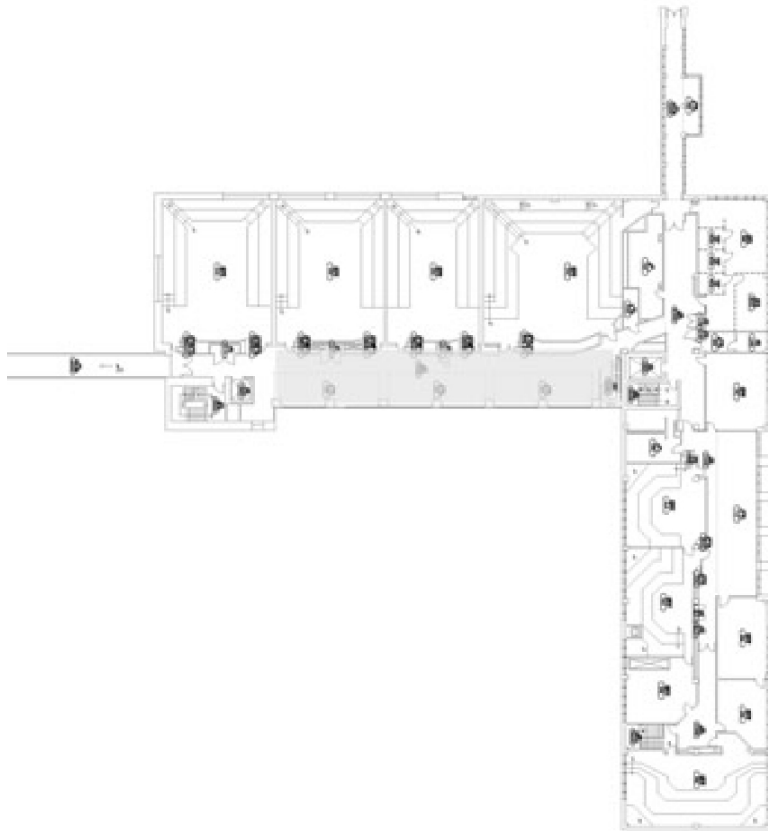
Figure 8: E51 Groundfloor Floorplan- Area of Study Shaded at Lower Right



Since we are focusing on Sloan, the following analysis is based upon our final structured set of observations of the Tang common room and 3rd floor corridor space between 1:30-2:30 on a weekday afternoon in early December, 2006.

The first floor lobby is actually three levels (see Figure 8). There is a lower level with six tables, two sets of sofas and several step-like benches that one can sit on. It is necessary to deviate from the main flow of traffic and walk down a half-flight of stairs to enter this level but there is no physical barrier blocking one's view into this space. The street level is mostly a wide corridor that leads to an elevator and a set of steps to other floors. There are some benches on the side that back the steps down to the lower level. Finally, there are steps that lead to a corridor on the second level. The space observed during this period was only the seating area on the lower level.

Figure 9: E51 3rd Floor Lobby- Area of Study Shaded at Left



The third floor corridor space consists of six tables and four sets of couches. They are outside of four lecture halls. Both space are heavily trafficked, especially during transitional times between classes.

Based upon our initial study, the use of common spaces seemed to be overwhelmingly with laptops (85/65%).⁵ Many seemed to work independently (55/42%). However, the laptop did not appear to be a barrier to conversation. The spaces were only slightly used for eating (17%) though often people stayed after they finished eating. People seemed to often eat while using their laptops. There was very little reading or writing with printed or handwritten materials though it is unclear what exactly the nature of the work was that was being done on the laptops. Most users were male (64/75%) and alone (54%). The main lobby was heavily used, receiving roughly 80% more stationary users than the third floor corridor. Spaces seemed to get

⁵ First number is Tang third floor corridor.

used in waves in accordance with class turnover. Only a quarter stayed at least an hour in the lobby. Most were primarily using their laptops, almost all used a laptop at some point. Some only used their laptop. No one was only doing any other single activity. Rather than multi-tasking most seemed to be “task shifting” (eg, eat → laptop → laptop → read → go), sometimes changing even over the course of only fifteen minutes. It is unclear whether certain patterns pervade. Few did the same thing the whole hour and those that did were typically on laptops. It was unclear to what extent they may have been rotating through various tasks on the laptop itself. Outlet use seemed to signal intent to stay a longer time but did not appear necessary for most users, even those with laptops, particularly if they did not stay long.

In other words, people were doing a lot of things. They were not just using their laptops but they were rather rapidly moving through different tasks. It is quite likely that they were also moving through multiple tasks on their laptop. But they also were not staying long. Whatever they were doing, it seemed to be mainly something to fill a gap of time rather than a specific task.

SURVEY

Paper-based surveys were distributed on location asking questions regarding what people had just been doing at that moment coupled with questions about their general use of that space (see Appendix C). 75 students were surveyed at eight different times between roughly 11 am and 3 pm in the lobbies of E51 and E52 as well as the Dewey Library⁶ during the months of March and April of 2007.

