Gamification and Human Factors in Quality Management Systems: Mapping from Octalysis Framework to ISO 10018

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Abstract. Human factors are important in order to achieve outcomes which are consistent and aligned with organizational strategies and values. However, understanding how to successfully deal with human factors involved in a Quality Management System is a challenging issue. Therefore, there is a need to move beyond traditional mechanisms to manage human aspects. While much attention has focused on the motivation of people though gamification in recent years our mapping found that others human factors described in ISO 10018 such as communication, education, engagement and teamwork could be achieved. Nevertheless, getting the best out of people is not always easy and it is a challenge that cannot be ignored.

Keywords: Gamification, Octalysis, ISO 10018, Human factors

1 Introduction

The overall performance of a quality management system and its processes ultimately depends on the involvement of competent people and whether they are properly introduced and integrated into the organization [1]. The involvement of people is important in order to an organization's quality management system (QMS) to achieve outcomes which are consistent and aligned with their strategies and values [1].

Gamification has gained noteworthy interest in industry and academic settings [2] being implemented in a panoply of settings. In the context of software industry, Gamification deserves special attention, given the human-intensive nature of software processes [3, 4]. Serious games are complete games whereas gamification is a way of designing products and services with the intention of a system that includes elements from games, not a full "game proper" [5]. Gamification is the use of game design elements in non-game contexts [5]. In recent years, there is a growing interest in gamification [3, 6] as well as its applications and implications in several fields such as

education and software process improvement. However, to the best of authors´ knowledge, given the relatively newness of the topic and the lack of formal guidelines for quality assessments in gamification settings in general, and applied to software industry in particular, there is a need to link mature efforts in the field of people and quality management and gamification environments. This paper is a first step towards this goal. In this paper, authors present a mapping on maybe the most mature framework on gamification and ISO 10018:2012 the standard on Quality management, providing guidelines on people involvement and competence.

The remainder of this paper is structured as follows: Section 2 presents the background of this study. Section 3 outlines the ISO 10018 and Octalysis Gamification framework. In Section 4 we report on the results of the mapping. Section 5 summarizes a conclusion as well as outlines future work plans.

2 Background

2.1 ISO 10018

ISO 10018:2012, Quality management – Guidelines on people involvement and competence, is a new ISO standard for organizations of all sizes, types and activities [7]. It is designed to work in conjunction with ISO 9001 standard and help organizations involve their people in the QMS [8]. Two of the key definitions in ISO 10018 are:

- *Competence* is defined as the "*ability to apply knowledge and skills to achieve intended results*"
- *Involvement* is defined as "*engaging in and contributing to shared objectives*"

The contents of ISO 10018 follow the structure of ISO 9001 with the exception of Clause 4 Management of people involvement and competence. Others clauses are: 5 Management responsibility, 6 Resource management, 7 Product realization, 8 Measurement, analysis and Improvement. Most of the activities listed in clauses 5 to 8 can be used as a checklist to assess the current status of an organization regarding people involvement and competence 11]. In addition, ISO 10018 contains two annexes: *a) Human factors that impact the QMS*, and *b) Self-assessment*. Consequently, other important definition in this standard is:

- *Human factors* is defined as "*physical or cognitive characteristics, or social behavior, of a person*"

The following human factors are addressed in the ISO 10018 standard [1] (a full definition of the terms can be found in the standard): *Attitude and motivation, Education and learning, Empowerment, Leadership, Networking, Communication, Recruitment, Awareness, Engagement, Teamwork and collaboration, Responsibility and authority, Creativity and innovation*, and finally, *Recognition and rewards*.

2.2 Octalysis Gamification framework

Octalysis is a complete gamification framework proposed by Yu-kai Chou [9]. We choose this framework because it is well known and has implemented at companies in the real world. In 2015, Chou won "Gamification Guru of the Year" award at the World Gamification Congress which is the biggest event about this topic in Europe. According to its author, it can be used as a tool in applying gamification and analyzing a gamified product or service. Chou claims "*the gamification is design that places the most emphasis on human motivation in the process*". In other words, he suggests that almost every game is "fun" because it appeals to certain core drives within human that motivate players towards certain activities [9]. In essence, Octalysis puts on a Human-Focused Design (as opposed to function focused design to get the job done quickly) [6]. There are five levels in total. Level 1 organizes systematically a list of gamified elements or cognitive drives. Previous studies have advocated that gamification can be used in software process development to make a set of task engaging and motivating [10, 11, 4]. The approach is based on an octagon shape hence its name with eight core drives represented by each side.

