Research Philosophies in Interaction Design and Children

Introduction to the session

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This document presents the views of five researchers in our field on their research philosophies. Telling someone about your research philosophy is not an easy task. Sometimes we just go through the motions of going from one research project to the next without taking the time to reflect on why we are doing the research, what approaches we use, and what outcomes we seek. For my part, I did not pay attention to this until I was close to getting my Ph.D. and had to write my dissertation.

This panel builds on last year's "Views on our field" panel at the IDC 2006 conference in Tampere, Finland. The idea behind this panel is to discuss the diversity of views in the IDC community by reflecting on the motivations behind our research, how we conduct it, and what outcomes we expect out of research projects. The goal is to provide the members of our community with a broader understanding of the research in our field, an opportunity to reflect on what type of research we are conducting and why, a chance to see our own research from a different perspective, and an occasion to be inspired for future work.

Our diversity comes from a variety of factors. The first is that we come from a variety of disciplines: computing, education, psychology, art and design, engineering, and so forth. Within each discipline, we come from different research traditions. This in turn may give us different approaches to research. 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, behaviorism, or cognitivism; others just want children to have fun.

We are also geographically diverse. Over the years, the 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). Our conference chairs have been evenly split by gender, and if you look at who will be presenting papers in this conference it is also evenly split. We may be the only field related to computing where this is the case. I believe this gives us 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. Cassell finished her BA that year, 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).

Where do I fit? I am motivated by providing children with experiences that will have a positive impact in their lives. I believe in using technology to support collaboration, creativity, and access to content of interest. I look for research outcomes that include widely available technology and useful guidelines. I am a computer scientist, who uses mostly quantitative data but appreciates qualitative data. I have done both novel technologies and incremental research. I have mostly been concerned with novel experiences but am starting to measure learning outcomes. I believe in participatory design and also have seen the value of developmental theories. I have worked on widely used technologies, novel interactions, and guidelines. I believe in constructivism, constructionism, social constructivism and situated learning. I do not like "intelligent" tutors. I appreciate the importance of family and neighborhood ties from my childhood in South America, the "be the world's foremost expert" attitude from my graduate studies at the University of Maryland, and the politeness and modesty of my Midwestern neighbors in Iowa where I now I live. I am a man, but most of my colleagues in research projects have been women, something I believe helped my research substantially. I was in 2nd grade when the first CHI conference took place.

Where do you fit?

‘Child as scientist’: How technology can be used to provide authentic scientific experiences in the classroom

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Dawn Woodgate has a first degree in biology, and worked as a science teacher for some years. More recently, she completed a PhD in Science and Technology Studies in 2001, and has since held research posts in the Departments of Computer Science and Psychology at the University of Bath. She is currently a Research Fellow in the Department of Psychology, and works on the Participate project www.participateonline.co.uk which is a DTI/EPSRC collaborative project involving the BBC, British Telecom, Microsoft Research, Science Scope (a company making scientific equipment for educational establishments) and Blast Theory (an arts company), alongside the Universities of Bath and Nottingham. The project’s focus is on developing pervasive experiences based on the theme of ‘the environment’, where a broad cross-section of the public contributes to, as well as accesses, contextual content – on the move, in public places, at school and at home. Broader research interests are science education, children and technology, collaborative learning, participatory design, and science and technology studies.

‘Child as scientist’: How technology can be used to provide authentic scientific experiences in the classroom

Much of the inspiration for my work comes from the discipline of Science and Technology Studies (STS), the history, sociology and philosophy of science. An understanding of how science works (as opposed to how it is supposed to work), profoundly influences the way you think about science education, and the types of activities you feel it should include. Work in STS over the last 40 years or so has shown that science is not simply the impartial study of the natural world, as it has often been conceptualized, but like other human activities, is actively constructed within a particular social, historical and cultural context, involving aspects such as power relations between different groups, implicit and explicit sets of rules and conventions, and availability and sources of funding. This view of science has been (and remains) controversial, though there is now a general (albeit still sometimes rather uneasy) recognition that science has social aspects.

Just as science itself is not value-free, neither is science education. The initial motivation for the establishment of formal science education in the industrializing west was an economic one. In 19th century UK for example, the transformation from a feudal, agrarian society to a largely capitalist industrial one then taking place brought about a need for a workforce equipped with new scientific and technical skills. Concerns such as this, which draw explicit links between science, skills, and the nation’s economy, are revisited periodically. For example, one stated purpose of a 2000 Government White Paper on science education was to help secure the UK’s continued competitiveness in global markets. Seen thus, the aim of science education is provide the basic training for the

scientists of the future. This way of thinking about science education has up to now been largely dominant. However, it is not the only way, and economic concerns are not the only legitimate ones.