Everyone using E51 lobby was an MBA student. Almost everyone said that they came because there was “nowhere else to go” or because it was convenient. On average people spent one hour in the space and came three and half times per week. Almost everybody was using their browser primarily for e-mail and surfing the web. Over half came for meetings. About a third of the people were also creating text and

⁶ E52 lobby was surveyed five times with a total of 41 persons, E51 was surveyed twice with 13 surveyed, Dewey Library was surveyed once with 21 responses.

spreadsheet documents. What they liked the best was that it was a light and open place with tables, chairs and outlets and that provided a convenient place to socialize. However students complained it could be crowded, uncomfortable and sometimes noisy with inadequate tables and seating.

People using E52 were eating, socializing, and studying in that order. Most people said they had been meeting colleagues and using their Web browsers, primarily for e-mail but also for some web surfing. Many also claimed to be eating and reading for class. A few were also working on spreadsheets and layout applications. On average, people claimed to spend about an hour and a half in the lobby⁷ and claimed they used the space four times per week. Most primarily used E52 to study, trailed by meetings, eating, and e-mailing. Overall, they seem to be looking for a convenient place to eat, socialize, and plug in their laptops to do some “work.” They want comfortable chairs with good daylight and access to views. However the acoustics make for a loud room and there are not enough outlets or seating.

In the Dewey library, three quarters of the people were male but only half of them were MBA students. They were mainly coming for quiet place with natural daylight and views in order to get some work done. Rather than socializing, meeting, or eating. All the non-MBA students tended to spend close to three and a half hours and come almost four times per week whereas MBA students spent less than three hours and came closer to two times per week. Almost everyone was reading or using their web browser, primarily for e-mail or internet. About half the people were using Word or PDF documents. Even in the library a few people were still meeting colleagues and eating. Almost everyone's favorite aspect was that it was quiet and about a third liked the light. The MBA students in particular complained about noise, lack of outlets, uncomfortable tables and seating and poor aesthetics.

Virtually everyone surveyed had a laptop. Convenience was a main draw but there was a lot of dissatisfaction. Most students used these spaces while coming and going between areas at Sloan. About a quarter of those surveyed would have used some other space if it had been available. What other type of space? Many preferred to

⁷ The mode, however, is one hour.

use the group space on the 2nd floor or study cubes on the 3rd floor or even the E52 lobby, but all were presumably full (or at least assumed to be full based on experience).

Public lounge spaces seemed to be mostly MBA hangouts. One LFM student almost refused to take the survey because she claimed that she never used the E52 lobby and preferred to use her own office. A Ph.D. student I spoke with in her office confirmed that she never worked in the lobby spaces— those were “just for the MBAs.” The library was much more mixed and used more by non-MBA students.

95% of those surveyed were carrying a laptop but they were using it differently in different spaces. 70% of MBA students used laptops in common areas but all of them used it the library. Wherever MBA students used it, they checked their e-mail. A quarter of them worked on spreadsheets regardless of space. About a third used Word in E51 and the Library but no one was writing in E52.

Each space was used for slightly different purposes. E51 seems to be mainly used for meetings and socializing along with a lot of web-based tools. E52 is similar but is a preferred spot for eating as well. It is also used for longer periods of time (90 minutes rather than 60), possibly for this reason. While some work can be done in these common areas, the library is better for heads down concentrated activities such as word processing and particularly for reading. It is unclear whether people were “reading” online or offline. However, observations suggest that people are often using both paper and computer resources simultaneously.

My own personal experience with using these spaces while taking two courses at Sloan is that a lobby is a good place to have lunch or to go during a break in class. However, they are very distracting for meetings. In my first group we had access to a shared, but key access, study lounge which was our preferred location for meeting. In my second group, we preferred to meet in the group study rooms on the second floor but they were virtually never available. We would typically meet in the lobby of E51 and then try to see if one of the study rooms was available. There was even some discussion of group members trying to reserve a room after their classes up to one hour prior to the meeting. If we could not find a study room we might try to find a vacant classroom. If that were not available, we might try to use one of the tables in the corridor on the third floor of the E51 which was slightly less distracting. If none of

those spaces was available, which happened once, then we might consider using the E51 lounge or whatever we could find. Once, we spent over 20 minutes just looking for a good space to have a meeting. Since it was so common that the study rooms would be taken, sometimes we would not even bother trying to find one.

In general, these are three types of space used in different ways by different people using the laptop differently in each context. The laptop is a tool which enables a high degree of spatial flexibility and multitasking. Perhaps because MBAs seem to be trying to multitask so much at once they need to have multivalent spaces. Yet they clearly still very much require enclosed study rooms for meetings. They may be using these lounge areas with frequency not because of preference but because of lack of viable alternatives. Also, those who were sitting down for more than a few minutes were more willing to fill out the survey than those standing or doing quick tasks before class, which might have skewed the data.

