Engineering Software-based Motivation: a Persona-based Approach

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Abstract—**Software-based motivation refers to the use of technology to enhance the engagement and efficiency of people in performing tasks and following a certain behaviour. Instances of such paradigm include gamification, persuasive technology and entertainment computing. Despite its potential, an ad-hoc introduction of software-based motivation to a business environment may lead to detrimental effects such as creating pressure and tension, and also reducing quality and authenticity. Hence, we advocate the need for a systematic engineering process to develop software solutions for motivation requirements. One of the challenges is in the high diversity in users' perception and acceptance of motivation strategies and their software-based incarnations. In this paper, we propose the use of personas as an intermediate step which increases efficiency in the engineering process for both engineers and users. We conduct an empirical research and identify elements which describe people with regard to their perception and preferences towards software-based motivational techniques and create a set of exemplary personas to aid the engineering process. We also present guidelines and challenges related to using persona-based engineering methods for software-based motivation.**

Index Terms—**Software-based motivation, Gamification, Persuasive Technology, Personas, User Centred Design, Social Adaptation**

I. INTRODUCTION

Motivation is a well established topic in psychology and other disciplines such as business management, education, and health care. Despite having a vast amount of definitions in the literature [1], a widely accepted definition of motivation is the "psychological processes that cause the arousal, direction, and persistence of behaviour" [2]. In addition, a motive can be described as the substance that can increase the will of a person to perform a particular behaviour [3]. With the recent advances in computer technology, software-based motivation [4] has seen a rapid growth, with the intention of changing the behaviour of its users [5]. Changing humans' behaviour is in the interest of various disciplines, e.g., psychology [6], business management [7], education [8], and healthcare [9]. There are several strategies towards designing software-based motivation and trying to model behavioural change and persuasion in a technological context, such as Fogg's persuasive strategies [10]. New advances in computing have enabled software-based solutions for business information systems (BIS) to increase motivation in a business setting.

These techniques aim to persuade their users to change their behaviour towards a desired one through persuasion, social influence, and rewarding, but not coercion [10].

Despite several instances of successful implementations of such software-based motivation being present in the literature [11], we argue that introducing software-based motivation to a BIS needs extra care. An ad-hoc introduction of software-based motivation to a BIS may fail to achieve the desired goals of its design, and also be detrimental. It is argued that ad-hoc design of software-based motivation can menace social and mental well-being of its users [12], [13].

One of the important factors in the success of software-based motivation is related to people's perception of the motives introduced to them. An engineering approach would need to cater for such diverse perceptions so that a healthy application of software-based motivation is achieved. This can help achieving a software-based motivation closer to its users' preferences which may lead to a better fulfilment of one business goal of the BIS, that is increasing motivation. An increase in motivation can increase the quality, increase the productivity, and also enhance the social and mental well-being of people within the workplace.

Despite the importance of involving people in the design process for successful software-based motivation solutions, this involvement has its own implications and costs which stem mainly from the high diversity in users' preferences of such a highly personal requirement. People can differ from each other in five aspects of their personality [14]. This means that a high number of distinct personalities and their preferences on motivational elements of software-based motivation can exist. Thus, it is hard to design a software-based motivation setting that can satisfy every single personality and preference. Therefore, we advocate the use of personas [15] in order to create a starting point in the design of software-based motivation and also decrease its costs. There are several uses of personas in software engineering, such as using personas in acquiring user feedback [16]. Mainly, using personas can help software engineers to avoid a cold start in user modelling and preferences elicitation.

Although the use of personas seems to be a promising method in identifying possible preferred settings of software-based motivation, creating personas is a challenging task and

there is no one-size-fits-all method for this purpose [17]. A pragmatic solution is based on eliciting users' perceptions and requirements with regard to a particular domain or design facet, e.g., motivation, and utilising such data in creating meaningful and actionable segments of users and representing them through fictional characters, i.e. personas [18].

In this paper, we conduct an empirical research and propose a set of constituents that can aid structuring and shaping users' preferences on software-based motivation and creating personas for that domain. Users' social and mental well-being within their workplace is a main driver of our study. These constituents help software designers to identify clusters and segments of their actual users with most similar preferences. This, consequently, will help the development of distinctive personas for each of the identified clusters and segments. Personas help to reduce the open space of possible personalities and attitudes and the cost of catering for their needs, requirements, and preferences [19]. It is noteworthy that personas are highly context-dependent and each user population and business may lead to a distinctive set of personas. Therefore, we propose a set of challenges when designing and employing personas in software design, including the selection of a representative user sample, elicitation of their preferences, identification of their clusters, creation of suitable motives for each persona and setting up the evolution plan for motives.

