

# Unleashed: Web Tablet Integration into the Home

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## ABSTRACT

To understand how web access from a portable tablet appliance changes the way people use the Internet, MediaOne gave families pen-based tablet computers with a wireless connection to our high-speed data network. We used ethnographic and usability methods to understand how tablets would be integrated into household activities and to define user requirements for such devices. Participants viewed the tablet as conceptually different from a PC. The tablet enabled a high degree of multitasking with household activities, yet flaws in form and function affected use. Results suggest that correctly designed portable Internet appliances will fill a special role in peoples' daily lives, particularly if these devices share information with each other. They will allow spontaneous access to information and communication anywhere.

## Keywords

Internet appliances, pen-based computing, hand-held computers, ergonomics, ethnography

## INTRODUCTION

One might call the 1990s the decade of the Internet. In 1992 [2] when the first graphical browser became available to the public, few people accurately predicted the rapid growth of the World Wide Web. The second half of the decade has been full of predictions about the rise of Internet Appliances [6], small wireless devices dedicated to one or a few Internet-based services. As the century turns over, the first of these devices have made it to market (e.g., Internet cell phones, Cidco's MailStation) with the promise of many more to come (e.g., pizza magnets, tablet appliances, etc.). In an effort to better understand how Internet appliances will be integrated into the home, MediaOne Labs has conducted several studies. This paper focuses on one of these, an in-home study of a wireless tablet appliance. The goals of the study were to understand how a web tablet appliance would be integrated into household activities, to understand how using the tablet to

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access the Internet would differ from using a personal computer, and to define the functional and design requirements for a web tablet.

## METHODS

The results of our study are based on findings from thirteen households to whom we gave tablets appliances and wireless network connections. The households were customers of MediaOne's high-speed data (HSD) service, a service providing a constant "always on" connection of 1.5 Mbps downstream and 356 Kbps upstream.

## Equipment: What is a Tablet?

Tablet computers have been used for a variety of business applications over the last ten years. Tablets that are available on the market are smaller and lighter than laptops, but bigger and heavier than palm-type devices. They are designed to support highly mobile occupations (e.g., delivery, hospital workers, etc). Although many tablets have a detachable keyboard accessory, they are designed as pen-based; tapping and handwriting recognition are the primary input methods.

The tablet appliance we used had a Windows 95 operating system with a Pentium 133MHz processor. The screen was a 7.5 inch passive matrix 256 color touch-sensitive display. Input methods included an active stylus for tapping and writing, a detachable slim-line keyboard, and an on-screen keyboard. We opted to use a full Windows 95 tablet (a vertical market device) rather than a more consumer-oriented device with Windows CE because it offered more in the way of a broadband experience; Windows CE did not support the use of browser plug-ins, chat clients, or streaming media.

We installed a base set of applications on the tablets, including browsing software, email, instant messaging/chat client, and a variety of plug-ins supporting animation and streaming media. Participants could also load or download software of their choosing to the tablet from the Internet or by using file sharing with their home PC.

## Demographics

Fifteen households were recruited from a random sample of 100 MediaOne HSD subscribers located in five suburbs of Detroit. We screened households by family composition, level of experience with PCs, and type of dwelling. By the

time the trial began, however, two households had dropped out because of concerns about the tracking methods that we planned to use; they were worried that we would have access to too much personal information.

Participating households varied demographically. Three households had no children, two had adult children living at home, five had children between the ages of 6 and 18, and three had children under the age of 6. Household incomes were distributed from \$25,000 to more than \$100,000. Nine participating households lived in multi-level single-family dwellings, three in apartments, and one in a townhouse.

Initially we estimated that we had a pool of 40 individuals of an age to use the Internet and therefore the tablet appliance (6-years-old and above). At end-of-trial however, we found that no one under the age of 9 had used the tablet, and that a few adults did not use it either, leaving us with a sample of 28 users: 23 adults, 4 teenagers, and 1 pre-teen. There were 13 females and 15 males, and in 12 households males were the primary users, even in cases where females were the owners of the primary PC in the household.

