
Playing with Your Data: Towards Personal Informatics Driven Games

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Abstract

Personal Informatics technologies and the quantified-self movement focus on helping people collect personally meaningful information to gain self-knowledge, which can go hand in hand with the drive to change behavior or improve oneself. The field of serious games examines how games can be used for purposes beyond entertainment, with common applications in areas such as education, training, or health care. This workshop paper overviews our research aimed at bridging and expanding the scopes of these fields through the design of personal informatics driven games: gameful and playful approaches to data capture, self-reflection, and behavioral intervention.

Author Keywords

Personal Informatics; Quantified Self; Games; Toys; Play

ACM Classification Keywords

H.5.m [Information Interfaces and Presentation (e.g., HCI)]: Miscellaneous; K.8.0 [Personal Computing]: Games

Introduction

Games are a powerful medium, and digital games in particular have a captivating ability to create deeply engaging experiences. Recognizing this, designers of interactive systems — including personal informatics (PI) tools — are increasingly using games (or game elements, i.e., gamifi-

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Figure 1: Our pressure-sensitive tangible self-report device for pain that can be embedded into serious toys in order to improve data capture from children

ation) to increase user motivation, adherence, and enjoyment. As gameful design continues to gain traction within HCI, we see a tremendous opportunity for digital games to connect more richly with our real-life behaviors and goals.

Potential impacts could be considered game-to-world or world-to-game. Serious games yield the former as they are intended to provide a player with real-world takeaways (e.g., knowledge, skills, or fitness improvements). The latter is less commonly encountered.

By developing prototypes that integrate real-world tasks (e.g., snapping photographs, taking public transportation, or doing volunteer activities) with in-game actions, exploratory HCI research has demonstrated the promise of world-to-game approaches for incentivizing pursuit of personal and social goals [5]. Today, a handful of commercial games do incorporate social media data, for instance from Facebook (e.g., Who?¹) or Twitter (e.g., Twirdie²). However, most games use sparse amounts of personal information as part of play, player-generated data generally has no impact on game dynamics, and most importantly, few studies have been undertaken to understand the range of uses and implications this approach might have.

Our research examines ways that gameful designs can help capture personal information as well as ways that games can transform such data into personally meaningful experiences and positive real-life impacts. In this paper, we overview our work exploring how games and toys can make manual self-tracking more reliable and less burdensome, what it means to literally play with personal data, and how personal-data-driven games can support individuals' self-management and behavior change goals.

¹<http://www.whothegame.com/>

²<http://www.twirdie.com/>

Games for Data Capture

A central aspect of personal informatics is gathering information about behaviors, experiences, or various other aspects of oneself that are of personal interest. However, burdens associated with common techniques (e.g., diaries, surveys, or ecological momentary assessments) present challenges, especially when incorporated into personal informatics systems intended for long-term, in-situ use.

In response, HCI researchers are increasingly designing more usable modalities such as more visually engaging interfaces or smart physical objects. Pursuing play-based approaches that promote adherence, data quality, and positive user experiences, one strand of our work investigates the use of toys and games as an alternative strategy for data capture of subjective or objective measures.

Consider the case of children, where it is difficult to precisely and reliably capture perceptions — for instance of pain intensity — through standard instruments. Investigating innovative forms of self-report, we have been developing a novel pressure-based tangible user interface shown in Figure 1 that is inspired by the way those experiencing pain grasp nearby objects or a loved one's hand [1]. For the pediatric context, we are designing ways to embed this sensor into toy-based form factors such as a squeezable teddy bear. Going forward, we aim to explore additional designs and application areas for such “serious toys”.

In the context of alertness assessment, stimulus-response tests such as the Psychomotor Vigilance Task (PVT) are commonly used to objectively capture personal data. However, such tools are known to be cumbersome and are particularly susceptible to in adherence when used outside of laboratory settings — for instance during everyday PI practices. Indeed, in our own research that made use of a smartphone version of the PVT [6], participants unani-



Figure 2: Our prototype game for collecting alertness data

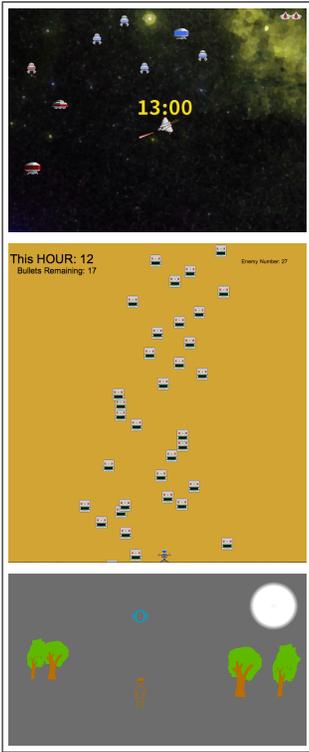


Figure 3: Variants of PlayMail, our ludic email game that supports awareness of personal patterns by mapping email usage attributes onto gameplay dynamics



Figure 4: Our picture-matching game injected with personal photographs to support self reflection and social reminiscence

mously expressed its highly burdensome nature and the improbability they would use it outside our study.

Further feedback from participants and follow-up design processes led us to explore game-based interactions as an input mechanism for collecting personal cognitive performance data. As first steps, we are prototyping (see Figure 2) and working to validate mobile versions of familiar Whack-A-Mole style games for alertness assessment as well as more novel games, such as a word stem generation game based on established psychological instruments for the evaluation of higher order cognitive functions.