The rest of the paper is structured as follows. Section II describes the methodology we followed in identifying the aspects of software-based motivation that have impact on social and mental well-being of users within their workplace. In Section III, we provide information about personas, how they are created, how they should be customised in order to be used for software-based motivation, and present our developed personas. In Section IV, we discuss how personas can be used to help designers to align a motivation configuration with a given persona. In Section V, we discuss the challenges software designers may encounter during persona development. We conclude our paper in Section VI.

II. METHODOLOGY

In order to identify aspects of software-based motivation that can influence social and mental well-being of the users within workplaces, this research has conducted empirical studies. Initially, an expert study consisting of interviews and a survey was performed to elicit experts views on best practice advices on the design of software-based motivation. Six experts were interviewed and 40 experts have participated in the survey. Next was a qualitative study based on the results of the previous stage in order to clarify the findings with 12 managers and employees. Third phase focused on users' preferences and their opinions on the identified aspects of software-based motivation. In this phase, 10 employees were interviewed. Lastly, 10 psychologists were asked for their opinions on the resulted personas. All the interviews were recorded and transcribed. In the following, we describe each phase in more details.

Following an extensive literature review, interviews and survey studies with experts in persuasive technology and gamification were used to elaborate on different views over best practice advices for the design of software-based motivation. The interviews followed a semi-structured approach and the survey study was designed as open ended in order to allow experts to add additional insights that were not thought of prior to the studies. Table I illustrates the characteristics of the participants and Table II provides the distribution of them regarding their country of origin and area of expertise. Participation in this phase was by invitation only to ensure collected answers were from actual experts in the domain. The full list of interview and survey questions are available via https://goo.gl/7xGtgT.

TABLE I: Characteristics of the Participants

Years of Experience		Level of Practical Experience		
Min	1	Expert	7	18%
Max	10	High	18	45%
Mean	3.12	Medium	14	35%
Median	3	Low	1	3%
Mode	3	None	0	0%

Next phase of this study was aimed at clarifying the findings of the previous phase from the perspective of the users. Twelve people familiar with computers and software-based motivation with industrial experience were invited to participate in this phase of the study. To keep the opinions diverse, seven employees and five managers were interviewed. Participants were all familiar with software-based motivation and used computers as a main medium for their jobs. Diversity in age, gender and work domain was also ensured, including nine males and three females, and their age ranged from 30 to 58 years old. The full list of interview questions can be found on https://goo.gl/QlQ0Cz.

For the next stage, considering the identified aspects of software-based motivation that can affect the perception of users regarding their social and mental well-being within workplace, 10 people were invited to take part in interviews. The participants' age ranged from 24 to 37 years old, consisting of 4 females and 6 males with a balanced academic and industrial experience. The interviews were aimed at eliciting users' preferences and priorities on different settings that software-based motivation could offer. Participants provided their priorities and opinions about various settings of software-based motivation. Moreover, they provided actions they may take where applicable, e.g., decreasing the quality of their work to just receive points. The results of this phase of the study, along with the rest of the findings, helped us in shaping the persona constituents necessary for structuring and developing personas. Furthermore, six different personas were created and used in the next phase of the study. The full list of interview questions can be found on https://goo.gl/QxvOye.

Finally, we have asked psychologists for their opinions regarding the created personas. This stage was focused on identifying if the created personas seemed realistic to them with regards to software-based motivation and users' preferences related to social and mental well-being within workplace. All personas and the persona constituents were explained in details for the psychologists. They have been given one week to study and reflect their opinions. Their feedback was used to analyse and enhance the persona constituents and the created personas.

