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Designing gamification and persuasive systems: a systematic literature review

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Abstract

Gamification design has been an important issue for practitioners and researchers since the beginning of research on gamification. With the increasing divergence of gamification in diverse areas, various design principles have been proposed. Yet, existing reviews focus on the synthesis of scientific knowledge about the design process and specific design elements, neglecting the importance of guidelines and principles to make appropriate design choices in order to achieve the desired outcomes. Therefore, this systematic review identifies, analyzes, and categorizes 30 articles that propose design guidelines for gamification and persuasive systems from various application contexts to provide scholars and practitioners with an overview in designing gamified interventions. More than 60 different principles have been identified, which can be divided into user-oriented principles to achieve the intended behavior, system-oriented principles to ensure a hedonic user experience, and context principles. Since the results are primarily conceptual, further research is invited to investigate the effectiveness of different principles based on the context of application to further refine the recommendations for specific use cases of gamification.

Keywords 1

Gamification, Design, Persuasive Systems, Literature Review, Gamification Design

1. Introduction

Over the last decade, gamification has evolved as an effective tool for creating positive experiences such as engagement and enjoyment [1]. Gamification is based on psychological effects of games, such as autonomy, competence and flow [2], and promotes intrinsic motivation for human behavior in non-game contexts [3].

The design of gamification has gained scientific attention in several disciplines, particularly education [4, 5]. But academic research remains still largely focused on listing and cataloging design *patterns* [6] or *motivational affordances* [1, 2]. These are elements such as badges and leaderboards [7] and represent the lowest level of abstraction in gamification design [7]. However, their use needs to be guided by *design principles* [7], which specify the overall *game model* developed by the use of particular *game design methods* [7].

Recent systematic reviews have analyzed design methods [8, 9, 10] and conceptual models [9] of game design. However, a comprehensive overview is still missing concerning design principles, where existing syntheses remain narrowed to the contexts of education [4, 5, 11] and energy games [12]. Design principles represent an important bridge between the two other levels of abstraction – design methods and models on the one hand and design patterns and motivational affordances on the other. They help practitioners, such as teachers, physicians or managers, to choose

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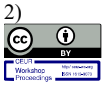

appropriate game design patterns [7] that lead to the desired outcomes.

A variety of design principles for gamification and persuasive systems, which is a related concept [6, 13], have been proposed by scientists from different disciplines, such as healthcare [14, 15, 16], education [17, 18], sustainability [12, 19] and fitness [20]. This increasing diversity reinforces the need for a systematic overview that enables practitioners to successfully decide on an appropriate gamification design.

To address this issue, this systematic review aims at *identifying and analyzing existing research on design principles for gamification and persuasive systems*. We present more than 60 different design principles and conceptually link the principles with exemplary design patterns and motivational affordances. The resulting framework bridges the gap between existing reviews of design processes and design patterns and contributes to comprehensive guidance for scientists and practitioners in designing gamification.

2. Gamification design and persuasive systems

Gamification can be defined as the *"intentional use of game elements for a gameful experience of non-game tasks and contexts"* [22, p. 17]. These game elements include patterns, objects, principles, models and methods inspired by games [21]. In an attempt to distinguish these concepts, Deterding et al. categorized them as different levels of game design abstraction [7], as shown in Figure 1. Game *interface design patterns* [7] include concrete design solutions such as badges, leaderboards or levels [7]. Closely related, game *design patterns* refer to the gameplay mechanics, such as time constraints and turns [7]. Both interface design patterns and design patterns can also be described as *motivational affordances* which, as a more experience-oriented rather than a system-oriented perspective, include game components that support the user towards the desired behavioral outcome [22]. Game interface design patterns and design patterns or motivational affordances represent a low level of abstraction in gamification design. The selection of motivational affordances is guided by *design principles*. Design principles are defined as evaluative guidelines to approach a design problem or analyze an existing solution [7] and form the bridge between low-level motivational affordances and the high-level game models and game design methods. While the *game models* refer to the conceptual framework of the game components [7], *game design methods* describe the practices and processes or steps of game design [7].

Motivational affordfances	**Game interface design patterns**	Common, successful interaction design components and design solutions (e.g. points, badges, leaderboards)
	Game design patterns and mechanics	Commonly reoccurring parts of the design of a game that concern gameplay (e.g. time constraint, turns)
	Game design principles	Evaluative guidelines to approach a design problem or analyze a given design solution
	Game models	Conceptual models of the components of games or game experience
	Game design methods	Game design-specific practices and processes

Figure 1: Levels of game design (own figure, based on [7])

While existing academic research still mostly focuses on game interface design patterns and design patterns [6], recent reviews have also analyzed design methods or processes [8, 9, 10] and conceptual game models [9] used in gamification design. However, a comprehensive overview of game design principles, representing the important bridge between the two other levels of abstraction, is still lacking.