NEW BUILDING

Sloan is constructing a new building that is slated for completion in late spring of 2010. I spoke with Lucinda Hill, Director of Sloan Capital Projects, about the process they used to develop design objectives for this new building and how they translated that to their current design.

Starting in 1997, they engaged in extensive programmatic research to define their largest problems. They knew that they wanted to promote interdisciplinary research among the faculty, they wanted to facilitate the training of MBAs as managers, and they needed to house Ph.D. students. They hosted a design concourse in which they held a three-month long design competition to select one of six architecture firms. Using an internal committee, they conducted space accounting research. In order to get an unbiased third party opinion, they hired Architectural Resources Cambridge (ARC), to conduct in-depth programmatic research. Using observations, interviews, and meetings with faculty and student committees, ARC developed a program for the new building.

The main design objectives seemed to be multi-functionality and flexibility for two reasons. First, Sloan is funding the building – not MIT – so they want to get the

most bang for their buck. Second, it is unclear how changes in technology and learning needs will play out in terms of spatial needs. Focusing on these two objectives allows them to optimize for uncertainty and maximize spatial needs with limited funding.

Based on this research, they realized that study rooms were vital. MBAs work in lots of teams but there is not much good space provided for them to have meetings. Time is wasted looking for space. The new design is full of study rooms with videoconferencing capabilities as well as a flat screen monitor to plug in laptops.

Classes at Sloan are scheduled to end five minutes before the formal ending time and start five minutes after the formal starting time. They noticed that a lot of students milled around in the hallways between classes so they suggested that corridor breakout spaces could be created for informal conversation during that period. ARC developed the idea that there should be four square feet of space outside of the classroom for every seat in that classroom.

The original design of the E51 lounge, also known as the “Diebold lounge,” was based on the objective of teaching students to interact. Originally, they installed only soft seating for group study, but did not factor in the laptops. They added some tables and chairs but students pushed them to the edges to get closer to outlets. In the 1990s, they redid the E52 lobby or the “Sloan lobby.” They added some lamps on movable tables with outlets attached to them. However, students moved the tables for salsa dancing classes. When students moved the tables back they didn't plug them in again. Students then complained that they did not have enough outlets.⁸ The design for the new building would need to be flexible but they also realized that electricity was a critical issue for students.

There are no Athena clusters at Sloan. However, the career development office set up about 10 computers initially for students to research and print out things related to employment opportunities. Students began using it because it was linked to a printer and it was convenient. To accommodate for this need, in the new building they want to install e-mail checking stations. They are also creating a business center with

⁸ “Nonfunctioning outlets” in the Sloan lobby is still a common complaint today.

printers, mailing supplies, etc. Designing this has been difficult since new technologies such as blackberries have rendered some things obsolete such as fax machines.

Most rooms will still be horseshoe shaped discussion rooms with a tiered floor. Based upon conversations with faculty about their space needs for the future, they decided to install a Technology Enabled Active Learning (TEAL) room such as the one in the Stata Center. Many different roundtables will be arranged around a flat floor room to enable students to work in small groups. Each table will have its own whiteboard with a camera. If the professor wants to show the rest of the class what one group is working on, she could video project that whiteboard onto a screen. Students will also have videoconferencing capabilities. However, they are also making the flat floor rooms with tall ceilings so they could be convertible to discussion rooms and designing the ventilation and electrical in the horseshoe discussion rooms such that they could be convertible to flat floor TEAL rooms.

Certain elements are designed to enable digital technology. In order to make it more cell phone friendly, they are designing nooks and crannies for people to make cell phone calls. They are trying to install outlets on the floors in as many critical areas as possible, although this is complicated on the first floor by the underground garage.

Paradoxically, “wireless” digital architecture requires a lot of infrastructure. On each floor there are two “TelData Control Rooms” (TDCR) that are nearly the size of a group study space for six people (125 square feet). These rooms need to be stacked one on top of each other on each floor and they need to be physically near where people are actually sitting. As the “wireless” becomes higher powered, you need more and bigger closets. One room roughly that size was taken over for a TDCR from the DUSP common room area just last semester. Money or space used for digital infrastructure must also come out of an overall budget, diminishing other potentialities.

Wireless isn’t equally distributed, nor is electricity. One of the biggest questions with this infrastructure is how to get the data and electricity to where students are if you cannot guarantee where they will be sitting? Hopefully this thesis will help answer that question.

CONCLUSIONS

This research might more usefully be viewed as a compilation of “pilot projects” that lead to empirically based hypotheses and further research questions rather than statistically significant conclusions. Individually, no project is a perfect representation of what is empirically happening but combined they start to trace the edges of describing observable phenomena. Results are most generalizable to similar university campus settings though some hypotheses may be generated that might be testable in other circumstances.