1. *Core drive 1: epic meaning and calling* is the need to contribute to something greater than oneself ;
2. *Core drive 2: development and accomplishment* is about motivating people because they are feeling that they are improving, they are leaving up an achieving mastery;
3. *Core drive 3: empowerment of creativity and feedback* is the core drive that motivates people to incorporate their creativity, try different combinations and strategies, seek feedback and adjust;
4. *Core drive 4: ownership and possession* is the primary core drive that motivates people to accumulate possessions, improve it, protect it and get more;
5. *Core drive 5: social influence and relatedness* refers to the activities motivated by the influence of other people (e.g., based on social pressure and what other people think, do or say);
6. *Core drive 6: scarcity and impatience* is what motivates people to want something they cannot have (e.g., because it is not immediately or easily obtainable);
7. *Core drive 7: unpredictability and curiosity* is willingness to discover the unknown outcome and involve chance;
8. *Core drive 8: loss and avoidance* refers to the motivating factors that help people avoid a loss or situations they do not want happening (e.g., to die in a game).

The main benefit of this framework is the connections between the core drives and its facilitation in balancing them. The core drives on the right are considered Right Brain core drive and are related to creativity, self/expression, and social aspects. It implies motivation techniques that are more intrinsic which means that the motivation is the activity itself is rewarding on its own [12] (you do not need a goal or a reward). In contrast, the Left Brain core drives are associated to logic, calculations and ownership. They have a tendency of being more based on extrinsic motivation which means that the motivation is to obtain something, whether it is a goal, a good, or anything

you cannot obtain [9]. However, Chou points out the Left/Right Brain Core Drives are merely symbolical as it makes the framework easier and effective when designing.

Moreover, Octalysis can be divided into two groups regarding their motivational urgency: white hat and black hat. White hat gamification contains the top core drives in the octagon. It is considered very positive motivations and provides people the feeling of being empowered and inspired. Also, it facilitates long term motivation and engagement. Conversely, black hat gamification contains the bottom core drives. It is considered more negative motivations and involves motives that drive active engagement based on uncertainty and the fear of losing something. It could create a high motivation for immediate tasks and drive short term results. However, the two core drives in the middle of Octalysis do not belong exclusively to white hat or black hat gamification. Those two core drives can go in both ways, depending on the applied game design elements and circumstances around the gamified process. To achieve a good Gamification process all eight core drives should be considered on a positive and productive activity so that everyone ends up happier and healthier [9].

Once Level 1 is mastered, one can then apply it to Level 2 Octalysis which tries to optimize experience throughout all four phases of a player's journey: Discovery, Onboarding, Scaffolding, and Endgame. Once you mastered Level 2 Octalysis, you can then push it one level higher to Level 3 and factor in different player types which is based on Bartle's Taxonomy of Player Types [13]: Achievers, Explorers, Socializers and Killers. Accordingly to Chou [14], Higher Level Octalysis processes are really there for organizations that are truly committed to making sure that they push their metrics in the right direction, while improving longevity of a gamified system.

Finally, our study is focused in Level 1 because it is usually sufficient for the majority of companies trying to create a better designed gamified product and experience. This framework contains an extensive list of game mechanics as well grouping them as to why they result in user engagement in a game. In the context of business and enterprise, a job would be considered gamified to the extent that mechanics are used to elicit engagement in the task.

3 Mapping

Although people are fundamental in the software process and in its assessment and improvement [15], enough attention to human factors is still not given [16–18]. Besides much research work has studied the application of gamification in software engineering (SE) for increasing the engagement and results of developers [3] but the existing research on gamification applied to SE is very preliminary or even immature, since most studies have been published in workshops or conferences, and few of them offer sound empirical evidence of the impact of their proposals on user engagement and performance. Therefore mappings allow the detection of differences and similarities between these approaches. Authors will follow the guidelines provided at [19] including these steps: 1) Analyze the models; 2) Design the mapping; 3) Carry out the mapping; 4) Present the outcomes and 9) Analyze the results. In what follows, the mapping performed is described using the method provided.

3.1 Models Analysis

The first activity is to analyze each reference model involved in a mapping process. Octalysis framework and ISO 10018 are studied in detail. An overview of these reference models are described in related literature section of this paper.

3.2 Mapping Design

Authors, following [19] carried out the following activities:

1. Identification of elements to be compared: Octalysis framework involves 8 core drives, and authors identified for each of them which human factors should be compared.
2. Direction of the comparison: the direction is from Octalysis framework to ISO 10018.
3. Comparison scale definition: authors use a "traffic light" scale for the one to one mapping. This scale is also used in the works of [6]:
   (a) E: explicit, the item has appeared in the framework's definition.
   (b) I: implicit, the item has not appeared explicitly in the framework definition. Inferred by the authors or referred inside a previous work of the authors.
   (c) U: unavailable, the item has not appeared anyway.
4. Comparison template definition: All these values are analyzed and checked from a holistic point of view and authors determine to what extent ISO 10018 human factors are fulfilled.

3.3 Mapping

This mapping is an iterative process in which authors analyze the Octalysis framework with ISO 10018. For Octalysis framework all core drives are studied. Authors identified specific techniques. The objective is not to set a naïve approach between Octalysis core drives' names and ISO 10018 human factors' names. In this mapping, authors analyze also whether specific techniques and human factors of the ISO 10018 are also meet. In order to carry out the mapping, a first relationship between reference models is defined. Then, a drilling down process analyzing in detail these relationships helps us to identify fine grained relationships. All these mapping are managed by using several spreadsheets where Octalysis core drives are displayed as rows, and ISO 10018 statements are displayed as columns. As a consequence of this process and given the relationship between Octalysis and ISO 10018, 77 techniques related to Octalysis framework are analyzed and compared to ISO 10018.

