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TOWARD AN UNDERSTANDING OF THE INFLUENCES OF MEANINGFUL FRAMING ON USER PARTICIPATION IN A GAMIFIED INFORMATION SYSTEM

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Research in Progress

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Abstract

Gamification with meaningful framing is a diegetic gamification approach that goes beyond points, badges, and leaderboards. Diegesis – the notion of connecting elements of the game, including tasks, narratives and stories – can help to imbue even very work-centric games with fantasy and a meaningful framing. This study proposes to investigate the influences of such meaningful framing, including meaningful framing of the game and the meaningful framing of the task, on users' participation in a gamified information system. We apply the S-O-R framework to construct interrelationships among a story-based game environment, user engagement, and player behaviors and propose a research model with hypotheses. We aim to uncover the role of story-based gamification in information systems research and encourage more research investigations in this direction.

Keywords: Gamification, Meaningful Framing, Stimulus-Organism-Response, Citizen Science

1 Introduction

The advancement of information technology now allows the possibility to recruit workers from online spaces. As a result, ways of leveraging the power of crowdsourced workforces have become an intriguing research topic for many researchers (Howe, 2008; Leimeister, Huber, Bretschneider, & Krcmar, 2009). Citizen science systems are one type of crowdsourced information system designed to recruit members of the public to participate in scientific activities. Though some sciences are "charismatic" and naturally attract participants (e.g. astronomy[1], birding[2]), many others are not. Furthermore, science tasks, even in charismatic sciences, can often be repetitive and tedious, e.g. picture annotation, classification, tagging, and so on. Therefore, it is of great importance to attract and sustain participants and to ensure the quality of their contributions.

Gamification has been considered an approach with great potential to engage crowdsourced workforces in non-game activities, allowing many people to simultaneously address large-scale problems while playing games (von Ahn, 2006). Extant research studied gamification from different perspectives. Deterding et al. (2011) defines gamification as the use of game elements in non-game contexts, and von Ahn (2006) further contends the injection of game elements into non-game contexts can motivate and engage players. Huotari and Hamari (2016) explicity emphasizes the motivational and psychological states afforded by gamification, which lead to users' overall value creation.

[1] http://www.galaxyzoo.org/

[2] http://ebird.org/

We concur that gamification is an approach that aims to afford gameful experiences, yet we are neutral on whether gamification requires a non-game context or not. For example, von Ahn's notion of "games with a purpose" (von Ahn, 2006) seems not to distinguish between tasks that have had game-like elements appended to them vs. full games that are then embedded with some real-world activity. In both cases, gamification is implemented through a collection of game elements that motivate players to accomplish some task or activity, whether the context originates as a game or not. Accordingly, in this research, we use the term "gamification" in a broad sense, using it as an identifier for experiences where purposeful activities are married to play for the purposes of motivation and engagement.

Three commonly used game design elements include points, badges, and leaderboards (Schlagenhaufer & Amberg, 2015). These points-based game elements mostly reflect player's progress and show a quantified approximation of their contribution. These game elements have been demonstrated to be effective in encouraging user participation, yet researchers have also noted concerns that these points-based rewards can be demotivating for participants in the long run (Eveleigh, Jennett, Blandford, Brohan, & Cox, 2014). Several prior studies have attempted to investigate the effects of other gamification approaches in citizen science projects, and some researchers have recently suggested that a more story-oriented approach to gamification could lead to enhanced play experiences for participants (Elson, Breuer, Ivory, & Quandt, 2014; Halan, Rossen, Cendan, & Lok, 2010; Prestopnik & Tang, 2015). For many participants, plots or stories can be an effective way of keeping them engaged for longer period of time, and many highly popular entertainment games rely upon story as a central element of the play experience (Eveleigh, Jennett, Lynn, & Cox, 2013).

Story-based gamification is a way of attaching meaningful framing to non-game activities, providing something beyond points, badges, or leaderboards. We propose to interpret meaningful framing of gamified citizen science systems twofold: meaningful framing of the game and meaningful framing of the task. Meaningful framing of the game refers to the storyline of the game, with an embedded, achievement-oriented goal system and a virtual world to explore. Every step forward in the system means something to players, helping them to open new spaces in the game world. Meaningful framing of the task relates to the value of contributing to embedded scientific tasks, informing the players the significance of their contribution to scientific community.