Gamified systems are not the only technology aimed at influencing motivation, attitudes and behavior in non-game contexts. Rather, gamified systems represent a subset of persuasive systems [6, 13]. Persuasion or persuasive systems as a broader concept describes technology attempting to reinforce, change or shape attitudes or behaviors or both [23], which includes the use of gameful design [6, 24]. In addition to this general relationship between gamification and persuasion [25], some studies specifically examine the use of gamification in persuasive systems [26, 27], indicating the potential of gameful design for persuasion. Conversely, gamification design principles that aim to shape attitudes or behaviors should not be limited to gameful design – instead, a more holistic perspective that includes insights from non-gameful persuasive systems is required to design

gamification in such a way as to achieve the desired motivational and behavioral outcomes [6].

Thus, we argue that consideration of design principles from both gamification and persuasive systems research is necessary to provide a comprehensive overview for deriving successful design principles.

3. Review procedure

The systematic literature review was conducted in line with the recommendations of Paré et. al. [28] and Webster and Watson [29] for theoretical reviews. The Reporting standards for Systematic Evidence Syntheses (ROSES) [30] provided detailed guidance on the specific steps of the screening and selection process.

For the identification of relevant literature, seven scientific databases were searched (Web of Science Core Collection, EBSCO Host (APA PsychArticles, APA PsychInfo, Business Source Premier), Wiley Online, ScienceDirect, SagePub, IEEE Explore and Taylor & Francis). These multidisciplinary databases were selected because they index a wide range of journals, supplemented by IEEE Explore as a specific database for the information systems research area. To include as many relevant results as possible, we searched for articles that refer to design principles of either gamification or persuasive systems, using various terms such as principle, guideline, framework, strategy, or recommendation. The search was therefore conducted using the following search string in September 2020: *TITLE-ABS-KEY ("Gamif*" OR "Persuasive system*" OR "Persuasive technology") AND ("design guideline*" OR "design framework*" OR "design principle*" OR "design strateg*" OR "design recommendation*")*.

To ensure research quality, only empirical and conceptual studies from peer-reviewed journal articles and peer-reviewed conference papers were included in the final sample. The reasons why the conference papers were considered important are that they account for a significant proportion of citations in computer science and research on human-computer interaction [31] and that the identification of studies from conference proceedings in systematic reviews is generally recognized as good practice [32]. As language criterion, only English articles were included. Furthermore, the studies were included if they developed design principles for the design of a gamified or persuasive application either in general or in a specific field of application, but excluded if they only used or investigated existing design principles, or if they focused on the design process, game model, game elements or functional requirements. For the critical appraisal of the quality of the reviewed articles, it was checked whether the authors formulated at least one clear research question or goal, if the research method was described and if the stated questions or goals were answered properly. Figure 2 illustrates the result of the search strategy and the screening process. In summary, 30 articles remained for data extraction and synthesis.

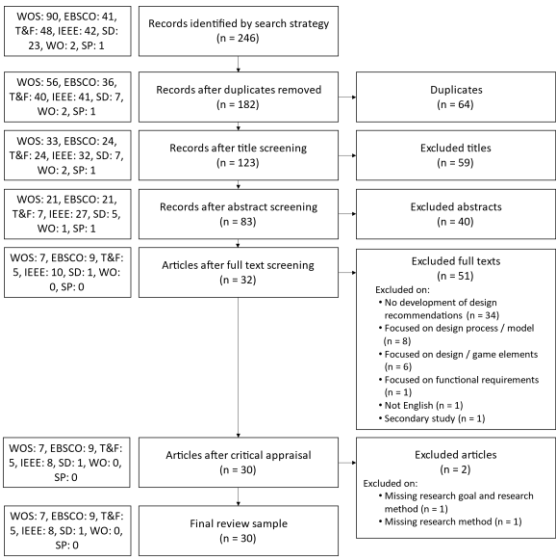

Figure 2: Flowchart of the systematic review process (own figure, based on [30])

According to the guidelines of Webster and Watson [29], author-centric qualitative data extraction involved coding the domain and methodological approach of the investigation, as well as the topic focus (gamification or persuasion) and the design principles, suggested in the respective articles. In the subsequent concept-centric phase, the coded results were analyzed and organized into frequency matrices.

4. Analysis and results

In our analysis, we first examine the research areas and methods of the reviewed

articles, followed by the qualitative analysis of the design principles presented.

