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**TECHNICAL REPORT TITLE -
Design Thinking and Acceptance
Requirements for Gamification Design.
A Research Preview.**

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Design Thinking and Acceptance Requirements for Gamification Design. A Research Preview.

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Abstract. [Context and motivation] *Gamification* is increasingly applied to engage people in performing tool-supported collaborative tasks. Previous experiences demonstrated that: i) available gamification guidelines are not sufficient; ii) motivational and acceptance aspects need to be considered; iii) stakeholders need to be involved in the design. [Question/Problem] Our objective is to develop a methodology to design engaging software systems. Therefore, we need to identify general requirements for such methodology, define how to select and combine suitable methods, and provide guidelines for evaluating results. [Principal ideas/results] We derive key requirements for a structured design methodology by analyzing the literature on gamification design and case studies experiences; propose the combination of *Design Thinking* and *Agon*, a framework for analyzing *Acceptance Requirements*, as concrete methodology. [Contribution] We provide general requirements for an effective methodology to support gamification designers; describe an example of concrete methodology fitting those requirements, and our future plan for implementing it.

Keywords: Design thinking · Acceptance requirements · Gamification · Requirements engineering · Human behavior

1 Introduction

The acceptance of a software system, i.e. motivating people in accepting and using a software system is a crucial factor for the success of such systems [1–3]. *Gamification* has been identified as a mean to meet such *acceptance requirements* [1–3] through the inclusion of game elements and mechanisms in systems that operate in non-game contexts [4] (e.g., air traffic management and decision making [3], software engineering tasks [5]). Practitioners tend to use available gamification guidelines and resources, which are provided in commercial platforms or in publicly available wikis¹. However, research literature on gamification

¹ e.g. https://en.wikipedia.org/wiki/Game_mechanics

design and on the evaluation of the effectiveness of the resulting solutions, points out the limits of current practices, identifies key concepts and discuss the need of specific methods to design engaging software, e.g. [2,6]. In particular, systematic methodologies should guide designers in the exploration of a design space of alternatives [1–3]. Such a design space is defined in terms of motivational, psychological, cognitive, behavioral factors [2] that influence the fulfillment of *Acceptance Requirements* [1,3].

The goal of our research is to define a lightweight and effective methodology at support of designers of gamified solutions. We structure our research along the following research questions (RQs). **RQ1:** What are the key requirements for a lightweight, effective methodology for gamification design? **RQ2:** How can we select and combine existing methods to obtain such methodology? **RQ3:** How can we evaluate the effectiveness of such methodology?

To answer **RQ1** we analyze related literature and lessons learned from documented case studies to derive key requirements for such methodology. A first set of requirements is described in Section 2. We address **RQ2** by analyzing characteristics of existing methods that can be related to the stated key requirements and, in Section 3, we provide an example of two candidate methods that, integrated together, can build such a methodology fulfilling those requirements. One is *Design Thinking* (DT) [7], a popular design technique for solving problems in IT, Medicine, Architecture and other disciplines concerned with design problems. The other is the method of the *Agon framework* [1–3] for analyzing acceptance requirements and operationalizing them through game elements.

The effectiveness of a proposed methodology should be measured in terms of quality of the resulting designed solution, as well as in terms of the degree of coverage of the stated key requirements. We sketch our approach to address **RQ3**, together with future work and concluding remarks in Section 4.

2 Towards Identifying Key Requirements for a Gamification Design Methodology

Challenges and open problems on the design and evaluation of gamified solutions are discussed in several recent works (e.g., [4,8]). Among proposed design approaches, worth to be mentioned are the MDA approach and the gameful design method, which recommend to use iterative design and development approaches which focus on early prototypes. However, a systematic empirical evaluation of the proposed approaches is still missing. Concerning the lessons learned from case studies experiences, in [9] an analysis of gamification patterns is presented. A recent work reports about the experience of developing a gamified collaborative requirements prioritization tool, starting from an analysis of specific requirements rooted into decision-makers' and organisation's objectives [10]. The tool has been validated in the context of three industrial use cases. Moreover, the effectiveness of specific game elements was further investigated through a controlled experiment [11] that revealed a lack of acceptance by intended users.

