*Cognitive Levers Project*


# *Universal Design:*
## *designing accessible interfaces for all people*

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CSCI 6838 - 2001.04.03

# Vision

*In a fair society, all individuals would have equal opportunity to participate in, or benefit from, the use of computer resources regardless of race, sex, religion, age, disability, national origin or other such similar factors.*

-- ACM Code of Ethics

# Contents

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# What is Universal Design?

*"Design products that can be used by the widest range of people operating in the widest of situations as is commercially practical"* (a)

- Design of universally accessible tools, i.e., tools that provide services that at least 90% of the households can successfully use at least once a week (b)
- An initiative that tries to bridge the Digital Divide
- "Design for All", "Inclusive Design", "Accessible Design"

SOURCE: a) Anderson, R.H., Bikson, T., Law, S.A., and Mitchell, B.M. *Universal access to e-mail: Feasability and societal implications*. The Rand Corporation, 1995; Santa Monica; CA, www.rand.org/publications/MR/MR650 b) Vanderheiden, G. Fundamental principles and priority setting for universal usability. In: Proceedings of *CUU 2000 – Conference on Universal Usability*, ACM SIGCHI, November 16 – 17, 2000.

# Availability of Related Technologies in U.S. Households

| Technology | Percentage of Households |
|---|---|
| Television | 95 |
| Telephone | 93 |
| Video cassette recorder | 85 |
| More than one TV | 66 |
| Cable TV | 64 |
| Pay-per-view service | 51 |
| Video game system | |
| Video camera | |
| Fax | 6 |

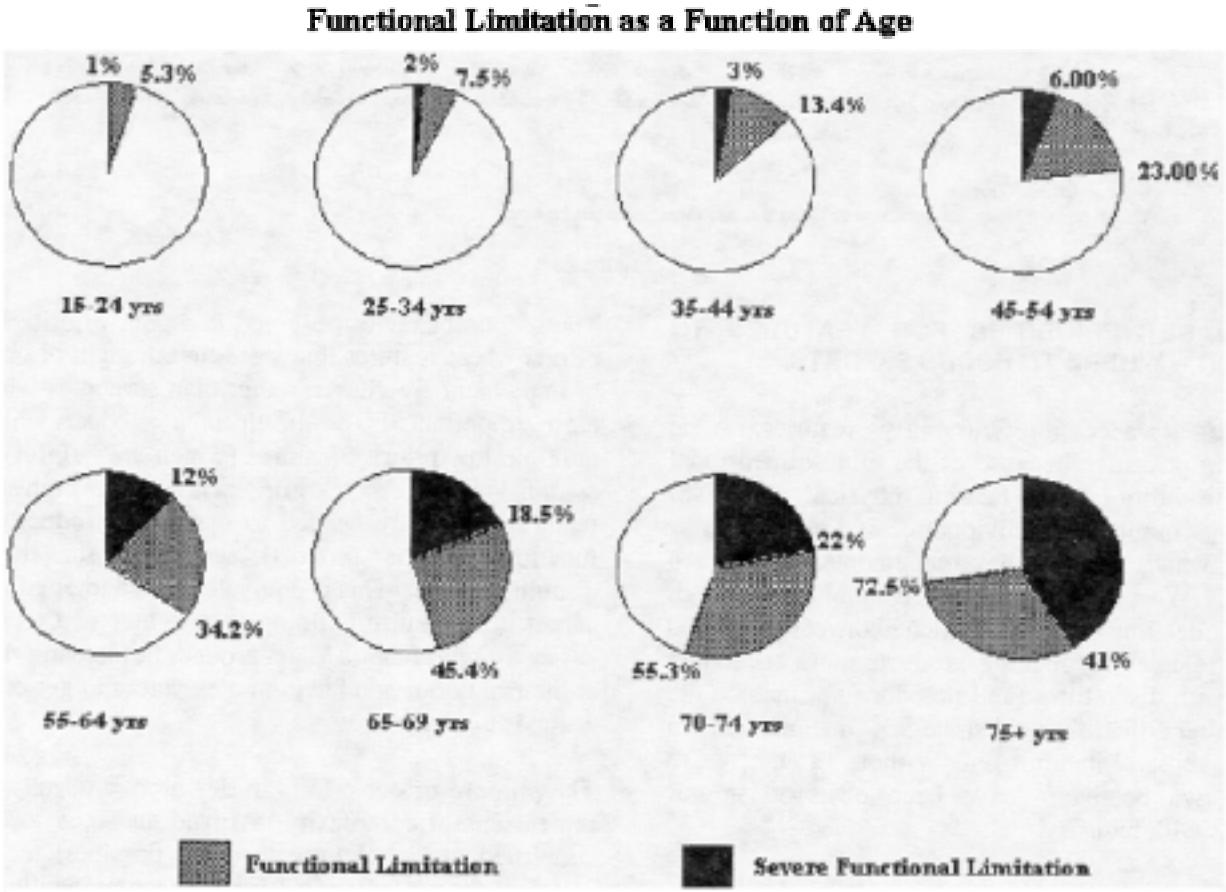
What is next?