**Data Collection**

In an effort to characterize the tablet experience more precisely, we used a variety of methods to collect and analyze several types of data.

We used an ethnographic approach to understand the context of use and how the tablet appliance was integrated into the daily lives of participating households. This included two in-depth semi-structured formal interviews, both pre- and post-trial (3-4 hours total). Interviews covered topics about family dynamics, household schedules, activity mapping of the home, as well as specific questions related to use of technology in the home and the Internet. This data was augmented with spontaneous informal email interviews and interactions throughout the trial, as well as photographic documentation.

To calculate actual use of both the primary PC in the household and the tablet appliance we used a computer tracking program that saved information in a local database on the primary PC and the tablet appliance. It recorded the captions and start/stop times of active windows, as well as the executable running in each window. Participants started tracking usage on their primary PC for two weeks before they received the tablets and continued throughout the trial. Mid-trial, we asked participants to send us their data files so we could use them to provide content for our post-trial interviews. We also collected this tracking data at the end of the study.

While some usability issues were disclosed naturally in the course of our post-trial interviews, we also made an effort to observe participants using the tablets, in both the initial and final interview. When we first delivered the tablets, we

gave participants a brief demonstration including use of handwriting recognition and the on-screen keyboard. Participants then used the tablet for about fifteen minutes while we observed their actions. We asked them to go to a web site and select links there, to use the Start menu, to close windows, and to type. We also showed them a different tablet design (one with an integrated keyboard and screen) and asked for their initial reaction to the form of each device. Participants also had an opportunity to type on the second tablet, which had a larger keyboard. During the trial, we asked participants about their problems with the tablets via e-mail, and when we returned for the final interview they showed us their biggest pet peeves.

**Duration and Design of Study**

Families had their tablets for approximately seven weeks. Two weeks before beginning the trial (mid-March 1999), we installed the tracking software on participants' primary PCs. In all cases, this was the PC with the HSD connection. We wanted to get baseline data about participants' use of general applications and the Internet with which we could compare our trial data. In the beginning of April we installed the tablet appliances and a wireless network. At this time, we conducted pre-trial interviews. Each household had their tablet appliance until the end of May when we returned to uninstall the networks and tablets, conduct post-trial interviews, and collect tracking data files.

**LANGUAGE: THE CULTURAL CONSTRUCTION OF A TABLET APPLIANCE**

Technological devices have no significance apart from the meaning, use and context that human beings construct around them. When trying to understand how a technological intervention (like a tablet appliance) "fits in" it is useful to ferret out native categories related to the objects in question. Native categories are spontaneous recurrent categorical references made by multiple individuals in relation to something else (in this case to the PC and tablet appliance). These categories become evident through a linguistic analysis of what people say, both in an informal conversational setting and in more formal interview situations.

In an effort to understand the semantic positioning of the tablet appliance we provided, we did a linguistic analysis of our interviews and informal interactions with participants. We found a striking contrast in the way people talked about their tablet in relation to their PCs (Table 1 below).

PC	TABLET
less comfortable	comfortable
work, serious	play, toy, fun, relaxing, casual
confined, chained	unchained, portable, mobile, take it anywhere, go anywhere
isolating	be with family
less convenient	convenient, handy, saved time