MAIN FINDINGS

Users will adapt to the affordances of new technologies and behavior settings to meet their needs more than the technologies or the spaces will “determine” use. The use of laptops in a WiFi setting does not necessarily lead to distributed working patterns. Which spaces are used and by whom is a combination of the type of work needed to be done, the type of tools required and available to complete the task and the type of spaces that an occupant can access.

Nearly all of students’ waking hours are spent between home (43%), class (15%), and office (16%) while only 18% of time is spent in all other campus locations combined. This does not mean that these other public spaces do not serve important functions but it does suggest that they are unlikely to replace the office or private residence as primary work environments.

Based upon empirical studies of laptop usage on MIT campus detailed above, laptops were used the most by people who had offices (which tended to be PhD students). Those who had an office or a lab as part of their life space seem most likely use it as a primary workstation. Those who do not have one, such as undergraduates and masters students, will probably use a comparable substitute. What you will substitute it with will depend in part upon whether you have a laptop with you or not, but probably more on the requirements of your particular life pattern and the

affordances of your particular life space. Undergraduates, for instance, spent a greater amount of time at home and may be treating this as their “office.”

Some shared facilities are used by laptop users (cafes, corridors, libraries, etc.). While it may appear that some of these “third” spaces are used heavily by laptop users, there are only a few places on campus (such as Sloan) where they are used for long periods of time by individual users.

MBA's at Sloan are perhaps leading the campus in terms of their use of laptops. They seem to use lobby spaces heavily for a variety of tasks, many of which include being on a laptop, though also for eating and face-to-face meetings and socializing. Yet this may be due to the fact that they work heavily in groups and they lack adequate meeting spaces. The design of the new building has tried to take these issues into consideration by including outlets, multivalent spaces and increased study lounges. They have also tried to maintain their goal of flexible and multifunctional spaces that can be reconfigured to serve multiple needs over time, such as a café that can become an auditorium with a few seating adjustments or a discussion room that can be remodeled to become a TEAL room.

HYPOTHESES AND INTERPRETATIONS

WORK: GROUPS V. INDIVIDUALS

Those that seem to use third spaces and use their laptops the most seem to be MBA's. These are individuals that have no offices and do lots of group work. This also requires a lot of communication (particularly e-mail), and frequent change of space for meetings. Yet there is a lot of work that these people must still do individually and most must happen on a computer. There is a lot of “downtime” between meetings and classes. Perhaps they carry their laptops and use third spaces so they can work during this downtime, not because it is the “best” space for their needs.

SPACE: MULTIPURPOSE USE

There seems to be multipurpose spatial usage, particularly in cafés and hallway eddy spaces. A primary use may serve as the draw but this also seems to serve as a

lead-in to other uses. For instance, an MBA might come to the E52 lobby primarily for eating or socializing but then stay to work once the food (and possibly socializing) is done.

BEHAVIOR: NEW TECHNOLOGIES, NEW POTENTIALITIES

Laptops might change the social behaviors previously supported or encourage others not previously supported in a particular behavior setting. For example, while it has always been frowned upon to talk in a library, the clicking of keys on a laptop while writing a paper is indistinguishable from communicating via email or IM. The library hasn't changed physically or programmatically, but new uses can open up as a result of new technologies.

TECHNOLOGY: BEYOND POLARIZING THEORIES

It is not that massive, technologically-driven changes occur when laptops and WiFi are ubiquitously available (Duffy, 1997; Weber, 1968; Fortunati, 2002) nor are there no changes at all. Bringing a laptop is not just “the same” as bringing a book or a notebook. A laptop can be used for communication, writing, reading, information gathering, design, data-crunching, video making or watching, programming, etc. In this sense, the laptop opens up new uses of spaces because you can perform more types of tasks in a wider variety of settings.

USERS: DIFFERENCES IN CONTEXTS AND NEEDS

As this research has tried to show, simply because the technology enables particular tasks or uses of space does not mean that those uses are a necessary result of using the technology. Different users using the same object in their particular life space serving their own life pattern needs will use spaces and objects in fundamentally different ways (Fischer, 1992:15; Mitchell, 1999:143). For instance, MBAs with laptops but no offices and a desire to interact seem to use lounges and meeting rooms whereas PhDs with offices or labs seemed to mostly stay put in their offices despite having laptops.

What we are not seeing in these examples are people being particularly “mobile.” We have always been “mobile.” Instead, as Manuel Castells has claimed, what we are becoming is more accessible and connected when we do move around. More importantly, increased capabilities and subsequently increased demands and expectations from others are making us feel we *need* to be more connected.

RECOMMENDATIONS

Bill Mitchell claims in *Me++* (2003:149) that with new ICTs “special places” that best meet our desires will become “powerful attractors.” The “special place” that most “liberated” student laptop users are choosing to use during their flextime appears to be their own office or home. Third spaces seem to be used primarily for only very brief periods of time, except in rare instances such as MBAs. Even then they appear to be unsatisfactory replacements for other types of spaces.

