
Storytelling as a Space for Reflection on Parent and Child's Physical Activity Data

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Abstract

We present an opportunity to engage families with activity tracking data through storytelling—a family centric interaction that can (1) satisfy the feeling of *social connectedness*, and (2) engage parents and children in *reflection*—the process of making sense of the objectively measured data and subjectively remembered past. We will conclude the design of *Tomorrow Story*, a storytelling and PA reflection application that is driven by activity tracking data.

Author Keywords

Family; Physical activity; Reflection; Storytelling;

ACM Classification Keywords

H.5.3 [Group and Organization Interfaces]: Computer-supported cooperative work

Introduction

Healthy living begins with the family, a social environment in which positive health behaviors are modelled, influenced, and supported [27]. Meta-reviews have shown that preventive health behaviors such as smoking, diet, and physical activity (PA) are affected by family influences [5,9,14,29].

Reflective Informatics is the study of how technology can help people examine personal data, and thus facilitating knowledge or attitude transformation [1]. Baumer described the three dimensions of reflective informatics systems:

Breakdown is a surprising realization or a conflicting discovery that does not fit the individual's understanding of her world.

Inquiry is the re-examination of this previously learned knowledge.

Transformation is the process of re-conceptualization to reach a more complete understanding of the world.

Figure 1 The three dimensions of Reflective Informatics

Given the importance of family in shaping one's health, we will discuss two data relationships: *parent-child* and *child-child* relationships with *activity tracking* data. We will first describe how a system that spurs family interactions could motivate families to engage with PA data. Then, we will describe how system-mediated reflections on family PA experiences can help parents to self-discover their personal role in their child's health. Finally, we will present the design of *Tomorrow Story*, a family storytelling and reflection application that is driven by activity tracking data.

Related Work

Our work is focused on reducing the risk of childhood obesity, a public health epidemic [22] that poses widespread health risks such as diabetes and cardiovascular diseases [7,15]. Given that obesity can be prevented through regular PA [28], the increased accessibility of activity trackers has created new opportunities for health promotion through PA tracking data visualization [4,17,19,21,32]. While this prior work has shown the promise of activity trackers in improving health outcomes, we identify two gaps in the current state of research.

First, a majority of this work is not designed to support behavior change in a family unit (with work by Saksono *et al.* [26] and Stanley *et al.* [30] as notable exceptions). Yet, multiple meta-reviews have shown that families have a significant influence in shaping the PA behavior of children [5,9,31]. Second, while activity tracking has been found to be instrumental in supporting behavior change, Klasnja *et al.* highlight that individuals may relapse after they discontinue their self-tracking behavior, and maintaining the said behavior is often attributable to the support structures

that they put in place when they were self-tracking [12]. This suggests that activity tracking tools need to support families to understand their data as a means to develop the structures to support a sustainable PA behavior—particularly in a family context, where health behavior promotion begins at an early age [27].

Bentley *et al.* demonstrate that technology can support initial behavior changes by showing the correlation between activity-tracking data with self-report measures (*e.g.*, mood scales) [2]. However, such measures on their own may not be sufficient as the categorizations available to users may not fully capture the richness of one's experiences [6]. For example, a run in the park will be recorded as step count data by health sensors, yet two individuals' personal stories about such experiences can vastly differ in what they describe and the details that they emphasize [6]. This underscores the need for activity tracking tools to help individuals explore and understand their data "beyond just sensor reading" [2]. Elsdon *et al.* described the process of "exploring and understanding" data as data *appropriation*—the process of making sense of the objectively measured data with the subjectively remembered past [6]. This resonates with the *reflection* stage in Li's Personal Informatics model [16].

The role of *reflection* for facilitating health and wellbeing has been examined by Human-Computer Interaction (HCI) researchers [8,11,20]. Baumer described this emerging area of research as *reflective informatics*, the study of how technology can help people examine personal data, and thus facilitating knowledge or attitude transformation [1]. This suggests the need to understand how digital tools can support

Can you think of a time when you were playing together with your mom?
What are the good feelings that you had after that?

Figure 2. Question for Pre-contemplative users who are not physically active and have no intention to be active.

Name someone you know who has cheered you on or exercised with you. How did they make exercise more fun?
How can they help you again in the future?

Figure 3. Question for users in the Contemplative or Preparation stage—users who are not physically active but are interested in being more active and may have made plans to do so.

Think about an activity that you have been doing every week. How do you feel when you know you can do it? How do you keep this up?

Figure 4. Question for users in the Action or Maintenance question—users who have been regularly active.

reflections on physical activity tracking data that is sensitive to the uniqueness of each family [27].

Storytelling as a Venue for Family Reflection

In our prior work, we designed a family collaborative exergame that was driven by activity-tracking data [26]. The game mediates the parent-child relationship by supporting the joint pursuit of a shared goal by both the parent and child. We selected collaborative game mechanics because we were concerned that competition around data about oneself could have a negative impact on the parent-child relationship. Indeed, prior work has shown that competition in exergames can have a negative effect on both adults [17] and children [19,32]. While the majority of parents expressed their desire for in-game competition, our qualitative inquiry suggests that the desire for a competition was prompted because parents felt that the competition-driven comparisons would spark social interactions. These interactions can satisfy the need for *relatedness* (i.e., their need to feel connected with their children [24]) and drive the enjoyment of exergame use [26]. We suggest that family activity tracking tools should be designed to spur health-centric interactions, as a way to support enjoyment and engagement [26].