4.1. Research areas and methods

The earliest design recommendations consist of the general persuasive strategies proposed by Oinas-Kukkonen and Harjumaa in 2009 [33], followed by several adaptions in healthcare [14, 16, 34, 35] between 2012 and 2014. Gamification design principles focused primarily on education and game-based learning until 2015 [17, 18, 36], but were later extended to sustainability [19], websites [37], information systems [38], fitness [20], crowdsourcing [39, 40] and context-independent recommendations [8, 41, 42, 43, 44]. In general, gamification design has gained scientific attention in recent years. Table 1 illustrates the distribution of subjects of the reviewed articles.

Table 1
Research areas of the reviewed articles

Research area	No.	Articles
Gamification	**19**	
Education	6	[17,18,45,46,47, 48]
Crowdsourcing	2	[39,40]
Fitness	1	[20]
Sustainability	1	[19]
Reading	1	[36]
Inf. Systems	1	[38]
Websites	1	[37]
Healthcare	1	[49]
General	5	[8,41,42,43,44]
Persuasive systems	**11**	
Healthcare	8	[14,15,16,34,35, 50, 51,52]
Sustainability	1	[53]
General	2	[33,54]

The majority of articles use qualitative methods to derive design principles for gamification and persuasive systems. These methods consist of either qualitative interviews (8 articles), case study analyses (2 articles), or participatory design (2 articles). Four studies mix several of these qualitative research methods, and ten studies can be classified as conceptual. Only a minority relies on quantitative analyses such as surveys (3 articles) and text mining (1 article).

4.2. Design principles

Overall, scientists suggest 63 different design principles that should be considered when designing gamification and persuasive systems in general (Table 2). Half of the articles agree on the importance of *informational content*, i.e., supplying background information about the goals intended by the intervention and supporting users to change attitudes and behaviors by providing assistance and cues. In addition, most articles suggest introducing *behavioral incentives*, which can take a tangible (e.g., cash prizes for the winner) or intangible (e.g., earning badges and certificates) form. Furthermore, scholars propose *personalizing the system contents and mechanics*, based on the assumption that the motivational function of different affordances depends on the personality or user type. *Immediate positive feedback* for good performance, such as earning points, and the *ability to compare oneself with others*, such as in leaderboards, also represent important principles for successful gamification design.

In contrast, other principles suggested in single articles, such as *supporting different roles* or *using fitting sounds* are not universally applicable and may be particularly valuable in certain contexts, e.g., when users with different functions (e.g., physician and patient) use the system or when acoustic signals in the system should support multisensory learning. Notably, some principles (e.g. *persuasive messages*) are mentioned more often in a particular area (e.g. healthcare) than in others, indicating that the choice of appropriate design principles also still depends on the application area and the intended outcomes. Table 2 presents all design principles proposed in the reviewed articles.

Table 2
Design principles of the reviewed articles

Design principle	No.	Articles
Offer informational content	15	[15,16,17,18,19,33, 34,35,36,38,43,47, 48,50,52]
Introduce behavioral incentives	13	[15,16,18,20,33,39, 40,41,42,43,47,52,5 4]
Personalize the system contents and mechanics	12	[16,17,20,33,34,36, 37,43,44,46,47,49,5 3]
Provide immediate positive feedback	11	[15,17,33,34,35,37, 40,43,45,47,54]