Our study contributes to extant literature in several ways. Story-based gamification approach in non-game tasks and contexts are not well-studied, so our study aims to further investigate the influences of story-based gamification on users' psychological states and behaviors. Our study fills in the gap of gamification research in the area of information systems. In recent years, gamification approaches have emerged to modify or improve information systems so as to attract and engage participants. Also, Extant research has mostly focused on mechanical game elements, such as rewards, status, and achievements (Suh, Wagner, & Lili, 2015); investigations of story-based gamification are pioneering efforts in the context of information systems research. We purposely designed the gamified information systems with two layers of meaningful framing. Unlike prior explorative and descriptive research (Bowser et al., 2013; Rotman et al., 2012), our study is theoretically grounded in the Stimulus-Organism-Response model and we proposes a research model that depicts how meaningful framing influences player's game engagement and behavioral outcomes. Our study intends to address the following research question:

RQ: How does meaningful framing via game narratives engage participants in gamified information systems?

2 Related Work

2.1 Gamification in IS Research

In information systems research, gamification is not a completely new area for study. Extant studies have identified the connection between information systems research and gamification research (Broer & Poeppelbuss, 2013; Schlagenhaufer & Amberg, 2015). Though not often termed as "gamification",

information systems researchers have used similar terms to denote gamification techniques, including terms such as games or game elements, play design, rewards, incentives, and scores, as well as terms relating to the intended outcomes of using gamification approach, including engagement, flow, and adoption (Broer & Poeppelbuss, 2013). These studies on gamification indicate the known importance of game-like environments and their connection to technology use behavior (Broer & Poeppelbuss, 2013). Game elements are becoming important design factors with profound effects on technology use, and gamification is becoming an important way to engage information systems users. Yet the extant research on gamification is at its early stages in the information systems discipline. Many questions remain unanswered. For instance, what are the game elements that can be applied to information systems? How might gamified information systems be adopted or used differently from traditional information systems? What theories are applicable in the research on gamified information systems? Overall, gamification offers a new paradigm for information system design and introduces a new perspective for IS research. Further research is needed to clarify the why and how gamified information systems make a difference.

2.2 Stimulus-Organism-Response Framework

The stimulus-organism-response (S-O-R) framework from environmental psychology lays out three critical components of person-environment interaction and suggests associations among those components: stimulus, organism, and response (Mehrabian & Russell, 1974). Stimuli in the environment are design elements that trigger internal processes inside a human's (organism's) mind, which then affect behavioral responses or behavioral tendencies. Two typical responses are approach and avoidance. Approach refers to actions that lead one toward the stimuli, such as stay, explore, work, and affiliate (Mehrabian & Russell, 1974). Avoidance indicates actions that keep one away from the stimuli, describing a person's behavior not to stay, explore, work, or affiliate (Mehrabian & Russell, 1974). The S-O-R framework has a widespread adoption in research, including purchasing behavior and technology use (Deng & Poole, 2010; Eroglu, Machleit, & Davis, 2003; Vieira, 2013), as it delineates a picture of how environment and human actor interplay with each other.

Interest in gamification techniques for citizen science has been growing steadily, yet the underlying mechanisms of how different gamification approaches take effect is not well understood. The S-O-R framework argues a role for environmental stimuli that influence an internal state and behavioral response. We consider the S-O-R framework be an appropriate framework to guide our research investigation. Interactive stories, as told through various game mechanics, are a powerful stimulus. Once experienced, they become an internalized element of the player's experience, an ineffable yet potent driver of resulting play behaviors, including task behaviors. As such, the S-O-R framework provides a guideline to understand how story-based gamification can impact players' experiences and eventually their behaviors. Figure 1 depicts the proposed research model.

