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Creating a Theory-Based Research Agenda for Gamification

Full Paper

Lisa-Maria Putz
University of Applied Sciences Upper Austria
lisa-maria.putz@fh-steyr.at

Horst Treiblmaier
University of Applied Sciences Upper Austria
horst.treiblmaier@fh-steyr.at

Abstract

Gamification is a topic which has recently gained significant attention in the IS community due to its relevance for both practitioners and academics. Being a boundary-spanning subject by nature, it also attracts interest from scholars from diverse non-IS communities, including education, marketing and business administration. In this paper we develop a research agenda for gamification which explicitly takes into account the important role of theory. An interdisciplinary expert panel evaluated and selected theories being relevant for gamification and subsequently derived research questions. Based on the respective theoretical background the resulting questions cover different aspects of the gamification domain. We conclude that taking a multi-theoretical perspective in the creation of a research agenda helps to produce a holistic picture, which allows classifying subsequent research and helps in structuring a domain.

Keywords

Gamification, Research Agenda, Theories in IS Research, Attitudinal Change, Behavioral Change, Education

Introduction

For centuries, people of all ages have been playing games for fun and occasionally also for profit. Recent research has shown that such activities not only serve hedonic or monetary purposes, but can equally be applied for achieving educational goals (Muntean, 2011). A popular form of active learning which is increasingly gaining attention in the academic community is gamification, which can be defined as "the use of design elements characteristic for games in non-game contexts" (Deterding *et al.*, 2011a, p. 13). Such elements, which are frequently deployed to gamify applications, include avatars, feedback, points, ranks, levels, competitions, challenges, rewards, badges or reputations. Well-known examples of gamified applications are LinkedIn, Foursquare (business/marketing), Nike+ (health) and EcoIsland (education) (Deterding *et al.*, 2011a; Deterding *et al.*, 2011b; Hamari *et al.*, 2014). One major goal in the gamification of educational applications is to enhance students' intrinsic motivation and to subsequently improve their learning results. This is achieved by creating personal engagement which in turn is crucial for achieving a positive learning performance (Hamari, 2013; Deterding *et al.*, 2011a).

Hamari *et al.* (2014) created a conceptual framework for gamification based on motivational affordances, psychological and behavioral outcomes. They conclude that gamification yields positive outcomes and highlight the need for a strong theoretical base. So far, only limited academic attention has been paid to create a well-established theoretical framework for gamification. Additionally, the impact of gamified applications on individuals' attitudes and behaviors has been largely ignored and a theoretically sound foundation explaining such effects is missing.

The necessity of creating agendas for new research domains is largely undisputed, as is the importance of theory in IS research. The former involves carefully conceptualizing the research domain under

investigation, e.g. by creating definitions and typologies and coming up with questions guiding further research (e.g. Kane *et al.*, 2014). As far as the latter is concerned, Gregor (2006) classified theories according to their goals into five major categories: (1) analysis, (2) explanation, (3) prediction, (4) explanation and prediction and (5) design and action. She illustrates what kind of interrelationships between those five types exist and concludes that it is in fact the mix of various theory types which gives IS research "a distinctive character" (p. 634). We combine these two approaches and suggest to explicitly acknowledge the important role of theories in the creation of a gamification research agenda.

A useful metaphor to illustrate how our predispositions shape the way in which we select and design our research approach is the ancient Indian metaphor of the blind man and the elephant. Various versions of this tale exist, but the main message is that a group of blind men get to touch an elephant in order to understand what it is like. Depending on which body parts they feel, they come up with different conclusions. We argue that the same holds true for academic research, with different theories constituting the initial mindset of a researcher. Figure 1 illustrates this idea. Based on her scholarly background (and the familiarity with different theories) as well as her research interests, a researcher will tend to choose one or more theories to investigate a specific subject. The research design and all further conclusions heavily depend on this initial choice. Explicitly evaluating the potential contribution of various theories in the creation of a domain might help researchers to put their own contribution into perspective or, in line with the elephant metaphor, to reconstruct the "big grey something" piece by piece. Additionally, structuring a domain in such a way also helps in identifying existing research gaps. In this paper we develop a research agenda for gamification based on a critical evaluation of suitable theories. This agenda will finally include research questions which may serve as a starting point for further study in this field.

