TECHNICAL REPORT TITLE - Gamification Solutions via Software Engineering and Organizational Studies: A Comparative Study

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Gamification Solutions via Software Engineering and Organizational Studies: A Comparative Study

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Abstract. [**Context and motivation**] *Gamification* is a powerful paradigm and a set of best practices for motivating people to carry out a variety of ICT–mediated tasks in a game–like fashion. [**Question/problem**] Designing gamification solutions and applying them to a given ICT system is a complex and expensive process as software engineers have to cope with heterogeneous stakeholder requirements on one hand, and *Acceptance Requirements* on the other, that together ensure effective user participation and a high level of system utilization. [**Principal ideas/results**] As such, gamification solutions require significant analysis and design as well as suitable supporting tools and techniques. [**Contribution**] In this work, we compare concepts, tools and techniques for gamification design drawn respectively from *Software Engineering* and *Human Behavior* and *Organizational* Studies. We conduct the comparison by applying both perspectives to the Meeting Scheduling exemplar from the Requirements Engineering literature.

Keywords: acceptance requirements · gamification · goal models · requirements engineering · human behavior · organizational studies

1 Introduction

Over the last decade, *Gamification* has been drawing growing interest among scholars and practitioners in many fields [9]. Indeed, gamification has been considered as a useful tool to enhance participation, social interaction, motivation and performance when carrying out certain activities and tasks. As such, gamification have been applied to many fields spanning collaborative activities and education [12, 26].

One of the most promising fields of application is software *Requirement Engineering*. In this field, the engagement and motivation of the users is of special interest considering the human–intensive nature of software–mediated processes. As a matter of fact, gamification has been applied to many aspects in this area such as for instance user requirement elicitation, software requirement analysis implementation and versioning [19].

The success of a software mainly resides in a good quality design of how the user interacts and is engaged and motivated by the software itself. Thus, the elicitation of user requirements is perhaps one of the key phases towards the implementation of a "gamified" software [16] Many practical tools as well as theoretical models manage and cover the relationship between *Gamification* and *Software Engineering*. Unfortunately, despite the large amount of hits on the topic, it is still an open problem whether and to what extent design and use gamification in this context. For instance, from an *Engineering* point of view, many models and best practices have been proposed but there is no holistic approach able to take into account the complexity of the behaviors and attitudes of the human being (lack in cognitive, psychological, sociological knowledge and relations) [22]. From a *Social/Economic* point of view, there are many theories and practices on motivation, incentives, human behaviors and game theories, but very little operative recommendations (a part of mechanism design in experimental economics), which help game designers to develop and manage incentives and relationship dynamics via software [7].

The main objective of this paper is to compare two different frameworks that respectively address these engineering and social/economic aspects. We do so by adopting existing gamification methodologies proposed in different disciplines, and analyze a meeting scheduling software system example as a simple example of social software that might be gamified. Based on such analysis, we show differences and correlations, and propose preliminary guidelines for an innovative and holistic framework based on the two different perspectives.

The rest of this paper is organized as follows: section 2 briefly recaps the literature on gamification and software engineering applied to gamification. Section 3 analyzes the two frameworks adopted in this work. Section 4 applies such frameworks to the meeting scheduler exemplar. Section 5 discusses the comparison results and section 6 concludes this work and outlines future work.

2   Related Work

With gamification it is usually intended the use of design characteristics of games in non-game contexts [6]. The increasing interest in gamification is in part due to the fact that game industry has experienced explosive growth over the last three decades showing the potential impact of such field on the behaviors of users. Gamification mechanisms have relevant importance also concerning advergames, in–game advertising, serious games and alternative reality games.