Games for Discovery and Reflection

Our second area of work focuses on creating personal-data-driven games to support self-discovery and reflection about one's self, behaviors, and past. Using personal information extracted from sources such as Gmail and Facebook, we are building a series of "tailor-made" games and conducting user evaluations to investigate engagement and the individual impact of these types of playful interactions with data. To date, we have focused on creating personalized adaptations of familiar games so that the difference from the norm is more apparent.

PlayMail uses a game metaphor to abstract personal email data into a ludic experience. Today, many people spend significant time tending to email and can struggle with effectively managing it. Email analytics tools like Gmail Meter³ provide statistics and graphs as a way to help people improve email practices. Communicating aspects of personal email data that are harder to access through traditional visualizations, PlayMail aims to help people discover and make sense of their own email patterns as well as gain insights and empathy about other email users through modes

³<http://www.gmailmeter.com/>

for two players or alternate personas (e.g., "Play as an Administrative Assistant").

We have created several PlayMail variants (e.g., adapting classic games like Asteroids, Space Invaders, and High Noon), as illustrated in Figure 3. Consistent to each design is a tight mapping between characteristics of the underlying data and gameplay elements. For example, in the Asteroids-style version, the number of enemy ships corresponds to the number of emails the player receives at the time of day being played in the game, the types of those enemy ships correspond to types of email senders, and the player's number of available bullets corresponds to that individual's number of sent emails.

Turning to ways to facilitate reflection, reminiscence, and maintenance of social connections, we have injected social media data into a memory game similar to Concentration, where a player flips over pairs of face-down cards in an attempt to match cards' photos and gain points. In our personalized version, shown in Figure 4, game material is drawn from a player's photos in social media networks like Facebook or from that person's smartphone camera roll. A multi-player variant also enables investigation of the use of PI games as icebreakers, storytelling tools, or vehicles for collaboratively making sense of personal information.

Games for Behavior Change and Intervention

For many individuals, the value in exploring personal data stems from a desire to translate gleaned self-knowledge into self-improvement strategies. Aiming to support PI motives related to behavior change, our final line of research deals with developing games that support self-experimentation, actionable feedback, and guided intervention.



Figure 5: Stress Fighter, our exergame stress intervention that maps daily stress levels onto opponent attributes and in-game biofeedback onto player performance

Type of Data	Examples
Health Data	Food intake, nutrition, exercise, sleep, health conditions
Physiological, Behavioral, and Soft Biometrics	Pulse, blood pressure, arousal, skin temperature, brain signals, eye gaze, motion detection, facial recognition, speech, height, weight
Technology Usage	Browsing history, app use logs, energy consumption
Context	Geo-location, movement, time, weather, light
Interpersonal Activity	Calls, texts, emails, social media

Table 1: A sampling of personal information that could be captured or examined via games or toys

Focusing on applications for mood and stress management, we are incorporating biofeedback passively collected through off-the-shelf wearables into custom games that deliver relaxation interventions to players. Stress Fighter, shown in Figure 5 and based on the classic game Street Fighter, is an exergame-style game we designed, where attributes of the opponent “boss” character correspond to the player’s sensed stress levels that day. Encouraging full body movement, Stress Fighter continues to capture and incorporate biofeedback during gameplay as well, since physical exertion itself can help tackle stress.

Compared to existing games incorporating biometric data, where the dominant game mechanic is instructing players to try altering their physiological measures in order to make something happen in the game (e.g., instructing players to relax in order to make a sun rise or change the color of ambient lights [7]), Stress Fighter allows us to study more subconscious approaches to stress reduction through play.

Inspired by games like EyeSpy, where searching for the approving face in a crowd of frowns is used to help recondition the mindsets of people with low self-esteem [3] or Play Attention, where neurofeedback is used to control game elements and in turn improve ADHD symptoms [8], our next step is exploring how games can be used as part of psychological or cognitive therapy. In particular, we are interested in the therapeutic role of video games in nonpharmacological treatments for managing mental illnesses such as bipolar disorder, for instance to help combat periods of depression or act as a safe outlet during manic episodes.

Significance to the PI/QS Workshop

Whether designed for entertainment or more serious purposes, games have an extraordinary potential to shape an individual’s mindset, behavior, and overall well-being.

By exploring creative ways to connect games with personal data, our research aims to contribute design patterns that aid the creation of personally meaningful, tailor-made games that can guide personal discovery and development.

Having only scratched the surface of opportunities for these personal informatics games in our work to-date, we see a vast design space to continue traversing going forward. For instance, there is a wide-range of personal data that could be captured through or plugged into games. Table 1 provides some promising examples of “playable” data [4], and it would be worthwhile to more deeply contemplate which among these and other data would be more or less conducive, appropriate, and helpful to incorporate into gameful experiences.

Moving beyond gamification, there is also a significant opportunity to study what gameplay dynamics are particularly compelling when playing with one’s own data, how personal goals might shape game mechanic choices, and what methods are most effective to evaluate the impact of PI games. Similarly, it is necessary to more fully examine the perceived value and receptivity of such systems that enable individuals to engage with personal information in such novel (and hence under-studied) ways.

In addition, it is important to consider potentially detrimental aspects or risks of personal informatics games, such as issues related to privacy, misinterpretation (mappings of data to game experience are non-perfect), and where care must be taken to not cross a line into “exploitationware” [2].

Finally, there is much room to investigate the application areas where novel solutions to PI challenges are most pressing as well as domains where personal informatics games would be particularly opportune, fitting, and well-received.

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