Towards addressing RQ1, we analyse these experiences and the literature and reflect on aspects related to the gamification of tasks in terms of stimuli and game elements and, more generally, on the need of a structured method that supports designers to explore in a systematic but creative way alternative gamification solutions. More specifically we derive some lessons learned: **LL1** points-based game elements have to be integrated with other game mechanisms to achieve a deeper and more persistent engagement; **LL2** understanding users' motivations and identifying appropriate leveraging mechanisms call for the use of the integration of creative and collaborative design methods; **LL3** a deeper understanding of acceptance requirements is key to help to identify design elements to keep the software system attractive and engaging, in relation to the specific context of use; **LL4** a balance among a systematic approach, collaboration and creativity should be enabled by a methodology at support of gamification designers.

In summary, the key requirements for a lightweight and effective methodology, we identified so far, are: **R1** systematic approach; **R2** participation/collaboration; **R3** creativity; **R4** acceptance orientation; **R5** gamification orientation; **R6** context characterization; **R7** guiding approach; **R8** solution ideation.

The methodology has to be systematic [1–3] (**R1**, **LL4**) (**a**) allowing the exploration of most of the factors influencing the user in being motivated to use a software [2,6] (**LL3**), and (**b**) employing effective techniques for analyzing those factors and designing mechanisms able to satisfy them [3] (**LL1**, **LL3**).

To address factors of (**a**), techniques and mechanisms mentioned in (**b**) [3] are needed as well as deeply involving stakeholders [10,12] (**R2**, **LL2**) in a collaborative (**R2**, **LL2**), creative (**R3**, **LL2**) way [12]. To involve stakeholders in the design is fundamental, because they have the knowledge required for analyzing deeply the specific domain, the situation and the user [10,12]. Collaboration [10] (**R2**) pushes them to a good brainstorming finding more valuable ideas together. Creativity [12] (**R3**) stimulates them in finding more enriched and complete solutions. Thus, techniques mentioned in (**b**), to maximize their effectiveness, should be executed in a participatory, collaborative and creative fashion [10,12].

The final aim of the methodology is to design engaging software for the user, thus, it is fundamental to explore most of the factors (see (**a**) above) that positively influence the user such as psychological, motivational, cognitive and behavioral factors [2] (**R4**, **LL3**). These are usually referred to *Acceptance Requirements* [1–3] and related techniques [3]. They are crucial for selecting psychological strategies as design mechanisms to use to make attractive the software [1]. Thus, the methodology has to be acceptance oriented (**R4**, **LL3**).

Factors analyzed through acceptance requirements have to be mapped with gamification concepts able to fulfill such requirements. It is important to choose those concepts as well as to decide properly how to put them together in a coherent and effective gamification design [1]. Such methodology has to support both these aspects, namely it has to be gamification oriented (**R5**). With **R5**, we mean that the methodology incorporates the gamification design knowledge [3] (**LL1**), and related techniques, able to support the designer in producing a high-quality

gamification design made of concepts, satisfying acceptance requirements, organized according to gamification best practices [1] (**LL1**, **LL3**).

The identification of acceptance and gamification strategies that are effective for a specific kind of user, depends strictly on the specific context variables [1–3] (**LL1**, **LL3**). Thus, such methodology has to support the characterization (**R6**) of context variables such as the human as a user and as a player [1], the goals and needs of the user, the task that the user carries out by using the software and related positive and negative user feelings, what can be produced by using the software and in which social context [2] (**LL3**). Furthermore, a methodology supporting **R6** uses these considerations in individuating which acceptance and gamification strategies best fit the specific context [3] (**LL3**).

Moreover, such methodology is a guidance (**R7**, **LL1**, **LL3**) for analysts and stakeholders [1–3] meaning that it has to: **(i)** guide them in all the phases with techniques supporting all the other aspects [1, 3], **(ii)** make them explore as many as possible relevant elements [2] and, above all, **(iii)** provide suggestions concerning psychological strategies, gamification concepts and best practices to use that are the most suitable ones for the context characterization [1, 3] (**R6**).

Finally, the methodology, to make more concrete suggestions obtained (**R7**) and ideas produced, has to support techniques for devising a solution [10, 12] (**R8**, **LL2**) in a collaboratively and creative way (e.g., collaborative sketching, prototyping, producing wireframes or mockups [10, 12] (**R8**, **LL4**)).

3 An Example of Candidate Methods

As an example of how we intend to address RQ2, we consider two methodologies, *Design Thinking* (DT) and the *Acceptance Requirements Analysis of the Agon framework*, that separately are able to cover partially the requirements above.

