CONSUMER WILLINGNESS TO ADOPT PERVASIVE COMPUTING APPLICATIONS: A COMPARISON OF THE DEAF AND NON-HEARING IMPAIRED COMMUNITY

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Abstract

Specifically, this research gauges the willingness of consumers to embrace pervasive computing. In particular, the hypothesis is that those with disabilities, and more specifically, the deaf, are more apt to embrace pervasive computing than those without disabilities.

Introduction

Aside from the seven electric motors inside the computer used to type this paper, there are approximately 38 individual devices that use electric motors in the typical home and automobile. What began with Michael Faraday in 1831 (when he demonstrated the principle of an electric current), has now reached maturity. Two words serve as accurate descriptors of this maturation process: *smaller and everywhere*. One might say, "And your point is?" The examination of the life cycle of the electronic motor provides insights into the future of computing.

Table 1 **Electric Motors Found in Cars and Around Homes**

Kitchen	Oven Fan	Toaster Oven	Oven Clock
	Dishwasher	Can Opener	Electric Clocks
	Blender	Sink Disposal	Microwave
		Refrigerator (multiple)	
Bathroom	Electric Razor	Hair Dryer	Electric Toothbrush
		Ceiling Fan	
Garage		Garage Door Opener	
	Electric Drills	Electric Saw	Electric Drill
Car	Power Windows on Cars	Power Seats (multiple	Car Heating/Cooling
	Windshield Wipers	Starter	Electric Radio Antennas
	CD Players	Tape Decks	
Other	Box Fans	Dryer	Washer
	Vacuum Cleaners	Clocks	Answering Machine
	VCR	DVD Player	Computer (7 or more)
	Furnace Blowers	Camera	Musical Snow-Globe

Computing is at a new dawn in its relatively young, but exciting, existence. Dynamic changes are about to occur that will alter the way people interact with the world in an unparalleled and dramatic fashion. Whether one dubs it pervasive computing, ubiquitous computing, ubicomp, calm technology, or wearable computing, the fact is that society is on the verge of some exciting times. This very reality, made possible by pervasive computing, can do a great many things for humankind, especially for those with disabilities.

The seeds planted by pioneering computing projects today, such as Project Aura at Carnegie Mellon University, Endeavour at the University of California at Berkeley (UC Berkeley), Oxygen at the Massachusetts Institute of Technology (MIT), and Portalano at the University of Washington--will be tomorrow's harvest of life-enhancing technologies. Each of these projects addresses a different mix of issues in pervasive computing and a different blend of near-term and far-term goals (Satyanarayanan, 2001, p. 13). These research efforts coalesce to achieve the vision first articulated by the late Mark Weiser, which defines the essence of pervasive computing: "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it" (Weiser, 1991, p. 94). Much like the electric motor discussed earlier.

Most research concerning pervasive computing up to this point has been largely concerned with the technical feasibility of applications. However, this research looks beyond the seemingly inevitable, and addresses the question, "Will people welcome the 'inevitable,' and at what cost?"

This research gauges the willingness of consumers to embrace pervasive computing. In particular, the hypothesis is that those with disabilities, and more specifically, the deaf, are more apt to embrace pervasive computing than those without disabilities. The framework that employed in testing this hypothesis begins by examining "The Existing," non-pervasive technologies available, as well as "existing" pervasive applications in their infantile stages of use. After examining existing technologies, the subsequent section called "The Exotic" examines potential applications of pervasive computing via two scenarios. Then, the "Empirical Evidence" section discusses and analyzes research findings in order to test our hypothesis. Finally, the paper concludes with a brief list of suggestions for future avenues of research based upon the empirical results and an acknowledgement of the challenges born out of this new wave of computing.

The Existing Non-Pervasive Technologies

Many technologies are already available to the deaf/hard of hearing community. These assistive technologies help deaf/hearing-impaired people enjoy aspects of life that hearing people take for granted. Some of these devices are specifically targeted toward work, while others are for use in public and private places. The applications with the biggest impact seem to be for personal and home use, each of these environment-specific applications will be discussed in the following subsections.

Professional Use

Some business applications for the deaf include two-way pagers, audio loops or AM/FM audio systems. The two-way pager is a current technology used for both professional and personal use. It is a constant communication tool with a vibration alert and display of text messages, rather than numbers (Notepage, Inc., 2002).

For group meetings, large dinners or business-type gatherings, there are several options a deaf or hearing-impaired person may utilize. An audio loop system includes a wire that loops around the seating area. It picks up the sound, transmitting it to the amplifier worn by the hearing impaired person.

An AM system transmits sound on AM radio wavelengths. It can either be connected to a public address system or operate alone. The difficulty with this system is the potential for interference. The FM system works in a similar way. Sound is transmitted through FM frequencies directly to a receiver worn by the hearing impaired. The FM system can work in a 300-foot range making it ideal for dinner meetings in dining halls, lounges, and large conference areas.

