

Universal Usability: Children

A brief overview of research for and by children in HCI

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Summary

The process of developing technologies for children users shares many of the same challenges with designing technology for adults. Some of those challenges include the visual presentation of content, avoiding clutter on displays, making large amounts of information easily accessible, improving information seeking and selection and optimizing the input interfaces by understanding motor skills of the target user group. There are also similarities in the design process itself, in particular the level to which the target user is involved, ranging from little involvement (e.g. providing feedback on existing technology), to a close collaboration throughout many iterations of the development cycle.

There are however also differences, when designing specifically for children; many of which are due to the early development stage of children. Some skills may not have fully developed yet, such as motor skills [HOU04, THO80], vision [SCH96], and relating complex relationships to each other. Further differences become apparent when working with children directly. User studies will have to be prepared differently, because children may get frustrated easier when a task is too hard or too easy, too boring or long. Classical interviewing methods need to be adapted to be suitable for children. Often kids find it intimidating when formal dressed researchers conduct interviews, notes are taken on large in size questionnaires, the language is too technical or sentences are too long. On the other hand video cameras that are present seem to affect children in their way of interacting with each other or with technology less than adults [DRU99].

Two issues became important to me throughout this work:

1) In work with children, user studies and design iterations take long, while on the other hand technology development cycles are getting shorter and shorter. Technology also becomes more and more accessible to children of young age (example iPad usage by 2-4 year old children is at 40%). There is an obvious gap to be bridged in HCI research which might involve (thoughtfully) cutting corners.

2) I find it important to think about exactly how much one can afford to involve children in a resource-limited design process (most are) before developing new technology. This also applies more generally to other user groups, but it is of elevated importance in designing for children, because design processes might take longer.

In summary, I would like to use an analogy: I recently had to make a decision on selecting and purchasing a canoe. After a good year of research my recommendation could be summarized into: "buy as light of a boat as you can afford". After looking into children in HCI and specifically

at the design process for and with children, I would like the take-away message to be: “Involve children as much as you can afford to in design of technology for children and adults”. If this question is asked prior to designing new technology, a lot has been accomplished already.

History and further literature

While the majority of the research involving children in Human Computer Interaction was published at conferences such as CHI starting in the late eighties and early nineties, earlier work relating to children’s interaction with technology can be found in psychology text books of the seventies. The topic was also sporadically addressed in technology oriented journals and in light of education research as early as the sixties. For the interested reader that would like to study the field further: [DRU99] contains a rather complete overview of the early and the recent literature. [INK12] is another good starting point as the author has been working in this field for many years and the references in the paper appear complete, especially with respect to video tools.

Topics of children in HCI

When browsing through the literature at a high level, I found that most research can fall into one of four categories: Information seeking (also: search & select tasks), motor skill differences in children and between children and adults, visualization of information for children and design methodologies for children (mentioned dominantly in the summary of this work). Following is a distilled summary of what I found important for each of these categories.

Information seeking

- Children see the world differently.
- Children require intuitive, simple to use, well organized and thought-through interfaces much more than adults would (who would to some extent be ok with adapting to something less than perfect).
- This should be seen as an opportunity rather than a limitation and encourage optimizing design not only just for children, but also learn how to make intuitive interfaces for other user groups.
- Many research projects relate to digital libraries for children, educational tools, and browsing through data. Often hierarchical vs. flat interfaces are compared. Many studies

are long term (3-5 years) and government funded.

- Results: Explorative behavior of kids should be kept in mind and support through technology. The need for typing, correct spelling using Boolean logic in searching should be avoided. If hierarchical structures are a necessity due to for example the amount and variety of content that needs to be accessed, the hierarchy levels should be kept to a minimum.

Motor skills and input devices

- Much research has been done in psychology and neuroscience. Motor skills develop up until the age of 20+ years. An example is reaction time which is shortest after the age of 22.
- In HCI some (not many) papers have been published related to point task performance differences between adults and children [HOU04].
- Not only limitations: For new devices such as touch screens, especially in mobile devices, I would expect the effective spatial resolution of touch sensing to be much higher for children, given that finger tips are smaller, compared to adults with large finger tips. I didn't find a mention of this in literature.

