Baby Lucent: Pitfalls of Applying Quantified Self to Baby Products

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Abstract
Quantified Baby products are a new area for the application of Quantified Self. Such products primarily focus on measuring infant's body data and vital signals. Our Baby Lucent system is a prediction of how Quantified Baby products may evolve in the near future and illustrates what dilemmas designers ought to overcome when devices are being designed to measure the body data of those that cannot decide for themselves. We intend to raise these questions and propose three design qualities that all Quantified Baby products should avoid: raising parental anxiety; inhibiting parental intuition; increasing distance between parent and child.

Author Keywords
Quantified Self; Quantified Baby and Family Products; Smart Pacifiers; Infant Body Data; Quantified Self Obstacles

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

Figure 1. The Sproutling baby anklet tracks the vital signs of babies was announced in 2013. [8]

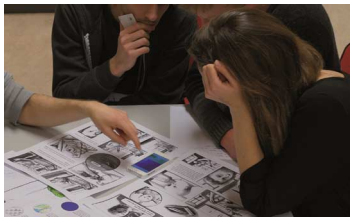


Figure 2. Focus group with storyboard and smartphone app prototype (Page 1).

Introduction

As health tracking and Quantified Self start to gain ground, practitioners are looking for new areas and target groups to apply these technologies to. This is especially relevant as sensors are becoming more ubiquitous. One area of such interest is Quantified Baby products. These can be categorized into two groups: those designed for use in hospitals and those intended for home use. An example for the former category is the Neonatal Smart Jacket [1]. This wearable sensor jacket monitors premature infants' vital signs at the neonatal intensive care unit. An example for the latter category is Sproutling [2] (Figure 1), a multifunctional anklet sensor that monitors vital signs as well as the environment.

For the purpose of this project we will focus on products of the lifestyle category aimed at first-time parents. The challenges they face can be overwhelming to anybody, as we have identified by interviewing four parents. They stated to feel insecure about their parenting decisions. They also needed time and patience to understand their baby's signals and cues. Parents are surrounded with an abundance of information sources (e.g. websites, books, family members, medical staff etc.) that it becomes difficult to filter out information that truly matters. Even worse, some of the information might be contradictory, unreliable or confusing.

We were quick to come up with lots of different ideas how sensor technology and Quantified Self might alleviate them of some parental pressure. We envisioned smart baby cribs that will rock the baby back to sleep, armbands that will wake up the parent according to their sleep cycles, and smart book covers that quantify how much time each family member spends on reading bedtime stories. All these design interventions seemed promising, but we questioned whether they were improving the situation. We had three main concerns:

1. Having access to a continuous stream of body data at any time and place might increase parental anxiety.

2. The development of parental intuition might be hindered, causing parents to rely on technology rather than being able to read their children's cues.

3. Relying on technology might distance parents from their children.

This led us to formulate our objective for this design project: to verify potential pitfalls in the design of future Quantified Baby products and to formulate recommendations that help designers overcome them.

Approach

To identify potential pitfalls of future Quantified Baby products we came up with our own design exemplifying our concerns (see Introduction). We did so by utilizing different information gathering and ideation activities that would help strengthen our concept. Finally we discussed our design in focus groups to find out whether future parents would share our concerns.

Brainstorming & Ethical Discussion

Using a series of time boxed brainstorming sessions with subsequent dot voting [3] we were able to continuously broaden and then narrow down our concept scope. To identify potential negative

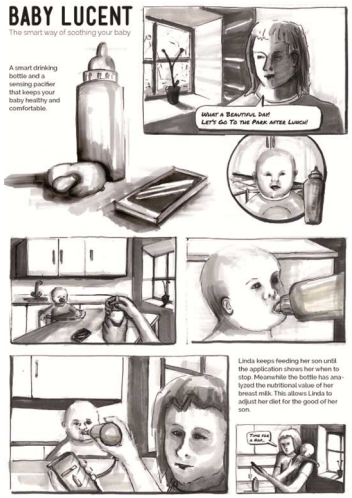


Figure 3. Storyboard illustrating the main usage scenario (page 1/2).

Figure 4. Screenshots from smartphone app prototype main usage scenario (page 2).

consequences of Quantified Self in the future we also generated ideas how body data could be misused. This reinforced our belief that there was an ethical discussion to have about the misuse of Quantified Self technologies.

Secondary Research

Secondary research helped us further understand the challenges that parents face. Around the same time we started focusing on Quantified Baby products the topic was also picked up by journalists in various online media [4, 5].

Interviews

To empathize with the difficulties and worries of parents of young children we interviewed four parents in one-hour interview sessions. This helped us understand the stress involved in parenting. We also discussed existing Quantified Baby products with them and noted that they were generally convinced by their premise as long as they were helping the recovery process of unhealthy children. However, we found that parents were concerned about how these products would impact the parent-child relationship for healthy children and questioned the underlying need for these products to exist.