Lastly, an infrared system is similar to the FM system, in that it is perfect for large areas such as theaters or auditoriums. An infrared light emitter is plugged into an already existing public address system. Then infrared light rays carry the sound to infrared receivers. These receivers are portable and can be distributed and collected at events. This system is the most expensive and requires more installation and maintenance than previously discussed systems. Before installing this system, careful consideration has to be given to alternatives (Dipietro, 2001).

Public Use

Some assistive technologies are becoming very popular. One example is the incorporation of TTY (Text Teletype machine) on some public phones. When a call is placed by a hearing impaired person and transferred by a third party acting as the relay, a metal drawer opens with a small keyboard. Not every public phone has this feature, but many are starting to adopt this technology. A hearing disabled caller types messages to the third party who can voice them to the hearing participant and vice versa. When the call is complete and the phone is hung up, the metal drawer closes and memory will be erased. This same technology could be used by someone who knows how to write the language but is unable to speak it. (e.g., a tourist in a foreign country).

Another applicable technology concerning communication is the amplifier handset. This can give up to 30% more power to a person with hearing loss or to someone who is in a noisy environment like an airport. Portable amplifiers are small enough to fit in a purse or briefcase, and they can attach to pay phones or public phones where an amplifier is not available. However, not all phones are compatible with this amplifier. Sufficient magnetic leakage is needed for these amplifying adapters to be effective and work on audio phones (Dipietro, 2001).

Personal Use

Many different kinds of technologies are available for the deaf/hearing impaired for personal use. TTY allows hearing-impaired individuals to call others. Like the TTY described in the public domain, a third party can be involved and act as the message relay, or if the same technology is present, at the receiver's end, interaction can simply occur. Additionally, closed caption devices can be attached to television sets to enable viewers to read the captions. The signal is carried invisibly parallel to the video and audio components being transmitted. One example of a closed caption device is the TeleCaption II Adapter. There has been a push to make all TVs caption enabled. The Television Decoder Circuitry Act mandated that "all television sets with screens 13 inches or larger that are manufactured for sale in the United States after July 1, 1993 must contain a built in captioning decoding capability" (Dipietro, 2001).

Many noises or warnings that are commonplace for those with no hearing impairment are inaudible by the hearing impaired. Alerting devices are used instead. These devices either flash lights, increase amplification, or vibrate. For example, an alarm clock will have a wire attached to a vibrator that is placed under the pillow to wake the hearing impaired individual at the desired time. The deaf or hearing-impaired person would literally be "shaken" awake.

Flashing lights on different devices indicate different circumstances, such as a doorbell, a baby's cry, or a telephone ringing. One light could portray all these occurrences through simple coding. For example, "three slow flashes may mean the doorbell; three quick flashes may mean the telephone; regular on-off flashes may signal the baby's cries" (Dipietro, 2001). Other technologies involve smoke and security alarms, and even things as simple as a vibrating watch to remind the person to perform everyday tasks (Alerting Devices, 2002). All these technologies are important in assisting, by making life easier or more efficient, a deaf or hearing impaired person.

This next section will explore some current and underdeveloped applications of pervasive computing. Since the majority of applications under development today are geared toward the home and business, rather than public use, those will be the two areas touched upon here.

The Existing Pervasive Technologies

Professional Use

According to recent research, "At the height of the dot.com boom in stock trading, online brokers were the first, earliest movers in offering wireless trading devices to active traders" (Panchanathan, 2002, p. 12). Currently, most traders and investment bankers carry pagers, palm pilots, and cell phones. These wireless devices allow them to check e-mail, give them market alerts, store customer information, and keep in contact with customers and the office. With the help of these applications, traders' and investment bankers' jobs are literally kept in their pockets.

However, with the recent economic downturn and the tremendous decrease in investments in the stock market, the push for wireless applications has decreased. Many people look at it as a future opportunity, though, as the change to more pervasive applications for investments seems inevitable. Yankee Group says that "about 500,000 people in the United States are using wireless Internet services to access brokerage and financial applications but predicts that 30 million people will be using wireless devices to access financial information by 2005" (Panchanathan, 2002, p. 14). Brokerage firms are providing wireless applications not only to their customers but to their employees in hopes it will increase productivity, reduce costs, and increase revenues. Using wireless devices will significantly decrease the time spent on the phone in an office, increasing traders' productivity.

Another technology that more users will adapt slowly involves voice recognition systems. People will be able to say something like "show me my portfolio," and the device will be able to read it to them. Voice commands are currently used to access account information, quotes, watch lists, and market indexes. These are current pervasive applications and where they could be going relating to the financial industry in the very near future. "Soon we will trade stocks in the park and receive faxes on the beach" (Fano, 2001, p. 13).