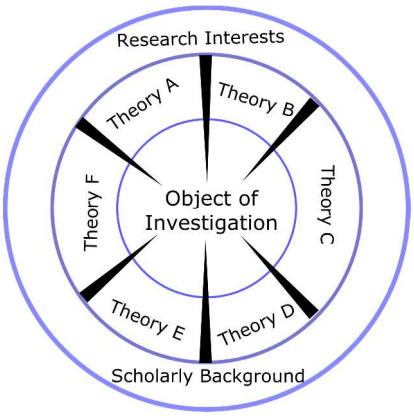

Figure 1: A Theoretical Lens

This paper is organized as follows. First, we explain the methodological background, which includes the formation of an expert panel as well as the process of theory selection. Second, we discuss the appropriateness and/or the implications of each theory sequentially. Finally, we wrap up our findings and comment on the suitability of our approach.

Methodology

Step 1: Identification of Relevant Theories

As a first step, we identified theories which are frequently used in Information Systems literature. Such collections of theories, which are publicly available, include the IS theories WIKI (Larsen *et al.*, 2014) and the webpage of the University of Twente (University of Twente, 2014). Additionally, we incorporated theories listed by Kapp (2012), who performed a literature review on theories which are specifically useful for gamification in education. Other theories were added "ad lib" if they have been previously applied to gamification studies in academic literature, as was the case e.g. for the "Homo Ludens" theory. In total, this approach resulted in an initial list of 158 theories.

Theories were classified as suitable for this project if they focus on individuals' attitudinal or behavioral changes (in a broad sense) as a result of a specific gamification stimulus. At the beginning, all theories were evaluated independently by five researchers with a background in IS, logistics and didactics. Subsequently, we discussed the individual results within the research team. If a theory was deemed relevant by all researchers, it was included in our final list. In case of inconsistent results, a third party validation was conducted. This process resulted in a final list of 11 theories or "bundles" thereof (in some cases it made sense to group theories due to their conceptual similarity).

Step 2: Developing a Research Agenda

As a second step, a discussion session with the experts was organized as a half-day workshop (Ritchie *et al.*, 2013) with the goal of discussing the 11 theories in order to identify appropriate gamification research questions. The experts were asked to apply the theoretical lens respectively and to come up with their own ideas. It has to be noted that the following research questions include some which are purely explorative in nature and others which are intended to specifically improve the overall effectiveness of gamification strategies. The latter follow a design science approach and may provide a roadmap for the creation of effective and efficient systems.

Theoretical Background for Gamification

The evaluation stage in phases one and two resulted in the following list of 11 theories (in alphabetical order):

- Behavioral Decision Theory
- Behavioral Intention and Actual Behavior
- Cognitive Load Theory
- Elaboration Likelihood Model
- Flow Theory
- Homo Ludens
- Information Processing Theory
- Keller's Motivational Model
- Organizational Learning Theory
- Self-Determination Theory
- Social Cognitive Theory and Social Learning Theory

In the following sections, each theory will be described shortly (and sketched in a figure if possible) in order to capture its essence, followed by a brief discussion of its relevance for gamification. Finally, we present research questions which came up during the panel session and which were identified as being relevant by all experts.

Behavioral Decision Theory

Behavioral decision theory is a collection of various descriptive theories which strive to explain humans' decision making behavior. The theory was founded by the psychologists Edwards, Simon and Kahneman (Simon, 1959; Takemura, 2014). It explores the consciousness of humans' decision-making and the processes of selecting between alternative choices. The starting point is usually rational decision-making (e.g. by weighing outcomes in a Bayesian way) followed by incorporating typical decision patterns. To date, purchasing or transportation decisions are popular application areas of behavioral decision theory. Humans make decisions when buying a specific product (Nissen and Sengupta, 2006) or when they decide on the mode of transport (Einhorn and Hogarth, 1981; Takemura, 2014). In the context of gamification, the focus of attention is on how to increase students' learning level and how to provide them with the information needed to decide in favor of the most desirable alternative. One important research question was identified by the expert panel:

- How does the presentation of information (gamified vs. non-gamified) impact the decision making process?