Taking away private offices and supplementing them with corridor space (such as in the Stata center) may be encouraging brief periods of interaction, but may also be pushing people to replace office space with even less interactive private home office settings during the bulk of their time. In other words, the most interactive spaces may not be “clubs” but “dens.” Some combination of these spaces, as Duffy suggests, is the end solution. The office cannot simply be taken away or replaced but could be complemented with a package of different types of rooms.

Duffy does not go into detail about exact proportions or the amount of time suspected to be spent in a given space. However, he has developed a successful business around providing context specific qualitative programmatic research to determine the specific needs of particular users. This sort of research should be extended beyond the realm of offices and universities and the role of new technologies. As it is hard to generalize to broad populations based upon theoretical assumptions, this type of research should be a core component of any design project.

While not all of these methods are pragmatic or applicable to all situations, some of the quicker probes such as a combination of observations, surveys, and

interviews could be done quickly and effectively to provide valuable data to direct programmatic and design objectives.

Virtually ubiquitous cellular technology and impending deployment of urban WiFi networks makes tracking of urban citizens cheaper and more feasible. Great care should be made to ensure privacy. This research should be done with the final analytic objectives in mind and coupled with more traditional ethnographic approaches. If not, we risk describing what people are doing but not explaining why.

The future is highly unpredictable and ever changing. New technologies rapidly become obsolete. Whatever changes we make to physical spaces should consider the role of new technologies but also be highly flexible and multifunctional, as in the new Sloan building.

FUTURE RESEARCH DIRECTIONS

SAME QUESTION, DIFFERENT METHODS

Future research might focus on the iterative processes by which people are willing and able to adapt to new circumstances and how this influences their use of space and technology. Researchers could gather more in-depth information about the range of individuals' agendas and how they have attempted to carry those agendas out in the past. What difficulties have they faced adapting to various settings, especially ones with new features such as WiFi? What are the processes by which individuals came to master these new settings and what difficulties did they have?

Techno-savvy researchers may want to use cell-phone tracking (such as those used at the SENSEable City Lab), time lapse video (two seconds recorded per five or ten minutes), or giving users cameras and asking for photos of problem and solution areas. Traditionalists may prefer to use interviews or cognitive mapping techniques. Data collection and analysis should mix qualitative and quantitative methods.

NEED FOR SPECIFIC SCALE AND GROUP TYPE

Many researchers in this field focus on the behaviors of tiny minorities of extreme users to make broad brush statements about enormous changes rather than

observing the more common complicated and hybrid phenomena that compose the majority of situations. Future research needs to be highly contextual, place and person specific, with an attention to scale and demographics. It is possible to get meaningful empirical data from a small extreme user demographic however one should be explicit about this and draw conclusions based upon this knowledge.

TETHERING

As Sherry Turkle argues in a forthcoming book, new ICTs are “always on” and “always on us” leading us to become “tethered” to our social networks. Perhaps it is not that we are becoming mobile, but it is our social relations and connectivity to the network itself that are becoming mobile. Rather than making us more free, does this make us more dependent upon physical spaces with a particular coupling of hardware, software and infrastructure that enable us to connect to these broader networks? How does this tethering change our agendas or the means by which we try to carry them out?

COMMUNICATION AND INTERACTION

New technologies may be good for public spaces with WiFi because they create a space where people can perform more types of *communication* (such as checking their email). How does this change the nature of *interactions*? Does decoupling the concepts of “communication” and “interaction” enable us to pursue new lines of thinking regarding connectivity devices and spaces?

THE VALUE OF CONSTRAINT?

Paul Saffo, Director of the Institute for the Future, presciently suggested in 1993 that “Heaven is the anywhere, anytime office. Hell is the everywhere, every time office.” To the extent that design can enable or constrain particular uses or behaviors, what sort of ethical duty do we have to make value judgments regarding our design objectives? Enabling all behaviors in all situations may not be desirable and may even constrain certain behaviors (consider cell phones in movie theaters). Is “ubiquity” always the best end goal for wireless services or are their contexts in which constraining rather than enabling certain behaviors may be preferable, such as the technology-free zones suggested by Eric Paulos at Intel?

Our “wireless” networks do not come without wires – we just do not see them. Much like the TDCRs at Sloan but at a larger scale, there are at least three such buildings in Cambridge (see Figure 10 below). Notice that it is possible for these to be beautiful, as the example near Harvard on the far left demonstrates. Since these buildings must be near the people they serve, how can they best be integrated into the context of the existing urban fabric?

Figure 10: Cambridge TelData Buildings



FINAL REFLECTIONS

“Freedom” from space is a value judgment that assumes that “mobility” is somehow innately preferable. However, the evidence seems to suggest that this perspective is likely only that of a tiny minority (such as those doing the research). Rather, users will adapt and adapt to rapidly changing new technology as it fits within their life patterns in existing and slowly changing life spaces.