**Table 1 Linguistic differences between tablet and PC**

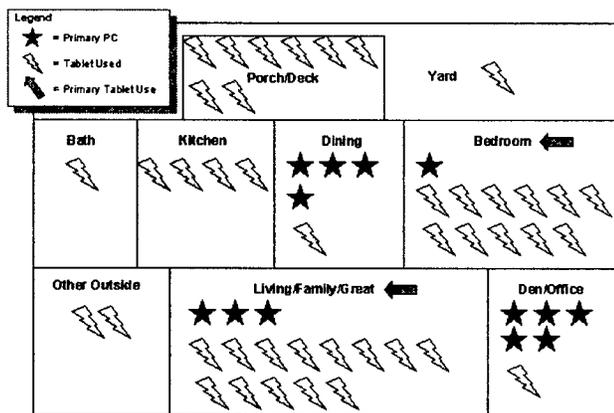


At our first interview, participants overwhelmingly used positive language with reference to their PCs taken in isolation, but at the end of the trial they talked about their PC experiences in contrast to their experience with the tablet appliance, often in more negative terms. PCs were referred to as being “less comfortable” to use because one had to sit in an upright chair at a desk, while the tablets were thought of as “comfortable” because one could sit, recline, or lie in any number of positions to use it. PCs were considered better than the tablet for “work” and “serious” activities, while the tablets were construed as “relaxing,” “fun,” and good for more “casual” use. PCs were frequently referred to as “confining,” and “isolating,” while the tablets engendered a sense of freedom, giving people the ability to go where they wanted, and to be with whom they wanted, typically family members. Finally, in contrast to PCs, the tablet appliances were considered “convenient,” “handy,” and “time-saving,” primarily because they enabled a level of multi-tasking that was unobtainable with their PCs.

This linguistic juxtaposition between the PC and the tablet appliance forms a conceptual framework into which the following findings fit.

**PORTABILITY: UNCHAINED, GO ANYWHERE**

Portability was cited unanimously as the tablet appliance’s best attribute. As one participant said, “It’s [the tablet is] nice, it unchains you . . . you are not chained to a workstation.” Consistent with findings of previous studies done by MediaOne [3], we found that households with children between the ages of 6 and 18 tended to place their primary PC in a common area of the house—in the living/dining areas. Households with adult children, children under 6, or no children in them tended to have their primary computer located away from common use areas—in a den or bedroom. In Figure 1, the locations of primary PCs are indicated with stars.



**Figure 1** Locations in which people use tablet and PC

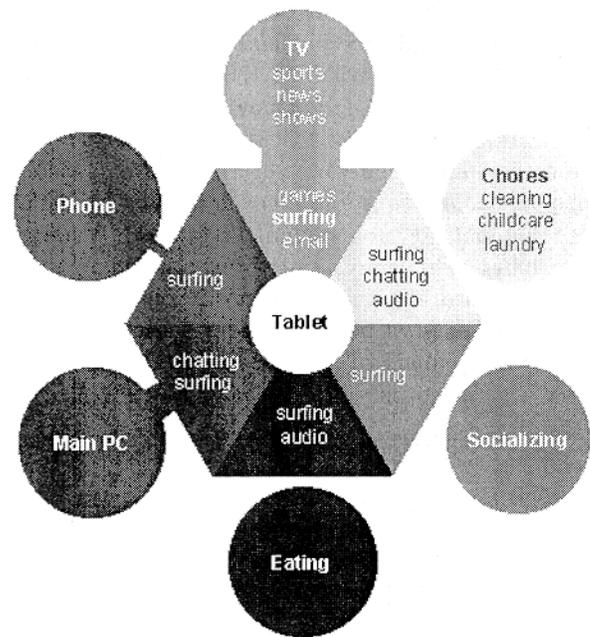
The tablet, represented by the lightening bolts in Figure 1, was used in every room of the house. All households

reported using it in the living/family rooms<sup>1</sup>, and eleven households reported using it in bedrooms. Eleven households also reported using it outside of their homes: on the porch or deck, in the yard, or at a neighbor’s. The only constraint was the 150 foot limitation imposed by the wireless network solution we used.

Eight households reported that a household member had taken it somewhere away from home to show someone. Many participants lamented that their Internet connectivity ended when they got into their cars and drove away from the house and wireless bridge.

**MULTI-TASKING: CONVENIENT, SAVES TIME, SOCIAL**

While portability was explicitly mentioned as the most valued attribute of the tablet appliance, we argue that it was so highly valued because it enabled multi-tasking—doing an activity on the tablet appliance while engaging in other household activities. Some households reported a limited subset of multi-tasking activities with their stationary “always on” PCs, but all households reported extensive multi-tasking with their tablet appliances. The types of activities people reported engaging in simply would not have been possible with a stationary PC. (See Figure 2 below).