Personal Use

Next, pervasive computing applications for personal use are addressed. Some of these new devices will make life easier and perhaps more interesting. For example, interactive wallpaper, an intelligent garbage can, an expert chef, remote eyes, and interactive books are all under development (Ethendranath, 1997).

Interactive wallpaper will provide sounds and visions that fit our mood, lessening the clutter within a room. Lights within the room will also be intelligently controlled. With landfills becoming filled more and more and the constant increase in waste, more stress will be put on recycling and keeping the environment clean. An intelligent garbage will help by sorting, compacting, and removing the odor of your trash, readying it for pick up.

The expert chef is an interactive tool that guides users in preparing dishes from around the world, dishes they are not use to making. Different types of expert chefs can be used, tailored with a specific style, pace, and level of detail desired by the user. Books will soon be interactive and have a touch-screen display. Text, moving images, and sound will be available providing many different stories. These books can help children learn to read or more advanced books may teach a different language. The user can control input on voices and pictures, making reading more interactive (Ethendranath, 1997).

These are just some of the technologies and devices headed our way, increasing computing all around us. These devices can benefit both adults and children, increasing the overall enjoyment of activities within the home.

The Exotic

This section of the paper takes a creative look at the potential pervasive computing offers if appropriately harnessed. The following scenarios embody the potential for improving one's quality of life. These scenarios offer us a glimpse into more than a new bundle of "killer apps"--provides insight into the possibility of a "richer way of living."

Scenario 1: Paris

Jack and Laura wanted to go to Paris for years. In the summertime they finally get their chance. Laura loves to shop but Jack does not; that is why it is a good thing Jack is wearing his special glasses, for he knows that there is a blues music CD sale, Laura's favorite type of music. This decreases the time needed to shop, providing Jack more time to do what he really wanted, sight-seeing.

In particular, Jack would like to go the Latin Quarter where he heard that it gets quite lively at night. However, he hates looking like the typical tourist and whipping out the old map, so it is a good thing he is wearing his glasses. He mildly says, "Find Latin Quarter," and voilà, directions appear at the bottom of his glasses, which give step-by-step instructions on how to get there.

Figure 1 **Eyeglasses Example in Paris**

Once in the Latin Quarter, Jack wants to find an affordable restaurant because, on the way there, the glasses were no match for Laura's intuitive shopping sense, and they spent quite a few euro-dollars. Thanks to the glasses he sees that the pricing for a restaurant 20 meters ahead is very reasonable. Once in the restaurant both Jack and Laura are having difficulty understanding what the waiter is saying concerning the specials. Jack then takes a quick moment and turns the miniscule dial on the side of his glasses to reduce the ambient sound in the restaurant, so he can verbally activate the language translator on his glasses in order to read exactly what the waiter is saying. The special seems very enticing, as well as reasonable. Therefore, to impress Laura with his exhaustive knowledge of the French language, Jack cleverly says, "Oui, s'il vous plaît," and signals the number two on his fingers to indicate they will both be having the same thing. After dinner, Jack uses the glasses once again to direct them to the Seine River, for a scenic walk to end a splendid evening.

Scenario 2: Prepared?

At Carnegie Mellon, research on a system called "Aura" that they propose can integrate all wireless systems along with facial recognition sensors that have the ability to sense emotions and recognize faces (Satyanarayanan, 2001, p. 16). Our scenario is based upon those pervasive applications found in a scenario put forth by researchers at Carnegie Mellon and is adapted in such a way to show how these technologies could benefit deaf individuals.

Dr. Jacobs is a professor at the Rochester Institute of Technology (RIT), and he is going to be giving a presentation concerning his current research on Neural Networks to the NTID. The NTID is the deaf college within RIT. It has been a very busy week for Dr. Jacobs, and he almost forgot that he had to give this presentation. Therefore, he is frantically working in his office just before the presentation and is afraid that he isn't going to be able to finish the slides by the time he needs to leave in order to get to the presentation room in time. The current slides that he is working on are downloaded to his hand-held device so he is able to work on the presentation while walking to the location for the presentation via verbal commands. The hand-held device connects with the projector in the room so the projector has a current version of the slides as they are updated.

J*ust before Dr. Jacobs is about to introduce himself, the biosensors in the room notice that the majority of the people in the room are hearing impaired. Therefore, Dr. Jacobs verbally states his authorization code. Once "Aura" authorizes the command, the virtual interpreter is activated, which is an embedded screen at the front of the room that has the ability to transform spoken language to text. As he is wrapping up his presentation, Dr. Jacobs comes across a slide concerning confidential financial grant information, but since the room senses that unfamiliar faces are present, via face recognition technology, Dr. Jacobs is privately warned and cleverly skips that slide. In the end, thanks to the power of pervasive computing Dr. Jacobs delivers a polished presentation as usual.*

Again, it is important to note that simple technologies that can make these scenarios available such as wireless devices, hand-held computers, devices that can interpret sign language into voiced language, room cameras, and connected projectors are all obtainable today. The conundrum that lends itself to projects like Aura has to do with the problem: integration. This is why we need to show the power of pervasive computing via scenarios. Once collaborative technologies, which can yoke these applications together in a harmonious and invisible fashion, are available, scenarios such as these will require no imagination.