Based on this finding, we focused our technology design on storytelling—a recollection of past experiences that families can use to socialize and emphasize important values [3]. Therefore, storytelling can support the feeling of relatedness without the competition design element. The reflective and value-rich nature of storytelling [10] can help families to reconstruct the meaning of their PA experiences and develop the structures for sustainable PA behavior—such as PA enjoyment and parental support [31].

We began our inquiry into parent-child PA storytelling and reflection using a paper prototype simulating a technology-mediated reflection [25]. Our inquiry suggests that parents become more attuned to their behavior and their child's attitude towards PA. This mirrored the *processes of change* within the Trans-theoretical Model (TTM) of behavior change [23]. Within TTM, individuals progress through stages as they move towards a desirable behavior. Movement between stages is supported by *processes of change* (activities and experiences that enable behavior adoption). Therefore, we suggest that activity tracking data should be designed to support stage-relevant reflection [25]. Examples of such reflections are shown in Figure 2-4.

Storytelling Centric Activity Data Reflection

We are designing *Tomorrow Story*, a digital storybook that helps families reflect on their PA experiences and move towards the action stage. In this system, reflections are presented at three points during user's interaction: (1) on the subplots, (2) during daily self-monitoring, and (3) during a failure to meet PA goal.

Reflection on story subplots

The storybooks in *Tomorrow Story* are composed of multiple subplots that are connected with cliffhangers, aimed to spur family interactions as well as to engage the family with the story [18]. Every subplot has a stage-relevant PA theme and a reflection question. When a family reaches the cliffhanger of a subplot, they must select a one-week PA goal to continue reading the story. The story will proceed based on their PA data.

This mode of reflection is composed of three stages. In the first stage, the system will ask the family to reflect and tell a story about their PA experience. Then, the

You were moderately active for 15 minutes at 12 pm today. How much of a BigMac™ did you burn off?

Figure 5. Reflection for daily self-monitoring. The system will search for a PA episode in the activity tracking data and connect it with food consumption metric.

Imagine that you are the character, and you are not as active as you want to be. What do you want the character's Mom to say?

Figure 6. Reflection question for a precontemplative family who did not meet their goal.

Imagine that you are the character, and you are not as active as you want. How might you deal with this?

Figure 7. Reflection question for an action stage family who did not meet their goal

system will give a follow-up question to focus the story to a specific PA correlates. For example, **Figure 2** is an example of a follow-up question to help discover the emotional benefits of PA, a *consciousness raising* process in the TTM. Finally, the system will present a concluding statement to help the family to realize the meaning of their answers. As their answers will be audio recorded, the family will accumulate qualitative answers about their experiences that are focused to PA correlates. These qualitative data can be used to help them constructing the support structures to maintain a sustained PA behavior.

Reflection during daily self-monitoring

As a family progresses through the week and self-monitor their progress, the system will engage the family in an experiential learning process [13] by asking them to reflect on their PA during the day and its relationship with nutrition. The system will tailor the question to the family's experience by searching for specific PA episodes in the PA data and construct a relevant question about food consumption (**Figure 5**).

Reflection during a failure in family's goal

At the end of the week, the family will discover the resolution of a cliffhanger if they meet their PA goal. When a pre-contemplative family misses their goal (which is reflected in their PA data visualization), the system will present a role-playing question to help families manage the negative experience to a positive one (**Figure 6**). Similarly, an family in the action stage will be presented with a role-playing question to manage relapse (**Figure 7**).

Our observations show that family storytelling and reflection interactions are messy and frequently do not

go as planned. However, the parents in our study guided and adjusted the reflection process which suggests that parents can appropriate a family reflection to better suit the uniqueness of their family [25]. Therefore, systems for reflection should facilitate each family's uniqueness by giving some flexibility to the parent to adjust and readjust the reflection.

However, introducing flexibility can potentially impact the parent-child discourse in a negative way. This can be particularly challenging if the reflection on data is not constantly monitored by a health professional. For example, a family discourse could steer towards a reflection of a negative experience that can be distressful for children [25]. We suggest that more work is needed to understand how reflective informatics system can minimize such risk.

Conclusion

We discuss *Tomorrow Story*, a data-driven family storytelling application and its three modes of physical activity reflections. We give an example of reflection questions that are appropriate to individuals' readiness to change. We also highlight the value of having a flexibility in a technology-mediated reflection and the potential negative consequence that might arise.

Authors

Herman Saksono is a Ph.D. student in Human Computer Interaction (HCI) and Personal Health Informatics (PHI). He examines how technology-mediated reflection, gamification, and storytelling can help individuals attain a healthy lifestyle. Andrea G. Parker is an Assistant Professor whose HCI and PHI research involves the design and evaluation of social computing tools for vulnerable populations.

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