MammiBelli: Sharing Baby Activity Levels Between Expectant Mothers and Their Intimate Social Groups

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Abstract
Many expectant mothers desire to share information about their pregnancy with family and friends in their intimate social group. This includes details about baby growth and activity (e.g., kicks). Based on interviews with new and expectant mothers, we have designed an initial prototype called MammiBelli that allows pregnant women to share baby activity information with family and friends over distance.

Keywords
Motherhood, pregnancy, babies, awareness, sharing

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design Human Factors

Introduction
When a woman becomes pregnant, her life begins to change dramatically. No longer does her focus remain solely on her partner, immediate family and friends. Instead, it begins to include the wellbeing of her new child. The excitement and chaotic emotion caused by this sudden shift can cause an increased demand on

expectant mothers to interact and communicate their needs and queries with close family members and friends. For example, many family want to know how the woman is doing, if the baby's growth is progressing on schedule, and how active the baby is. In order to address this need, we have designed an initial version of a prototype system for mothers to share baby activity information with her partner, family, and closed friends. This work-in-progress paper will describe our interviews with expectant mothers, a prototype design for baby information sharing, as well as our future plans for design iteration and evaluation.

Related Work

Research has shown the importance for family members and friends to share information about each other's lives [5,6]. This includes sharing an awareness of one's activities, locations, and well being where the amount and type of information varies depending on the relationship [5]. The sharing of awareness information helps make people feel close to one another [5,6]. When women become pregnant, one thing that family members and close friends like to know about is the status of the mother-to-be's pregnancy and the unborn baby's health.

Several companies and researchers have looked at the design of systems to help parents monitor, track, and share baby information. Kientz et al. [3] designed Baby Steps, which allows parents to record health related information about their child. Through natural motivation to share baby information, parents can also upload and share this information online. Kientz et al. [4] also propose the idea of embedding baby monitors with sensors and cameras to automatically capture important events of child development.

The Mommy Tummy consists of an apron that fills up with water, grows, and vibrates to simulate and experience all stages of pregnancy and the foetal movements for the person who wears [1]. It is designed as a sympathy device that focuses on replicating the cumbersome effects of pregnancy in a short period of time. The kickTrak foetal kick and contraction counter is described as "a safe, reliable, non-invasive, hand-held, record-keeping device to help you keep a reliable diary of your baby's movements… over the last ten sessions" [2]. In order to record the number of kicks and contractions, the user must manually press a button and the device will count how many times the user has pressed the button [2]. While the system is certainly beneficial, it is likely that manual data entry can be cumbersome.

Our work builds on these projects through interviews with expectant mothers and design work to create an interactive and wearable system that pregnant women can use to automatically track and share baby activity information with family and close friends.

Interviews with Expecting Mothers

To understand the communication needs of women for sharing information about their pregnancy with their family and friends, we first conducted a series of semi-structured interviews. We recruited ten women who were in their third trimester or had a baby less than two years of age to share their thoughts on mothers' communication during pregnancy. Questions focused on understanding who they communicated with most often about their pregnancy and baby and what information they shared.

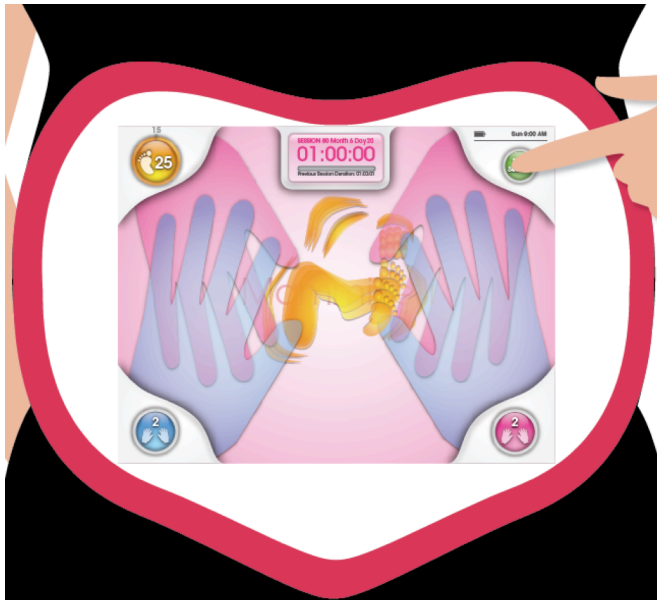

Figure 1. The MammiBelli being worn by a pregnant woman.

Results

Our interviews showed that pregnant women most often communicated with their birth mother about physical issues relating to their pregnancy. This was because their mothers had experienced many of the physical struggles that the women currently faced, and were considered experts in providing solutions to problems that arose.

On the other hand, women would turn to their partner or spouse most often to talk about emotional concerns, fears, anxiety, or excitement, rather than physical needs. Many were hesitant to share this type of information with their mothers because they feared their opinions may conflict. They also felt that their partners were unable to relate to many of the physical demands and conditions that arose during pregnancy and, thus, would not discuss them very often with their partners. This was despite them wanting their partners to have a better understanding of the physical demands of pregnancy.

Women would also turn to their friends or siblings who had previously been pregnant to discuss issues with their own pregnancy, but this was more casual and intermittent. Such exchanges typically only occurred when the pregnant women wanted to share information or when issues were left unresolved after discussing them with one's mother or partner first.