Another potential motivation for science education concerns scientific literacy (or lack of it) among the general public. 'Scientific literacy' refers to people's ability to understand the often complex social, economic, legal and ethical issues raised by emerging technologies If the purpose of science education is to bring about a scientifically literate population, its role is perhaps therefore more to do with providing tools to enable citizens to engage in informed public debate about scientific topics, such as an understanding of scientific practice and scientific thinking. Should we therefore think about science education as a form of early training for the next generation of scientists, or alternatively as a means to achieve a scientifically literate public capable of participating in informed debate? These aims are not, of course, mutually exclusive, though subtly different strategies may be required in order to achieve them. Finally, how does this relate to IDC?

I am going to provide examples from our work in the Participate project to show how an understanding of science as culture, alongside the use of emerging technologies to provide hands-on, authentic scientific experiences for children, have the potential to make school science lessons more interesting, engaging and motivating. In doing so, I will argue that such an approach can fulfil both the purposes for providing an education in science as outlined above.

A second source of inspiration comes from the work of the Participatory Design community, particularly that with children. We have carried out a pilot study which has improved our understanding of participatory design by engaging children and their teacher in the design process 'in the wild'; in an everyday classroom setting. The *Mobile (Phone)s in Schools* project (Towards a National Scale eScience and Education Project) enlisted a full class of Year 9 students (age 13-14) at a UK school as design partners to help develop new types of sensors, engaging their enthusiasm by using the mobile phone as a platform. Two prototypes were produced, and we carried out some limited evaluation, introducing the students to these prototypes, and eliciting their feedback. We also have carried out some preliminary analysis of video material we collected throughout the school sessions, and conducted teacher interviews on their understandings of, and attitudes towards mobile technologies as tools for learning, and issues which could potentially hinder their acceptance in the school context. We have focused initial analysis on the Participatory Design approach, reflecting upon how this work, carried out in school with a whole class of around 30 students, bears upon previous PD work with children which has tended to focus upon small numbers of children in a more controlled, laboratory situation [5,6]. Initial conclusions are that a participatory design approach to the development of educational technologies in everyday classrooms, despite problems such as the limited time available and large numbers of students, is potentially useful in terms of generating a lot of ideas quickly, and for the rigorous testing of prototypes of educational technology in the situation in which its use is intended, and could prove valuable if used in conjunction with more conventional PD studies and other methods such as ethnographic study.

The studies I will refer to place children in the role of scientist. I will show how newly developed technologies can help facilitate the provision of authentic scientific experiences for children, enabling them, for example, to collect reliable scientific data using simplified versions of the equipment used by professional scientists. Secondly, technologies can help them to form their own scientific communities to discuss, compare and contribute data across, as well as within individual schools, and in some instances with experts in the particular field. Thirdly, schoolchildren can be actively involved in the development of the technologies concerned, coming up with design ideas and providing feedback on prototypes.

Interaction-driven design: start from user's behaviour

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Interaction-driven design

Very often interactive applications for children start from the basis of a storyline that is presented in the fashion of an interactive book. Many other applications are based on specific content that educators and developers wish to transfer or transmit to children through an educational interactive experience. These two approaches are the mainstream in interaction design for children and are based on what we call *content-driven* interaction design. In other words, the design process starts from the content that the application or experience wishes to teach/explain/show. Then the type of user is analysed to understand the specificities of properties such as age group, cultural background, social aspects, etc. Then finally, interaction is designed in such a way that the content is put forward according to its internal structure, order sequence, complexity increase, etc. This is all done, of course, through participation of a group of potential users to make sure it is a

user-centred approach and designed, developed and tested in iterative cycles until one gets it approximately right.

There are many other times, though, where the final interactive application wishes to provide other types of experiences such as free creative experiences, open ended play, “living” of abstract concepts, acquiring a sense of agency and control, socialising activities, etc. We believe that a content-driven design approach does not provide a good context to design such experiences. On the one hand, because in many of these other examples there is no such initial content to guide the design; on the other, because these other types of experiences mainly wish to induce the user(s) to portray a specific behaviour.