**Figure 2** Schematic of multi-tasking

Figure 2 illustrates household activities (watching TV, doing chores, socializing, eating, using the main PC, and

<sup>1</sup> In the U. S., the family room is an informal living area that often adjoins the kitchen, while the living room is reserved for special occasions. In homes that do not have a family room, the living room serves the same informal purposes as the family room.

talking on the phone) in relation to activities that were done simultaneously on the tablet (surfing, playing stand-alone games, reading/sending email, chatting, and listening to audio programs). The bars linking the household activity to the tablet activities represent the strength of relationship between the corresponding activities. For example, when people were doing something on the tablet and doing chores, socializing, or eating, what they were doing on their tablet had no relation to the corresponding household activity. In contrast, there was often a relationship between simultaneous PC-tablet, phone-tablet, and TV-tablet activities.

The relationship between household-tablet activities was strongest for TV-tablet. All 13 households reported extensive television viewing while using the tablet. Eight of the households reported that their tablet activities were sometimes related to what they were watching on TV. The most commonly reported activity was looking up a web site based on a URL announced during programming or commercials. The second most frequent activity reported was watching sports events on TV and also following them on the web. Other simultaneous related activities included sending e-mail to news shows and looking up company information during investment-related programming.

Simultaneous unrelated (parallel) use of the main PC and the tablet was the norm for most households, but four households reported simultaneous related use. For each household, the related use was different. Three households reported using the tablet to do ICQ/Instant Messenger chat on their tablet while doing something related on their PC. One participant liked to use the tablet to chat while he played "his" online game; he felt he gained a strategic advantage.

*Talking [chatting] to other people and playing [online games] gave me a competitive advantage...I even thought of a way to cheat!*

Three households reported using chat between the PC and the tablet. One example of this is interesting because it illustrates a creative simultaneous use of the PC and tablet to accomplish a task. From the tracking data, we noticed that one household was simultaneously looking at the same web site on both the tablet and the PC, while using chat. When we asked what was going on, it turned out that two household members were looking at *www.realtor.com* together to find a house to buy. Even though their PC was located in the dining area adjoining their living room and they were only feet away from each other, they were using chat to send each other URLs to look at. At the same time, they were vocally discussing the items they were viewing.

In sum, the tablet experience was a qualitatively different experience from the PC. This is evidenced in what people said about the two experiences, and also by how and where they used the tablet appliance. The tablet's portability gave

families freedom to use the tablet anywhere in the home, and enabled a high degree of multi-tasking.

#### A TABLET IS NOT A PC: THE TRACKING DATA

In the previous sections we showed that users had differing conceptual frameworks for the tablet and the PC. In this part of the paper, we focus more specifically on how tablets were used compared to the PC. Tablet use and PC use differed in some striking ways, but they both followed a basic pattern in the way people used their on-line time.

#### Spending Time on the Tablet

Our first question was whether introduction of the tablet would change the way people used their desktop PCs. Would the availability of the tablet increase the total time spent on-line, or is there a limit to the amount of time people can spend on the Internet, so that they simply switch time from PC to tablet? And would the activities carried out on the tablet be the same as those on the PC?

Overall, families used their tablets less than their PCs. This was not surprising, since the tablets lacked some of the capabilities of the PCs, such as productivity software and the specialized hardware that supported favorite networked games. Before receiving their tablets, households spent an average of 3.4 hours per day on the PC, 56 percent of that on-line. The percentage of on-line time is similar for the tablet, 55 percent. This was a surprise to us; we had expected more on-line time on the tablet, since it didn't have many standalone applications. It turned out that participants were playing games like solitaire and FreeCell, and they reported to us that they often played these games while doing something else like watching TV or sitting with their families.

Households did not switch their on-line activities from the PC to the tablet but rather added tablet on-line activities to their day. As shown in Figure 3, they spent 1.85 hours per day on-line on their PCs during the trial (not significantly different from the 1.92 hours they spent on-line before the trial), and they spent an additional 32 minutes per day on-line on the tablet.