TABLE II: Distribution of Participants

Participants per Country			Participants per Area of Expertise			
UK	11	Switzerland	2	Education	11	Exertion Interfaces	1
USA	6	China	1	Psychology	7	General	1
Netherlands	6	Italy	1	Enterprise	4	HCI	1
France	3	Japan	1	Tourism	4	Marketing	1
Germany	3	Taiwan	1	Linguistics	3	Modelling and Theory	1
Portugal	2	Norway	1	Game Design	2	Sociology	1
Spain	2			Software Ergonomics	2	Software Engineering	1

III. PERSONAS

The result of this study suggests that people have diverse requirements, preferences, and perceptions about various approaches that software-based motivation uses in order to motivate them with regards to their social and mental well-being within workplaces. As mentioned earlier, it is not feasible to design a software-based motivation that satisfies the requirements of all users. However, we propose the adoption of developing personas in the design phase of software-based motivation in order to tackle this challenge by reducing the number of user types to an actionable amount. The concept of persona is rooted in marketing [15] and is used as an interactive design tool to model users' requirements in the process of software development [20], [21].

As a user centred design (UCD) approach, Cooper [15] advocates the use of personas in shifting the focus of the design towards the end-users of the software system and their requirements. Cooper defines personas as fictional characters that each can describe different types of users and their requirements through ethnographic and empirical analysis of the actual end-users of the software system. Also, Idoughi et. al [22] mentioned that personas try to model the user and point out their important characteristics, goals, and requirements. In order to give life to the fictional personas, usually they are assigned names, age, gender, photos, and jobs.

A. Why Personas

Developing personas should aid software designers to consider the requirements of the actual users in the design process [20] and this can help achieving a software system that is closer to the requirements, needs, and preferences of the final end-users. There are several benefits to the use of personas as discussed in [23], [24], [19], [25]:

- Instead of abstract user information, software engineers will relate to personas easier as they are given life
- Software engineers and software designers can communicate with each other in a fast and effective manner through the use of personas
- Personas will make the design closer to the actual end-users' requirements, rather than what is convenient for the stakeholders
- Personas will enable designers to view the system from the lens of other users, and not just themselves
- By creating a subset of users, designers will be able to focus more on satisfying the requirements of each user type
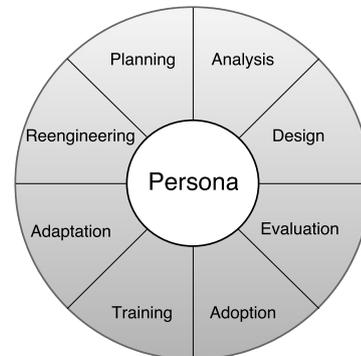

Fig. 1: Involvement of Personas in Software Engineering [25]

- Personas can aid the validation of the software by reviewing the needs and requirements of personas against the behaviour of the software system
- Personas can inspire the designers in the design process (see Fig. 1)

These benefits resemble the potential benefits of developing and using personas in the design process of software-based motivation as a solution to tackle the challenge of satisfying the requirements of end users. Personas can help software designers and software engineers by creating a channel of communication between the actual users and the designers. This can help achieving a software-based motivation that is more acceptable by users from the social and mental well-being aspects.

B. Creating Personas

Using personas in the design of software-based motivation can be a helpful way of having a closer design to the actual requirements of its users. However, developing a representative set of personas is a challenging task on its own and there is no one-size-fits-all solution for creating personas [17]. As Mulder and Yaar [17] state, the most traditional approach for designing personas follows the following steps (as illustrated in Fig. 2):

- **Qualitative research:** This refers to various types of studies, such as interviewing with end users, usually between 10 to 20 people, usability testing which involves observing users behaviour, or field studies, that is observing users in their native environment which has the benefit of asking about users goals and attitudes in a real-world case.
- **Segmentation:** Creating groups of users based on the gathered data from the qualitative research is performed mainly with the goal of finding patterns in users behaviours or requirements and assign them to a similar
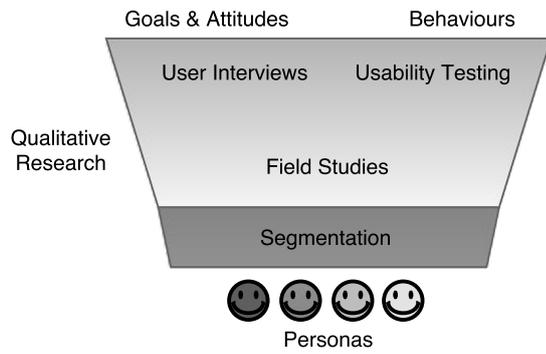
Fig. 2: Persona Creation Approach [17]

group. Typically, each group has a different attitude, goal, and/or behaviour in comparison with other groups.

- **Creating personas:** Each segmented type of users can be transformed into a persona by giving life to them. This is performed by supplying them with names, age, gender, picture, and scenarios.