Affinity Diagramming

We used affinity diagramming [6] to synthesize the parents' quotes into specific insights. This helped us to identify the following areas of design intervention: improving parental self-esteem, fostering self-reflection, avoiding (external) impulses. We focused on the these areas to come up with our recommendations.

Focus Groups

Holding focus groups (Figure 2) with 2 to 3 participants each helped us to quickly gather the opinions of 14 participants (11 female, 3 male) regarding our Baby Lucent concept. Focus groups may be more suitable than one-on-one interviews to get critical feedback [7]. To facilitate the discussion we provided our realistic product renderings (Figure 6), a detailed storyboard showing a potential user scenario (Figure 3) as well as an interactive iPhone app prototype (Figure 4).

Baby Lucent Concept

Baby Lucent is our critical interpretation of how a Quantified Baby product might look like in the near future. We formulated our assumptions largely by extrapolating existing technologies and baby monitoring products [1, 2] and using our user research insights to identify the difficulty of reading infants' cues in case of general unease or hunger. Our goal was to use this design to facilitate the discussion about potential pitfalls of Quantified Self products in the context of parenting. The next paragraphs describe the scope of this fictional system (Figure 5).

Baby Lucent is aimed at first-time parents and allows them to reflect upon and improve their parenting behavior based on real data. The system consists of three products – a smart pacifier, a feeding bottle and a smartphone app – and an underlying service that tracks the baby's health and nutritional information.

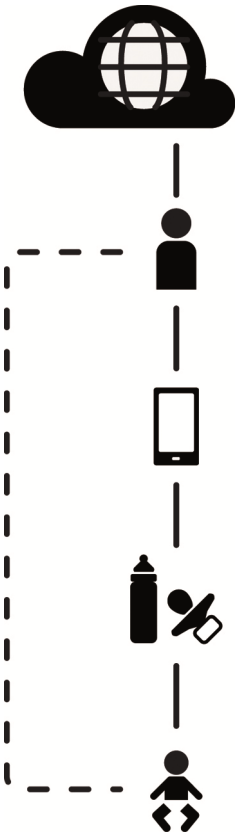


Figure 5. System diagram for Baby Lucent.

Figure 6: Overview of the Baby Lucent pacifier, feeding bottle and smartphone app feature set.

The Smart Pacifier

The Baby Lucent Pacifier contains sensors arranged as pores on the mouthpiece to analyze bacteria levels and the temperature of saliva. The pacifier periodically takes new readings and sends it to the Baby Lucent Internet service.

The Smart Feeding Bottle

The Baby Lucent feeding bottle measures the infant's food intake and analyzes its nutrition content. Parents not only can see the optimal food amount and feeding time, but also can reflect on the mother's behavior and diet if the feeding bottle is filled with breast milk.

The Smartphone Application

The smartphone application acts as the primary interface for parents and visualizes the recorded information stored on Baby Lucent's web servers. Parents can see their child's likelihood of catching infections in nearby areas (e.g. the playground). The application suggests the optimal feeding time, and visualizes both current and recommended nutrient levels in food and breast milk.

Reactions

Most of the 14 focus group participants reacted similarly when shown the Baby Lucent design renderings, storyboard scenario and smartphone app prototype. Their initial reaction was generally positive and they expressed that they thought the product was inherently useful. The following statements confirmed this: "it seems fine if I track the bacteria level of my baby; without the product I cannot know it"; "in the beginning it is hard to understand the baby – a week of crankiness can suddenly be explained with this". However, their initial enthusiasm later gave way to more critical thinking. People stated that "you trust too much the app and not your instincts" and "it might drive parents nuts with information, even relatives try to hide information from parents sometimes". Based on participants' responses we were able to identify 11 major insights categorized into the following five overarching topics.

Influences Parental Intuition

Most participants recognized that Baby Lucent might influence the parent–child relationship because the parents were relying on what a smartphone application was telling them instead of instinctively learning about their baby's needs. As one participant put it: "it might change relationships, you trust too much the app and not your instincts".

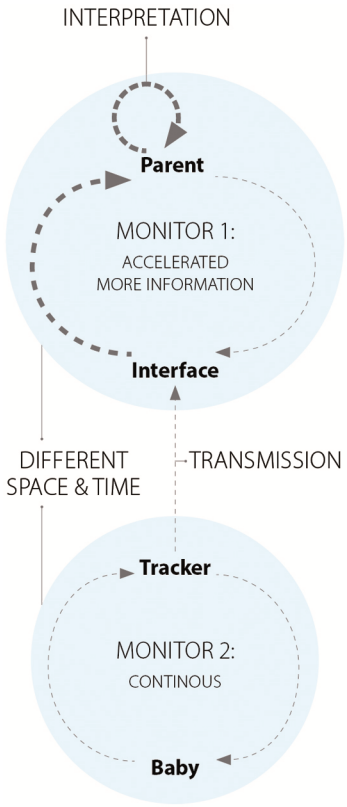


Figure 7. An inappropriate application of Quantified Self in a parenting context, where technology introduces a barrier between parent and child.