Behavioral Intention and Actual Behavior

The theory of reasoned action (TRA) describes the behavioral process whereby attitudes and subjective norms determine the intention of an individual to exhibit a certain behavior (Fishbein and Ajzen, 1975). The theory of planned behavior (TPB) additionally accounts for perceived behavioral control which is an individual's perception of her ability to perform a certain behavior (Ajzen, 1991). The combination of those two theories provides an ideal starting point for any model striving to measure behavioral and / or attitudinal changes, since it includes beliefs, norms (e.g. peer pressure) and intentions (Ajzen, 1991; Fishbein and Ajzen, 1975). TPB is a popular theory in Information Systems with various modifications and alterations such as the Technology Acceptance Model, which introduced the popular constructs of "ease of use" and "usefulness" (Davis, 1989) as well as the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al.*, 2012; Treiblmaier 2009). One recent addition is the Hedonic-Motivation System Adoption Model (HMSAM) (Lowry et al., 2013), which includes behavioral antecedents such as curiosity, joy and immersion which all account for users' intrinsic motivations.

All of these theories have the potential to explain why students actually use (and continue to use) a certain technology, which in our case could be any gamified application. By taking into account both extrinsic and intrinsic factors, these theories are well-suited to comprehensively explain behavior. The expert panel agreed on three major research questions, which should subsequently be refined in order to account for the multitude of constructs which have been previously tested in that area of research (Figure 2 shows the TPB with cognitive absorption representing various constructs measuring intrinsic motivation):

- How can perceived "ease of use" and "usefulness" be enhanced through gamification?
- How can the attitude toward a desired behavior be positively influenced through gamification?
- How does gamification help to increase cognitive absorption (and its related second order constructs)?

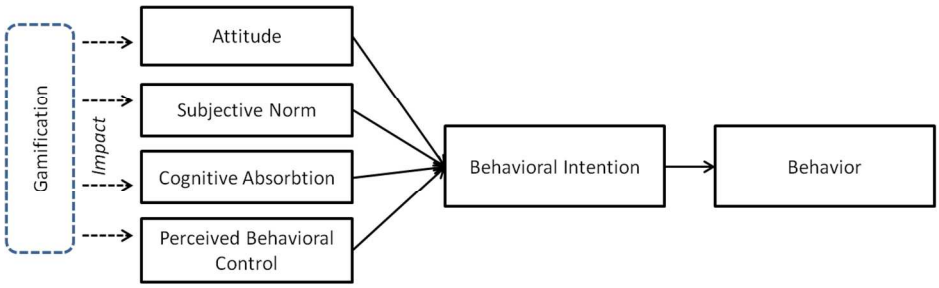

Figure 2: Gamification and Theories Dealing with Behavior(al Intentions) (cf. Ajzen, 1991)

Cognitive Load Theory

In the late 1980s Sweller and Chandler started developing the cognitive load theory which deals with the instructional design necessary to reduce learners' amount of mental effort, i.e. the cognitive load. It postulates that in spite of restricted human working memory, long-term memory is virtually unlimited. An instructional design which keeps the cognitive load as low as possible increases the capacity of the working memory (Sweller, 1988, 1994) and, as a consequence, the learning process can be enhanced by the reduction of extraneous cognitive load (i.e. redundant reflections) (Sweller *et al.*, 1998). Domain specific knowledge (also referred to as schemas) is the major criterion which distinguishes novices from experts (Paas *et al.*, 2003). The cognitive load theory is commonly used for the efficient development of learning material and multimedia learning offers (Homer *et al.*, 2008).