SOURCE: Times Mirror Center for The People & The Press, *Technology in the American Household*, Los Angeles, California, 1994

# Why Universal Design?

- Ease of use: we are becoming increasingly dependent on technology for e-commerce, communication, health care, education, finance and travel
- Broadening usability reduces product costs and increases markets
- Democratic ideal
- Compliance with legal requirements: Telecommunication, Rehabilitation, American with Disabilities Acts
- Rise of mobile computing

# Sooner or later we will all need it




Source: Bureau of the Census, Series P-70, #8
Survey: SIPP, 1984

# Challenges from the user's side

- Cost
- Perceived usability difficulty
- Lack of utility

# Challenges from the developer's side

- **Technology variety**:1/100 ratio of processor speed, network bandwith and display size, ... aging machines
- **User diversity** in terms of skills (computer and specific), knowledge (domain expertise), age, gender, disabilities, language, literacy, culture, income
- **Disabling conditions**: mobility, sun light, noise, interoperability

Is a single system possible? Will lowest-common denominator technologies be useful at all?

**Is e-mail the next universally accessible communication technology?**

# E-mail versus other communication technologies

- Supports true interactive communication among many participants.
- Asynchronous medium. Communication does not depend on the simultaneous availability and attention of sender and recipient.

*"Generalizing greatly, e-mail increases the power of individuals, permitting them to be active participants in a dialog extended in both time and space, rather than passive recipients of 'canned' programming and prepackaged information."*

SOURCE: Anderson, R.H., Bikson, T., Law, S.A., and Mitchell, B.M. *Universal access to e-mail: Feasability and societal implications*. The Rand Corporation, 1995; Santa Monica; CA, www.rand.org/publications/MR/MR650

# Perspectives to consider (I)

- **Demographic**: access and localization of people from and to everywhere (user directories, public sites)
- **Technical**: create appropriate, secure and reliable infrastructure, access from different devices, ...

"*There are no fundamental technical barriers to providing universal access to electronic mail services in the US*"

- **Economic**: who is going to pay the bill? Is it viable?

SOURCE: Anderson, R.H., Bikson, T., Law, S.A., and Mitchell, B.M. *Universal access to e-mail: Feasability and societal implications*. The Rand Corporation, 1995; Santa Monica; CA, www.rand.org/publications/MR/MR650

# Perspectives to consider (II)

- **Social**: will society become less cohesive? Will everyone have an account? Breakdown of status-based social structures?
- **International**: compliance to standards
- **Educational**: How to address literacy barriers? How to deal with large amounts of messages?
- **Political**: E-mail can help vitalize or reinvigorate democratic governance

# Perspectives to consider (III)

- **Legal**: privacy (who is going to have access to what and how?), integrity (make sure no one opens or modifies messages), interconnectivity and charges policies
- **Cognitive**: make the process easier and more supportive
- **Cultural**: most e-mail systems have been designed for use in academic or business settings. Better understanding of the capabilities and limitations of current user-computer interfaces is needed

# Perspectives to consider (IV)

To some extent, all these perspectives affect the tool design...