Empirical Results

"In order to understand the impact of pervasive computing on everyday life, we navigate a delicate balance between prediction of how novel technologies will serve a real human need and observation of authentic use and subsequent co-evolution of human activities and novel technologies" (Abowd and Mynatt, 2000, p. 46). What is apparent is that pervasive computing can revolutionize the way in which we live our lives. However, revolutions are not often easily embraced. Next, the pace and costs associated with adoption of this new wave of computing by those with and without disabilities is explained.

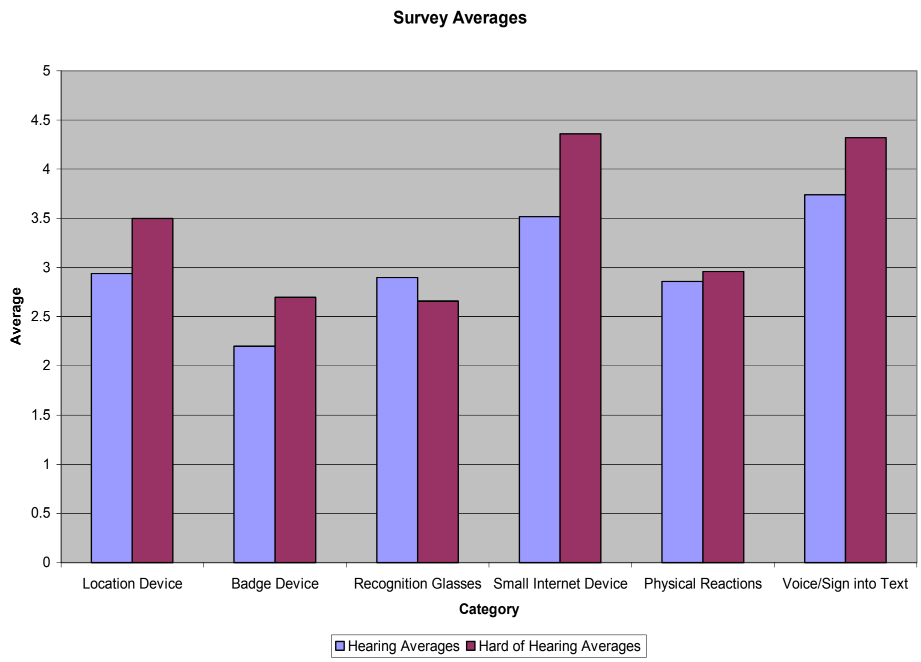
A survey was administered that measured the difference between those individuals with and without disabilities in regards to which group prefers certain "pervasive" devices, how much they are willing to pay for those devices, and who is quicker to adopt new technology. The survey was administered in the Rochester, New York community; and the Rochester Institute of Technology (RIT), which in particular, has a very large deaf population, and that community served as the primary disabled community in our study. There were 50 respondents each from both people with and without disabilities, mostly between the ages of 18 and 23. The survey contained three different sections: *general information, interest in technology*, and *technology and you*. The first section asked a total of three questions which were age, gender, and if the person being surveyed is disabled. The next section gives examples of six different technologies, all pervasive in nature, and a ranking system from one to five (no interest to very interested). The final section relates to personal technology preferences. Our results from both groups, hearing and hearing impaired, bore some similarities, but substantial differences did exist. The following sections segment the results into three main criteria: interest, spend, and speed.

Interest

When interest in particular potential pervasive applications was gauged, the resultant averages revealed somewhat surprising information. For all but one of the devices, the hearing impaired average interest was higher than that of the hearing people surveyed. The one device that was not higher was the "pair of glasses that has the power of facial recognition and could give you the identity of the person you are talking to." The biggest difference between the hearing and hearing impaired was the "small internet device;" however, the "voice/sign into text device" also had a large gap in the average interest ratings. These results are shown in Figure 2.