Design principle	No.	Articles
Allow social comparisons	10	[15,19,20,33,34,40, 43,45,51,54]
Frame the intervention with storytelling	9	[18,36,37,38,40,41, 42,47,52]
Encourage social collaboration	8	[15,17,19,33,41,45, 47,54]
Show how behavior relates to the goals (cause and effect)	8	[15,33,34,35,40,47, 48,54]
Guide users with persuasive messages	8	[15,16,19,33,34,45, 50,52]
Increase and adjust difficulty over time	7	[15,17,35,37,38,47, 54]
Allow showing status and gaining social recognition	7	[15,20,33,39,40,41, 45]
Provide data for (self-) monitoring	7	[15,16,20,33,34,36, 50]
Consider the context and location	7	[15,33,43,46,47,53, 54]
Visualize progress	7	[20,35,38,40,44,45, 47]
Divide content in tasks and steps	6	[15,20,33,35,47,54]
Connect users for social interaction	6	[19,20,33,41,43,45]
Enable freedom of choice	6	[17,20,41,44,45,47]
Prioritize aesthetic design	6	[18,33,37,38,47,52]
Include target group in co-design	6	[8,14,17,35,44,46]
Provide community support	6	[15,35,40,42,43,50]
Allow social competition	6	[15,19,33,41,47,51]
Provide clear and meaningful (self-set) goals	5	[15,35,37,40,47]
Allow for the evaluation of one's own knowledge	5	[17,18,35,36,47]
Consider the ethics of design and privacy protection	5	[8,33,41,45,54]
Ensure continuous excitement with new or hidden content	5	[35,44,47,52,54]
Provide multiple paths to achieve a goal	5	[38,47,48,51,54]
Enable social learning	5	[15,19,33,34,35]
Respect the outcomes or goals targeted	4	[19,43,48,49]
Enable self-comparison	4	[36,41,47,51]
Connect the system with other soft- and hardware	4	[14,43,47,50]
Include normative influence	3	[15,19,33]
Set reminders	3	[19,33,47]
Check the fit of intervention and technology	3	[19,36,47]
Provide enough content for additive motivation	3	[37,38,41]
Keep system persistence	3	[42,49,54]
Allow self-organization in groups and teams	2	[36,41]
Communicate system credibility	2	[15,33]
Support different roles or profiles	2	[36,38]
Ensure fairness	2	[8,51]
Avoid downwards comparisons	2	[42,51]
Enable sharing of results	2	[16,52]
Allow practice	2	[15,47]
Introduce punishment and losing options	2	[15,42]
Avoid penalties and allow failing	1	[47]
Set clear rules	1	[37]
Communicate challenges	1	[45]
Use known designs and metaphors	1	[53]
Use fitting sounds	1	[47]
Relate to real-world experiences	1	[54]
Build a system of resources and economy	1	[40]
Avoid social competition	1	[36]
Provide social feedback	1	[15]
Allow anonymity	1	[36]
Ensure accessibility	1	[47]
Avoid behavioral incentives	1	[44]
Build memories	1	[42]
Encourage creativity and problem-solving	1	[54]
Display system navigation	1	[17]
Enable routines	1	[20]
Maintain equilibrium between elements	1	[49]
Foster curiosity	1	[40]
Onboard first-time users	1	[39]
Check for easy usability	1	[50]

As Table 2 shows, scientists propose a variety of heterogeneous design principles for gamification and persuasive systems, some of which relate more to the content of the system (e.g., *behavioral incentives, immediate positive feedback* or *persuasive messages*), while others refer to the mechanics (e.g., *increase and adjust difficulty over time* or enable *freedom of choice*) or the context of the intervention (e.g., *include the target group in co-design*). For a comprehensive overview that can successfully guide gamification design, we argue that the identified principles require further conceptual discussion and categorization.

5. Discussion

To the best of our knowledge, this work is the first review that focuses on synthesizing the diverging views and recommendations of design *principles* for gamification and

persuasive systems from different contexts, thereby closing the gap between process-oriented design methods [8, 9] and element-focused design patterns or motivational affordances [1, 2, 55]. We have identified a variety of more than 60 different design principles. As the first point of discussion, the analysis reveals that some recommendations for the design of gamification and persuasive systems seem to be contradictory.

For example, some scientists argue against punishment and for the motivational nature of safe environments [47], while others favor losing options to exert pressure for behavioral change [15, 42], in line with behaviorist theories of positive and negative reinforcement [56]. Thus, we suggest that the important aspect of co-designing the intervention with the target group [8, 14, 17, 35, 44, 46] should include discussing whether losing options are perceived as a barrier or facilitator of motivational effects.

Negative and positive reinforcements, such as rewards, represent external events as stated in cognitive evaluation theory [57] that can undermine intrinsic motivation [58], which is why Chen [44] argues that behavioral incentives should be avoided. In contrast, a large number of the reviewed studies strongly suggest the introduction of behavioral incentives, not only conceptually, but also backed up by qualitative interviews [20, 47, 52] and quantitative surveys [54] that emphasize their motivational power. Since tangible extrinsic incentives, such as money, can pose the crucial challenge of influencing behavior only as long as they are available [3], we propose implementing intangible incentives such as achievements and badges that could be more efficient than tangible prizes.

Moreover, Wehbe et al. [36] suggest avoiding social competition, whereas other scholars strongly favor social competition mechanisms [15, 19, 33, 41, 47, 54]. Social comparison theory [59] underlines the introduction of comparison and competition mechanisms as a motivational drive for self-evaluation through comparison with others. However, it is suggested that interventions should be carefully designed to ensure that people do not perceive a high risk of exposing their own inferiority to others [60].

Second, as we argued in the results section, the proposed principles refer to different aspects of the design of gamification and persuasive systems. The design of a positive user experience typically depends on three elements: the user, the system and the context [61].