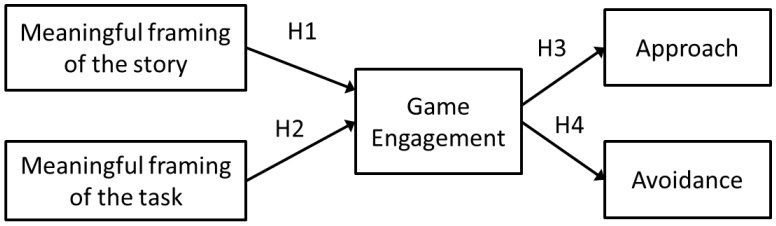

Figure 1. A Proposal Research Model

2.3 Gamification with Meaningful Framing

Incorporating game elements into repetitive and monotone tasks can make participation more fun and enjoyable (Flatla, Gutwin, Nacke, Bateman, & Mandryk, 2011). Game elements usually include two principal components: mechanics and narratives (Elson et al., 2014). Mechanics comprise the game "rules" and define the options for interaction in and with a game. Three top game mechanics that are applied in gamified information systems are points, badges, and leaderboards, all of which are directed

primarily at competitive forms of play. Some researchers argue that points-based gamification focus too much on techniques such as points, scores, and badges (Bogost, 2011). Gamification should not merely include points-based mechanics; instead, gamification covers a much broader category of features.

Game narratives, the other principal game design component, are "stories with a beginning, middle, and end that provide information about the characters and plot" (Lu, 2015, p. 19). The game narrative tells the story and presents a bigger picture for players to comprehend and move forward. Thus, the meaning of game resides in game narratives. Meaningful framing refers to statements presented by the system about the mission, goal, or in-depth meaning of user behaviors, which helps to attach an activity – e.g. science tasks or game objectives – to the player's personal goals and interests (Elisa D. Mekler, Florian Brühlmann, Klaus Opwis, & Alexandre N. Tuch, 2013a). This meaningful framing gives compelling reasons – beyond competition – for players to work on embedded non-game tasks. For instance, in *Forgotten Island*, players follow the storyline to unlock new areas of the virtual world and to find out what happened to their character and other characters in the game. Because of the story, they have meaningful reasons to work on scientific tasks and earn in-game money.

Experiences in games emerge from the dynamic interaction with game environment. Story-based gamification indicates a more dynamic, user-centric experience, and players enjoy the games partially because of their stories (Schneider, Lang, Shin, & Bradley, 2004). A few studies have noticed the importance of meaningful framing in encouraging player participation and improving data quality in citizen science projects (Bowser et al., 2013; Mekler et al., 2013a), yet more research effort is needed to address the gap in the literature.

2.4 Game Engagement

Gamification is considered as a significant motivating technique for engaging users in different contexts, making some repetitive tasks more fun and enjoyable (Flatla et al., 2011), or improving employees' motivation and performance in organizational activities (Liu, Li, & Santhanam, Forthcoming). Especially in the realm of citizen science research, studies have identified the importance of game design elements in stimulating positive psychological outcomes from participants (Hamari, Koivisto, & Sarsa, 2014). A few related constructs also denote the psychological outcomes of using information systems, include flow (Csikszentmihalyi, 1991), immersion, and engagement (Hamari et al., 2014).

Game engagement refers to the player's state when interacting with a game. Game engagement is stimulated by game design elements, and in turn, influences players' behavioral outcomes. Game engagement is a part of game experiences, encompassing multiple dimensions of a player's subjective feelings (Gajadhar, Kort, & IJsselsteijn, 2008). Brockmyer et al. (2009) conceptualize game engagement as a generic indicator of game involvement, and other relevant concepts, such as immersion, flow, psychological absorption, indicate the progression of ever-deeper engagement.

People can participant in online gaming for different reasons. Among those motives, being part of a story is one interesting reason for users to work on embedded tasks. Narratives or stories make players focus on events occurring in the game and transport them into a story (Green and Brock, 2000). Mekler et al. (2013b) compared points-based and meaning-based gamification systems and found that meaning played an important role in encouraging user engagement. In *Forgotten Island*, meaningful framing of the game, that is, the storyline, is intentionally designed to allow players to follow a meaningful line when exploring the game world and working on in-game tasks. The framing of the game also establish an in-game goal system for players to achieve. This goal system can give challenges to players and make them feel more engaged with the game. Therefore, we hypothesize:

H1: Meaningful framing of the game positively influences game engagement.