Sweller *et al.* (1998) distinguish between intrinsic cognitive load, extraneous load and germane load, with the latter referring to the amount of work needed to create a schema. All three factors have the potential of increasing or decreasing the cognitive load. When complex tasks are executed, a high level of intrinsic load is created and dissimilar topics tend to further increase it. Germane loads contribute to the construction of schemas and are directly connected with learning itself. Extraneous loads must be reduced

in order to reduce cognitive load. The expert panel concluded that gamification may help to shift the (perceived) cognitive load (cf. Figure 3):

- Does gamification reduce overall cognitive load?
- How can gamification help to improve cognitive load in order to increase learning performance?
- How can gamification be deployed to promote germane loads?

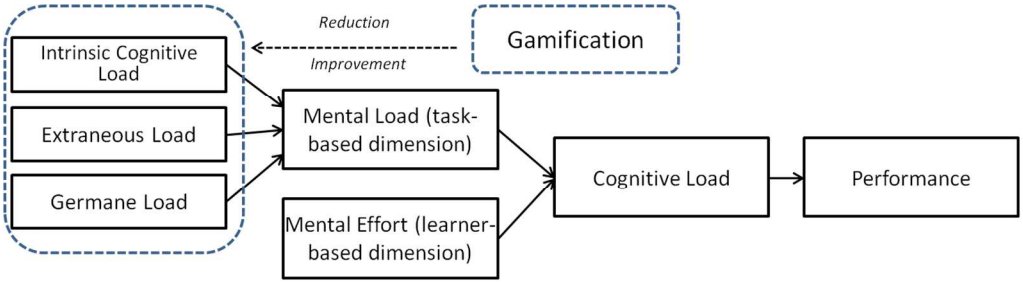

Figure 3: Gamification and Cognitive Load Theory (cf. Sweller *et al.*, 1998)

Elaboration Likelihood Model

The elaboration likelihood model (ELM) is a psychological theory being developed by Petty and Cacioppo in 1986. It addresses the process of persuasion and describes how attitudes form or change. It postulates two major routes of information processing, i.e. central and peripheral. The central route occurs in case an individual carefully considers relevant details, and the peripheral route pertains to simplistic associations of negative and positive attributes to an object, action or situation. The key determinant in this process is involvement, i.e. the motivation of an individual to actively consider the problem at hand. The ELM is one of the most popular models for media impact research and is frequently applied in IS literature (Petty and Cacioppo, 1986).

When dealing with gamification in a learning environment, it is essential to consider the student as a central factor. ELM allows us to exactly do this by adding individual characteristics which may or may not foster the process of knowledge acquisition. Since it is a theory dealing with the change of attitude and the process of persuasion, it can be applied to answer questions pertaining to how gamification can contribute to changing individuals' attitudes (Figure 4):

- How can a person's motivation or ability of information processing be influenced by gamification?
- Does gamification rather promote peripheral processing or central processing in comparison to non-gamified settings?
- To what extent can gamification enhance the cognitive effort of a person which is needed to address the central route?

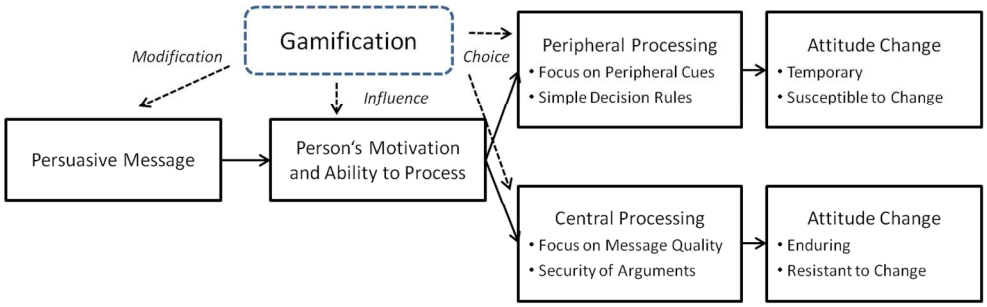

Figure 4: Gamification and the Elaboration Likelihood Model (cf. Petty and Cacioppo, 1986)

Flow Theory

Flow theory originates in the 1970s and was developed by Csikszentmihalyi (1975). Flow describes a mental state where an individual is fully involved and engaged in an activity and completely focused on current activities. It is a feeling of total engagement and immersion. For instance, a person forgetting to have lunch when engaged in an activity such as playing a game or completing a task at work is considered to be in a "flow". Flow theory mainly deals with intrinsic motivation and describes the area between anxiety and boredom during an activity.