...How to deal with such complexity?

# The I-Mail (Inclusive Mail) project

*Develop an e-mail client suitable for people with cognitive or physical disabilities ...*

*... In addition to helping people with disabilities participate more actively in society, I-Mail will provide an easier entry point to the Internet for kids, the elderly, and anyone who is in the process of learning to read or write.*

# Major challenges (I)

- The disability domain is not intuitive for us
- There is no “standard user”
- There is not much about universal design in the literature
- Traditional design approaches – participatory design, thinking aloud – do not seem to apply

# Major challenges (II)

- We cannot interact directly with the final users until we have an operational version of the system
- There are no prototyping environments with support for disabilities
- How to promote system's adoption?

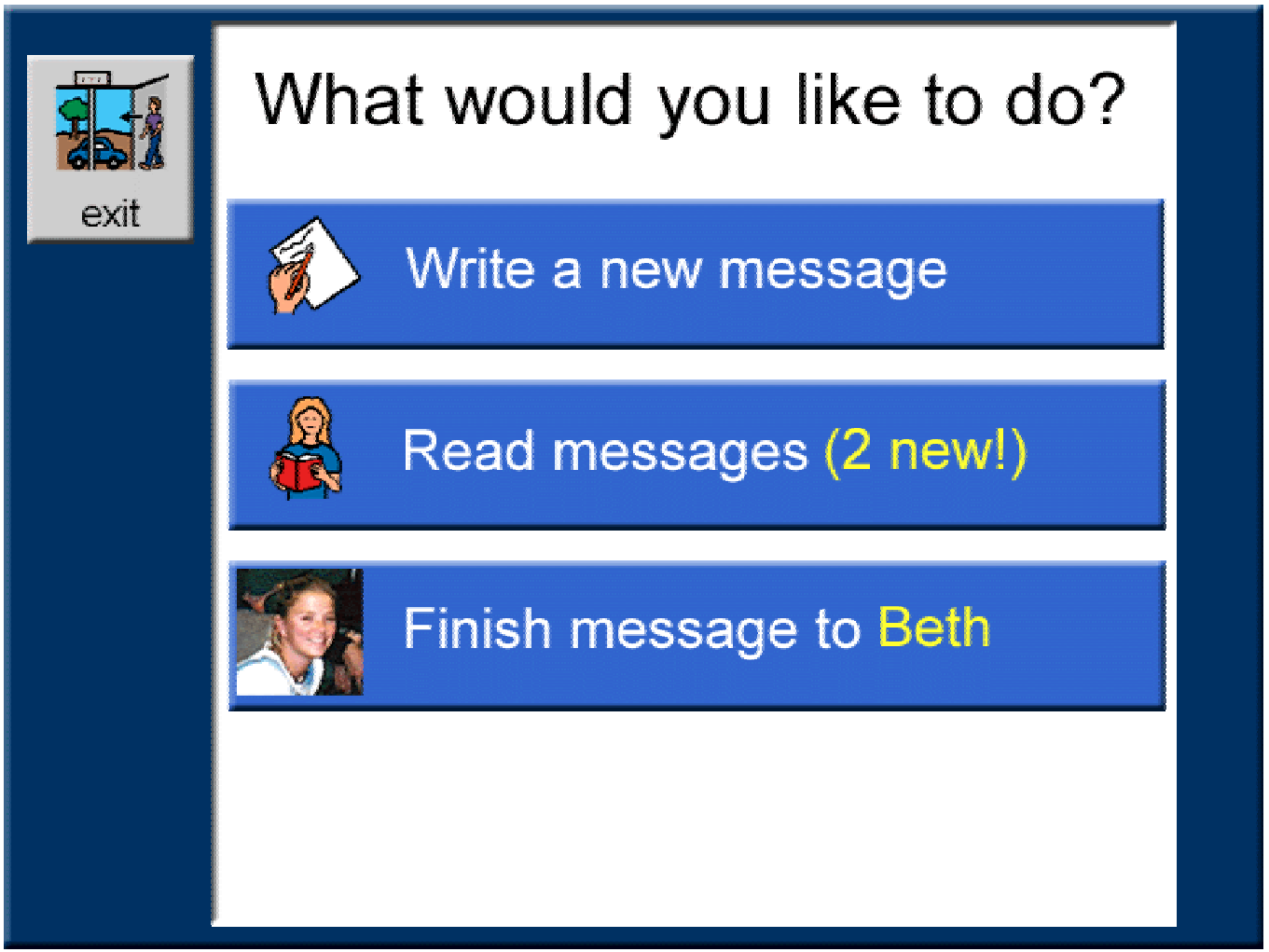
# Our approach (I)