Meaning framing of the task informs the add-on value of working on in-game classification, Players aware of their potential contribution to science if they carefully work on those tasks. Keeping this in

mind, players will give more attention to classification tasks and care more about their performance when they read feedback message. Thus, we hypothesize:

H2: Meaningful framing of the task positively influences game engagement.

2.5 Behavioral Outcomes

Approach and avoidance describe some fundamental differences that are reflected in behavioral responses. Approach and avoidance can be in any combination of one or more types of behaviors: (1) stay (approach) or leave (avoidance); (2) further explore and interact (approach) or ignore (avoidance); (3) communicate with others (approach) or ignore them (avoidance); and (4) feelings of satisfaction (approach) or dissatisfaction (avoidance) with service experience (Bitner, 1992; Donovan & Rossiter, 1982; Turley & Milliman, 2000). In the citizen science game world, when player experiences game engagement, it is very likely that they would like to stay in the game environment, exploring and interacting with the game world. On the other hand, if they don't feel engaged with the game environment, they will probably choose to leave the game, that is, to avoid playing the game. Therefore, we hypothesize:

H3: Game engagement positively influences a player's approach behavior.

H4: Game engagement negatively influences a player's avoidance behavior.

To examine the influences of a meaningful, story-based gamification approach, we designed a game, *Forgotten Island*, as a vehicle for study. *Forgotten Island* is designed to support a real-world, crowdsourced science activity (taxonomic classification of living things). Players are informed the meaning of working on the classification task. It is also designed around a storyline that leads players to explore and interact with a game world and story, motivating them to complete scientific tasks. *Forgotten Island* is part of an ongoing exploration of citizen science and gamification, and so is also purpose-built as a tool for information systems inquiry. We introduce details of Forgotten Island in the following section.

3 Gamified Citizen Science System——Forgotten Island

In the life sciences, experts and enthusiasts routinely collect photographs of living things, captured with digital cameras or cell phones that automatically tag them with time and location metadata. These photos are only valuable, however, when the subject of the photograph (the plant, animal, or insect captured) is known and expressed in scientific terms, i.e., by scientific species name. Such information is rarely recorded when the photograph is captured in the field. Biologists use taxonomic keys to guide their identification of species. These keys are organized around character-state combinations (i.e., attributes and values). For example, a character useful for identifying a moth is its "orbicular spot," with states including, "absent," "dark," "light," etc. If sufficient characters and states are identified for a single specimen, it is possible to classify to family, genus, and even species.

Forgotten Island is designed to assist scientists with taxonomic classification through crowdsourcing. *Forgotten Island* was built as a part of a suite of systems called *Citizen Sort*[3], and is a story-driven, gamified information system where taxonomic classification is embedded into a point-and-click adventure. *Forgotten Island* employs two layers of meaning described in section one. The story is a created meaning, intended to engage players and give them a variety of reasons to play. From the first moments, *Forgotten Island* also explicitly tells players about the importance of their scientific contribution, providing external, real-world meaning (see Figure 2).

[3] http://www.citizensort.org

Figure 2. The Forgotten Island welcome page.

The large and complex game world includes a unique, visually and aurally stimulating world to explore, a mystery narrative that paces the game and provides twists, payoffs, and goals for the player to pursue, humorous characters to interact with (e.g., Figure 3), and a variety of puzzles and other activities to engage in during play. These features are intended to attract otherwise uninterested players and "seduce" (Jafarinaimi, 2012) them into repeatedly doing small bits of science in exchange for several hours of enjoyable interactive entertainment. The science itself is done through a device called the *Atomic Classifier*. Players are tasked with answering character-state questions about photos they collect throughout the game, using a drag-and drop interface. Most photos in *Forgotten Island* are unclassified; the player is contributing data by answering the questions. Some photos, however, already have known gold standard answers generated by scientists. These photos are used to periodically score the game (about 1 in every 5 classifications) and verify player performance. Poor classifications are noted with a warning from the game's antagonist, along with a breakdown of the player's correct and incorrect decisions. This feedback is framed by the created story meaning, but directly reflects the real-world scientific meaning of the activity.