Through context-specific ethnographic behavioral research, we can develop empirically grounded design objectives in tune with the specific needs of users. Architects and urbanists should pay attention to how pervasive digital connectivity is changing the use and functionality of spaces while not falling prey to radical and speculative technological or spatial determinism.

Yet probably no matter how “virtual” the experience– the context of physical place does not “go away.” Where we are matters (Castells, 2006; Mitchell, 1999; Blanchard, 2004). Even the most technologically enhanced cyborgs of the future will still need to inhabit physical space but they will become increasingly dependent upon an intervening layer of virtual connectivity.

APPENDIX A: MIT WIRELESS MOBILITY DEMOGRAPHIC QUESTIONNAIRE

Please make up a randomly selected four-digit number to identify your survey

Home address

Male Female

Age

Course # (eg Course II):.....

Degree Program (eg Master in City Planning):.....

Years spent at MIT:

2. Do you live on campus?

Yes No, but <15 minute walk No and > a 15 minute walk

3. How are you currently getting to MIT on a regular basis at the time of this survey? (multiple selections allowed)

On foot Bus Subway Bicycle Car MIT Shuttle

4. How much do you pay for your room/apartment per month (utilities included)?

< \$400 \$401-600 \$601-800 \$801-1000 > \$1001

5. How important is it for you to use a computer for study/work purposes?

Optional Important Extremely Important

6. Please list the applications you most regularly use (i.e. Outlook, CAD, ...), in order of decreasing frequency (with 1 being the *most* used and 4 being the 4th most used):

1..... 2..... 3..... 4.....

7. How many different computers do you use on a regular basis?

laptop laptop + one desktop computer laptop + more than one desktop computer only desktop computers I do not regularly use a computer

8. If you have a laptop, how often do you bring it to campus? If you live on campus, please answer how often you use your laptop outside of your dorm room.

almost never about once a week about three times a week daily

8a. If you answered “daily” in question 8, how many hours do you use your laptop per day?

< 1 hour 1-3 hours 3-7 hours > 7 hours

9. How many classes are you taking this semester?

10. How many projects and independent studies are you involved in?

11. How many face-to-face meetings do you have on a weekly basis (i.e. with your advisors or with peer students)?

almost never 1 to 2 3 to 4 5 to 6 >7

12. Do you need any special equipment for your work other than computer and paper-based tools? (i.e. lab or studio equipment). If yes, please specify:

13. Do you have a primary space you use as the base for your work?

Multiple Yes, a common room Yes, my home Yes, a shared office/lab/studio Yes, my own office

14. How much do you feel part of a group on campus (i.e. your program or lab)?

not at all somewhat average a lot quite a lot

15. Do you usually use your cell phone when on campus? (If you live on campus, answer whether you use your cell phone outside of your dorm room.)

Yes No I do not own a cell phone

16. If you answered “yes,” about how many times do you use it on average? (incoming+outgoing calls+SMS)

almost never 1-2 3-4 5-6 7 or more

MIT Wireless Mobility Study

ID Number:
Weekday:

Please describe your mobility over the course of the day.
Please specify the destination (ie 10-485, classroom).

	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
My Mobility Today															
My Alternative Mobility															

Laptop on campus today: YES NO

If YES

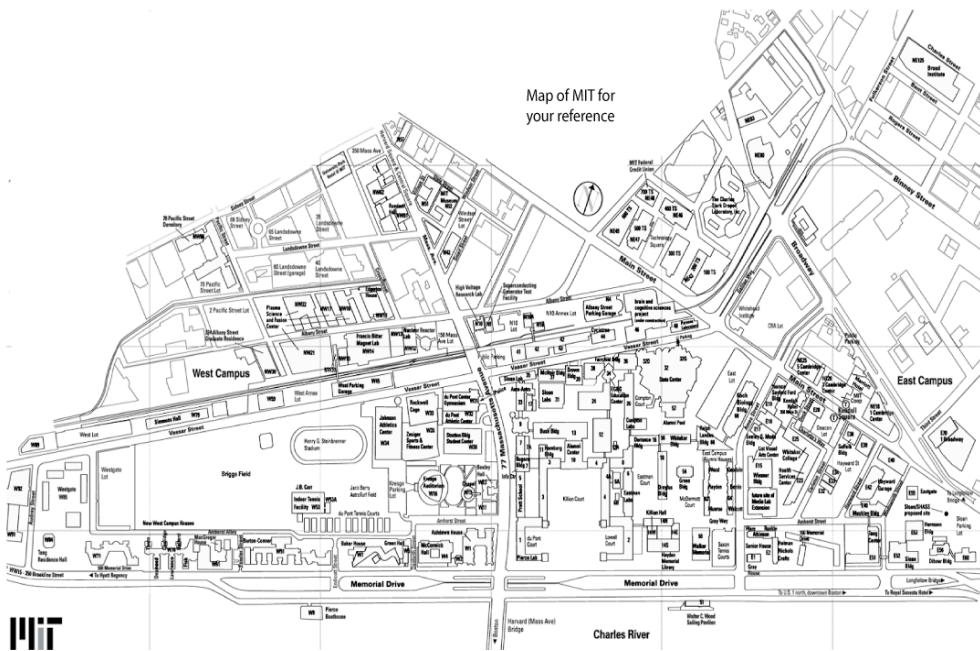
Please fill in your alternative mobility imagining that you did not have a laptop today.