It is evident from literature that learning games need to be designed neither too difficult nor too easy and they still must pose an interesting challenge to the players (Kapp, 2012; Csikszentmihalyi, 1997; Csikszentmihalyi, 1975). Eight dimensions were identified which support the flow experience: achievable tasks, concentration, clear goals, feedback, effortless involvement, control over actions, concern for self disappears, and loss of sense in time (Csikszentmihalyi, 1993). All of them turn out to be relevant when it comes to the evaluation of gamification efforts. Since flow theory is generally considered as a theory for gaming success, it might serve equally well to describe the success of gamification (Agarwal and Karahanna, 2000). The following topics emerged as a result of the expert panel discussions (cf. Figure 5):

- What are the most important individual characteristics needed to reach a flow experience with gamification?
- What is the right level of difficulty of a gamified task for students to reach the area between anxiety and boredom?
- How can games be designed to induce a state of flow?

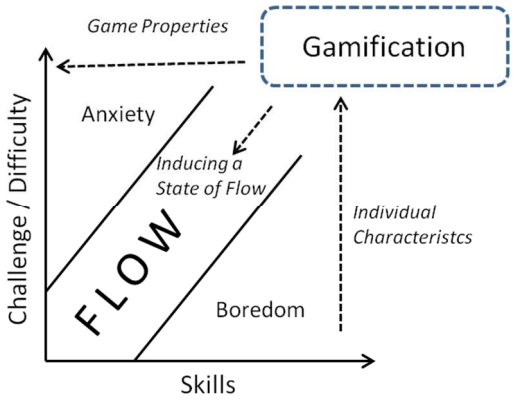

Figure 5: Gamification and Flow (cf. Csikszentmihalyi, 1997)

Homo Ludens

The theory of Homo Ludens (Latin for "playing man") is based on a book written in 1938 by the Dutch cultural theorist Johan Huizinga. The term has been used to illustrate the transformation process which takes place when purely rational behavior ("homo economicus") turns into something which is more hedonic in nature (Hamari, 2013). This theory discusses the importance of play for people and society. Playing is considered a central factor in human culture which is essential for societies' development. As a result, games can be found everywhere: sports, arts in general, theater, carnival, or rituals of any kind (Huizinga, 1955).

The theory of Homo Ludens is frequently mentioned in the context of gamification and thus may foster the basic understanding of this subject and the nature of games in general. The expert panel suggested the following topics:

- To what extent is the motivation for playing games intrinsic? Or is it rather determined by culture?
- How does the predisposition of "homo ludens" differ from "homo faber" (Latin for "creating man") when it comes to the effectiveness of gamification?

Information Processing Theory

Information processing theory (IPT) was founded by Miller (1956) and is a theory of cognitive psychology. This research area gained popularity in the 1950s and studies mental processes such as thinking, memorizing or problem solving (Anderson, 2010; Miller, 2003). IPT combines the concept of "information chunking" with the idea that the learning process of humans is very similar to the way computers process information. It specifically postulates that the capacity of humans' short term memory is limited to five to nine "chunks" of information. Miller (1956) argues that seven plus or minus two is the ideal number of chunks which can be processed by short term memory, implying that the human brain resembles a computer according to the way information is processed, stored and encoded (Miller, 1956; Schunk, 1996).

In the context of learning, IPT implies that learning content needs to be divided into small parts ("chunking"), five to nine of which will be remembered at a time (Schunk, 1996). Thus, developers of gamified educational environments need to consider the maximum amount of information which can actually be processed by learners. Two main ideas emerged from the panel sessions (cf. Figure 6):

- How can gamified applications be designed in order to incorporate Miller's "seven plus or minus two rule"?
- How can gamification impact the transition process from short-term memory to long-term memory?

