Parent Comfort with Sensors: Implications for Human-Data Interaction

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1 INTRODUCTION

Wearable and mobile sensors have the potential to revolutionize the study of infant development because of their ability to provide access into children's daily experiences [1]. Sensors have the ability to collect various signals, from physiological activity to video data, and machine learning algorithms are able to process these signals into meaningful markers of developmentally relevant activity, such as motor activity [2] and parent affect [3]. While traditional laboratory settings may distort natural behavior and lead to inaccurate conclusions [4], sensors have the potential to provide insight into children's behavior as they occur in natural settings [5]. However, the use of sensors to study development is still relatively new and there is little known about parent comfort with these devices. Thus, we sought to assess parent willingness to collect and share their children's data from mobile sensors so that we may improve the design and success of future research.

This study also provides insight into human-data interaction, which refers to "the broad topic of providing access and understanding of data that is about individuals and information on how their collected data affects them…" [6]. The core principles of human-data interaction are legibility (making the data transparent and comprehensible), agency (allowing the user to effectively engage with the collection and use of their data), and negotiability (the ability to change their engagement with the collection and use of their data) [7]. This study furthers our understanding of human-data interaction by providing insight into what data users are comfortable collecting and sharing, which has implications for the consent process and design of studies and devices.

2 METHOD

In order to better understand parents' perspective and their comfort level of various types of data under different situations, we administered a survey to parents of children under the age of five years (N = 210). The survey used Likert scales to assess comfort with different types of sensor data (location, communication, video, audio, and motion), willingness to share data with various entities under different conditions (personal use only and not shared beyond the household, shared confidentially with researchers, shared anonymously with researchers, and shared with technology companies according to their policies), and whether informational feedback impacts willingness to collect and share data. Parent gender was equally split (n = 105 fathers and n = 105 mothers. The majority of parents were between the ages of 25 and 35 (n = 120) and were married or in a domestic partnership (n = 167). For a full description of the study, please see [8].

3 RESULTS

We found that parents of infants were most comfortable sharing their children's motion and physiological data and least comfortable sharing audio data. Under a Bonferroni correction, chi square analyses revealed that parents were significantly more willing to collect motion and physiological data than audio data and video data ($\chi 2(1) = 26.94$ and 24.55, $p < .005$). Parents were also significantly more willing to collect location than either audio or video data ($\chi 2(1) = 13.97$ and 12.23, $p < .005$). Additionally, we found that typical privacy-preserving techniques (e.g., audio snippets as opposed to continuous audio) did not significantly make parents more comfortable. Results also revealed that parents were significantly more comfortable with collecting data in personal-use scenarios (i.e., when it would not be shared beyond their household) than sharing confidentially with researchers (i.e., with protection of personally identifying data) or with technology companies ($\chi 2(1) = 5.84$ and 11.70, $p < .0083$). Notably, there was no significant difference between comfort with collecting data in personal-use scenarios and sharing anonymously with researchers. In terms of the impact of informational feedback on parent willingness, the majority of parents reported that they would be at least somewhat more willing to share data if provided feedback in any domain. In terms of the type of feedback, the only significant difference to emerge when using the Bonferroni corrected level of significance indicates that parents were significantly more willing to collect data if it provides information on allergens than information on deviant behaviors ($\chi 2(1) = 4.04$, $p < .0014$).

4 DISCUSSION

These results provide insight into the human-data interaction concepts of legibility and negotiability. We found that parents of infants were most comfortable sharing motion and physiological data and least comfortable sharing audio data. This may reflect the commonality of sensors that use motion and physiological data. However, the commonality of these devices does not indicate that the parents understand the risks and implications of these types of data. In other words, the commonality of these devices does not equate with the **legibility** of these devices. Parents may be comfortable with motion and physiological data because they own other devices that use these data (e.g., Fitbit), but this does not mean that the data and implications of the data are transparent and comprehensible. Future research should investigate the impact of educating parents on the implications of motion and physiological data on willingness to collect and share this data. This also opens the question of who is responsible for educating users and improving the legibility of these devices and data. Research that utilizes sensors should think deeply about the consent process. The consent process should include information on not only the type of data being collected, but also the markers of behavior that can be identified from that data. In order to obtain *informed* consent, participants should be made aware of the possible implications of the data.

While our study only accessed comfort and willingness to use sensors at one point of time, we recognize that parents' opinion and comfort may change over time. For example, as their children age, the parents may become more or less comfortable with collecting and sharing their children's' data. This highlights the need for **negotiability**, or the ability to have ongoing engagement with their data and preferences. Future studies should compare these results to parents of children of different ages and see if and when their preferences change. For example, parents of adolescents may be less comfortable collecting and sharing data on their child's location because the child is going more places without the parent present. By knowing when parents' preferences change, a system could actively prompt them to update their preferences.

5 CONCLUSION

The results from this study provide a preliminary understanding of parent comfort with collecting and sharing their children's mobile sensing data. However, future research is necessary to determine the impact of legible information on comfort with these devices as well as the level of negotiability that should be offered when using mobile and wearable sensors. While parent comfort is a unique case, these results provide insight into questions that should be asked when investigating the comfort of other users, such as why users are more comfortable with some devices and what factors may change their comfort. More research must be conducted regarding comfort with sensors in order to improve human-data interaction. During the workshop, I look forward to discussing how we can improve the consent process to make data more legible and negotiable based in part on what was learned from the study presented here.

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