Figure 3. The science task is embedded in Forgotten Island's story.

In Forgotten Island, players need to find or purchase various items and equipment to move forward, and this requires in-game money to accomplish. Money is earned using the Atomic Classifier (i.e. by undertaking the science task) (see Figure 4). We note that the Atomic Classifier is more than simply an

obstacle imposed upon players to throttle their progress in the game. Rather, the classifier is presented to players as an integral part of the story, with the game's antagonist framing the classification task as a form of penance for perceived wrongs. The main character of the game explicitly decides to play along in hopes of unlocking the secrets of the island and his/her forgotten past.

Figure 4. The Interface of Atomic Classifier.

New puzzles and goals are assigned to the player as the story unfolds, necessitating more exploration, new items, game money, and regular classification interactions. The interlocking dependencies of Forgotten Island (exploration is needed to advance the story, items are needed in order to explore, money is needed to acquire items, and classifications are needed to earn money) mean that the player is rarely forced to focus on the science task for long durations. Rather, the game oscillates between various kinds of play, demanding engagement with the science task only at irregular intervals. This story and mechanic-based framing helps to make the science activity meaningful to players within the game world as well as within the real world of scientific contribution. Classifying pictures of living things becomes an aspect of narrative and an important and necessary game mechanic.

4 Methodology

The aim of this study is to investigate the influences of meaningful framing on users' game engagement and their behaviors. We are also interested in observing players' actual play data, which can complement our findings from the subjective data. Currently, *Citizen Sort* has attracted more than 5,000 users. Users who sign up to participate provide their email address, along with some preliminary information about their demographics and interest in science, nature, and games. Through the provided email address, we are able to reach out to players who have used the system with some regularity to follow-up about their participation and interest. We will send invitation emails to registered users and send another two reminders if they do not respond within certain period of time.

Data will be obtained from two sources, the actual play data recorded in the game system and an online survey. Total numbers of classifications that players have completed, as well as the quality of their contributions, will be retrieved from the game system. Two constructs, meaningful framing of the game and meaningful framing of the task, are new in the literature. We will follow the guideline of instrument development to create measurements of these two constructs(Moore & Benbasat, 1991). Measurements of other constructs are adapted from prior research on game engagement measurements (Brockmyer et al., 2009), and approach and avoidance behaviors (Mehrabian & Russell, 1974). We will adapt the measurements to fit our research contexts. For the structured quantitative data, we will use PLS-SEM to validate our research hypotheses.

From a qualitative standpoint, we are especially interested to understand how different elements of a story -driven game can motivate and inspire people to participate in a public, crowdsourced scientific activity. Especially, we are interested to learn more about how a story-driven framing of a science activity can influence individuals understanding of that activity, how seriously they take it, how meaningful it becomes to them over time. We are interested to use both quantitative and qualitative data together to organize such findings in a coherent and structured picture that can guide future study.

Accordingly, we intend to ask open-ended response questions in our online survey, connecting these to the more explicitly quantitative data we also collect. Open-ended responses will be analyzed using content analysis or other interpretive techniques, allowing us to probe the meaning of our quantitative data.

5 Expected Contribution

Gamification is a trend for information systems design, receiving increasing interest from both practices and research community. Our research contributes to the progress of gamification research in information systems in several ways.

First, we explicitly investigate the application of gamification approach in the design of information systems. Unlike prior studies that mostly focus on points-based measurements, we are interested in how meaningful framing of gamified information systems affect player's engagement and participation behaviors. Theoretically, we posit to apply the S-O-R framework to guide this research investigation, providing a more solid theoretical foundation to explain the influences of story-based gamification approach in non-game systems. Methodologically, this study will answer the call for survey research to attain more accurate linkages among game design elements, psychological effects, and behavioral outcomes (Hamari, 2015). In addition, we will integrate subjective and objective data collected from different sources to present a better picture of user's reactions to the gamified information systems. Practically, we hope this meaningful framing of gamified information systems can be a more common approach for system designers, engaging more people and resulting in more potent crowd-based scientific inquiry.

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