If NO

Please fill in your alternative mobility imagining that you had a laptop today (please consider that all MIT campus is Wi-Fi covered).

Please open your MIT email account and provide the following data:

Total number of received messages	
Total number of received messages from a local sender	
Total number of sent messages	
Total number of sent messages sent to a local recipient	



APPENDIX C: SLOAN SPACE SURVEY

1. Age:
2. Gender:
3. Program and Year:
4. Why did you choose to come to use this room?
5. What were you doing before this?
6. Where?
7. What time did you arrive?
8. What are you going to do next?
9. Where?
10. When will you leave (guess, if necessary)?
11. Do you own a laptop?
12. Do you have it with you?
13. What have you been doing since you got here (please check all that apply):

Eat

Meet colleague

Paper-based Reading

For class/work?

For pleasure?

Web Browser (e.g. Microsoft Internet Explorer)

For email (eg, Webmail)?

For casual surfing?

For research/class/work related?

- Word Processing (e.g. Microsoft Word)
- Image Manipulation (e.g. Adobe Photoshop)
- PDF Application (e.g. Adobe Acrobat)
- Layout Application (e.g. Adobe Illustrator)
- Chat Window (e.g. Instant Messenger)
- Media Player (e.g. iTunes)
- Spread Sheet (e.g. Excel)
- VoIP (e.g. Skype)
- Mail Application (e.g. Eudora, Mail- NOT online)
- Other (please explain)

14. Are these the activities you had planned to do in this room?

15. Was this your 1st choice of space?

16. If not, where might you have wanted to go and why didn't you go there?

17. How many times have you come here in the past week?

18. What did you use this space for primarily (can be multiple)?

19. Looking back at the past week, how long on average were each of these visits to this space?

20. What are your three favorite elements of this space?

21. What are your three least favorite elements of this space?

BIBLIOGRAPHY

BOOKS

Barker, Roger. "Settings of a Professional Lifetime" in *Behavior Settings: A Revision and Extension of Roger G. Barker's "Ecological Psychology"* by Phil Schoggen, ed., Palo Alto, CA: Stanford U Press, 1989.

Behavior settings are units of observation and analysis which empirically exist objectively, are specific to a time and space, and contain human as well as physical elements. Patterns of behavior are consistent with physical environment (synomorphy).

Duffy, Francis. *The New Office*. London: Conran Octopus, Ltd., 1997.

Leading consultant's perspective on changes in offices and work behavior with respect to new technologies.

Fischer, Claude. *America Calling: A Social History of the Telephone to 1940*. Berkeley: University of California Press, 1992.

Importance of context, not about "impact" of new technologies on society. Technology and society are mutually influencing.

Graham, Stephen, ed. *The Cybercities Reader*. London: Routledge, 2004.

Outline of major works in the field of telecommunications and urbanism as it stands today.

Hall, Edward. *The Hidden Dimension*. Garden City, NY: Doubleday, 1969.

Cross-cultural concepts of space, how use of space can affect social and business relationships, planning.

Höflich, Joachim. "A Certain Sense of Place: Mobile Communication and Local Orientation" in *A Sense of Place: The Global and the Local in Mobile Communication*, Kristof Nyiri, ed. Vienna: Passagen Verlag, 2005.

People on mobile phones in public spaces are in two places at once. They are simultaneously present and not. You can not fully get away from place- virtual distance is only temporary.

Jacobs, Allan. *Looking at Cities*. Cambridge, MA: Harvard U Press, 1985.

Methods for observation.

Kelley, Tom. *The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm*. New York: Doubleday, 2001.

Insider secrets about how to use user studies and prototyping to innovate from a leading design firm in Silicon Valley.

Martin, Leslie and Lionel March, eds. *Urban Space and Structure*. London: Cambridge U Press, 1972.

Example of a campus design evaluation from the 1970s using similar methods.

Mitchell, William J. *City of Bits: Space, Place and the Infobahn*. Cambridge, MA: MIT Press, 1995.

_____. *E-Topia: "Urban Life, Jim— But Not As We Know It"*. Cambridge, MA: MIT Press, 1999.

_____. *Me++: The Cyborg Self and the Networked City*. Cambridge, MA: MIT Press, 2003.

Three books from one of the leading theorists on the relationship between telecommunications, computers, and architecture.

Project for Public Spaces. *How to Turn a Place Around*. New York, NY: Project for Public Spaces, 2000.

Guidelines for "place" development by a leading public space consulting firm begun as an offshoot of W. Whyte's Street Life Project. Contains methodological tactics for observation.