In recent years, gamification has been applied to systems and apps in different scopes, sectors, and for different reasons, with positive results [9,13]. In fact, both practical experiences from the market and studies from the literature, confirm that gamification can be very useful in heterogeneous sectors [9]. Therefore, an increasing amount of studies regarding the *Gamification Engineering* (Software Engineering of Gamification) have been appearing [10,11,13,22,27], with the aim to improve the related process trying to make it easier, rapid and cheaper. They

are mainly related to *Gamification Frameworks* (also called *Platforms*, *Engines* or *Systems*) and *Languages*.

According to *Human Behavior* and *Organizational Studies*, a lot of carefully crafted policies and best practices have been developed and can be used to design tools promoting the user participation. Since the 1930s, various motivational factors have been identified in *Organizational Studies*, *Experimental Economics*, *Sociology*, and *Political Science*. In the last decades, various studies have been carried on, focusing on user motivation and human willingness to participate (antecedents) and best practices (mechanism design) that encourage participation. Although these studies reveal that the inner motivations that drive people to participate are heterogeneous and strongly connected with the uniqueness of each project, we have identified some regularities categorizing motivation as needs of reciprocity, reputation, competition, conformity to a group, altruism, self esteem, fun and personal enjoyment, implicit promise of future rewards, and money [5, 29]. Nowadays some of these factors can be profitably used as best practices, not only to design incentives within a company, but also to design games.

By focusing on *Organizational Studies* and analysing various studies on motivation, we have identified some variables that influence the contributor/worker performance. These variables are described in the *Motivational Antecedents Framework* which includes the goal of any activity, the set of task a person has to carry on in order to pursue the goal, the social structure in which the actor behave (a team of peers, a company, a community), the nature of the good being produced (is a public, club or private good). This framework will be described in the following section.

A *Gamification Framework* is a software system that supports the analyst/designer/developer concerning software engineering activities (e.g., analysis, design, development) by applying gamification to a system and by offering well–established gamification procedures and ready–to–use tools.

Gamification frameworks from the market, besides their advantages, have still important limitations [27]. In fact, most of them are not flexible and generic to be applied successfully to a variety of cases due to their domain–specific design (e.g., Youtopia focuses only on education), many support only a reduced set of gamification concepts (e.g., UserInfuser and Mozilla Open Badges) [10] that implies a limited expressiveness to design a significant variety of gamification scenarios. Another limitation is due to the dependence on third–party environments in relation to configuration, implementation, maintenance or runtime aspects, such as most of the platform illustrated in [10].

In literature there are still a few (but increasing) studies that try to overcome the market frameworks limitations, thus that topic appears to be an open, new research direction. Some researchers propose generic gamification engineering approaches and generic frameworks that are more flexible and employable in a wider range of cases [10, 13, 27]. Herzig et al. [10] presented a prototype of a generic gamification platform for enterprise information systems and business–to–business integrated systems based on an event driven architecture. Kazhami-

akin et al. [13] designed a generic and extensible service oriented gamification engine and tested it successfully in an on–the–field case study concerning motivating citizens to use sustainable urban transports. Sripada et al. [27] described a generic, extensible framework for modeling gamification concepts as modules able to expose RESTful web services. They defined a service oriented architecture able to integrate and extend already existing gamification services. Their study aims at gamifying software engineering tasks.

Regarding *Gamification Languages*, GaML, a language for modelling gamification concepts introduced by Herzig et al. [11], is the most completed one. In fact, other similar studies are not completely able to model gamification concepts. Additionally, they are either too specific, or readable/writeable only by designer with relevant IT background.

Gamification frameworks mentioned earlier provide support regarding gamification design and development activities. As far as we know, at the moment of writing, the only framework able to support the analyst in the *Requirements Elicitation* and *Analysis* phases for applying gamification to a system is *Agon* [22], discussed in greater detail in the next section. *Acceptance Requirements* [22] are a significant class of requirements as important as usability, performance and security requirements classes. Sometimes acceptance requirements are also called in the literature as *Usage Requirements* or *User Acceptance Requirements*. Related works tackle a wider problem, technology acceptance [1, 23], or issues for narrow domains related to software systems acceptance [28] by employing well–established or ad–hoc *Acceptance Models* [30, 31] derived from psychology and sociology theories.