Since 1998 [1], we have been working through what we call an *interaction-driven* design strategy, which has proved to be extremely adequate and useful to guide the design of these latter experiences. This strategy is based on understanding the interaction that the designer wishes for the user. The process starts from the behaviour(s) of the user(s) that the designer thinks will best enhance and foster the experience. These behaviours might range from a set of physical responses in front of a set of playing rules, to a set of attitudes in front of a set of social interactions with other users. The important fact is that one must keep in mind at all times that this behaviour will help describe and define the actions and reactions of the user and the application and hence, the interactive dialogue or *interactive communication* between user(s) and system. Examples of projects in which we have applied this strategy are: “MEDIATE” (FP5-IST-EU, 2001-04) [2][3], “Water Games” (Universal Forum of Cultures, Barcelona 2004) [4] and “Connections” (CosmoCaixa Science Museum, Barcelona 2006-07) [5][6].

Although the interaction-driven strategy is not a specific design strategy for children, it is especially apt for designing interactive experiences for them as can be seen from the projects above.

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Introspection: where do I fit?

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Jerry Alan Fails is a PhD candidate in the University of Maryland's Department of Computer Science, where he has been an active member of the Human-Computer Interaction Lab for the last four years while working with Dr. Allison Druin. He previously received his MS in Computer Science at Brigham Young University in 2003 working Dr. Dan Olsen Jr. who was recently recognized as an ACM Fellow. His primary focus of research is Human-Computer Interaction, with a current focus on technologies that support children's creativity, mobility, and collaboration. He has participated in IDC for the last for years in various capacities: as primary and co-author, reviewer and student volunteer.

Research Methods

As a PhD student I recently have gone and continue to go through the process of defining my own research philosophies. While going through this process, and having associated with several other researchers, I believe this process is an ongoing one – one that continues throughout one's research tenure. Therefore, in the spirit of last year's panel, *Views on Our Field*, an introspective examination is fitting to determine which research approach each of us adheres to. Two years ago, Jensen and Skov offered a thorough survey of varied approaches [1]. Methods throughout the field offer different focuses within the landscape of the following areas: children, design, technology and various forms of evaluation.

A few questions to consider: How do I design? How/what do I create? How do I evaluate? Further: Do I always use the same method? Do my methods fit with the research task? Do they evolve to fit the task at hand? As researchers we have many tools that we have learned, some have learned more than others, some, like me, perhaps less. My overall philosophy is that the addition, refinement, evolution and variation of these tools refine the researcher consequently impacting individual and collective research quality. No single method – both in the design and evaluation stages – should be the only one in our "research bag of tricks". That said, we do and must each have our own niche and this is important, but what can we gain from other perspectives?

In summary, I suggest frequent introspection can broaden our horizons, and invite all to ask: "Where do I fit?"

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Too Many Variables!

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Dr Janet C Read is the leader of the ChiCI group, a research group focusing on Child Computer Interaction. Her research interests focus on the use of digital ink technologies with children but she has also published several broad papers on the evaluation and design of interactive products for and with children. She has participated in every IDC conference, co-chairing IDC in Preston in 2003, chairing tutorials in 2005, chairing a MasterClass on Child Computer Interaction in 2006 and chairing the doctoral consortium in 2007. She has recently co-edited a special edition journal on methodological research in Child Computer Interaction.

Abstract

Research is an interesting activity and an interesting word. Research can be defined in several ways and each definition allows for a different take on what is good research and what is essential for research. One definition of research is that it is 'the systematic study of a phenomenon (or several phenomena) that results in new understanding, new meaning, or new knowledge'.

When I began as a researcher, I 'assumed' I knew how to do research. I constructed what I thought were fair 'experiments' pitting one set of situations against another and measuring what I could. For instance, I let children of several different ages use a range of different text input techniques and, using counterbalancing to minimize learning effects and so on, created a 'nice' experiment.

In 2001 I spent a week teaching in Finland and met Scott MacKenzie from Toronto, a text input research specialist. During an interesting week, we often chatted about research and specifically about the research that I was doing. He asked me questions like 'How old were the kids?', 'What sort of text were they inputting?', 'What did you measure?', 'How smart were the kids?' and so on….. The detail of all the questions he posed to me during that period have been lost over time but one enduring comment remains 'Too many variables!'

'Too many variables' is a major problem in empirical research with children and much of this variability is a direct result of the variability of the child. More homogenous groups of individuals (for instance, 16 undergraduate computing students) pose much less of a problem for the empirical researcher than, say, 16 five to six year olds. The more variables there are in a research study, the more subjects are needed, the more subjects are needed, the more lengthy / costly the study.

