Heuristic Evaluation for Gameful Design

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Abstract

Despite the emergence of many gameful design
methods in the literature, there is a lack of evaluation
methods specific to gameful design. To address this
gap, we present a new set of guidelines for heuristic
evaluation of gameful design in interactive systems.
First, we review several gameful design methods to
identify the dimensions of motivational affordances
most often employed. Then, we present a set of 28
gamification heuristics aimed at enabling experts to
rapidly evaluate a gameful system. The resulting
heuristics are a new method to evaluate user
experience in gameful interactive systems.

Author Keywords

Heuristic Evaluation; Gamification; Gameful Design.

ACM Classification Keywords

H.5.2. User Interfaces: Evaluation methodology; H.5.3.
Group Interfaces: Evaluation methodology.

Introduction

Gamification, using game design elements in non-game
contexts [9], complements user experience (UX) meth-
ods to increase user motivation and engagement in
many different fields, such as education, health, social
networks, and business [14,33,38]. Some gameful de-
sign frameworks and methods have been suggested

Heuristic Evaluation for Playability (HEP) [6]

A set of heuristics for playability comprised of four categories: gameplay, game story, game mechanics, and game usability.

Games Usability Heuristics (PLAY) [7]

A set of seven principles aimed to evaluate action-adventure, RTS, and FPS games.

Game Approachability Principles (GAP) [8]

A set of guidelines to create better tutorials or experiences for new players.

Playability heuristics for mobile games [18]

A set of heuristics for mobile games comprised of three categories: game usability, mobility, and gameplay.

Networked Game Heuristics (NGH) [32]

A set of heuristics that consider specific issues related with group play over a network.

Heuristics for social games [30]

Created from a critical review of video game evaluation heuristics

GameFlow [39,40]

A comprehensive heuristic set designed as a tool to evaluate player enjoyment.

Table 1: Existing heuristic evaluation models for game design.

[11,23] with prescriptive guidelines on augmenting an application with motivational affordances. We refer to *gamification* and *gameful design* interchangeably since both frame the same set of phenomena from different points of view [9]. Motivational affordances are properties added to an object, which allow its users to experience the satisfaction of their psychological needs [10,42]. In gameful design, motivational affordances are often used to facilitate intrinsic and extrinsic motivations as advocated by self-determination theory (SDT) [4,35–37]. Thus, motivational affordances that support the user's feelings of competence, autonomy, and relatedness are used to facilitate intrinsic motivation, whereas rewards facilitate extrinsic motivation.

Although many gameful design methods have emerged recently, designers still lack standard evaluation methods. While several studies have investigated the effectiveness of gameful applications by studying their users [14], there are no guidelines on evaluating the implementation of gameful design elements into a system. For other established areas of UX, heuristic evaluation methods are commonly used [27,28]. They are fast and inexpensive tools that can be used to identify and address design issues early in a project. They are not meant to replace user tests, but rather add to the set of evaluation tools: while heuristic evaluation can be applied early in a project, user tests are conducted later to find issues that could not be captured before.

Our work aims to contribute to the HCI community by presenting a new set of guidelines for heuristic evaluation of gameful design in interactive systems. First, we reviewed several gameful design frameworks and methods to identify which dimensions of motivational affordances were most common. Next, we created a set of heuristics focused on each of the identified dimensions. The resulting heuristics set provides a new way of evaluating gameful user experiences. It is the first tool of its kind focused specifically on evaluating gameful design through the lens of intrinsic and extrinsic motivational affordances.

Background

In usability engineering, heuristics are general principles or broad usability guidelines that have been used to design and evaluate interactive systems [29]. Heuristic evaluation is the use of said principles as a usability inspection method by experts to identify usability problems in an existing design as part of an iterative design process [27,28].