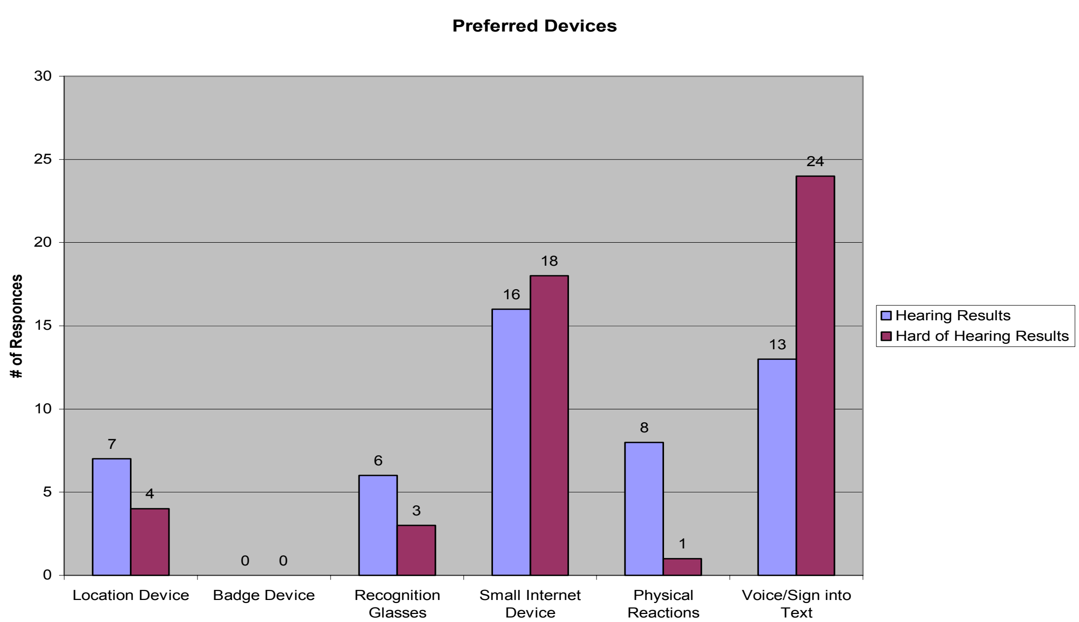
In order to obtain a comprehensive idea as to which sample more preferred pervasive applications, we analyzed the question that asked which of the six new technology devices the person would prefer. With the hearing community, there was not a single device that was the clear winner. The gadget that did receive the most response was the one that was described as, "A device that will always be connected to the Internet, but small enough that you can keep it in your pocket. This device will allow you to, for example, email or surf the web" (Pedaci, 2002, p. 1). From the 50 people surveyed, there were 16 responses to that device.

Figure 2 **Survey Averages Comparing Hearing and Hearing Impaired in Reference to Which Devices They Would be Interested In**



The hearing impaired community had two separate devices that stood out in terms of interest. The first item is the internet device that was just described above and the other device is the one that will "turn voice or sign language into written text" (Pedaci, 2002, p. 1).

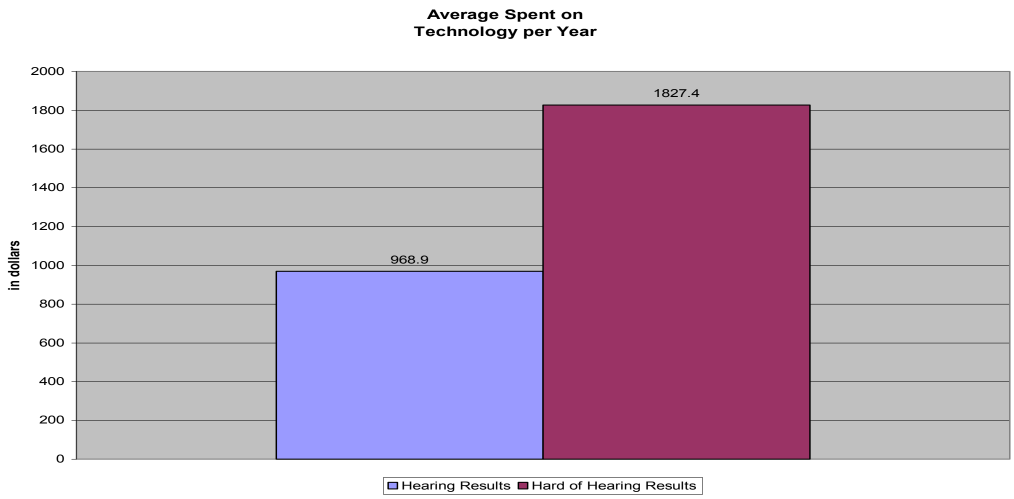
Figure 3 **Preferred Devices when Comparing Hearing and Hearing Impaired**



Spend

Another analysis that we conducted on the data collected was the current amount that is spent per year on "technology." Since this is a broad term, the results have a loose range from $20 all the way up to $9,000, but when taking the average, the results are more clearly defined. As you can see from the chart, on average the hearing impaired community spends almost twice as much as the hearing community on technology per year.