In our IDC field there is an uneasy understanding of empirical research. Far too often papers report what seem to be 'partially constructed experiments' with tiny samples of

children. Some commentators would 'forgive'' this behaviour, pointing to the invariable disclaimers in the write up that say things like 'given the small sample used in this study it is not possible to generalize the results'. Another weakness in our field is in the interpretation of results 'the results show that there is a difference between the two conditions, although that difference is not significant'.

This sort of research design and research reporting is bad and it is a direct result of a poor understanding of experimental design and statistical interpretation. As a community, we do ourselves no favours publishing this sort of work. Either we 'learn' how to do it properly or we quit doing empirical research all together as there will always be 'too many variables' to deal with.

Is Child-Computer Interaction a Distinct Research Discipline? A socio-cultural activity theory approach to CCI

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Ole Sejer Iversen holds a position as an Associate Professor at the Department of Information and Media Studies, University of Aarhus. His main area of research is interaction design with an emphasis on spatial IT concepts for new interactive school environments. The development of these new interactive school environments is inspired by the Scandinavian Participatory Design tradition with a special emphasis on the involvement of teachers, experts and students throughout the design process. Ole Sejer Iversen has published at the Interaction Design & Children conference since 2002.

In this panel session, I want to introduce my research philosophy by asking the question: Is Child-Computer Interaction (CCI) a distinct research discipline within HCI?

I have a background in Scandinavian Participatory Design with a Socio-Cultural Activity Theory foundation. For several years I have conducted research in Participatory Design for work practices in industry. In 2000, I became interested in the possibilities of involving non-professionals in participatory design processes. In a research-through-design process, I wanted to investigate the consequences of engaging non-professional and under aged users in the design of future technology. My hypothesis was that participatory design needed an entirely new toolbox for conducting collaborative design sessions with children. I was wrong. I discovered that design with children can benefit from most conventional participatory design methods, tools and techniques. Moreover, designing with children does not need more preparation or more special treatment than

designing with other communities of practices such as doctors, teachers, plant operators, etc. Socio cultural activity theory provides the theoretical basis for understanding children as participants in communities of practice and thereby provides the arguments for including them as authentic stakeholders in participatory design processes.

Socio Cultural Activity Theory: Children are authentic stakeholders in design

To some extent, CCI research is rooted on the Piagetean scheme theory emphasizing that children lack knowledge and experience and have fundamentally different experiences and understanding of the world compared to adults. According to the work of Piaget, children are in a cognitive developmental process in which cognitive skills are accommodated and assimilated in the process that leads to the ultimate goal of adulthood. An alternative view in Socio-cultural theory (as presented by the Russian scholars Vygotsky and Leontjev) acknowledges the work of Piaget but voices the need for a more socio-cultural frame for understanding children's development. According to Leontjev, personal development takes place through participation in social practice and is dependent on the condition these practices give for a person's participation in specific activities. Different phases in children's development can be related to the qualitative changes in institutional practice. Leontjev introduces the notion of appropriation to emphasize the social nature of children's development and learning. According to Leontjev, the child's appropriation of culturally devised tools comes about through involvement in culturally organized activities in which the tool plays a role. Leontjev treats human development as primarily driven by the social and cultural expectations of the individual, when engaged in cultural practices. Thus, with this point of departure, we embrace a focus on children as technically competent, resourceful partners with a distinct social practice, able to make key decisions in the design process on the same terms as any other stakeholder. Thus, from this perspective there is no reason why children should not be admitted into the participatory design process as authentic stakeholders and be seen as a resource in design on equal terms with any other partners.

So is CCI a distinct research discipline within HCI? I have my doubts. In the words of Toni Downes, once the adult assumption of superiority based on age and cognitive maturity is put aside, researchers can build on the techniques that field workers long ago developed. This in not to say that there isn't a need for CCI research. On the contrary, I envision CCI as an HCI outpost through which new tools and techniques can be added to the existing Participatory Design toolbox.

The Socio Cultural Activity Theory approach to CCI is further developed in Iversen, O.S., & Brodersen, C. (2007): *Bridging the Gap between users and children - A socio-cultural approach to designing with children*, selected for inclusion in Springer's journal Cognition, Technology and Work for the special issue on Child-Computer Interaction: Methodological Research.