Swept Away in a Sea of Evolution: New Challenges and Opportunities for Usability Professionals

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In this paper I will explore the future and examine the role of usability professionals. I will then address some practical considerations and some real life examples of usability engineering. Finally I will look at opportunities for us in the coming decade.

THE FUTURE . . .

As we approach the millennium, the importance of Usability Engineering to Society will grow. Opportunities and challenges will create a demand for Usability Professionals never before seen . The pace for product cycles is quicker, the tolerance for bad design is less. Products are evolving in ways we had not imagined. Who would have guessed that the basic telephone and telephone industry would evolve into ubiquitous integrated services, the first really big effort to combine a variety of technologies into a useful, portable device?

Breakthroughs in memory density, display technology and speed of computers will turn them into "communicators", not number crunchers-(i.e."computers"). The integration of electronic devices will finally yield the ultimate computer experience, that is when the concept of computer as we know it will disappear into the background. They will be integrated and intelligent. A quality experience, one in which products work as expected, correctly fresh out of the box. They may even be joyful to use. As the future unfolds the demand for quality will increase. People will demand experiences that are simple and elegant, in a word: wonderful!

Competition will be fierce. For every bad experience, customers will immediately move to select other choices. Usability will contribute significantly to the winners. Shoddy workmanship will not be tolerated. Software driving technology during this phase of the millennium will become reliable and useful and operate as expected. Productivity and quality of life will improve thanks in large part to wide scale use of Human Factors, including usability engineering.

A glimpse into the near future...smart rooms, smart clothes

Scientists and engineers are finally beginning to talk about "Smart Rooms" and "Liquid Computers" in a regular fashion. Up until recently, computers have been essentially blind and deaf. Humans and our pets are able to recognize us and make sense of what we are thinking. Yet computers were not able to easily and cheaply do the same task.

For the past five years Alex Pentland and his students and associates at MIT have been experimenting with computers that recognize faces, expressions and gestures. Imaging living in a house that always knows where the children are whether they are getting into trouble. Imagine working in an office space that is aware of you, that can interact with you or protect you if you are in a special meeting.

Perhaps the room will automatically handle interruptions such as the phone or visitors and take messages. Or if you are alone in your smart room and are talking, perhaps it will sense that you are alone (not on the phone and not with a visitors) and will try to understand what you are saying. In Sun Microsystems future vision film STARFIRE we tried to address some of the experience associated with. Imagine the opportunities for Usability Engineers over the next decade!

What is the future like?

When Ive talked to people about their ideas of the future, these words have profound implications for technology:
Simpler
Smaller
Smarter
Stronger
Faster
Lighter
Cheaper
Bolder
Happier

Some of the words in the list are a surprise. I added happier because I believe that products of the future should celebrate life! They should be a joy to use. I predict that Joy of Use will become an important factor in product development and product success. As technology becomes more efficient, products will become commodities. That is, they will be cheap enough that it will be hard to tell one product from another. Products seeking to differentiate themselves will draw on the skills of the usability community. New metrics and techniques to measure joy of use will need to be developed.

More Bandwidth and innovation means true sensory integration!

Over the next 10 years or so, as bandwidth becomes more available and cheaper, and compression and other techniques improve, we will begin to see the evolution of products like the present day computer (it computes bits using numbers). In the future the word computer will disappear from our language. The computer will evolve into an integrated personal aura and communications device- which I shall call an Aura Device (AD). It will become a personal envelope that surrounds each of us and helps us in all situations. It will enable fast, and easy ability to communicate with others. Our Aura Devices will be like an

invisible envelope, extending in all directions around the person. (radar detectors in our cars are an example of such a device)

If we have global video services available there will still always be the problem of time zones....if you are communicating with someone 12 times zones away, there will continue to be the question of exactly who gets up in the middle of the night to have the meeting. Perhaps advances in asynchronous communication will help solve the problem. Video mail will replace e-mail.

Eventually, perhaps in 15-20 years we will evolve out of the dark ages of computers. Today we can use visual media and auditory media with our computers. But what about the other senses? What about smell, taste, touch? What about liquid computers which will enable us to feel new sensations? (we are liquid computers!). As bandwidth and compression techniques develop, we will finally begin to get true sensory experiences which will include smell, taste, pressure as well as other aspects of people meetings which we cannot yet quantify. Perhaps rates of endorphins will be able to be varied, thus giving the participant a very realistic experience. For example in the future if I am watching a sporting event, like a running marathon, I should be able to smell the sweat and feel the endorphins of the winner pumping though my own body [Hence the excitement!].

When my vision of the future happens, the world will be an augmented and joyful place! Imagine the usability opportunities! New ways of measuring our satisfaction will have to developed. Usability engineering will help the products succeed or fail on the global market!