One way to develop a representative set of personas is to elicit qualitative and quantitative data about the users and turn them into understandable fictional characters that can help designing a certain product [18]. There are several factors that define how personas should be designed [17]:

- Methods used and expenses they need (Money, time, resources), in order to elicit the information,
- how the created personas will be used, and
- final users of personas and their requirements

C. Personas for Software-based motivation

In order to perform the qualitative phase of developing personas, it should be known which aspects and properties of software-based motivation can affect the social and mental well-being of its users. By further analysing our findings in [12] and an additional user study, we come up with the constituents which are important for the users from the perspective of their social and mental well-being in their workplace. In the following we describe the constituents and illustrate them in Fig. 3. In this section, we provide users' views on various properties on software-based motivation and their social and mental well-being within workplaces. We structure our discussion on these properties using Fogg's persuasive model [10]. Furthermore, we use this model as a baseline for the identification of personas constituents which will aid us in the development of personas with regards to social and mental well-being of the users, as illustrated in Fig. 3.

1) Persuasive Tools and Social and Mental Well-being:
Here, we describe how persuasive tools can affect social and mental well-being of the users of software-based motivation.

Tunnelling and reduction: An instance of tunnelling and reduction in software-based motivation techniques is goal setting. It means that users are given pre-defined and step-by-step instructions to perform certain tasks. It enables users to monitor their progress by collecting information regarding the progress of each step. Users have shown various opinions

towards tunnelling. Some users liked the idea and stated that it will ease their job. They found it helpful to have decisions already made for them. However, some found this feature of tunnelling and reduction to be restrictive and stated that "it will make me work like a robot". These users were interested in having the freedom to choose how to perform their tasks instead. Moreover, some others showed interest in having the steps towards achieving the goals, if given the freedom in defining the steps. Users had various opinions on the monitoring aspect of this mechanism. This was of interest of some users as this would inform them in case their task is dependent on another. Some others were worried their managers using this as a leverage to make them to work more.

Tunnelling and reduction requires information related to the performance of its users. Users found this aspect to have an impact on their perception regarding software-based motivation being a source of pressure or stress. A main concern was the frequency of updating. Some users wanted to know about their progress status, reflected by points, instantly. They found it stressful to wait for a period of time to figure out how many points they have achieved. Some others preferred longer intervals, from one day interval to weekly updates. "It will kill the joy if I get the points instantly, I want to feel accomplished when I am done with my task". Others also mentioned that they preferred to have the element of surprise, and receiving all the achievements at the end of the week would provide them with such element and give them more motivation.

Tailoring and suggestion: A common example of tailoring and suggestion is the feedback provided to the users. Feedback is generally an analysis on the performance of users in a period of time. Feedback can be generated algorithmically, by means of computer or can be created for individuals by means of managers or people with the authority. Users had different opinions on this feature of software-based motivation with regards to their social and mental well-being within their workplace. Some preferred human generated feedback over computer generated one. They believed that a computer cannot understand and take into account circumstances in humans' life. Therefore, users thought this could be a source of pressure as they cannot describe to a computer the source and cause of problems. On the other hand, some preferred a computer generated feedback as an algorithm cannot have bias. This assures them of a fair feedback. Otherwise, they worry if "managers have [subjectively] favoured another employee over them". Another aspect being important for users is the frequency of receiving feedbacks. Various frequencies were of interest of users. Some found more frequent feedback to be useful and helpful, stating "if I am doing wrong, I prefer to know it soon so I have time to fix it". Some others found less frequent feedbacks to be useful and less stressful.