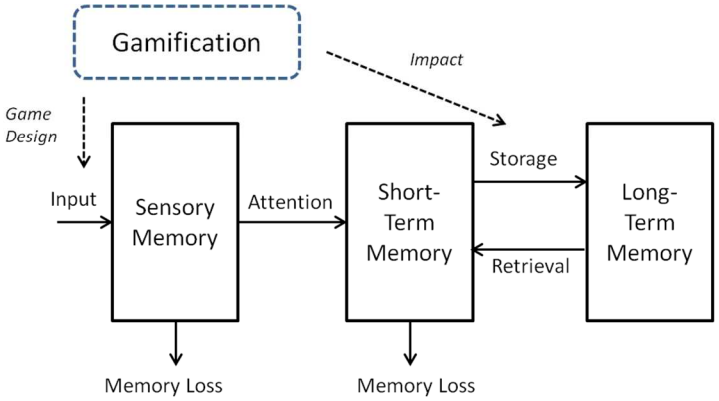

Figure 6: Gamification and Information Processing Theory (cf. Schunk, 1996, p. 166)

Keller's Motivational Model

The ARCS (attention, relevance, confidence and satisfaction) motivational model investigates how to effectively motivate learners. These four factors are frequently seen as important antecedents of learning performance in a self-directed environment. Attention means that the contents must be appealingly designed for the learners. This could be achieved through variety of learning media or by giving surprising information. Learning contents and aims must be relevant for the learners and presented in a context which helps them to classify and combine with existing knowledge. The concept of confidence states that learning aims have to be balanced between challenge and boredom (see also flow theory or self-determination theory) since learners must feel they are capable of reaching their goals. Learners feel satisfied if they succeed in the translation of theoretical knowledge to practical problems (Keller, 1987b, 1987a, 1999).

Applying Keller's motivational model helps to identify requirements for engaging gamified applications. Kapp (2012). For example, the model recommends to use distinct difficulty levels (such as easy – intermediate – advanced) to target a person's individual knowledge level and to attain the right level between boredom and anxiety to achieve the learning goals. Educational research demonstrates that the

application of theoretical knowledge to practical problems is crucial. Thus, real-life problems which support learners to apply theoretical knowledge in practice must be included in gamified applications. Moreover, a variety of learning methods is essential for users' motivation, since a mix of gamification, case studies, group work and individual work achieves a better learning performance than using only one of those in isolation (Lutz and Birou, 2013). Four major topics mainly related to game design emerged from the panel session (cf. Figure 7):

- How can challenging practical problems be included in a gamified learning environment?
- What kind of game attributes attract students' attention?
- How can games be designed in order to meet students' expectations?
- Which level of variety must a gamified application exhibit in order to enhance users' engagement?

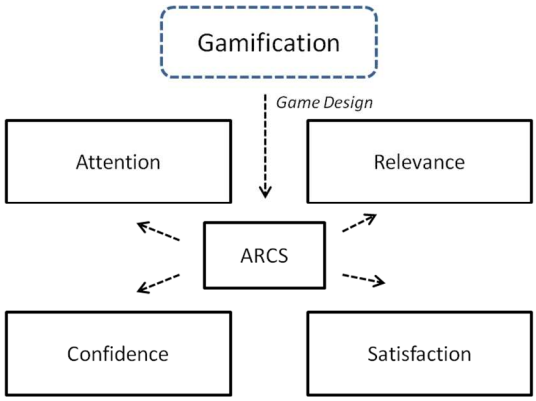

Figure 7: Gamification and Keller's Motivational Model (cf. Schunk, 1996, p. 166)

Organizational Learning Theory

Organizational learning theory (OLT) describes how learning in organizations takes place and how knowledge is created, retained and transferred. Organizational learning is considered as the foundation which is needed to compete in volatile environments (Fiol and Lyles, 1985; Daft and Weick, 1984; Levitt and March, 1988). Organizational learning starts with learning at an individual level. In order to turn into organizational learning, information must be retained and shared in the organizational memory and explicitly included in its official goals. OLT includes various constructs and additional factors supporting organizational learning. In this study we mainly focus on learning processes as described by Daft and Weick (1984) and adapt this construct for individual learning. "Pure" organizational learning is beyond the scope of our research.