3   Frameworks

In this section we present two different frameworks, the first is grounded in organizational studies, human behaviors and job design, the second is grounded in cognitive science and software engineering. In section 4, these are applied to the meeting scheduling exemplar.

Motivational Antecedents Framework. The first framework is called motivational antecedents frameworks and is based on four main variables that characterize games and influence contributor performances [26, 29] (Fig. 1). These are: (i) `Goal`; (ii) `Task`; (iii) `Social Structure`; (iv) `Nature of Good`.

The `Goal` is what people want to pursue and their aspiration to achieve it. For instance, individuals are not motivated if the goal is too easy and feel frustrated if the goal is too difficult. Also the perception about how much time is required to achieve the goal, affect the aspiration level. If the goal is difficult to achieve, the aspiration level can be raised by a high level of communication and participation, through which individuals understand and redefine the goal, getting more and more committed. So, a reasonable difficulty level significantly correlates with motivation and how much effort and persistence individuals will exert to achieve their goals [2, 15].

Goal		Tasks		Social Structure	Nature of good being produced
Communciation level (about the goal)	High	Variety	High	Hierarchy-neutral	Public good (non rival, non exclusive)
	Medium		Medium		
	Low		Low		
Participation level (in defining the coal)	High	Specificity	High		
	Medium		Medium		
	Low		Low		
Clarity level	High	Identification	High	Hierarchical	Private good (rival, exclusive)
			Low		
	Low	Required skills	Highly specific		
			Trivial common		

Fig. 1. Motivational Antecedents Framework and its elements highlighted for this study

The `Task` refers to the set of actions actors have to deal with in order to achieve a goal. Various elements affect individuals' inner motivations, which, in turn, influence their performance in terms of quality and speed of the performed action. Variety refers to the multiplicity of activities needed to perform the job. It correlates positively with individuals' competencies and ability to coordinate multiple activities and adapt to change. For that reason, various tasks and games should be designed. Task identity is the extent to which people perceive a job as a complete set of steps that lead to clear results [8] individuals tend to appreciate being able to produce a meaningful outcome that is identifiable as their own. Task specificity and clearness are related to performance. When a task is not well understood, participation and meaningful negotiation with others can help individuals better understand it. Autonomy and task discretion refer to how much freedom individuals have to perform in terms of time and quality. If the task is mandatory and the level of goal congruence is low, various incentives are necessary to reduce individuals' opportunistic behaviors and guarantee good performance. Task significance refers to the impact a specific task can have on those outside the individual or group that is performing the task [17]. Task significance is considered critical because individuals are increasingly concerned with doing work that benefits others and contributes to society as a whole.

The `Social Structure` denotes a set of relationships that occur among individuals involved in pursuing a goal. Social norms have a strong influence on the channels of communication, coordination mechanisms, beliefs and views, feelings, and motivations that affect these relationships [24, 25]. Being in a hierarchical organizational structure, means to be affected by the so called *Principal Agent* relationship in which the principal delegate an agent to deal with a specific task. In this case the agent has the obligation to deal with the task and the principal needs to control it (as in a employer–employee relationship). In hierarchical neutral organization, participants are a group of peers.

The `Nature of the Good` describes the relationship between the good produces and who consumes it. Private goods are excludable and rival, namely a specific user can take exclusive advantage of it (consumers might have to pay to use it). By contrast, public goods are neither rival nor excludable. Namely,

as soon as they are created any individual can use them, and nobody can be excluded. Typically, if the good is private the creator want to be payed for that, if it is public he/she can create it for free as for a "noble" cause.