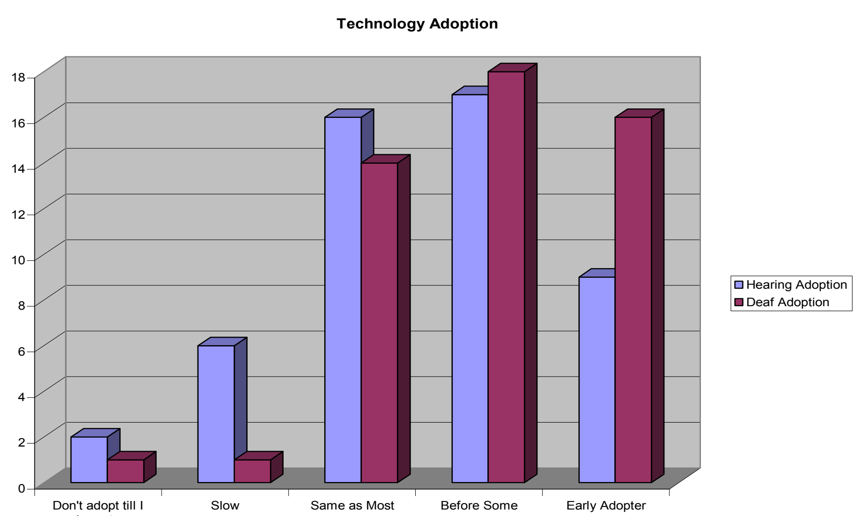
Figure 4 **Average Spent on Technology over a 1 Year Period**



Speed

The key chart that shows the information that we were looking for can be found in Figure 5. This shows that people with hearing impairments feel they are much quicker to adopt technology. As you can see from the chart, there is a large gap in the "Early Adopters" category with 16 hearing impaired people versus only 9 hearing people who view themselves as these early adopters.

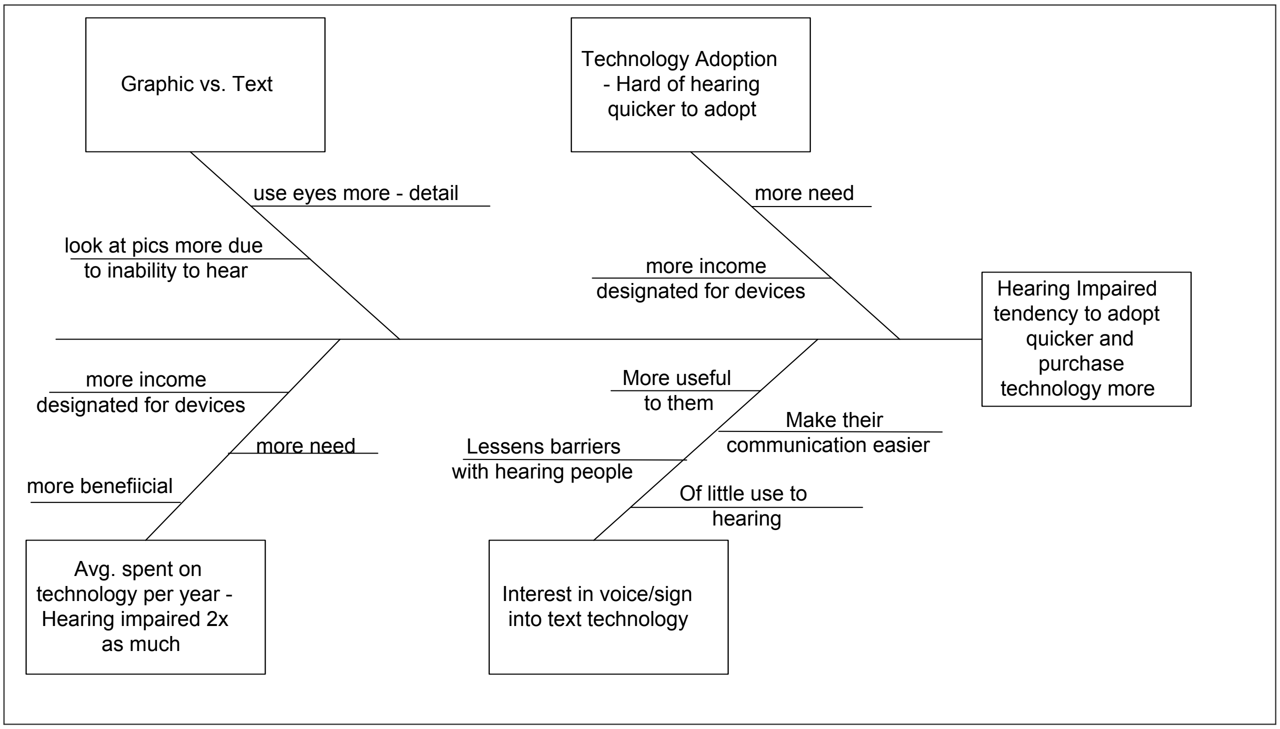
Figure 5 **What's the Difference in Adoption Speed?**