Schoggen, Phil. *Behavior Settings: A Revision and Extension of Roger G. Barker's "Ecological Psychology"* by Phil Schoggen, ed., Palo Alto, CA: Stanford U Press, 1989.

Explanation and extrapolation of the theory of behavior settings based on Roger Barker's work.

Scifo, Barbara. "The Domestication of Camera-Phone and MMS Communication: The Early Experiences of Young Italians" in *A Sense of Place: The Global and the Local in Mobile Communication*, Kristof Nyiri, ed. Vienna: Passagen Verlag, 2005.

MMS and camera phones enable increased connections between physical and social spaces- not a weakening of place.

Schön, Donald. *The Reflective Practitioner: How Professionals Think in Action*. Aldershot, England: Ashgate Publishing Ltd., 1983 [1991].

Argues for a new type of pedagogy in professional design practice that is more *process* oriented.

Turkle, Sherry. "Always On/Always On You." In *Handbook of Mobile Communications and Social Change*. James Katz, Ed., Cambridge, MA: MIT Press, forthcoming.

A short piece on how new mobile technologies become integrated into and shift our daily behavior. Lacks somewhat in discussion of the role of physical context in the interaction between person and object.

- Whyte, William H. *The Social Life of Small Urban Spaces*. Washington, D.C.: The Conservation Society, 1980.
Methodological case example of how to conduct observations, especially using film, to develop urban design recommendations.
- Webber, Melvin. "Order in Diversity: Community Without Propinquity" in *Cities and Space*. L. Wingo, ed. Baltimore, MD: Johns Hopkins Press, 1963.
- _____. *Explorations into Urban Structure*. Philadelphia, PA: U of Pennsylvania Press, 1964.
Predicted the rise of telecommunications would lead to linked "interest-communities", yet disparate "place-communities" which should force planners to reconceptualize the "urban" as being rooted to placeless social interactions ("urban realms"), not physical settlements.
- Wigley, Mark. *Constant's New Babylon: The Hyperarchitecture of Desire*. Rotterdam: Witte de With, Center for Contemporary Arts: 010 Publishers, 1998.
Argues that new technology will lead to *Homo Ludens* or playful, work-free existence.
- Zeisel, John. *Inquiry by Design: Tools for Environment Behavior Research*. Cambridge, England: Cambridge U Press, 1984.
Good qualitative methods book.

ARTICLES AND PAPERS

- Blanchard, Anita. "Virtual Behavior Settings: An Application of Behavior Setting Theories to Virtual Communities" in *Journal of Computer-Mediated Communication*. Vol. 9, Issue 2, January 2004.
A sense of place is communicated via psychological awareness of the "co-presence" of others in a virtual setting.
- Dal Fiore, Filippo, Ezra Goldman and Emily Hwang. "Does Laptop Usage Affect Individual Mobility?" MIT Paper, forthcoming.
- Fortunati, Leopoldina. "The Mobile Phone: Towards New Categories and Social Relations" in *Information, Communication and Society*, pp 513-528, Vol. 5, Issue 4, 2002.
Cell phone is "not only changing society, but...framework in which society lives." We are gaining ability to "multi-space" and "multi-task." There is a thickening of space and time. We retreat to the "safety" of the familiar.
- García-Herrera, Cristobal. *Spacing Innovation and Learning in Design Organizations*. MIT CMS MS Thesis, 2004.

Tries to answer the question of what designs function best for spaces that want to be innovative and creative looking at IDEO, Media Lab and Design Continuum as case studies.

Mitra, Anita and Rae Lynn Schwartz. "From Cyber Space to Cybernetic Space: Rethinking the Relationship between Real and Virtual Spaces" in *Journal of Computer-Mediated Communication*. Vol. 7, Issue 1, October, 2001.

Argues that a new type of space is emerging that is a hybrid of space and technology that they label "cybernetic space."

Norman, Don. "Affordance, Conventions and Design." From *Interactions*. May, 1999. pp 38-43.

Argues that it was "perceived" affordances that was important in the original theory.

Patton, Phil. "The Virtual Office Becomes Reality." In *New York Times*, 28 October, C1.

Sevtsuk, Andres. "Effects of ICT on City Form". MIT paper, 2005.

ICT will not have major changes to city form in the near future but is affecting the way in which cities are designed (CAD, etc.) and used (just-in-time/real time communication).

INTERVIEWS

Lucinda Hill, Director of Sloan Capital Projects

WEBSITES

MIT Campus Map, <http://whereis.mit.edu>

MIT Office of the Registrar, <http://web.mit.edu/registrar>

MIT Department of Facilities, <https://floorplans.mit.edu>

MIT Information Services and Technology, <http://web.mit.edu/ist>

MIT Sloan School of Management, <http://mitsloan.mit.edu>

MIT SENSEable City Lab: iSpots, <http://ispots.mit.edu>