In conceptualizing the identified design principles, we argue that they can be distinguished into *user-oriented principles* that drive user behavior, *system-oriented principles* that relate to the mechanisms that lead to hedonic experiences or affective reactions such as enjoyment and satisfaction, and *context-oriented principles* that refer to the context of the intervention. User-oriented and system-oriented principles, in particular, can guide the choice of interface design patterns or motivational affordances. To better illustrate the link between design principles and motivational affordances, we suggest examples from the variety of motivational affordances proposed in the academic literature [1, 2, 55] that can be selected to implement specific design principles. As can be seen in our examples, a particular affordance can serve to implement multiple design principles, in line with the observations of Deterding [6], e.g. achievements visualize one's own progress for the intrinsic need of competence [3] and constitute an incentive [57], while peer-rating provides community support and allows social recognition.

As a result, we propose a conceptual framework of design principles for the successful design of gamification and persuasive systems (Figure 3) that comprises the most substantiated design principles considered important by at least five of the reviewed articles and examples of their implementation with motivational affordances.

User-oriented principles are those principles that lead to both *individual* and *social* behavior outcomes. For example, providing immediate positive feedback (e.g., with points and badges), introducing incentives (e.g., rewards) or guiding with persuasive messages (e.g., reminders and suggestions) directly induce individual user behavior towards intended outcomes. On the other hand, allowing social comparisons (e.g., with leaderboards) or encouraging collaboration (e.g., with teams) lead to a community drive towards individual behavior change.

System-oriented principles include design principles that promote hedonic experiences. For example, personalization of the system (e.g., with avatars and customization) promotes the identification with the system, and freedom

of choice (e.g., different missions) leads to enjoyment.

Context-oriented principles refer to the context of the intervention, such as considering the location or including the target group in co-design.

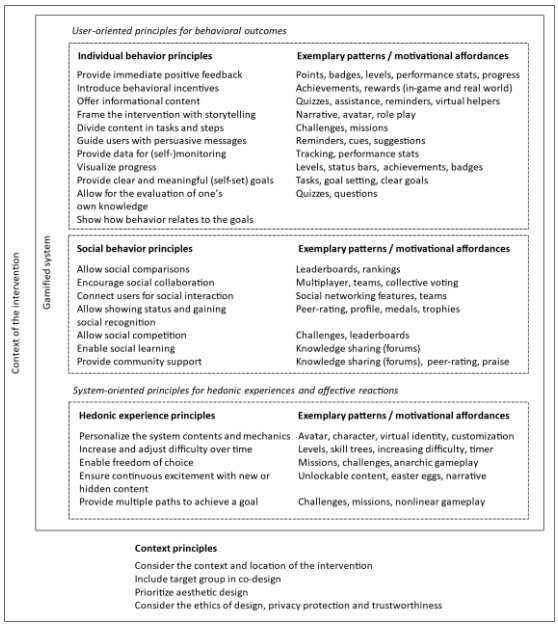

Figure 3: Framework of design principles

Regarding the game design model, e.g. in form of the mechanics, dynamics and aesthetics model, our framework of design principles that relate to dynamics can help select appropriate mechanics (i.e., motivational affordances) to achieve intended aesthetics or emotional responses [62]. Concerning various game design methods, which share the common steps of defining objectives and expected behaviors, identifying player types and then deploying appropriate game design principles [9], our framework can assist in identifying suitable design principles for the objectives. For example, the evaluation of knowledge may be highly relevant in game-based learning, while it may be negligible in the fitness context.

By bridging the level of motivational affordances with the levels of the game model and the game design methods, our conceptual framework of design principles aims to help scientists and practitioners successfully design gamified interventions in a scientifically grounded manner.

6. Limitations and Outlook

As with any scientific work, this study is not without its limitations. While this work aimed to provide a generic overview of design principles for the design of gamification and persuasive systems from the academic literature, it neglected the design experiences of practitioners, which could also be considered valuable for deriving effective design principles. Further work is invited to expand the review with books, reports, and other sources of practitioners to verify consistency with the principles drawn from the scientific literature.

Since this review, to the best of our knowledge, represents the first systematic analysis of design principles in gamification and persuasive systems, the identification and classification of design principles was based primarily on our own assessment of the similarities and differences between the principles proposed in the reviewed articles (e.g., "immediate feedback", "positive feedback", and "feedback mechanisms" were combined into "immediate positive feedback"). We, therefore, encourage further research to repeat or expand our review to verify the reliability of our design principles.

Finally, the selection of appropriate design principles for a given application context should be facilitated by empirically comparing the effectiveness of different principles in diverse areas, uncovering the most important principles for specific contexts, such as, but not limited to, education, business, sustainability, healthcare, and fitness, which are among the most popular in current research on gamification and persuasive systems.

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