Several heuristic evaluation models for game design exist (see Table 1). However, to the best of our knowledge, no heuristics set is available for gameful design. Some heuristics for evaluating games or playability could also be employed to gameful applications; however, they will not cover the full range of common motivational affordances. For example, *meaning* is a dimension of motivational affordances often used in gameful design which is not covered by existing heuristics. Some of the existing gameful design methods, namely Octalysis [3], HEXAD [21], and Lens of Intrinsic Skill Atoms [11], suggest procedures to evaluate an existing system. Nevertheless, these procedures are aimed at providing a starting point for the design process. They are less-suited for being used as a separate evaluation tool by an independent quality control team because they lack a concise set of design heuristics with concise descriptions, which could be quickly checked by an independent expert. Our research aims to fill this gap.

Review of Gameful Design Methods

Several gameful design frameworks and methods exist [11,23] (see Table 2). However, only a few of them feature a classification of motivational affordances in different dimensions, which were used as a theoretical background to devise our heuristics. Therefore, we focused our analysis on those that included this feature (see Table 3). After reviewing and comparing them, we identified twelve common dimensions of motivational affordances, which were based on the theories of intrinsic and extrinsic motivation [35–37] and behavioural economics [13], as well as the authors' experience.

Gamification Heuristics

Our set of heuristics is aimed at enabling experts to identify gaps in a gameful system's design. It was constructed based on an examination of the literature cited in Table 3, by writing adequate guidelines for each of the twelve identified dimensions. Prior research on motivation [35,36] enabled categorization of the twelve dimensions into *intrinsic*, *extrinsic*, and *context dependent* motivational categories (see Table 4). Next, we built our set of gamification heuristics based on this categorization (see Tables 5–7) to highlight the different uses of intrinsic and extrinsic motivators.

Gamification by Design [43] Gabe Zichermann and Christopher Cunningham
Six Steps to Success [41] Kevin Werbach and Dan Hunter
Gamification framework [12] Francisco-Aparicio *et al.*
Octalysis [3] Yu-kai Chou
HEXAD [21] Andrzej Marczewski
The Kaleidoscope of Effective Gamification (KEG) [17] Dennis Kappen and Lennart Nacke
Loyalty 3.0 [31] Rajat Paharia
Gamify [1] Brian Burke
The RECIPE for Meaningful Gamification [24] Scott Nicholson
Gamification Model Canvas [16] Sergio Jiménez
Super Better [22] Jane McGonigal
The Lens of Intrinsic Skill Atoms (Motivational Design Lenses – MDL) [11] Sebastian Deterding

Table 2: A summary of existing gameful design frameworks and methods considered in our research.

Dimension	Octalysis [3]	HEXAD [21]	RECIPE [24]	KEG [17]	Super Better [22]	MDL [11]
Purpose and Meaning	Epic Meaning & Calling	Philanthropist	Information; Reflection		Epic win	
Challenge and Competence	Development & Accomplishment	Achiever	Engagement	Competence; Challenge	Challenge; Bad guys	Challenge lenses; Intrinsic rewards
Completeness and Mastery	Development & Accomplishment	Achiever		Competence; Achievements	Complete quests	Goal lenses; Action lenses; Intrinsic rewards
Autonomy and Creativity	Creativity & Feedback	Free Spirit	Play; Choice	Autonomy		Object lenses; Intrinsic rewards
Relatedness	Social Influence & Relatedness	Socialiser	Engagement	Relatedness	Recruit your allies	Intrinsic rewards
Immersion			Exposition	Perceived Fun	Secret identity	
Ownership and Rewards	Ownership & Possession	Player		Extrinsic motivation	Power-ups	Intrinsic rewards
Unpredictability	Unpredictability & Curiosity	Free Spirit	Play			Varied challenge; Varied feedback; Secrets
Scarcity	Scarcity & Impatience					
Loss avoidance	Loss & Avoidance					
Feedback	Creativity & Feedback					Feedback lenses
Change and Disruption		Disruptor				

Table 3. Common dimensions of motivational affordances from the reviewed gameful design methods.