Agon: an Acceptance Requirements Framework. Agon [22] is a generic framework for supporting the analyst in designing effective gamified solutions that coherently take in account cognitive aspects able to affect positively particular kinds of users. This can be especially useful in the context of social software systems, where it is even more important to find ways to motivate users in participating to system activities, because this is crucial for determining the success or the failure of those systems. Therefore, Agon guides and supports the requirements analyst, especially the one of social software systems, in relation to the *Acceptance Requirements Analysis* [22], aiming at producing a gamified solution able to maximize the social software usage. It can be used also for *Acceptance Requirements Elicitation* [22] by involving stakeholders in a participatory way during this phase.

Principal elements of the framework [22] are two goal models: a generic *Acceptance Model* and a generic *Gamification Model*. The first one represents the problem space offering refinements for acceptance requirements as psychological factors that can positively contribute for the acceptance of a social software system. The second one captures gamified operationalizations for acceptance requirements as gamification elements and design patterns for maximizing the utilization of a social system.

Agon consists also of a *Tactical Model* that is a goal model acting as a bridge among the two far worlds of acceptance and gamification. In fact, it covers the gap among the acceptance and gamification models and at the same time is a component for decoupling them. Moreover, the tactical model offers further refinements (named tactics) for acceptance requirements and links them with gamification goals.

Each model is located at a different abstraction layer into the framework. At the highest level of abstraction, the acceptance layer, there are psychological needs that can be refined by tactics located at the tactical layer, which is less abstract, and, finally, tactics can be operationalized by the more concrete goals that compose the gamification layer.

Moreover, different kinds of people are motivated effectively by different kinds of acceptance and gamification strategies [3, 14, 31, 32]. This concept, in Agon, is captured by a *User Context Model* and *Context Dependent Rules*. Dimensions of the user context model are user characteristics related to common aspects (e.g., gender and age), gamification aspects (e.g., player types such as socializer, achiever, explorer, killer) and acceptance aspects (e.g., expertise and awareness regarding the system proposed). Context dependent rules associate those dimensions with the most pertinent acceptance and gamification concepts for representing best strategies able to improve user involvement depending on the user characteristics. Moreover, the acceptance and gamification models are annotated by these rules and Agon, on the basis of them, can execute reasoning over them

for selecting most suitable strategies for engaging the intended group of users and propose this result to the analyst.

Agon models are generic reference meta–models, because they do not refer to a particular domain and can be applied to a variety of domains. They are composed of 270 goals and 376 relationships of different kinds and have been continuously growing and improving in dimension and quality by adding new psychological factors, gamification concepts and best practices [22]. The acceptance, tactical and gamification models were designed by extending the *NFR Framework* [4] and the user context model by extending *Context Dimension Trees* [18]. Complete models and a glossary (concerning elements of the Agon Framework) are respectively available online at [20] and [21].

The *Acceptance Requirements Process* can be summarized as follows. The requirements analyst characterizes the intended group of people to motivate by referring to the user context model. Agon, on the basis of the user characterization chooses psychological factors that best fit by using the acceptance model. These factors are refined by tactics of the tactical model that in turn are used by the framework for selecting most suitable gamification concepts and best practices. On the basis of selected elements, Agon provides the analyst with a gamified solution. Moreover, the process can be interactive because the analyst can make decisions, during all the phases, concerning intermediate and final solutions proposed by Agon.