Today, in 1997 we are beginning to see the evolution of smart card technology. We are entering the age of sensors. Devices that measure and integrate will become common. Smart cards largely introduced this year, are typically financial transaction devices with information about the person stored on them. Smart cards of the future will become our biometric trust. The will have information, like our DNA on them. Networks will have an Integrated Sensorium-not just sight and sound, but true sensory experiences including smelling, tasting, touching being transmitted to us. Eventually they will record and replay our total experiences. Linked to our personal Aura Devices (ADs) they may even include our dreams!

Computers will become secondary to the appearance of how we live our lives, because they will blend into our environment. No longer getting between us and the thing we are trying to do! They will be integrated and knowledgeable. Operating behind the scenes they will be able to augment and improve our lives. Imagine wearing clothes that are intelligent. Perhaps your hat will have a built in recognizer, and everytime you see someone, their face is recognized and their name and other relevant information is presented directly to your brain (of course at first there will be tiny displays !). You need never appear to forget again!

The environment forming your room will communicate with your Aura Device, and will recognize when you are alone, versus in an important meeting. Perhaps it will perceive that the meeting is so important that it will take all calls automatically based on its own decision. We show a scene alluding to that idea in our movie, Starfire.

THE PRESENT . . .

Now I'd like to bring us back from the future and look a bit at the present and the state of being a usability professional in today's times. One of the problems we have had in the field of usability engineering is justifying our existence. Although we know we are important to successful product development, it has been hard to show how we contribute to the bottom line of our companies. Concrete data that can be presented to the financial justification side of our organizations has been scarce. In the future it will become obvious.

Lets look at history. Only 12 years ago (1985) we were in the Iron Age of computing. The experience was primarily of text based searching. Low speeds were used. Data bases like DIALOG (~1974) had a limited amount of scientific titles and abstracts. In the medical community, MEDLINE and MEDLARS were a decade old by 1985.

Looking back three years to 1994, we find that we were in the Bronze Age of computing. It was the first time you probably ever heard the word web or home page. We saw the development of on line shopping malls (with text and photos). We learned a horrible new interface: (http://www.xxx.com/) Whats your URL? first entered human languages as mankinds newest line. :-)

By last year, 1996, we had entered the Silver Age of computing. This period was characterized by multiple media, higher speeds (28.8, 56Kb etc.) and finally a critical mass audience of perhaps 12,000,000 ! For the first time we saw original content being developed. New channels to serve new markets.. Network initiated, purchased or produced shows. In 1996 it was common to have a personal web site.

Over the next decade a dramatic increase in the number of personal home pages is likely to evolve. There will be lots of opportunities for usability engineering!

Within another two years (1999) we will enter what may be the Golden Age of computing. We will begin to see lots of data streaming. Full motion video. The next thing: cable , telephony , data communications and
Hollywood blended together. We will see a proliferation of advertising. In fact a lot of the support for the net will be due to advertising. We will see more consumers using PCs in the prime time than TVs. Of course this vision of the future implies that the problems of speed and performance on the network has been solved.

One of my colleagues, Dr. Jakob Nielsen has a list of Usability Slogans which we have put to good use in our engineering community:

> Your best guess is not good enough
> The user is always right
> The user is not always right
> Users are not designers
> Designers are not typical users

Less is more
Details matter
Help doesnt

Time doesn't permit me to expand each item, but you get the idea.

THE OPPORTUNITIES OF USABILITY ENGINEERING

*There is a theory that the amount of intelligence
in the Universe is constant...
Unfortunately, the population is growing!*
-author unknown

As we move into the next millenium we note a number of changes required for successful products. Customers are already changing what is acceptable in a product. My short list is:

1) low tolerance for poor usability
2) immediate gratification
3) support fast learning
4) must be engaging
5) No Fear
6) no error messages
7) supports both passive and active use
8) ENJOYMENT ! - Joy of Use
...which means
Simplicity & Elegance
A Quality Experience

Incorporating these concepts into products will help make them win in the coming decade.

Over the course of my career I've had the opportunity to be involved with the development of several of the major operating systems. My team's work on usability has led to the development of some excellent products.

Designing System 7 for the Macintosh- a real life example:

Sometimes in the design of interfaces to products we have to draw on other fields. In the design of various operating systems that Ive helped develop, weve had to draw on the principles of magic to improve the overall experience. During the development of Apples Macintosh System 7 (the first time the interface was ever changed) we were doing usability testing on some aspect of the interface. We had designed the hard drive icon to open in a list (View Menu by name) view. I wanted a way of each folder to show the contents without opening another window to see the contents of the folder, so we put a radio button beside each folder. The person clicks the radio button and the folder folds open.