Intrinsic Motivation Heuristics	**Intrinsic Motivation Heuristics**

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Intrinsic Motivation Heuristics

This category includes affordances related to the three psychological needs introduced by SDT [35,36] (competence, autonomy, and relatedness), as well as purpose and meaning, which facilitate internalization as suggested by SDT [5], and immersion as suggested by Ryan and Rigby [34,37] and Malone [20].

Extrinsic Motivation Heuristics

This category includes affordances that provide an outcome or value separated from the activity itself as suggested by SDT [36] and Chou [3]: ownership and rewards, scarcity, and loss avoidance.

Context Dependent Heuristics

This category includes the feedback, unpredictability, and disruption affordances, which can afford either intrinsic or extrinsic motivation, depending on contextual factors such as the kind and the user's personal perception regarding the task at hand.

Table 4: Categories of motivational affordances in our gameful design heuristics.

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Intrinsic Motivation Heuristics

Purpose and Meaning: Affordances aimed at helping users identify a meaningful goal that will be achieved through the system and can benefit the users themselves or other people.

I1. *Meaning*: The system clearly helps users identify a meaningful contribution (to themselves or to others).

I2. *Information and Reflection*: The system provides information and opportunities for reflection towards self-improvement.

Challenge and Competence: Affordances aimed at helping users satisfy their intrinsic need of competence through accomplishing difficult challenges or goals.

I3. *Increasing Challenge*: The system offers challenges that grow with the user's skill.

I4. *Onboarding*: The system offers initial challenges for newcomers that help them learn how it works.

I5. *Self-challenge*: The system helps users discover or create new challenges to test themselves.

Completeness and Mastery: Affordances aimed at helping users satisfy their intrinsic need of competence by completing series of tasks or collecting virtual achievements.

I6. *Progressive Goals*: The system always presents the next goals users can pursue that are immediately achievable.

I7. *Achievement*: The system lets users keeps track of their achievements or advancements.

Autonomy and Creativity: Affordances aimed at helping users satisfy their intrinsic need of autonomy by offering meaningful choices and opportunities for self-expression.

I8. *Choice*: The system provides users with choices on what to do or how to do something, which are interesting but also limited in scope according to each user's capacity.

I9. *Self-expression*: The system lets users express themselves or create new content.

I10. *Freedom*: The system lets users experiment with new or different paths without fear or serious consequences.

Relatedness: Affordances aimed at helping users satisfy their intrinsic need of relatedness through social interaction, usually with other users.

I11. *Social Interaction*: The system lets users connect and interact socially.

I12. *Social Cooperation*: The system offers the opportunity of users working together towards achieving common goals.

I13. *Social Competition*: The system lets users compare themselves with others or challenge other users.

I14. *Fairness*: The system offers similar opportunities of success and progression for everyone and means for newcomers to feel motivated even when comparing themselves with veterans.

Immersion: Affordances aimed at immersing users into the system to improve their aesthetic experience [15], usually by means of a theme, narrative, or story, which can be real or fictional.

I15. *Narrative*: The system offers users a meaningful narrative or story with which they can relate to.

I16. *Perceived Fun*: The system affords users the possibility of interacting with and being part of the story (easy fun; [19]).

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Table 5. Intrinsic motivation heuristics.

Extrinsic Motivation Heuristics

Ownership and Rewards: Affordances aimed at motivating users through extrinsic rewards or possession of real or virtual goods. Ownership is different from competence when acquiring goods is perceived by the user as the reason for interacting with the system, instead of feeling competent.

E1. *Ownership*: The system lets users own virtual goods or build an individual profile over time, which can be developed by continued use of the system and with which users can relate to.

E2. *Rewards*: The system offers incentive rewards for interaction and continued use, which are valuable to users and proportional to the amount of effort invested.

E3. *Virtual Economy*: The system lets users exchange the result of their efforts with in-system or outside rewards.

Scarcity: Affordances aimed at motivating users through feelings of status or exclusivity by means of acquisition of difficult or rare rewards, goods, or achievements.