In section 4, we show a complete case study concerning how to motivate users of a Doodle–like meeting scheduler to indicate their preferred dates for scheduling a meeting. In the following, we describe a very simplified version of it for providing an example of the process [22]. First of all, the analyst characterizes the intended group of people to convince: senior employed males that are achievers as kinds of players, they are not experts regarding using Doodle or similar software, it is not mandatory for them to fill the Doodle and they have not scheduled meetings by using IT systems previously. Agon, on the basis of the characterization proposes to take in account the `Reduce Effort Expectancy` acceptance need, because there is a rule annotating it saying that elders are influenced positively if that need is satisfied [31]. Agon chooses `Improve Perceived Ease of Use` as need that can contribute positively to the previous one, and as refinement of it the `Improve System Perception via IT` tactic. Finally, it individuates as operationalization of this tactic a gamified training element that is `Provide Tours`. Thus, the gamified solution is to motivate elders making them aware using Doodle requires low efforts, by improving their perception of it through a gamified IT solution: a gamified tour showing how to use Doodle. Concluding the example, because Agon models are generic reference meta–models and do not refer to a particular domain, the analyst has to instantiate the tour with elements specific of her domain, the meeting scheduler. Thus, she adds final tasks [4] (activities that can be executed by a person or the system–to–be fulfilling the upper goals) for indicating the features to show in the tour concerning the usage of Doodle, for proposing the tour before compiling and the possibility to skip the tour making it an optional feature.
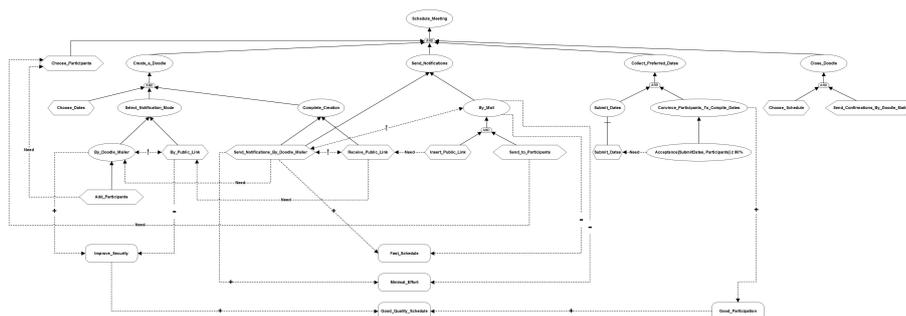
4   Case Study

For conducting our case study, we use the *Meeting Scheduler Exemplar*, a well–established exemplar concerning the *Requirements Engineering Community*. However, due to our need to have social software characteristics, we propose a *Doodle–like version* of it. In this version, as in most of social software systems, participation is a crucial aspect, because these kinds of systems require that tasks users complete some important tasks in order to make the system works, for achieving its target and for having success. We applied our frameworks and the two different approaches and perspectives to this case study.

In the following, we start illustrating the problem of this case study, the related exemplar employed and the characterization of the group of people to stimulate. Then, we show the process in using the two different frameworks and which solutions can be obtained.

The Doodle–Like Meeting Scheduler Exemplar and the Target Group.
The system to gamify, in this case study, is the Meeting Scheduler Exemplar adapted to Doodle [22]. Its requirements specification is illustrated in Fig. 2 as a goal model [4]. Principal goals (refined until tasks) concern the creation of a


Fig. 2. The Doodle–like Meeting Scheduler exemplar used in the case study [20]

Doodle, the choice of available meeting dates, the decision of the notification mode and the notification activity itself to potential participants with the request of indicating their favourite dates. In this case, the crucial goal to fulfil is `Convince Participants to Compile Dates`. It is crucial due to the fact that on its fulfilment depends also the success of the entire system. In fact, if users do not fill the doodle, it is not possible to find a date for the meeting and organize it. This is a typical acceptance and gamification issue, because it highly depends on the users and on the way we decide to engage them. The frameworks of this case study show how to design a solution for it.

Before designing a solution, it is important to define the characteristics of the users to engage. The scenario used in this case study is that of university