As we reviewed the video tapes from the usability lab we noticed that every person always made a comment like gee --- this is slow when they clicked on the radio button (a subsequent investigation noted that CPU speed did not appear to make any noticeable difference.) . We were not testing the speed of the system, but were looking for data on how people used the trash can.

I went to the team that owned that part of the Operating System (OS) Code and asked them to speed up the rate at which the folder unfolded. After about three days of evaluation, they came back and told me that if they did it, it would break all applications since it would violate Inside Macintosh our technical specifications . Clearly the perception of the user lost out if nothing was done. However not one to be defeated, I went back to my team and asked them to brainstorm with me on how to improve the quality of the experience. I pointed out that perceived performance was as important as performance, and there must be some way to solve the problem.

During the course of our discussions we examined several other fields for fresh ideas, and decided that our user interface problem had a lot in common with Stage Magic. So as we talked about what do magicians do?. We noticed that one thing they did often, was to divert your attention from one place to another. So we decided to draw on their techniques. Since part of the problem was that a radio button has a sense of immediacy associated with it (you touch it and it changes), we needed a delaying tactic. We invented the triangle that animates downward when you touch it (the user interface item currently in the interface). We never sped up the performance, we merely gave the user something to occupy their time. We never heard any complaints about the performance again!

The lessons learned from this example, include the fact that sometimes you have to draw on other fields to improve your design.

Principles of Magic and their application to Human Interface Design.

One of my colleagues, Bruce Tognazzini, human interface designer and magician, wrote a paper about similarities of magic and human interface design. He discusses ideas which all of us should consider in our work. See Principles, Techniques, and Ethics of Stage Magic and Their Application to Human Interface Design, proceedings of InterCHI, 1993 (Amersterdam, The Netherlands, April 24-29, 1993). ACM, New York , 1993, pp. 355-362.

Virtual Realities

Both human interface designers and magicians create virtual realities. Magicians bring their act alive on stage. It is really an alternate reality. They appear to defy laws of physics and nature right before your eyes. In the same way, human interface designers bring their act alive on the display. Human Interface Design is really *the user illusion* .
Examine some of the principles that Magicians use, and you will see the similarities:
>
> *Consistency*
>> You make people believe if you are consistent

Unity
Tying things together - we are part of a system
Use of Real World Metaphors
Magician's tools should be disguised to look like objects
in the real world. User Interface designers follow the same principle
Perform user testing
Both for magic and interface design
Showmanship
Presentation is part of perception
Smoothness
Fit and finish or silky smoothness makes a finished product.
Get to the point
- be brief. Elegance and Simplicity have become a mainstay.

WHAT ARE THE CHALLENGES FOR THE FUTURE?

New Devices require new designs. Lets look at the near future and guess at some things that will be evolving.

Ubiquitous computing finally!
Computers everywhere! Even more than now! And they communicate with each other too!

Intelligent Offices and environments.
They adjust your environment according to your needs. Personal Videoconferencing will become ubiquitous. Well communicate with everyone with a visual call! or video mail!

Integration of personal & work life
Systems will develop that allow us to be in contact with our personal life and work life at the same time. Cellular phones are the first example of technology being used this way.

We will begin to see different displays arrive on the screen including Brain Displays-Displays imaging directly to your brain. We will also see flexible, lightweight flat panel displays everywhere. We may also begin to see "Globe displays"- The ability to utilize holographic spherical projections for many activities will make our lives safer. Consider the use of three dimensional displays for air traffic control systems. We can visualize problems well in advance of a real problem.

Finally we will see the creation of devices that are usable, in part because of their increased intelligence and in part because of our use of usability engineering . People of the future no longer will tolerate shoddy workmanship, or imperfect products, thus giving the Usability professional a lifetime of employment.

What can we expect over the next several years? Looking at the toy industry it, we will begin to see different input devices. Some of these devices will be controllable by our own nervous system. NASA has worked with eye gaze control for more than a decade. We are finally seeing a lot of breakthroughs happening. Perhaps in the not too distant future we will be able think about something and actually interact with it. The work of Usability Professionals is never done!

In the not too distant future we will see the emergence of brain-interface devices. Devices where we interact with them by "thinking". For and example information see: "Controlling Computers with Neural Signals"- (Scientific American, October 1996)

Neural Interface design will become increasingly important. It will help people with physical disabilities take charge of their environment. Eventually it will help all of us. We are TABs-Temporarily able-bodied. There is always the chance that something could happen to make some of our sensory processes stop (ie. blindness). As we grow older the need for reading glasses increases. It is important to consider usability access for all individuals, because the older you get, the more likely you are to require them.