E4. *Scarcity*: The system offers interesting features or rewards that are rare or difficult to obtain.

Loss Avoidance: Affordances aimed at leading users to act with urgency, by creating situations in which they could loose acquired or potential rewards, goods, or achievements if they do not act immediately.

E5. *Loss Avoidance*: The system creates urgency through possible losses unless users act immediately.

Table 6. Extrinsic motivation heuristics.

Context Dependent Heuristics

Feedback: Affordances aimed at informing users of their progress and the next available actions or challenges.

C1. *Clear and Immediate Feedback*: The systems always inform users immediately of any changes or accomplishments in an easy and graspable way.

C2. *Actionable Feedback*: The system always informs users the next available actions and improvements available.

C3. *Graspable Progress*: Feedback always tells users where they stand and what is the path ahead for progression.

Unpredictability: Affordances aimed at surprising users with variable tasks, challenges, feedback, or rewards.

C4. *Varied Challenges*: The system offers unexpected variability in the challenges or tasks presented to the user.

C5. *Varied Rewards*: The system offers unexpected variability in the rewards that are offered to the user.

Change and Disruption: Affordances aimed at engaging users with disruptive tendencies [21] by allowing them to help improve the system, in a positive rather than destructive way.

C6. *Innovation*: The system lets users contribute with ideas, content, plugins, or modifications aimed at improving, enhancing, or extending the system itself.

C7. *Disruption Control*: The system is protected against cheating, hacking, or other forms of manipulation from users.

Table 7. Context dependent heuristics.

Using the Gamification Heuristics

Similar to previous heuristic UX evaluation methods, the gamification heuristics should be used by experts to identify gaps in a gameful system's design. They can be used to evaluate the implementation of new gameful design elements into a system or to compare two different gameful systems. Experts should consider each guideline to evaluate whether it is adequately implemented into the system's design. They also need to consider the balance between intrinsic and extrinsic motivational affordances. Cerasoli *et al.* [2] showed that intrinsic motivation is a stronger predictor of performance in qualitative tasks whereas extrinsic motivation is a stronger predictor in quantitative tasks. Thus, combining intrinsic and extrinsic motivations can lead to improved performance. Additionally, prior studies have shown that evaluations conducted by many evaluators are more effective in comparison to evaluations by an individual evaluator [25–27].

Conclusion

We have created a set of 28 gameful design heuristics aimed at enabling experts to evaluate a gameful system to identify design gaps. Our heuristics are based on prior motivational theories and gameful design methods. By deriving our set of heuristics from the common dimensions of motivational affordances employed by different gameful design methods, we have presented a novel and comprehensive approach that encompasses a broad range of motivational affordances. Moreover, by categorizing the heuristics according to motivational type (intrinsic, extrinsic, and context dependent motivation), our model also contributes to raising designers' awareness of the different motivation types. Furthermore, the heuristics are written in a concise form to enable expert evaluation.

Future Work

Our future work will address the use and validation of the suggested heuristics set. First, we need to assume that a gameful system may not need to include all available affordances. The complete set of heuristics represents the best scenario; however, after identifying which affordances were not included in the system, designers will need to further evaluate if these are really needed. A system might be able to accomplish its goals without implementing all the heuristics, in the same way that a game does not need to include all existing game mechanics to be enjoyable. Therefore, future research needs to establish a way to inform designers how to better use these heuristics.

Additionally, we will compare our gamification heuristics with the game design heuristics cited in Table 1. Some overlap between them is expected; however, our method should be better suited for evaluating gameful applications or systems since it excludes heuristics that are applicable to games but not to gameful applications, while at the same time adding new dimensions of motivational affordances. Finally, we will validate our heuristic evaluation method by inviting designers and experts to use it and provide us with feedback.

Our work contributes to the HCI field by presenting a novel evaluation tool that has the potential to inform future research on gamification and gameful design.

Acknowledgements

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