- Target the most challenging class of users first – the cognitive disabled – and then expand the system to the other ones
- Staged participatory design
  - Work very close to experts in disabilities
  - Gradually move from specialists to users with increasing levels of disabilities
- Hide complexity as much as possible and only bring it back in case of necessity

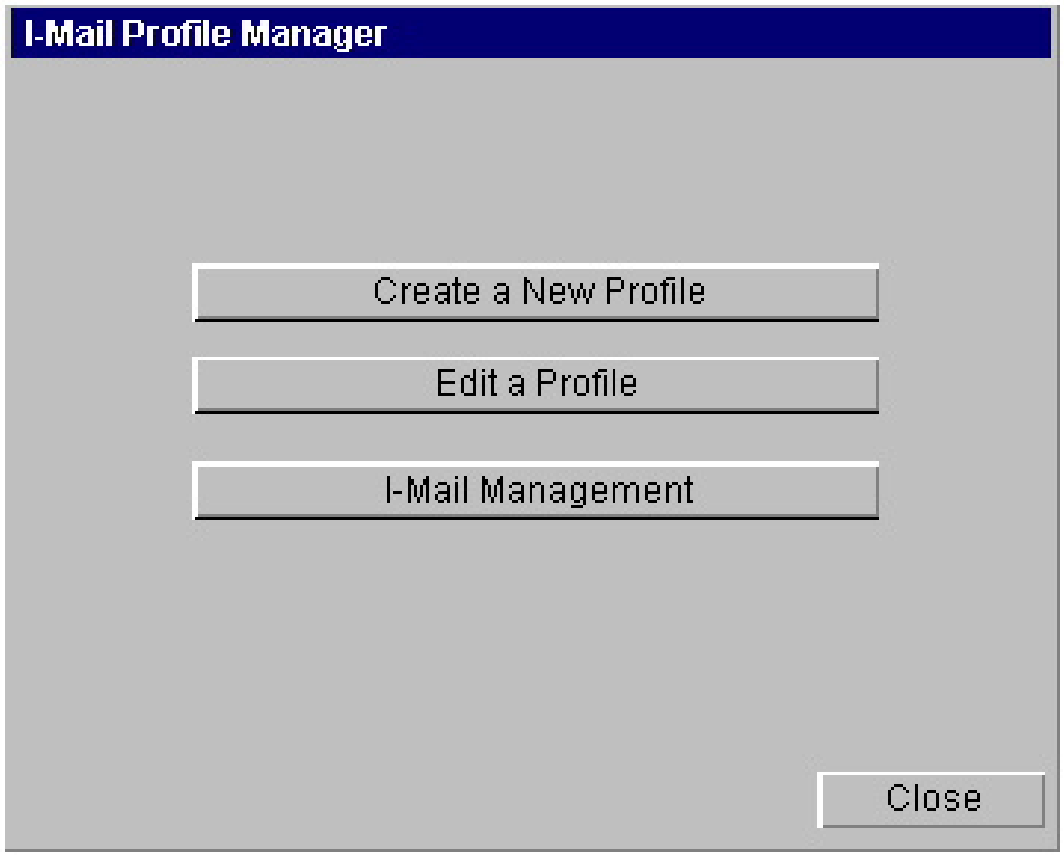
# Our approach (II)