Misaligned Goal
Some participants remarked that being ill and catching infections is a normal part of being a child: "we protect ourselves from [bacteria], but you need to do the opposite to evolve our bodies by being exposed [to them] and become resistant to them as an adult, so I'd not protect my child from sick people."

Data Reliability and False Conclusions
Some participants voiced concerns that the system is only as good as the number of people using it. This was especially relevant to mapping the likelihood of a baby getting sick at a specific location. A participant noted that "what if in the park only 3 babies have the system and they are all sick? Will it say that 100% of the kids are sick? That's wrong data!". Other participants noted that the presented data was not actionable and that parents might draw the wrong conclusions from it, potentially making them worry unnecessarily.

Privacy Concerns
Some participants remarked that "babies are the most fragile human beings, and this system quantifies and objectifies them." Mothers would need to take on the responsibility of sharing the information without knowing how the data would be used in the future.

General Usefulness
Multiple participants had also questioned if the product had any real benefits for parents with healthy babies. One participant stated that the product might help fathers more than it would mothers: "useful for fathers. [They] never know how much and when to feed."

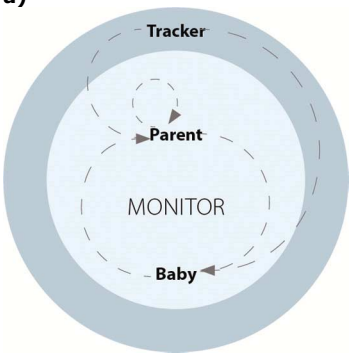
It is important to note that more than half of the focus group participants were designers, possibly resulting in feedback that was slightly skewed towards professional rather than personal opinions. We also had to resort to focus groups due to stringent time concerns. We expect that this might have led to some confounding of participants' opinions.

Recommendations

Most focus group participants picked up on the same concerns that we also had after having been confronted with Quantified Baby products for the first time. In fact, some participants opened our eyes to new concerns, such as "I would not protect my child from sick people"; "we need to do the opposite to evolve our bodies". We did not aim to question the legitimacy of Quantified Baby products but much rather to raise awareness to the need to of designing them appropriate to the context. This is especially relevant, as young parents are one of the most susceptible groups to be targeted by marketing. A collective effort should be made to ensure that any technology introduced into their lives leads to positive change. By introducing a Quantified Baby product the designer alters the context of parenting. It encourages the parent to focus on the technological appliance to measure the baby's well being (Figure 7). Instead of putting technology in the foreground, we suggest that it be moved to the periphery (Figure 8a). This precludes that monitoring the baby's vital signs and the mother's behavior needs to be integrated with preexisting parenting behavior. The following three recommendations show how this can be achieved in practice:

Recommendation 1: Limit Access to Data
Quantified Baby products should not offer parents continuous access to their children's body data.

a)



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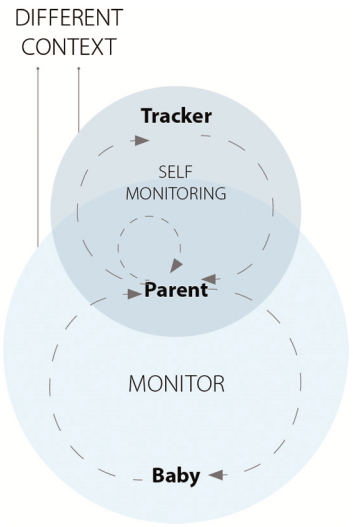

Figure 8 a,b. Two examples of how Quantified Self applications can be appropriate for the parenting context.

Although this might conflict with parents' expectations, limiting the amount of times the parent can access their children's body data may be an effective way to reduce the risk of parental anxiety.

Recommendation 2: Consider Parental Growth
Well-designed Quantified Baby products should foster the children's development as well as the parents' confidence in their abilities. Technology should let them learn to recognize individual patterns in their children's cues rather than interpret signs based on statistical data.

Recommendation 3: Respect Parental Bonding
Quantified Baby products ought to only allow access to body data while parents are attending to their children. This way the technology is less likely to create distance within the family.

Conclusion

In the beginning of this design project we strove to find new and interesting areas to apply Quantified Self technologies to. The more we researched it, the more obvious it became that merely adding sensors and presenting body data was not going to be enough in the context of parenting. When we started to focus on how Quantified Self might make the life of parents easier, we felt concerned about what implications badly designed Quantified Baby products might have on family life. To validate our concerns we designed Baby Lucent, a future concept of a Quantified Baby system and showed it to future parents. Finally, we summarized how Quantified Baby products ought to be designed to avoid the three biggest pitfalls: increasing parental anxiety, inhibiting parental intuition, and increasing the distance between parent and child.

Future work in form of qualitative studies is needed to verify if our postulated recommendations.

Acknowledgements

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