professors who have to schedule a meeting. The characterization [22] of the group of people for this case study is (Fig. 3): senior male professors and achievers as kinds of players [3]; the users are not experts regarding using Doodle or similar software, it is not mandatory for the users to fill the Doodle, users have never scheduled meetings by using IT systems previously.
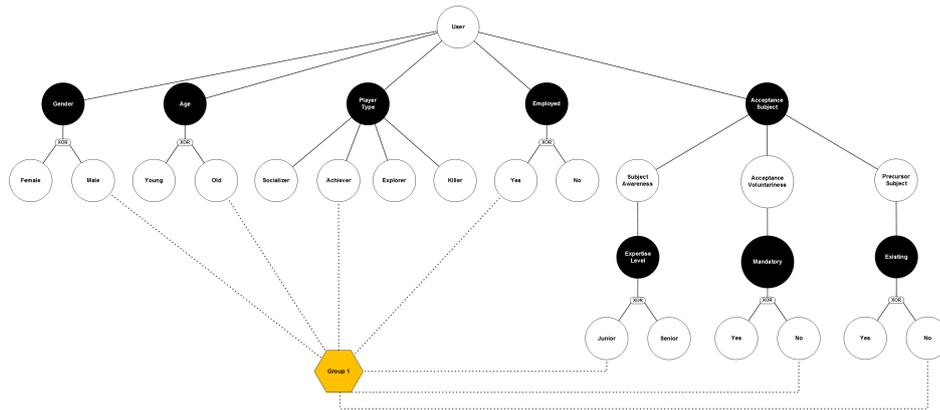
Fig. 3. The target group of users for the case study defined by using the User Context Model [20]

Using the Motivational Antecedents Framework. According to the case study, the `Goal` (Fig. 1) is to find a suitable timeslot in order to schedule the meeting. The goal is very simple and very clear, therefore both communication and participation levels are very low. For instance a single message can be sent to the professors and participation can be even asynchronous and via short messages.

Analysing the `Task` (Fig. 1), we argue as follows: the set of activities needed to achieve the goal are very simple, easy to understand, and have low level of variety. Namely if the task is getting to be repeated various time, participants will get bored. The task also requires a low level of specificity and trivial skills. Even if professors did not use any technology to schedule a meeting, the user interface and the actions that should be taken are very intuitive and the identification of the task is very low. In other words professors consider this activity as trivial, boring, and time spending.

The `Social Structure` (Fig. 1) refers to the university, as in a organizational hierarchy, but to deal with this task professors can be considered as a group of peers.

Finally, the `Good` (Fig. 1) that is produced is a public good, or better a club good, shared by all invited professors, even if they did not compile any date.

Using the Acceptance Requirements Framework. Agon [22] is an acceptance requirements framework that offers also a design process for generating incrementally a gamified solution. The process starts from taking in consideration the acceptance requirements to fulfil (`Convince Participants to Compile Dates`) and the user characterization defined by means of the Agon user context model (Fig. 3). In the following paragraphs, we describe the phases of the process [22] applied to our case study and outline some examples. In the last paragraph, we provide a summary of the complete gamified solution [20, 22] obtained by employing Agon. In each phase, the analyst can make further decisions over solutions generated automatically by the framework, also by reading a glossary related to elements of the Agon models [21].

The first phase regards context–based reasoning over the acceptance model. It is context–based reasoning, because takes in account the characterization provided and the rules annotated in the acceptance model, for elaborating an acceptance solution [20] made of most suitable psychological needs. For example, `Increase Social Influence` is effective if you are dealing with females [31] and, because we are dealing with males, Agon removes it. According to it, Agon selects `Reduce Effort Expectancy` because there is an annotated rule saying that elders are influenced positively if that need is satisfied [31]. The analyst confirms another proposed need, `Improve Perceived Ease of Use`, because it can supply the user with an introduction to the tool, which is enough concerning Doodle. According to this, the analyst discards `Improve Skills` because it can lead to define intensive training that is too much for learning to use Doodle.

Then, there is a requirements selection made at the tactical and gamification levels of the framework involving interactively the analyst. `Improve System Perception via IT`, `Support Achievement` and `Improve Perceived Status` are tactics found by Agon that can satisfy the acceptance solution. The analyst confirms all of them. The framework suggests other particular tactics, related to gamification aspects, that do not guarantee to solve the acceptance problem, but, as side–effect elements, can improve the gamified experience of the player. For instance, the analyst accepts `Increase User Surprise`, `Support User Penalization` and other related tactics.