- Support specific, semi-independent abilities (such as hearing, vision, cognition) and provide mechanisms to deal with combinations of them
- Adopt commonly used icons and technical solutions
- Partner with major organizations

# The I-Mail Interface



# The I-Mail Profile Manager



# The I-Mail Profile Manager

- Aims to hide the complexity inherent in the I-Mail configuration and to facilitate student monitoring

- Is targeted at facilitators (caregivers) in the schools

# The Profile Manager scope (I)

- System configuration
  - Audio-visual feedback
  - Message composition/comprehension support
  - Special devices interface (switches, touch screens, keyboards)
  - Mail accounts
  - Printing services
  - Privacy

# The Profile Manager scope (II)

- Address book management
- Picture library management
- Message management
  - Incoming and outgoing message approval
  - Message uploading and downloading
  - Trash bin control
- Usage logging

# What we have learned

- The I-Mail interface is a combination of software, specific devices and people. We have to move beyond the traditional user<->computer interaction and address a much broader context
- It is not easy to find the proper balance between functionality and simplicity
- User's opinion is essential

# Managing complexity (I)

- Plan for expansion, adaptation and interoperability
  - Iterative design
  - Modular architecture
  - Personalization techniques
  - Conformance to standards
- Involve users right from the beginning
  - We don’t need to become experts in everything
  - But we should be able to communicate
  - Paper-based mockups facilitate participation

# Managing complexity (II)

- Set priorities carefully
  - Essential X convenient features
  - Independence X codependence from other people
  - Frequency of use
  - Urgency (reversibility, severity of consequences)
  - Ease of implementation

SOURCE: Vanderheiden, G. Fundamental principles and priority setting for universal usability.
In: Proceedings of *CUU 2000 – Conference on Universal Usability*, ACM SIGCHI, November 16 – 17, 2000.

# Conclusions and Discussion

- Universal Accessibility is not an add-on. It has to be considered right from the beginning
- Universal Design is a new field
  - Still mostly based on guidelines
  - Still fragmented: focus mainly on web accessibility and on cognitive and physical disabilities
  - Lack of design techniques that consider the sociocultural, psychological, economical, and historical context
  - Lack of tools to support development and testing (accessibility certificates, interoperability standards, components, ...)

# “Universal” is a relative concept...

- Developing a kiosk for a shopping mall is very different from developing something for an entire country or the rest of the world
- Most of the research seems to be focused in the U.S. and Europe. Remember that:
  - More than 80% of the world’s population has never made a phone call (a)
  - Only 5% of the world's population has any sort of access to the Internet
  - There are more Internet hosts in New York than in all of Africa

*“We have been unable to locate in the social science and ‘human-computer interface’ literature studies of the usability of these existing interfaces [Windows and Macintosh] for persons in the lowest quartile of income and education in the United States- -persons less likely to be ‘computer literate’ and therefore possibly unfamiliar with the many metaphors on which these interfaces are based.”* (b)

SOURCE: a) BBC news, 1999. http://news.bbc.co.uk/hi/english/special_report/1999/10/99/information_rich_information_poor/ b)Anderson, R.H., Bikson, T., Law, S.A., and Mitchell, B.M. *Universal access to e-mail: Feasability and societal implications*. The Rand Corporation, 1995; Santa Monica; CA, www.rand.org/publications/MR/MR650

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