Design Thinking. DT [7] allows participants to collaborate closely, generating many ideas and concepts, for devising a solution that best suits the initial problem. This participatory feature can be exploited involving in the process people from heterogeneous teams and, above all, having different knowledge for analyzing the problem from different design perspectives. The method is characterized by different activities. *Personas Definition*, where participants empathize with the typical users to understand their goals, needs and frustrations; *Problems Investigation*, where participants define the typical day of the user, by describing activities and positive/negative feelings; *Solution Ideation*, where participants creatively generate ideas and decide which should be used in next phases; *Prototyping* of a possible solution and *Solution Testing and Presentation*.

Agon: Acceptance Requirements Analysis based on Gamification. The Agon framework [3] and its methodology [1, 2] supports the analyst in analyzing acceptance requirements and fulfilling them with gamification design concepts. Furthermore, Agon provides the analyst with models [3], techniques [1, 2] and a tool for executing its methodology, a systematic acceptance requirements analy-

sis based on gamification. In a first phase of the methodology, the analyst defines and elicits acceptance requirements on the basis of the context characterization. The analyst supported by Agon analyzes and characterizes the (as-is/to-be) software, looking for the crucial functionalities to be gamified, focusing on functionalities that are complex, or not attractive and whose fulfillment lead to the fulfillment of software goals. Moreover, Agon allows to characterize the user, specifying age or gender, her player categories (e.g., socializer, achiever, explorer) or her expertise regarding software usage. In a next phase the analyst can use the Agon Acceptance Model [3] to receive suggestions, as psychological needs and strategies that best fit the specific context [1,2] identified in the first phase. As last phase the analyst can use the Agon Gamification Model [3], containing different gamification elements, for producing a gamification design as a solution.

Why Design Thinking and Agon are Candidate Methodologies. DT and Agon and their interaction are the complementary baseline methods for the methodology we envisage in this work called DTA (Design Thinking & Agon).

DT partially covers **R6** considering user characteristics, needs and goals, while Agon fills the DT **R6** gaps by characterizing the user regarding her player characteristics and the social context where she uses the software to accomplish her goals. Though DT considers (partially) context variables, we cannot define it as completely acceptance oriented (**R4**), because DT does not guide the analyst in using context variables for eliciting psychological strategies to use, for improving software functionalities, by inserting components fulfilling those strategies. The same is for **R5**, because DT does not specifically consider gamification design and related techniques for enhancing software functionalities. While, Agon is compliant with **R4** and **R5**. Furthermore, DT is partially systematic (**R1**) in the sense that, it provides effective techniques and design mechanisms for analyzing relevant motivational factors, but those are focused only on a subset of relevant variables pertaining **R6** and **R4**. Accordingly, DT partially covers **R7** due to the lack in providing **R4** and **R5** suggestions. Agon is **R1** and **R7**, though, focusing specifically on **R4** and **R5** aspects and related **R6** variables.

In summary, DT is a powerful methodology for effective software design. Its best peculiarities reside in its approach that makes participants collaborate proactively and creatively (**R2**, **R3**) also through prototyping (**R8**). However, the DT approach is generic and, thus, does not cover specific concepts and techniques regarding gamification design (**R5**) and, it is only partially acceptance oriented (**R4**). Agon covers at all **R8**, not mainly **R2**, but stimulates **R3** offering many suggestions (**R7**) and a interactive approach.

Accordingly, being DT a strong generic design process, we propose DT as the backbone of DTA. The Agon methodology, being specific of acceptance and gamification design, done in a systematic and guiding way, can be inserted in DTA to have a wider set of context variables to consider and, specific acceptance and gamification techniques, missing in DT. Thus, Agon contributes making DTA a systematic and guiding approach concerning acceptance and gamification, and DT, making DTA, a participatory, collaborative and creative design process.

4 Concluding Remarks and Research Plan

We illustrated the three research questions that guide our research aiming at defining a lightweight and effective methodology for designing gamified software. We presented preliminary findings, derived from the analysis of literature on gamification of software applications and case studies, in terms of key requirements the methodology should address. This is our first step towards answering RQ1. Concerning RQ2, we describe an example (DTA) where we consider combining DT and the Agon framework. Moreover, we performed a feasibility study applying the resulting methodology, DTA, for the gamification of DMGame, a tool within the SUPERSEDE European project, and results are promising.

As future work, we intend to refine all the aspects of the methodology and provide guidelines to evaluate it. We also plan to apply these guidelines for evaluating DTA through feasibility studies in the field of gamification applied to the design of tools in the decision-making area.

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