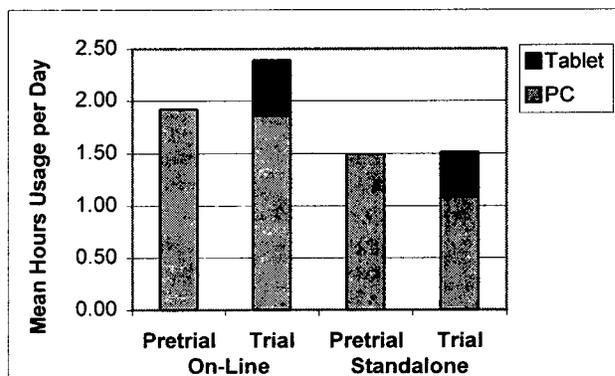


Figure 3 Time spent in on-line and standalone activities

Participants told us that one advantage of the tablet was that more than one person in the family could surf the web at the same time: the tablet reduced contention for the household's high-speed data connection. Thus, at least some of the increased overall on-line time may be due to additional family members being able to access the Internet. This relationship did not hold for standalone activities such as word processing and graphics: it appears that while households had the tablets, they spent less time on standalone activities on the PC.

As shown in Figure 4, the most time-consuming on-line activity for both tablet and PC was web browsing, followed by chat and e-mail. By browsing, we mean not only web surfing but listening to and viewing multimedia accessed from web sites, for example streaming audio. And "browsing" is probably not an accurate term, since participants reported more targeted access of specific web sites than wandering on the web. The dominance of web use over e-mail differs from patterns found in the HomeNet trial [5]. Our participants' high-speed, always-on Internet connection may facilitate web browsing.