The next phase regards context–based reasoning over the gamification model. It is context–based reasoning, because takes in account the characterization provided and the rules annotated in the gamification model, for elaborating a gamified solution [20] made of most suitable gamification concepts and best practices. Moreover, the gamified solution produced by Agon is computed by selecting gamification elements able to fulfil the acceptance and tactics requirements chosen in the previous phases. For example, due to the rule saying that dealing with elders it is better to use publishable badges than private ones, because they operationalize `Support Social Behavior` [22], which is desired by elders, and the `Set Publishable` gamification goal related to badges operationalizes one of our confirmed tactic (`Improve Perceived Status`), Agon selects `Set Publishable`. Furthermore, the analyst can take further decisions over the gam-

ified solution generated automatically by the framework. For instance, she can just keep gamification goals, cut some of them or even add new goals and tasks (hexagons in [20]) as shown in the next phase.

The last phase is the gamified operationalization made by the analyst over the gamified solution produced by Agon. It is important because Agon models are generic reference meta–models that do not refer to a particular domain. Therefore, it is the responsibility of the analyst to adapt the valuable gamification solution generated to the constraints of her domain. For instance, the analyst changes the way leader–boards are computed. In fact, even thought Agon suggests to calculate them on the basis of points, a generic best practice, the analyst prefers a more precise solution: to reward the first users that indicate their favourite dates. Therefore, for operationalizing her decision, the analyst substitutes `By Points` with `By Compiling End Time` as task for fulfilling the `Set Leader-boards Calculation Strategy` gamification goal.

In this last paragraph, we provide a brief summary of the complete gamified solution [20] obtained by employing Agon for supporting the analyst in operationalizing the `Convince Participants to Compile Dates` goal. In the gamified meeting scheduler, some of the gamified activities (`Gamifiable Actions`) the player can perform are: have an optional (`Set Skip the Tour feature`) tour (`Provide Tours`) offered before filling the Doodle (`Propose Tour Before Compiling`), or fill the Doodle winning a badge (`Set Potential Participant Badge`) and 10 redeemable points (`Set 10 RP`). At the acceptance level, the analyst discarded the `Improve Skills` acceptance need, because it would have led to intensive training solutions that is too much for learning to use Doodle features. According to it, the training solution generated by Agon, `Provide Tours`, meets exactly the expectation of the analyst to give to the user just an introduction, to main features of Doodle, creating a perceived knowledge and satisfying the `Improve System Perception via IT` tactic which in turn fulfil the `Improve Perceived Ease of Use` need, both confirmed by the analyst in the process phases. If the analyst would want an intensive training, she should confirm the `Improve Skill` acceptance need, refine it by the `Support Skill Improvement` tactic and operationalizing the latter with `Define Training Paths`, which needs `Provide Tutorials` that leads to create hard learning paths. Then, the first 3 players that compile the Doodle are the winners in the podium (`Set Traditional Podium`) of the leader–board (`Set First Doodle Compilers LB`). Here, the idea is to stimulate people to fill the Doodle as soon as possible. This concept is emphasized also by the fact that these winners are awarded also with redeemable points and badges. In fact, the first wins `Set First Compiling Badge` and `Win 10000 RP Points`, the second `Set Second Compiling Badge` and `Win 1000 RP Points`, the third `Set Third Compiling Badge` and `Win 100 RP Points`. Redeemable points collected can be redeemed in a gamified market (`Set Market`) with tangible rewards (`Add Tangible Rewards`) on the basis of market rules (`Set Market Policies`) designed, especially redeeming rules (`RP Define Exchange Points Rewards`). Lastly, social actions (e.g., `Suggest Meeting`), rewarded by redeemable points (`Win 10 RP`), and a related community, where it

is possible to publish all the publishable (`Set Publishable`, it operationalizes the `Improve Perceived Status` tactic confirmed in the process phases) badges earned, have been specified.

