Interaction Design
and Children

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  - Discount evaluation techniques
  - Design and interaction
  - Ethnography
- Theory
  - Models of cognition
  - Empirical methods of evaluation
  - Qualitative methods of design and evaluation
- Technology
  - Programming the graphical user interface
  - Input technologies
  - Output technologies
- Computer supported cooperative work
  - History of CSCW in HCI
  - Organizational issues
  - Online communities

- Games
- Communication technologies
- Interdisciplinary influence
  - The role of the social sciences in HCI
  - MIS and HCI
  - Graphic design
  - Artificial intelligence and the user interface
  - Architecture and the role of the physical environment
- Advanced topics and tends
  - Information visualization
  - Web design
  - Assistive technologies
  - Multimodal interaction
  - Perception and the user interface
  - Specific user groups (children, elders, etc.)
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Abstract

Children are increasingly using computer technologies as reflected
in reports of computer use in schools in the United States. Given
the greater exposure of children to these technologies, it is imperative
that they be designed taking into account children's abilities, interests,
and developmental needs. This survey aims to contribute toward this
goal through a review of research on children's cognitive and motor
development, safety issues related to technologies and design method-
ologies and principles. It also provides and overview of current research
trends in the field of interaction design and children and identifies chal-
lenges for future research.

To understand children's developmental needs it is important to
be aware of the factors that affect children's intellectual development.
This survey analyzes the relevance of constructivist, socio-cultural, and
other modern theories with respect to the design of technologies for chil-
dren. It also examines the significance of research on children's cognitive
development in terms of perception, memory, symbolic representation,
problem solving, and language. Since interacting with technologies most
often involves children's hands this survey also reviews literature on
children's fine motor development including manipulation and reach-
ing movements. Just as it is important to know how to aid children's

development it is also crucial to avoid harming development. This survey summarizes research on how technologies can negatively affect children's physical, intellectual, social, emotional, and moral development. Following is a review of design methodologies for children's technologies organized based on the roles children may play during the design process including a description of cooperative inquiry and informant design methods. This is followed by a review of design principles obtained through experiences in developing technologies for children as well as research studies. It includes design principles related to visual design (e.g., icons, visual complexity), interaction styles (e.g., direct manipulation, menus), and the use of input devices (e.g., pointing, dragging, using mouse buttons). The latter half of this survey summarizes research trends in the field of interaction design and children, grouping research efforts in the following areas: supporting creativity and problem solving, supporting collaboration and communication, accessing, gathering and exploring content, learning from simulations, supporting children with special needs, interacting with intelligent characters, supporting healthy lifestyles, learning skills, mobile, tangible, and ubiquitous computing, and designing and evaluating technologies. This survey concludes by formulating research challenges for the future and identifying three information age "plagues" children are in danger of facing in the near future.

Contents

1

Introduction

The review of the literature on interaction design and children in this survey shows the diversity of research approaches in this field. This diversity comes from a variety of factors. The first is that the researchers come from a variety of fields: computing, education, psychology, art and design, engineering, and so forth. Within each discipline, we come from different research traditions. We approach research using different theories and value research based on different criteria.

For example, some of us prefer quantitative, others qualitative data, others do both. Some will work on novel technologies even if their impact on children's development is unclear, while others prefer incremental research grounded in theory and controlled experiments. Some will develop technologies with the goal of producing measurable developmental goals, others will be mainly concerned about enabling new experiences with technologies. Some will work with children as design partners, others believe it is better to adhere to well developed educational theories. Some will look to design novel ways for children to gain basic skills, others will concentrate on providing children with

new ways of expressing themselves. Some will concentrate on producing technology, others on novel interactions, guidelines, or design and evaluation activities. Some believe in constructivism, others in constructionism, social constructivism, situated learning, or behaviorism; others just want children to have fun.

We are also geographically diverse. Over the years, the Interaction Design and Children (IDC) conference has received submissions from all continents except for Antarctica. In addition, the share of papers from Europe and North America have been roughly evenly split over the years regardless of the location of the conference, in contrast to other conferences such as CHI. While the Internet has made accessing research materials from other parts of the world significantly easier, geographic diversity still brings different approaches as we have gone through different educational systems, deal with different funding realities, and may even see childhood from different perspectives.

We are diverse in terms of gender. Many of the founding parents of our field are women (e.g., Druin, Cassell). The conference chairs for the IDC conferences have been evenly split by gender, and paper authors have also been evenly split. Interaction design and children may be the only field related to computing where this is the case. I believe this gives the field a tremendous advantage over other areas in computing.

We are diverse in terms of age as well because many of us work with children as design partners. We are still a young field though, and many of our fields' founders had not even started graduate school by the time the first CHI conference took place in 1982 (e.g., Druin was a teenager, Mitch Resnick was working for a magazine). Our youth and intergenerational approach give us some advantages over other fields where novel approaches and radical ideas may not be as well received. At the same time, we are more prone, due to lack of experience, to make mistakes. But we shall learn from them.

Interaction design and children is indeed a young field, but it has strong foundations to build on. Decades of work on child development provide a starting point. Research on children's motor skills can guide the development of low-level interactions. An awareness of the risks that technologies may pose provides warning signs for areas to stay

away from. Following empirically based guidelines can ease the way. But many challenges remain and my hope is that this survey will be a valuable tool for those who want to become familiar with the field as well as for those looking to get up to date with current research on interaction design and children.

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95

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