Conditioning: This refers to introducing incentives and punishments for the users. Incentives could be virtual goods such as badges that software-based motivation gives to users or could be tangible rewards such as gift cards. Moreover, a negative reinforcement could be in place to prevent unwanted behaviours. Despite being motivating, having a negative reinforcement by itself is a source of pressure and stress. However, positive reinforcement can be demotivating or even a source
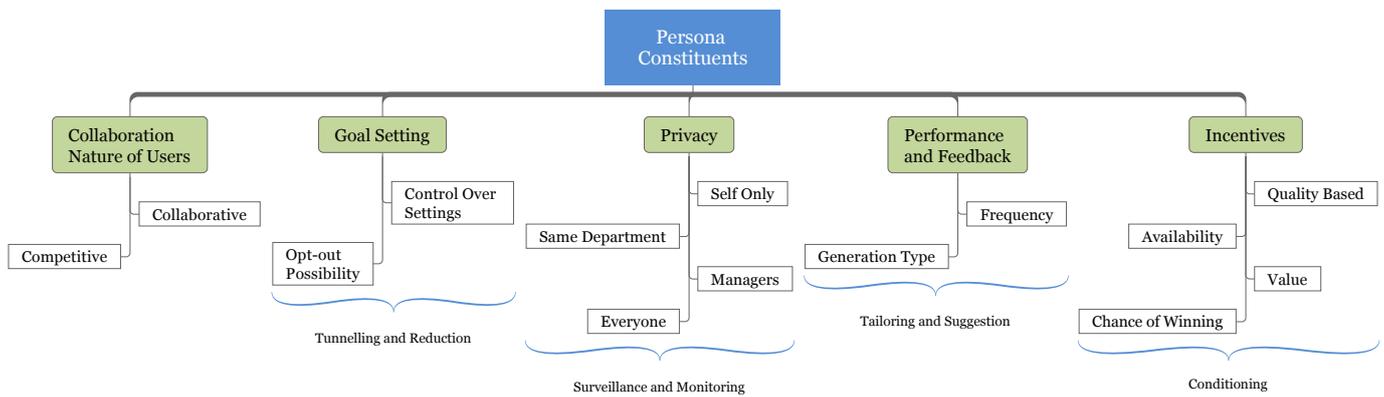
Fig. 3: Persona Constituents

of issue if not aligned with the preferences of users.

As such, the rewarding strategy was of importance for users. An aspect of the reward that concerned all users was the relativity of the reward with the effort needed to achieve it. Some preferred to have higher chance of winning, even if it means reducing the value of the reward. They did not find a big prize appealing as they found it hard to achieve. It was mentioned by some users that "same people are going to win the prize anyway, what is the point of even trying". On the other hand, some users stated that it is not fair for the first place winner to receive a reward the same or similar to the 20th place. They preferred to have a reward with high value available. "I want to receive a reward that reflects my efforts".

Surveillance and self-monitoring: Software-based motivation collects various forms of performance data. It is considered as surveillance in Fogg's model when managers, peers, or others within the workplace have access to all, or part of the collected data. It is also considered as self-monitoring when the users themselves use the performance data to track their progress or achievements.

People had different perceptions of such feature and some of them said that they would quit and will not tolerate such characteristics in their workplace. As a part of performance evaluation and appraisals, managers have access to performance information of employees in classical working environments. However, in contrast with periodic reviews, some found it a source of stress if software-based motivation could provide managers with real-time information. Users found various aspects of software-based motivation as a monitoring mechanism to be influential in their preference regarding their social and mental well-being within their working environment. A proportion of users found it motivating to compete with other peers and have access to each other's information as a result. Some others preferred an inner-group competition and wanted the information to be available to peers from same departments. Some others preferred to have information available to themselves and managers only. Moreover, a proportion of users had no issue if only their general information was available to others, i.e., their strengths and skill points.

2) Personas Constituents: In this subsection, we provide our findings of constituents that are important and need to be taken into account in the process of creating personas.

Collaboration nature of the users: This is a contextual constituent that needs to be considered prior to the design of software-based motivation and personas. It refers to the preferences of users on whether to compete or collaborate towards achieving certain goals. In our study, some users showed interest in a strategy that promotes competition and individualism. It was stated that, "I am a competitive person, I seek competition", for these users, a collaborative strategy would be a source of pressure as they showed concerns about situations where they have to "pull others weights" and do others' job for being able to stand out in the crowd. On the other hand, a proportion of users showed interest in collaborating with others to achieve their goals. "I don't like to compete with others in my work, it will definitely increase the tension in the environment". Some other users were interested in a strategy that promotes both collaboration and competition. "I don't like to compete with everyone in my working environment, but I will enjoy a friendly inner-group competition". Finally, to some users, having a short-time competition, for instance, a competition in the training course was interesting, however, a long-term competition in the workplace could be "too much of tension".