5   Discussion

As we can derive from these two analysis different set of incentives can be created and implemented in the Meeting scheduler tool. The first framework has taken into consideration mainly how the working environment affects users' behaviors, the second has analyzed primarily psychological aspects of participants.

In particular, the Motivational Antecedents Framework considers *Motivations* as internal and external factors that stimulate desire and energy in people to be continually interested and committed to a goal, a task, and a role in a social structure. In other words, motivation is the resulting entanglement of the working context, relationship among actors. That framework provides the theoretical elements for characterizing all these elements in order to define most suitable incentives. Agon considers motivations as factors which derive from the characterization of the user and from the psychological needs extracted by the acceptance model thanks to the context dependent rules.

In relation to the concept *Role of the User*, the first framework includes it in the social structure, referring to relationship among individuals according to their competences and abilities in dealing with the task, or knowledge in managing relations with others. Also in this case, the framework provides the theoretical elements for analyzing these elements for defining most suitable incentives. Agon considers the *Role of the User* as deriving from the characterization of the user and it is a dimension to take in account for selecting psychological factors to employ.

Regarding the *Goal of the User*, the first framework considers it as: the goal is characterized in a dependent way over other two dimensions, the task and the motivation. For Agon, it coincides with the stakeholder goal and it is composed of acceptance requirements to be fulfilled by psychological factors and gamification strategies.

Regarding the *Goal of the Stakeholder*, the first framework considers it as a general goal with the relationships: individual 1:1; principal agent structure n:1; n:n goal of the team (e.g., a group in a company). Agon, considers it indirectly because it is composed of acceptance requirements to be fulfilled by psychological factors and gamification strategies.

Concerning *Acceptance* and *Gamification Concepts* and *Best Practices*, Agon models the knowledge related to most of them by its models, characterization and context dependent rules, and offers a semi–automated process for selecting them and producing a gamification solution. Instead, the motivational framework considers some of those as general categories to analyse in order to select most suitable incentives. Thus, it does not support or model best practices/patterns from acceptance and gamification, and the analyst should have the related expertise and use it in combination with categories above used as valuable indications.

6   Conclusion

The contribution of this work is a comparison of two frameworks (one coming from Human Behavior and Organizational Studies and the other from the Software Engineering field) for designing (as future work) an innovative and holistic framework based on the two different perspectives. The *Motivational Antecendent Framework* is more focused to grasp the complexity of real life dynamics and working environment and, *Agon*, the *Acceptance Requirements Framework*, analyses mainly individual psychological characteristics and how gamification mechanisms can derive. In particular, the support provided by the motivational framework is theoretical and not engineered. In fact, this framework provides the theoretical elements for analysing and characterizing strategic dimensions of the problem. This can help the gamification analyst to have crucial elements useful to select, in a second moment and in a not automated way, the most suitable incentives for designing a gamification solution. Thus, the motivational framework, in comparison to Agon, considers more real life dimensions and in a more precise way. However, Agon is a requirements engineering framework that, taking into account acceptance and gamification best practices as knowledge mapped in its goal models, supports the analyst, in a semi–automated interactive way, in designing a complete gamification requirements specification.

On the basis of the comparison of this work, we envisage an integration of the two frameworks. In particular, Agon, thanks to its gamification engineering nature but also an orientation toward cognitive analysis, is the candidate framework for providing a baseline architecture where to insert theoretical concepts of the motivational framework (as further strategic characterization assets). The resulting innovative and holistic framework will guide the requirements engineer in designing a gamified solution that take into consideration human behaviors and social context aspects as much as cognitive and psychological elements. In the next future, we will refine this innovative framework testing it in concrete case studies. This iterative process will help us to understand if all the aspects considered in the framework are enough to represent a real case and define game mechanics.

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