Data collection is the first step in learning and involves the process of acquiring a memory of data and information. Next, this information is interpreted based on previous and acquired knowledge. The third step pertains to actions being taken based on interpretations (Daft and Weick, 1984) and frequently reflects a change in attitudes and/or behaviors. Thus, this three-step model can be adapted as a basic template for the design of gamified applications. The recommendations from the panel are closely related to the three phases of the model (cf. Figure 8):

- How must a gamified application be designed to facilitate scanning (data collection)?
- How can a gamified application support the interpretation process?
- How can a gamified application facilitate the transition process from interpretation to learning?

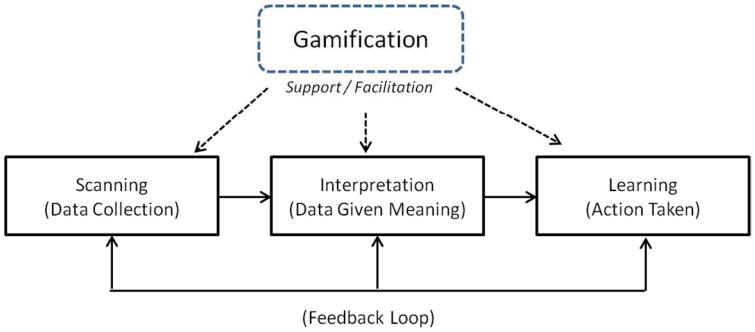

Figure 8: Gamification and Organizational Learning Theory (cf. Daft and Weick, 1984, p. 286)

Self-Determination Theory

Self-determination theory (SDT) was mainly developed by Deci and Ryan and focuses on what factors driving an individual to make choices without external influence. In this context, activities are performed because they are enjoyable or interesting and represent the natural human propensity to assimilate and learn. As a result, intrinsic motivation represents an important concept for education and educational research (Ryan and Deci, 2000; 2000b).

SDT identifies autonomy, competence and relatedness as essential concepts for intrinsic motivation. It postulates that the degree to which these three psychological needs are satisfied determine self-motivation and mental health. Autonomy defines an individual's assessment to which extent she can control and determine the outcome of her actions. In general, human beings are striving for as much autonomy as possible. Competence means that individuals have goals and possess the relevant skills to achieve them. The social factor is described by the concept of relatedness. Amongst others, the feeling to be respected and cared for is essential for every learning process (Ryan and Deci, 2000, 2000b; Kapp, 2012). SDT is used to describe motivation for various fields of human activities such as healthcare, sports, work and education (Zhao *et al.*, 2011).

SDT has been previously applied in gamification literature (Hamari *et al.*, 2014; Nicholson, 2012; Kapp, 2012; Kenyon, 2011). Relatedness in this context mainly describes the perceived connection to others and represents an essential antecedent for intrinsic motivation. It can be achieved through a multi-player mode or if two or more students have to solve a task together. In addition, gamification must challenge users and give them the opportunity to make decisions on their own in order to enhance the level of intrinsic motivation (Kapp, 2012; Kenyon, 2011). The expert panel therefore mainly focused on the potential of gamification to increase intrinsic motivation:

- How much autonomy must be given to learners to increase their intrinsic motivation when using gamification?
- How can relatedness between learners be created with gamification?
- How can the individual level of (game) competence be determined to challenge the learners?