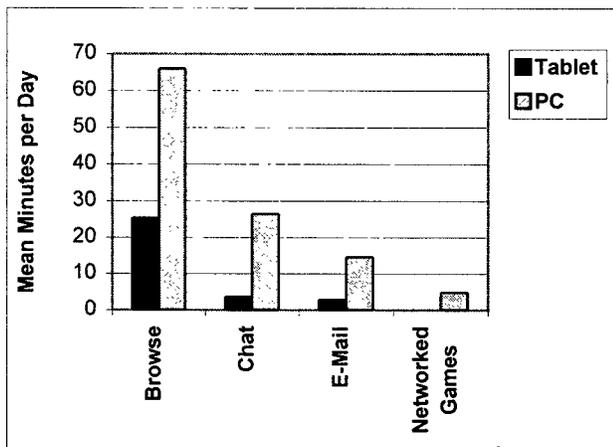


Figure 4 Time spent in various on-line activities

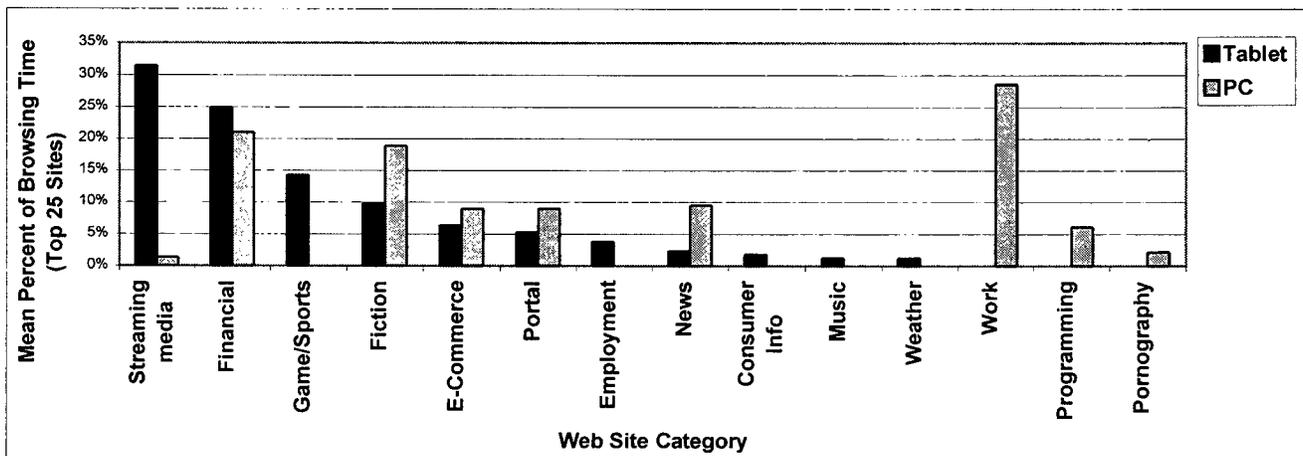


Figure 5 Time spent on web sites by category

Chat on both tablet and PC consisted primarily of using Instant Messenger or ICQ with friends, relatives, and game-player communities, not meeting strangers in a chat room. Chat and e-mail were not as common on the tablet as they were on the PC. Many participants reported that they were frustrated by the tablet's inadequate text input methods, which may account for the relatively low time spent in text-intensive activities. For example, one person told us, "Since the handwriting [recognition] feature doesn't work, and the keyboard is hard to use, I am not able to use the tablet for ICQ like I was hoping." We discuss this further in the usability section, below.

Averaged over households, the time spent on chat was not significantly higher than e-mail. (The difference was not statistically significant on either device). Interestingly, while only six of our households used chat on the tablet (eleven used e-mail), those households used chat more than twice as much as e-mail. When chat is used, it may be taking over a position previously occupied by e-mail.

#### Web Destinations

On both the tablet and PC, there was a great diversity of web sites visited. On the tablet, 270 sites accounted for 75 percent of the time spent browsing, and 85 percent of the top 100 sites were visited by only one person. Certain categories of web sites were popular across households (for example, six of the thirteen households visited financial sites regularly), but each household had its own favorite site within those categories.

People surfed to different types of sites on their tablets than they did on their PCs. Just as participants often used their tablets while doing other things, the types of web sites they visited seemed, in general, to be more suited to multi-tasking, while sites visited on the PC required greater focus. Figure 5 categorizes the top 25 web sites participants visited using each device. (These are the top 25 sites based on total time spent on each site. These 25 sites accounted for 50% of all time spent browsing on each device.)

The tablet and PC share some favorite web categories such as financial sites. Several of the top sites, however, differ on the two devices. On the tablet, participants spent a lot of time listening to streaming audio, primarily archived radio programs. One participant reported listening to audio while folding laundry and supervising his child in the bath. On the PC, using streaming media was an infrequent activity. Similarly, game and sports-related sites were frequently visited on the tablet but not on the PC.

To summarize, households used the tablets to reduce contention for access to browsing. There is evidence that they would have used e-mail and chat on the tablet as well, but for usability problems. They spent their time browsing different sites than they typically did on the PC: frequently visited sites facilitated time-sharing the tablet with other household activities and people.

### ERGONOMICS AND USABILITY

The tablet that we used in this study was designed for vertical markets, for use in settings such as warehouses, oil fields, and beverage delivery. In these settings, users would often be standing and would not do extensive text entry. While our participants reported that it was easy to perform the basic activities with the tablet—selecting links in the browser—in many ways the design of the tablet was not well suited to home use. The following sections discuss the form of the tablet, its input methods, and the display.

#### Form

One of the biggest advantages of the tablet, according to participants, is that they can use it in places they can't use their PC, often in comfortable positions. We asked people to show us the most common locations and positions in which they used the tablet. Of 21 locations/positions, 18 were on a couch, easy chair, or in bed. Only two people reported using their tablet often at a desk or table.

The desire to use the tablet in non-traditional positions was its downfall. Figure 6 shows a typical user position, illustrating that it is difficult to hold the screen at the optimal angle and type at the same time in this relaxed posture.