3.4 Outcomes

Following the guidelines provided in [19], the document Result of Comparison compiles the mapping and is shared and agreed among authors. Table 1 shows the resulting mapping for core drives. Each column has a fulfillment result based on the inter-

section of human factors. The comparison reveals that core drives do not include all human factors proposed in the ISO 10018. *Recruitment* is overlooked and *Awareness*, *Leadership*, *Networking* and *Responsibility* have appeared implicitly. Furthermore, it is not surprising that *Attitute and motivation* and *Recognition and rewards* are bringing in all core drives. Therefore the current mapping does not cover 100% the ISO 10018. However, accordingly to Werbach and Hunter [20] game thinking can yield winning solutions to real-world so gamification can be applied to recruitment if managers and future co-workers can undertake some part of the recruitment process. That means that properly applied techniques, in a creative way, can enhance any human aspects but it will require a great deal of thought about the entire design of the system, including understanding the nature of users, thinking about what one would like them to do and how best to make them do it – among many other considerations [20].

Table 1. Mapping between Gamification elements to human factors of ISO 10018

	ISO 10018												
OCTALYSIS FRAMEWORK	Attitude and Motivation	Awareness	Communication	Creativity and innovation	Education and learning	Empowerment	Engagement	Leadership	Networking	Recognition and rewards	Recruitment	Responsibility and authority	Teamwork and collaboration
Epic Meaning & Calling	E	U	E	U	U	U	E	U	U	E	U	U	U
Developments & Accomplishment	E	U	I	I	E	U	U	U	U	E	U	U	I
Empowerment of Creativity & Feedback	E	U	E	E	E	E	E	U	U	E	U	U	U
Ownership & Possession	E	U	U	U	U	U	I	U	U	E	U	I	U
Social Influence & Relatedness	E	I	I	U	E	U	E	I	I	E	U	U	E
Scarcity & Impatience	E	U	U	U	U	U	U	U	U	E	U	U	U
Unpredictability & Curiosity	E	U	U	U	U	U	E	U	U	E	U	U	U
Loss & Avoidance	E	U	U	U	U	U	U	U	U	E	U	U	U

On the other hand, four core drives receive more coverage: *Epic Meaning and Calling*, *Developments and Accomplishment*, *Empowerment of Creativity and Feedback*, and *Social Influence and Relatedness.* When *Epic Meaning and Calling* is activated, participants choose to be members of your system and will take action not because it necessarily benefits them directly, but because it turns them into the heroes of the organization's story. *Developments and Accomplishment* stimulates positive emotions, building up a learning curve of the player who receives the feeling of moving forward and achieves a clear goal "satisfying work". In relation to *Empowerment of Creativity and Feedback*, the best way to implement it is by giving people a lot of choices or options to solve one problem. In a good de-

signed gamification this process continuously reoccurs and provides a high engagement over a long time. *Social Influence and Relatedness* is related with the influence of other people, human desire to connect and compare with one another. This can be in order to impress other people, belong to a group and be conform to its social norms, or in order to avoid being excluded or mocked. However, it is mainly addressed in a way of teamwork, where they need or get help from others, and gaining recognition and respect. The power of this element is both in the motivation and satisfaction to belong and contribute to a group. Moreover, the engagement of actually inviting others to the game comes from the understanding the reason of doing so. They know how this benefits themselves.

4 Conclusions

In a work place environment, gamification can increase motivation. Nevertheless, the impact of gamification in the intrinsic motivation can also be negative. But it is not easy design an engaging gamified solution that also fulfills business metrics [9]. Although our current mapping does not cover 100% of the ISO 10018 the insights of this study indicate that gamification can be designed for addressing all human factors. The mapping is defined and applied following Baldassarre et al. approach [19].

The main conclusion from this study is that gamification can be used as method for improving QMS in particular initiatives focus on software process. In fact, we are currently in the process to define and validate a framework that enables the integration of specific gamification mechanisms in the organizational change management of software process improvement (SPI) [10, 11]. However, there are still multiple questions unanswered in the context of applying and implementing gamified solutions in organizations. For instance, whether there is an economic value in applying gamification and how it can be measured. Whereas costs are probably easy to gather, the expected future profits are very difficult to value and the benefits are hard to express in monetary terms.

The results of the study can be used as a basis for further research in the area of gamification and its impact on human factors related to QMS. It is necessary to conduct further research that particularly addresses the effect of gamification in the long run with a focus on the impact on these human factors. Long term studies should be performed, in order to see the impact of repetition and possible boredom after some time. Further research is needed on the risk of alienating people, when the gamified tasks are customized to targeted test subjects.

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