If we begin to look beyond the next decade we will see devices that are truly integrated with our lives. They will have intelligence and natural interfaces. Finally they will also include our other sensory processes.

Trends and Issues

Over the next few years we will begin to see more bandwidth and compression schemes develop. As bandwidth increases, the integration of products and natural (and augmented) user interfaces will need to be developed.

Already we are becoming overwhelmed with the vast amount of data and information available. We will see the emergence of a valuation system for data, probably by our Active Agent who will rate each piece of material for integrity. As we sleep at night, our active Agents will roam the universe (OK ...initially just the internet :-)) in search of trends and events of importance and interest to us. Of course each of these agents will be followed by a financial agent who will tally up the nanomoney transactions (i.e.. nano-cent or nano mark) and take them from our accounts and deposit them in the appropriate places.

We will begin to see the world drive to a financially driven market, one in which you will also be paid (in nano-money) to read your e-mail or deal with your asynchronous video mail. In fact one prediction that Im sure of , is that in 10 years from now you pay money not to be on net. A whole new business model will evolve in *access transactions.* Your agent, or room will guard you from unwanted intrusions because you paid a fee for the night not to be disturbed by outside forces. Already Sun Microsystems has released Java commerce, a way to transfer small fractions of money around the net. A corollary model is one in which you raise the bar of access to yourself. For example, you may tell your guard agent that you will only

accept e-mail if $1000 US Dollars are deposited in your account. Or you will only accept that phone call from your boss if you get a raise! We will become a financially driven world over the next 20 years.

Of course this scenario is only for the technologically wired. Vast segments of the population will rebel against this type of life style. They will demand all of the good things that technology can deliver, but none of the straight jacket things.

Usability engineering for the Web

There will be tremendous opportunities for usability engineering related to the web and home page design. Shortly there will be millions of people attempting to design user interfaces. The creation of a successful web page includes a tremendous amount of usability engineering. In fact, roughly the same amount of effort of developing an application, can easily go into the development of a web site.

User interface design and all its methodology will become more important. Even the designers will evolve. Today, video designers (as in advertisers of shows that we watch on TV) are designing un-interactive sites. Their goal is to keep your finger off of the remote control button that changes the channel- so you watch their compelling advertisement. An Interactive Visual Designer has different skills. Here their goal is to keep you interacting with the system. Your finger (or other sensory modality) is always on the button!

International Usability Engineering

Dont overlook internationalization aspects of usability, especially as it relates to the Web. A good source of information is: International User Interfaces, 1996, Elisa M. del Galdo and Jakob Nielsen, editors, New York: John Wiley & Sons, Inc.

Usability Engineering at Sun Microsystems

In late 1991, Sun recruited me from Apple Computer (where I was Manager of the Human Interface Group - the ones making all of the design decisions on the Macintosh) to come and build a Human Factors Department. Included was enough commitment for me to shape the future of the company and its products. I obtained funding to develop several state of the art usability centers at a variety of Sun Microsystems sites in the United States.

Sun is committed to usability engineering all of our products. As a whole, the computer industry has seen benefits of human interface design and usability engineering in:
Increased Productivity
Increased customer satisfaction
Increased Sales and Revenues
Decreased Training and Support Costs
Reduced Development Time and Costs

[handwritten notes:]
Start five Topics
· Simplicity
· at of work & play
· Time compron
· Privacy

· Simple administration
· Nomadics

USABILITY REQUIREMENTS ARE CHANGING

Minimal Instructions
- more reliance on software intelligence. Devices that will set themselves up, or talk to you to help set them up.
No tolerance for obvious bugs
- we have become far too accepting of bad products from the computer world, especially in software design. You wouldnt use your telephone, if every third time you dialed you actually got the right number! Consumers of the future will be much more demanding. The way the computer industry runs will not be acceptable. Products will be expected to work the first time correctly and as the consumer expected.

Commodities and Joy of Use
- Intelligent Products become commodities. They are everywhere and we dont think of them. You will wake up in the morning and buy coffee and electronic devices without thinking about them. You will tend to buy devices that you like, so joy of use will become an even more important issue in the future.

Users demographics are changing

They are much younger and wiser with respect to electronic computer related devices. After all they always grew up with computers and electronic complex devices.

They are competent with vast amounts of information and their demands are different. They have no tolerance for errors . Its also best to realize that HELP doesnt!

We are also seeing the beginning of an older population using devices. They have the time and are beginning to explore. Good visual support material and simple instructions are essential. Simplicity and elegance will be a characteristic of the winning products.

Conclusion

The future will increase the opportunity for Usability Engineers. Fierce competition will drive out less usable products. The winners will not only be usable, but they will be a joy to use!

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