Figure 6 A typical user position with the tablet

The most common complaint about the tablet (half of the users cited it as their biggest pet peeve) was that the screen and keyboard were not integrated. This was a problem for several reasons. First, the lack of a structural unit made it impossible for users to prop up the screen at the desired viewing angle without holding the screen or leaning it against an object like a pillow or the knees. As we discuss below, achieving the correct screen angle was important to achieve a clear display with this passive matrix technology. Second, it was inconvenient to carry two pieces—the screen and the keyboard—with the result that the keyboard was often not there when it was needed. Finally, the keyboard was difficult to position, especially while lounging. The user in Figure 6 kept his keyboard out of the way, and pulled it up onto his stomach only when he really needed to type. Some participants' favorite positions—lying on one's side propped up on an elbow, for example—would have made it difficult to type at all, and participants often used on-screen input methods in these positions. Thus, the ideal form must allow for adjustable screen tilt even with the keyboard tucked out of the way.

One aspect of the form-factor was acceptable to all participants. The weight of the tablet—2.2 pounds—was light enough to be comfortably carried.

#### The Stylus

One design feature that distinguishes a tablet appliance from a laptop computer is its touchscreen. Previous work has suggested that a touchscreen may perform better than a touchpad [4] and at least as well as a mouse [7]. While we did not perform rigorous testing with the touchscreen, we tried to discover any performance issues associated with the stylus and to understand participants' preferences for the touchscreen compared to their PC's pointing device.

The stylus was an electromagnetic, active stylus. A normal pen or finger could not be used, and it was necessary to hold the stylus perpendicular to the screen for the touch to register. In their first encounter with the stylus, approximately half the participants had no problems with tapping, dragging, and using cascading menus. The remaining users had two types of problems. First, holding the pen in a vertical position was not instinctive. Second, the required gestures were not natural to some people. For example, a definite tapping motion was needed to perform the equivalent of a mouse click; a press was not sufficient. While most participants had mastered the stylus by the time of our second visit, we found a small set of people who had developed the habit of tapping on a browser link repeatedly until it "went." Similarly, a gesture that seemed natural—crossing out text to delete it—did not work in the language of this tablet's handwriting recognizer.

Two of the twenty participants we interviewed said they preferred their PC's pointing device (a trackball and a mouse) to the touchscreen. Most participants, however, liked the convenience of being able to select an item

directly on-screen, and it appears that this direct manipulation method was well suited to the positions in which they used the tablet. Participants adapted to the peculiarities of the touchscreen, and by the concluding visit, we observed few usability problems.

### Text Entry

The tablets had three methods for entering text: the external keyboard, an on-screen keyboard, and handwriting recognition. We wondered whether all these methods were necessary, particularly given the slowness of selecting letters on the on-screen keyboard.

Participants' complaints suggested that none of the available text input methods was ideal. Their preferred input method depended on the task. For e-mail and chat, 71% of users preferred the external keyboard. For entering URLs, 67% preferred an on-screen method. Several users said they tried handwriting recognition first and then turned to the on-screen keyboard when the handwriting recognition was too inaccurate. It seems that the speed-accuracy tradeoff between handwriting and the on-screen keyboard necessitates both methods, given the current state of handwriting technology.

Browsing was by far the most common task, and two reasons for preferring an on-screen input method for that task were that the keyboard was awkward to use in a lounging position and that the keyboard frequently had been left behind in another room. Users seemed to turn to the keyboard only for text-intensive activities, and at least four users indicated they had limited their use of chat or e-mail because of input problems. Keyboard size was too small; some participants could not fit their fingers on the home row and abandoned the keyboard for this reason. Keys were 12 mm in diameter, which is within the ANSI standard [1], but key spacing (center-to-center distance) was 15 mm, which is below standard.

We don't know the extent to which the keyboard would have been used if it had been integrated with the screen, but since the stylus is needed to select links in the browser, an on-screen input method for entering URLs would seem to be most convenient. Given users' postures, the ideal tablet would have an integrated keyboard available for text-intensive activities but would allow the keyboard to be tucked away for transport or while browsing, with an accurate handwriting recognition method available.

### The Display

Most participants found the color, brightness, and contrast of the passive matrix display acceptable. The narrow viewing angle necessitated by the passive matrix technology and the small screen size (7.5 inch diagonal) received the majority of display-related complaints. While a few participants were annoyed with the need to scroll most web sites (resolution was 640 x 480 pixels), this was less important than physical size. That is, participants

wanted larger pixels, not more of them. Informal observation revealed that several users hunched over the screen in order to see it better. We showed participants a different tablet that included a 9.4 inch diagonal display. While their experience with this tablet was limited, most participants said they preferred the larger size.

