Child-Computer Interaction SIG: Ubiquity and Big Data – A Changing Technology Landscape for Children

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Abstract
This SIG will provide child-computer interaction researchers and practitioners an opportunity to discuss topics related to challenges brought about by the increasing ubiquity of computing in children's lives, including the collection, and use of "big data". Topics include control and ownership of children's data, the impact of personalization on inclusion, the proper role for the quantification of children's lives, and the educational needs of children growing up in a society with ubiquitous computing and big data.

Author Keywords
Child-computer interaction; big data; ubiquitous computing; privacy; computer literacy.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
This SIG is an opportunity to discuss the impact of ubiquitous computing and big data on children. Ubiquitous computing brought about mainly by tablets and smartphones has made interactive technologies available to children just about anytime, anywhere from young ages. At the same time, the ease of data collection (given in part by ubiquitous computing),

inexpensive storage, large parallel processing capabilities, and the application of artificial intelligence methods is ushering the use of big data on children.

How might these developments affect children? What are the opportunities and threats? Will children get to control technology, or will their lives be controlled through technology? How do we educate children to successfully participate in a world with widespread use of ubiquitous computing and big data?

Ubiquitous Computing

Most children in high-income countries have access to tablets or smartphones [1, 3, 8, 7]. These devices are not only available, but thanks to touchscreen technology, very young children can use them effectively [6]. The other key characteristic of these devices is that they are mobile, meaning that not only is computing accessible to younger children, but it also is available anytime, anywhere.

Other technologies are likely to add to ubiquity. For example, voice agents, such as Amazon's Alexa, are becoming commonplace, enabling more complex interactions with computing, such as searches for information, before children are able to read and write. Similarly, it is likely that there will be voice agents designed specifically for children, with examples already available through toys. Such technologies are likely to add the ability to capture more information in the future, including video, location, activity patterns, and so forth.

Children are also using computers more frequently at school and to complete homework. This can be seen in the increasing popularity of one to one laptop programs [5], and in classroom situations where teachers allow children to use their personal devices as part of schoolwork. Teachers are also using computers to track children's behavior (e.g., ClassDojo).

As these trends continue, computers are becoming an integral part of education, communication, access to content, entertainment, and play for children. In all these activities, data is typically collected, stored, and analyzed.

Big Data

Large-scale data collection of children's behavior is something relatively new, fueled by the ubiquity of computing in children's lives, but also by inexpensive storage and large processing capabilities. The promised benefits are experiences personally tailored to individual children's needs, abilities, and interests. These experiences can of course include advertising and the modeling of children as consumers [4].

Big data can affect children in many ways as they grow up. These include tracking and surveillance, learning analytics, the quantification of children, and the formation of digital identities.

Behavior tracking and surveillance of children through technology are becoming commonplace. Anxious parents now have an array of tools they can use to find out about every aspect of their children's lives, including their activity with technologies, their current location, detailed information on their behavior and grades in school, and so forth [2]. Schools and companies controlling the technology children use can also take part in these tracking and surveillance activities. In most cases, children do not have a choice

on whether their activities are tracked, and whether information about them will be forgotten.

One application of children's tracking relevant to the HCI community is learning analytics [11], which attempt to model children's learning in order to provide relevant educational experiences. Ideally, learning analytics can provide advantages over one-size-fits-all approaches, accounting for, among other factors, different starting points and different learning styles across children. At the same time, such an approach can bring challenges if the modeling of children's learning or the selected personalization is inaccurate. An additional challenge can occur by making learning experiences so personalized that they isolate children in their learning, getting in the way of inclusion.

All the data collection and easy access to it can lead to the quantification of children. While schools have for a long time provided some forms of quantification through grades, the detail and frequent updates of data could make it so children identify with the way they are quantified. These quantifications can also happen outside of school, in games, social media, tracked behaviors and so forth. There can be positive aspects emerging from such practices, such as greater attention to school and engagement in healthy behaviors. At the same time, there are also implications to children's self-perception and how the information that is tracked can affect their values. For example, if children view points in a social media app as an important part of their identity, they may choose chatting with a friend through the app instead of face-to-face [e.g., 10].

Discussion

There are several dimensions to consider in identifying the right balance needed for changes in the ubiquity of technologies and big data to benefit children. One is control and ownership. To what degree can and should children control data about them? At what ages should the level of control change? Are control, ownership, and data privacy transparent and easy to understand?

Another dimension to consider is a singular versus a holistic view of the impact of technology. Should technologies focus on maximizing personalization and individual benefits? Or should priority be given to societal goals, such as integration and inclusion? Should technologies focus on single outcomes (e.g., learning a very specific skill) or overall benefits (e.g., learning to self-regulate)? Can both be achieved?

A final dimension to consider is superficiality versus depth in the representation of children and their lives. When are superficial quantifications useful? When can they get in the way of fully considering the complexity and depth of each child?

As we consider these dimensions, we also need to take into account the educational needs of children growing up in a ubiquitous computing, big data world. How should we prepare children for such a world? Do computational thinking, computational practices, and computational perspectives [9, 12] as a framework sufficiently embrace the skills and competences needed in a digital age? How do we teach children and teens to be critical/reflective about artificial intelligence and machine learning? How do we support children's online safety by use of industrial, social and technical

mediation? What should be the role of peers, parents and schools in mediating online safety?

Agenda

During the SIG, we will introduce the topics, allow those in attendance to introduce additional discussion items related to ubiquity and big data, break up for discussion, and report back to the entire group with an opportunity for whole-group discussion. The SIG invites newcomers, as well as experienced researchers and practitioners in child-computer interaction, to engage in the proposed discussion.

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