Survey Conclusions

After analyzing both the hearing and hearing impaired results, we found that those people with hearing impairments are quicker to adopt technology, pay more for that technology each year, and view themselves as quicker to adopt the new technology. Each of these conclusions could be a result of different reasons, but we can only speculate as to the different causes. Some of these speculations can be summarized in the following diagram:

Figure 6 **Fishbone Diagram Explaining Survey Results**



The four boxes representing the big bones of the diagram illustrate what we found as the foundations of our conclusion. In other words, these are four smaller conclusions derived from the survey. We found that the hearing impaired wanted graphic display more than text, they adopted technology quicker, they spent around two times as much as hearing people on technology, and they had an overwhelming interest in voice/sign into text technology. Then we had to find the reasons why we derived these particular conclusions, which are illustrated by the lines going down the bone.

Some possible reasons why hearing impaired like graphic over text display is their use of eyes and paying attention to detail more in reading sign language. Also, they could feel this way based on looking at many graphics and pictures throughout their life due to their inability to hear. Hearing impaired people's tendency to adopt technology quicker could be the result of a greater need for certain technologies. Also, they may have more income designated for such technological devices. This is also a possible reason for the huge amount they spend on technology per year when compared to hearing people. The strong interest in voice/sign to text technology could be caused by many things. Perhaps this device is more useful to the hearing impaired community than the hearing population. This could make their communication with the hearing world easier, since the world as a whole is predominantly hearing. It may be important to the hearing impaired to lessen the barriers with hearing people. This device would be of lesser use to hearing, forcing the hearing impaired to take the initiative to have technology that allows for and perhaps bridges the communication divide.

This diagram is very simply laid out and easy to comprehend. There is not a lot to it, but it gives reasons (causes) for our final conclusion (effect) as well as possible explanations of the ideas that lead us to that conclusion. A more in-depth survey would have to be done with a larger and better-selected sample size in order to support our inferences.

Future Research

The next section delves into possible future research topics based upon the empirical evidence. While it is difficult to gauge a user-centric perspective when dealing with applications under development, it is still necessary to do so. One basic reason is that someday it is a consumer who is going to pay for these applications either directly or indirectly. At the center for Ubiquitous Computing (Cubic) at Arizona State University they are examining that very perception (Panchanathan, 2002, p. 15). While our survey did provide useful information, the probing efforts can go far deeper. "To understand the consumers' real rather than perceived needs, it's important to first engage in user-centric discussions with the target population. This requires assembling focus groups of consumers and listening to their needs as well as conversing with them about how technology could augment or enhance their lives" (Panchanathan, 2002, p. 13).

It would also be most beneficial to engage other related specialists. For example, if one were making the same analysis we did in this work, it would be beneficial to first get a feel for real needs by consulting deaf and hearing individuals of different age groups and educational levels, mobility instructors and educators of deaf and hearing individuals, researchers involved in disability studies, and companies that already manufacture current pervasive applications. The outcome of this consultative process would most likely capture real needs, which could then be fed back into the application development process.