Visualization

- Some research suggests that children can be seen as a 'series of cognitive communities' [SCH96]. This is actually the only paper I found on this topic and I was a bit disturbed by the language, although some of the results appear valid. Maybe this is a (subjective) indication that more research can be done in visualization for children. Other papers include the work on the digital children library. Visualization isn't specifically mentioned but is obviously a large component of the design.
- Considerations that need to be made for visualizing content for children include that kids cannot fully reason yet and are often only able to hold one item in memory at the time. The attention span is shorter depending on age.

Role of Children in the Design of New Technology

- It is important to consider the level of user/children engagement one can or should afford before designing new technology.
- Different levels of engagement make sense for different type projects. Ideally one would involve children throughout the entire design process. However this is a costly and lengthy process.
- These are the main take-away points; specific examples and more details can be found on the accompanying slides.

Final thoughts

While working through the literature, I found that some excellent research work had been done in HCI for and by children, namely the elaborative work on several encyclopaedias and digital libraries, such as the Digital Children`s library [DRU99+] as well as work in video conferencing technologies [INK12]. However it did not feel like a very crowded research space, so there is room for more work by more groups. I think the limited research efforts might have to do with the amount of effort that has to go into studies involving children, potentially also with restrictions and limitations of ethics guidelines. From a market perspective and from looking at the size of the user group this lack of research almost seems counter-intuitive. I will remind again of the example of young children as iPad users in the beginning of the accompanying slides [CSM12]. A solid proposal of how to rapidly adapt new and ever changing technology to needs of children as an ongoing process might make for a strong publication.

References

- [CSM12] Zero to Eight. A Common Sense Media Research Study. FALL 2011. Children's Media Use in America. Common Sense Media, San Francisco 2012; (<http://www.commonsensemedia.org/sites/default/files/research/zerotoeightfinal2011.pdf>)

Data on tablet and mobile phone usage by children of different age groups. Public, non-profit organization. Presumably the data is not biased towards specific markets or products. Authors collaborated in later discussions with the Seattle Children's hospital on work related to table computer usage and risks.

- [BOR95] Borgman, C., Hirsh, S., et al. (1995). Children's Searching Behavior on Browsing and Keyword Online Catalogs: The Science Library Catalog Project. *JASIST*, 46 (9), 663-684

Long-term (3 years) study with children on the Science Library Catalog Project, comparing text-based vs. hierarchical search strategies.

- [HOU04] Hourcade, J., Bederson, B., et al. (2004). Differences in Pointing Task Performance between Preschool Children and Adults Using Mice. *ACM Transactions on Computer-Human Interaction*, 11 (4), 357-386.

The paper discusses the differences in pointing task performance using a computer mouse. Specifically the authors set up a well-controlled experiment measuring accuracy, efficiency, target re-entry and drag and drop performance.

- [THO80] Thomas, J. (1980). Acquisition of Motor Skills: Information Processing Differences Between Children and Adults. *Research Quarterly for exercise and Sport*, 51 (1), 158-173.

One of the earlier papers that discusses differences in motor skills during the development stages of children and compares to typical capabilities of adults.

- [SCH96] Schneider, K. (1996). Children and Information Visualization Technologies. *Interactions*, 3 (5), 68-74.

One of the few papers specifically on visualization techniques for children. The author describes the benefits of a fish-eye view, combined with a reduced number of vertices when data is visualized as graphs for children. I was personally less impressed with this particular paper as it seems to be somewhat adult centric in the design process and describes children largely as adults with limitations to which technology needs to be adapted.

- [DRU99] Druin, A. (1999). The Role of Children in the Design of New Technology. *Behaviour and Information Technology*, 21 (1), 1-25.

An elaborate discussion on how to design for children. Both past and present research is summarized, with lots of examples from the author's own experience in working with children. The focus of the paper is on describing the different levels of bringing children into the design process and the author argues that treating children as equal design partners can lead to the design of exceptional technology.

[INK12] Kori Inkpen, Honglu Du, Asta Roseway, Aaron Hoff, and Paul Johns, [Video Kids: Augmenting Close Friendships with Asynchronous Video Conversations](#), in *CHI 2012*, ACM, May 2012.

Microsoft research paper describing the design of colorful video conferencing tool 'videoPal' designed to share outdoor activities of children with adults at home or on the go.