Social Learning Theory and Social Cognitive Theory

Social Learning Theory (SLT) was developed by Robert Bandura in late 60s and early 70s. SLT assumes that learning is a cognitive process which takes place in a social context, i.e. that individuals learn from one another through observation or direct instruction. The process of observational learning can be separated in the components of attention, retention, motor reproduction and motivation (Bandura, 1969; Bandura, 1977; Bandura, 1986). Social cognitive theory (SCT), which is also based on work from Bandura (1986), assumes that understanding, predicting and changing human behavior is based on personal

factors, behavior and the environment. Sometimes both theories are used interchangeably. The main determinants are cognitive factors (or personal factors) which include knowledge, expectations or attitudes as well as environmental factors such as social norms and influence on others. SCT postulates that a change in behavior, believes or attitudes can be achieved by people influencing each other (Bandura, 1977; Bandura, 1986).

SLT and SCT are both theories which are commonly used for research in Information Systems and education (Compeau *et al.*, 1999; Santhanam *et al.*, 2008). SLT posits that people learn from role models and over time change their behavior or attitude towards this model (Bandura, 1977; Bandura, 1986). Virtual models such as avatars (anthropomorphic agents) are considered to be able to socially influence humans' attitude and behavior. Avatars are frequently used in gamified marketing or learning environments. In addition, the replayability (i.e. the sustained interest over the course of several playthroughs) of gamified applications can be used to gain retention (Kapp, 2012). The expert panel came up with two research questions especially related to the design of gamification:

- Are avatars, which represent the social context in the learning process, able to induce changes in attitude or behavior?
- How does replayability of a gamified application increase retention?

Conclusions and Further Research

In this paper we develop a research agenda for gamification which was created with the help of a panel consisting of interdisciplinary experts who came up with research questions related to eleven carefully selected theories or bundles thereof. Table 1 lists those theories which were deemed relevant for gamification research being organized in two categories. The first category includes theories which directly address the effects of gamification on behavior and / or attitude. The second category shows those theories which turned out to be useful for the design of gamified applications. Research questions in this category cover topics such as how gamification must be designed to make the overall experience challenging, but nevertheless accomplishable. It is important to note, however, that the causalities (i.e. the "roles") of the variables do not always correspond to those in the original theories, as is evidenced e.g. by "Ease of Use" and "Usefulness" which are well-known antecedents in the Technology Acceptance Model, but were suggested to be dependent variables by the experts. In other words, they turn into mediating variables if the complete TAM model is being used.

	Independent Variable(s)	**Dependent Variable(s)**
Theories Addressing Change in Behavior or/and Attitude		
Behavioral Decision Theory	• Presentation of information	• Decision making process
Behavioral Intention and Actual Behavior	• Gamification (and various attributes thereof)	• Ease of use • Usefulness • Attitudinal change • Changes in cognitive absorption (and related constructs)

Elaboration Likelihood Model	• Gamification (and various attributes thereof)	• Motivation • Ability to process information • Peripheral processing vs. central processing • Cognitive effort
Social Learning Theory and Social Cognitive Theory	• Game design (i.e. avatars, replayability)	• Attitudinal change • Behavioral change • Retention
Theories Addressing the Design of a Gamified Application		
Cognitive Load Theory	• Gamification design	• (Total) cognitive load • Learning performance • Germane load
Flow Theory	• Individual characteristics • Levels of difficulty • Gamification design	• State of flow
Homo Ludens	• Individual predispositions	• Motivation for playing games • Effectiveness of gamification
Information Processing Theory	• Gamification design	• Information processing
Keller's Motivational Model	• Gamification design	• Expectation • Motivation • Attention • Engagement
Self-Determination Theory	• Autonomy • Gamification	• Intrinsic motivation • Relatedness • Competence
Social Cognitive Theory and Social Learning Theory	• Gamification design (e.g. avatars, replayability)	• Attitudinal change • Behavioral change

Table 1: A Research Agenda for Gamification

The final outcome of this research is a theoretically-founded research agenda which will support future research in the academic field of gamification. Our study is limited by the expertise and expectations of the participating experts, i.e. we presume that replication studies will lead to more insight and different perspectives. This paper presents a starting point which is intended to inspire the ever-growing academic community investigating the field of gamification. At the same time it is a plea for structuring a domain in a way such that researchers are cognizant of the respective role they play. This should not only help putting one's own work into perspective, but also makes it easier to identify research gaps and useful theories to investigate them.

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