Figure 7 **Application/Product Development Cycle**

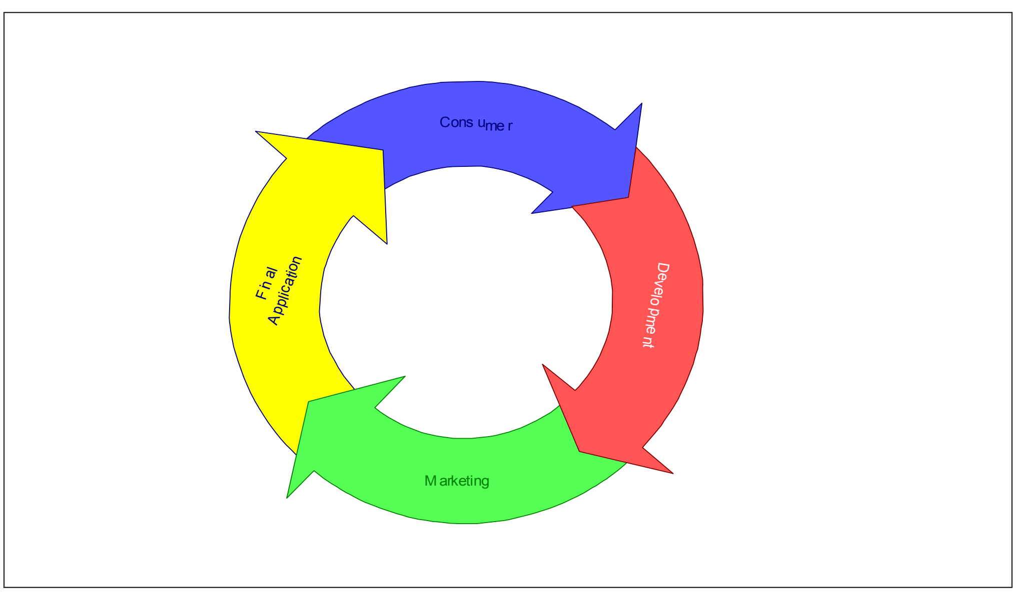


Figure 7 is representative of the ideal way in which any application/product development cycle should flow. The main point is that it should start and end with the consumer. “Developing effective business models for ubiquitous computing systems will clearly be crucial to their success, yet at best, system designers poorly understand this issue” (Davies and Gellersen, 2002, p. 28). Therefore, while it is no doubt exciting, to say the least, that this new era of computing is a prevalent reality, that excitement should not cloud the true purpose of such advancements. That true purpose can be defined as the betterment of human existence and research to see if this wave of computing is perceived as doing this would be of great value, “a customer driven, not R&D driven approach will determine the future winners” (Niles, 1999, p. 8).

Challenges to Pervasive

Some issues to consider as this new stage of computing is being ushered in are interoperability, privacy, regulation and oligopoly, repackaging software, reliability, rendering of parochial technologies as obsolete, and the issue that we tackled in this paper, reception and cost (Press, 1999, p. 22).

Interoperability

While we have stated that the majority of the technologies required to make projects like Aura at Carnegie Mellon University are currently out on the market, there was still the issue of integrating those technologies. The two most visible companies making inroads to support this new wave of computing concerning integration are Sun, with its Universal Plug and Play, and Microsoft, with Jini (Press, 1999, p. 23). The question that remains is that if both of these firms are the crucible for integrating these new pervasive technologies will you need both--whether it is in the form of a smart card--or will one firm serve as the main source of integration? If so, will their battle for the number one spot, which would be bloody, hinder or help the ushering in of pervasive computing?

Privacy

“As we place devices into spheres of life that traditionally have been free of intrusion, privacy concerns will intensify” (Borriello, 2000, p. 125). With the bio-metrics research experiencing much success in recent years, business and other firms will switch to that as a primary means of identification. Therefore, information concerning one’s identity will be increasingly difficult to hide. “Surprisingly, however, over the past decade, a series of successes have made general personal identification appear not only technically feasible, but economically practical (Choudhury and Pentland 2000, p. 50). So, as this is an inevitable fact, the question remains that if the general public is aware of this reality, will they welcome technology they know is diluting their sense of privacy?

Regulation and Oligopoly

“The ultimate vision is that our homes and offices will all have LANs, and connect to the Internet over an always-on, high band-width link” (Press, 1999, p. 23). It will be deemed necessary by providers of that high-speed band-width to take advantage of it. While it is difficult to predict what exactly will occur, the interaction between regulators in all nations concerning the rules of the game, and the chase for self-interest by large, oligopolistic carriers and content providers like Telefonica, Time Warner, News Corp., and Microsoft will help to shape our pervasive computing world (Press, 1999, p. 23).

Reliability

If your car breaks down, the lights burn out, or your TV is busted, you miss these devices sorely. The same will be true in the future of pervasive applications. When it does not work, your daily grind could come to a screeching halt. This is an issue because household or office hubs acting as routers, local stores, directory and application servers, and so forth are a single point of failure (Press, 1999, p. 24)

Rendering Parochial Applications as Obsolete

In this realm of pervasive computing things like cash and paper are no longer needed. With nothing ever entered into a system manually, as we saw in our scenarios with Jack and Dr. Jacobs, everything will either be copied or retrieved from somewhere else. In your home, dinner is prepared, your investments are managed, entertainment is scheduled while yard sprinklers, security systems, and temperature sensors quietly do their thing (Press, 1999, p. 24). Therefore, considering human nature is no advocate of change, the problem arises when age-old ways are replaced.

Reception and Cost

All of the aforementioned issues coalesce to be bundled into the questions of reception and cost. When all is said and done, no matter how magnificent the applications, if it costs too much and serves no practical purpose one can count on failure. Therefore, it is crucial to gauge these criterions throughout the ushering in of pervasive computing, in order to make sure academia has not gotten away with itself, requiring a humbling in the form of a big, "Not interested," by the general public.

Concluding Thoughts

This paper set out to educate, explore, and interpret this new wave of computing, called pervasive computing. The primary focus was to test the hypothesis that disabled persons, in particular the hearing impaired, are more willing to adopt pervasive computing when compared to those without disabilities. This paper also explored current and potential pervasive applications and found that consumers are willing to adopt these applications. Moreover, in order to fruitfully welcome this new era of computing, it is essential to continuously gauge the potential across the cost versus adoption curve. These applications, as they fade into the fabric of everyday life, are creating an exciting time for humanity.

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