### THE IDEAL TABLET

'Our participants' behavior and comments suggest that an Internet appliance intended for general web access and text-based communication must have three characteristics. First, the software must be sufficiently full-featured that people find it useful. Second, the device must be highly portable and comfortable to use in relaxed positions, with an integrated keyboard and screen and accurate on-screen input method. And third, it must have a large enough screen and keyboard to be usable. Tablets available for the general market today tend to lack one or another of these characteristics. For example, some tablets have better form-factors than the one used in this study, but they run limited browsers that preclude activities that we found to be popular, such as streaming media and chat. By contrast, other tablets have full operating systems but inappropriate form-factors for the type of leisure home use we saw here. While a full operating system is not required (in fact, may be a detriment for less experienced PC users, as we found with some of our participants), our results suggest that the browser must be able to handle standard plug-ins, and that the tablet must support standard chat software.

To pin down critical features of an ideal tablet, we asked participants to define their ideal tablet, first in free-form discussion and then by rating a set of candidate features. Table 2 lists the mean importance ratings for the set of candidate features we supplied.

	Mean Importance Rating
Surf the web	5.91
Internet anywhere in house	5.68
E-Mail	5.24
File/print share	4.59
ICQ/Instant Messenger	4.23
Streaming Audio	4.18
Internet away from home	4.14
Internet in yard	3.95
Streaming Video	3.77
Create/save Notes	3.76
Internet Games	3.57
Chat (other)	3.32
Shockwave	3.27
Internet Phone Call	2.82
Videoconference	1.81

Table 2 Mean importance ratings for tablet features

The applications people are looking for are consistent with their usage: surfing, e-mail, Instant Messenger, ICQ, and streaming audio. The top capabilities included portability within the home and file/print sharing with other PCs in the home. Participants also dreamed of a device that they could use to access the Internet from anywhere; this was a top request in the free-form "ideal tablet" interviews as well. The other feature that came up frequently in those interviews was that users wanted a faster processor, to improve the quality of streaming video, download pages faster, and play networked games. It appears, then, that at least experienced PC users with broadband connections are looking for a tablet that combines portability with some of the power of a desktop PC, to take advantage of the broadband connection.

We should say a word about home networking, which was also mentioned frequently in ideal tablet discussions. Six households set up file and print sharing with the household PC. They transferred files from the PC to the tablet, primarily bookmarks and software, and they told us it was important to be able to print web pages from the tablet to the PC's printer. Usage data indicated that a primary benefit of home networking is that household members can surf the web from different devices at the same time. But home networking and multiple Internet access can lead to a problem: different devices will contain different subsets of information needed by the same person. For example, five of our participants ended up reconfiguring their e-mail program or forwarding e-mail to themselves so that they didn't end up with downloaded e-mail split between tablet and PC. As Internet appliances proliferate in the home, it will be important for them to be able to share information, to share e-mail, bookmarks, files, and perhaps software, without extra work on the part of the user.

#### CONCLUSIONS: THE FUTURE

This study suggests that Internet appliances will eventually fill a special role in people's daily lives. These small, portable appliances can make information and entertainment accessible without demanding focused attention. To optimize this type of use, the functional and design characteristics of a tablet-type appliance must conform to the way people conceptualize and use it. That

is, a web tablet is not, and should not strive to be or replace the PC. Nonetheless, as PC users grow more sophisticated in their use of the Internet, they will come to expect appliances to be as powerful in some ways as a PC. We found that people expected the tablet to be able to access the broadband plug-ins and personal chat applications they used on their PC. It is likely that as broadband connections become more prevalent and people make greater use of video communication, they will expect the tablet to support this functionality as well. But they will expect it in a portable package that both conforms to relaxed usage positions and connects to the other devices in the home. In the future Internet appliances may really be fingers of a larger Internet access capability that enables true portability by providing access to information and tools anywhere.

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