Nearly 80% of our participants said that they would share baby pictures or baby bump pictures via Facebook. In fact, in most cases, the women thought it was therapeutic to talk with other adults, in particular those in similar situations. They valued that Facebook allowed them to quickly and efficiently update people on their pregnancy via text or photo sharing. However, they would typically only send private rather than public messages because they felt it was safer and more intimate.

MammiBelli Design

We were greatly inspired by our interviews and wanted to create a device that would allow pregnant women to more easily share the physical aspects of their pregnancy with those in their intimate social circle. Our initial prototype of a baby activity sharing system is called MammiBelli. The design consists of two components: a physical wearable maternity waste band with embedded display, and a website for sharing and viewing baby information.

Maternity Waist Band and Embedded Display
The physical device consists of a seamless maternity waist band that pregnant women wear on their belly (Figure 1) for the purposes of counting the number of kicks, contractions, and other types of movements made by the fetus as well as the amount of hand touches made by the expectant mother and her partner.

Embedded within the band are sensors that detect baby movement and a LCD display that shows the user interface. We have prototyped the display by embedding a tablet computer in the waist band, however, we would expect future versions of the device to use a flexible LCD that can contour and conform to the shape of the woman's belly.

As can be seen in Figure 2, the central area of the interface shows graphical representations of feet in locations where the sensors have detected baby movement. It also displays hand images in places where someone has touched the display. The components that display data can be found in the four corners (Figure 2) in order to make the movements and hand touches the central focus of the interface. The session number, month and week of the mother's pregnancy term, the session duration, and the previous session are located at the top-center of the interface. It also includes a bar that moves along the right-hand side to indicate how long the session duration is in comparison to the previous session's length. The top-left hand corner displays the kick, contraction, and movement counter, with the current session's count located at the centre while the previous session's count is located at the top of the ring around the icon.

Figure 2. The user interface showing baby kicks and the location of parents' touches.

Similarly to the previous session's bar, the ring will fill with colour for the purposes of comparing the amount of movements made in the current session with the previous session's count. The top-right hand corner will display the date, time, battery power, and the "Stop/Start Session" icon for the expectant mother to touch, and it is the only corner that will facilitate touch for that purpose.
The two icons at the bottom of the interface serve as the touch counters for the spouse and the expectant mothers, with the blue counter icon representing the amount of touching made on the belly by the father and the pink icon representing the expectant mother.

Figure 3. The web interface. Users can browse through all sessions that are recorded and listed.

The goal of the design is to enhance the intimate experience of creating an emotional connection with the unborn child by allowing those who are present with the expectant mother to know where the baby's movements are located. Since expectant mothers tend to feel their belly, thus establishing a bond with their unborn child, we wish to explore how that bond grows through quantifying the amount of physical contact that not only the mothers make but also by those who are around her.

After the expectant mother has finished a session of wearing the device, the information and a screenshot of the movements can be downloaded and posted on to a website, described next.

Website

We have created an initial version of a website that will be used for sharing information downloaded from the wearable device (Figure 3). Once complete, it will allow data to transfer from the device wirelessly via Bluetooth to a computer that will upload it to the web. This is particularly convenient since the Mammibelli will automatically store the recorded data into the website, rather than having the expectant mother take extra time to manually blog or post the information. We will allow for mothers to subscribe to our website through their Facebook account.

The website will grant access to close friends and family that the new mom has selected from her Facebook list. This ensures that the information is private amongst only a close group of intimate individuals and it gives the freedom for the mother to choose who are included in the news feeds about her pregnancy. The mother may also allow these people to receive text or email alerts if they opt to be notified when the mother has posted a new session.

Usage Scenario

We now describe the design and its use through a usage scenario. Joanne is a 36-year-old woman who is 7 months pregnant. She lives with her husband, James. Since Joanne suffered a stillbirth last year, her OBGYN has instructed her to keep daily records of the amount of movement that the fetus makes in order for Joanne to be aware of any decrease in movements that may indicate complications in her pregnancy.

On a typical Sunday, Joanne notes that she needs her daily one-hour kick count recorded in order to complete her count for the month. She will discuss this during her doctor's appointment on Monday. She decides to wear the MammiBelli while she is cooking breakfast in order to have her count for the day completed. The device gives her the freedom to collect the data hands-free without having to manually do it herself. Joanne puts on the device and presses the "Start New Session" button on the display (Figure 2, top right).

Joanne notices after 10 minutes that there are two marks on the display; the baby has kicked twice. She touches the display lovingly and a mark appears representing her hand. James then walks over to where she is sitting and places both hands on her belly. The display updates to show the touches by James. Later that day, Joanne connects the MammiBelli to her computer and uploads the data to the website share with her close family members. She notices that her mother-in-law, who is one of the people she invited from her Facebook, has posted a comment, noting that the baby moved more.

Future Work

Our work-in-progress paper has described the initial stages of our research project focused on the communication and sharing needs of expectant mothers. We have interviewed pregnant and mothers and used this as design inspiration to create an initial prototype of the MammiBelli system. Our future plans include looking at the integration of flexible LED screens into the design, creating approximately 4 to 6 fully functional prototypes, and then evaluating the design with pregnant women over the course of several weeks. Since the fetus starts moving when it is 20 weeks old, the study subjects will consist of women who are between 5 to 8 months pregnant where they will wear the device for approximately one hour per day for approximately four weeks.

The types of data that will be gathered from the research will consist of the aesthetics of the design, the orientation and types of information presented on the design, the error rates that the mothers encounter (such as bodily movements that are not made by the fetus but are interpreted as such by the sensors), and the quality of the bonding experience between the pregnant mothers and their spouses through physical contact with the design as they touch the belly.

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