Incentives: Software-based motivation can provide tangible and intangible incentives and rewards in order to motivate its users. From the perspective of users, there were several important aspects that may influence their motivation and perception. Users were concerned about the relativity of the reward with the efforts needed to achieve it and the possibility of winning the reward. Some expressed that a reward low in value will not motivate them to put their best efforts to achieve it, stating that "if I am the first in the list, I want to win big, I don't want a small prize for being the best in the work". On the other hand, some expressed that they preferred to have rewards lower in value, but higher in number to have a higher chance of winning. "A big prize is motivating, but after a while, I will just give up. A certain number of people are going to win anyway all the time. I think it is better to have a higher chance of winning, however, the prize should still mean something to me for the effort I need to put". It was mentioned that providing a combination of high, medium, and low value incentives for the users could be an appealing solution as it can cover the preferences of all users from this aspect.

In addition, some wanted the assurance that the quality of their work is considered in processing their achievements. Others were worried that involving a human in processing their achievements can produce bias. Therefore, they preferred to know how many points they will achieve for accomplishing a task. Moreover, some showed interest in having the element of surprise for their achievements. They found it motivating and fun to have the feature of obtaining hidden achievements. "If someone has something that I do not have, it will definitely motivate me to go and explore to achieve it." However, this view was not shared amongst all users, as some of them stated that it could make working like a game, and some found it as a source of stress and tension. "I do not mind if others achieve something and I did not, but if they start to show off their achievements, I do not like it."

Privacy: One main concern of users with regards to their social and mental well-being within their working environment was their privacy. Many had concerns regarding their privacy being violated by means of software-based motivation. Even some users interested in competing with other peers were worried about people who can have access to their detailed work information. Depending on the context of the information, people showed different concerns and preferences. To an extent, some users had no issue regarding their general working information being available to all in the working environment. These users were mainly competition seekers. Moreover, some collaborative users found it helpful if it will help others to find them regarding their strengths and skills, if the information reveals only this kind of information. Regarding the information being available to peers in the same department, users had different views as well. Some found it interesting as it would create the inner-group competition that they were looking for. However, a majority of users were concerned that the information being available to peers need to be general enough that does not reveal users detailed working information, i.e., their work routines. Furthermore, majority of the users agreed that the managers already have the right to access the information captured by means of software-based motivation, it was mentioned that the information should be their general working information. To some extent, a proportion of users showed concerns about their managers having access to detailed information about how they are working and stated that "I may want to take it easy on some days and work harder on other days. I don't want my managers to have access to this information, this is very stressing, I will feel that I have to constantly work".

Performance and feedback: Software-based motivation provides reporting features to managers and users which is enabled by collecting data from users performance. Users showed concerns on how this feature is configured. One of the concerns was regarding the frequency of updating the report. There have been various views on this aspect of software-based motivation. Some users found real-time reporting to be motivating, "I want to see how many points I have received for what I have done", where as some others preferred less frequent updating of the report for various reasons, i.e., "real-time update will kill the joy of finishing the task for me", or "I like to know about my performance at the end of the week,

it creates an element of surprise for me to wait and see how I have done at the end of the week". For the feedback generated from these collected data, beside the frequency of receiving a feedback, users were concerned about the way the feedback is generated. Some preferred computer generated feedback. They found it to be less vulnerable to bias as a computer cannot have bias towards other users. Some others preferred to have the feedback to be generated by a human, i.e., the manager, as a human can "tailor the feedback for each user" and consider circumstances that caused a failure or a special success.

Goal setting: Software-based motivation can be used to break-down the tasks for users in order to guide them through the path to achieve the final goal. Although some users showed interest in being given the exact steps needed to perform a task, a considerable proportion of users found it demotivating and believed that this will threaten their social and mental well-being as it gives a feeling of working like a "robot". Some users stated that they would like to have the feature of setting steps towards achieving the goals if the steps are as guidelines only or they have the freedom and control and can define the steps themselves.

D. Developed Personas

At this stage of our research, we followed our proposed persona constituents illustrated in Fig. 3 to develop a set of personas. This should help better understanding of how these constituents can be adopted in the design process of developing software-based motivation in BISs. Empirical studies of this research provided us with the information necessary for developing a set of personas according to the preferences of our participants with regards to social and mental well-being of them when using software-based motivation within their workplace. In general, some found specific properties of software-based motivation interesting and encouraging, and some others found the same settings to be of no use or a source of stress. Therefore, we created personas that each could represent a type of person that actual users of software-based motivation could relate their preferences to, regarding their social and mental well-being within workplace. At the end, we developed six personas and enhanced them. The personas are summarised in Fig. 4 and the full description of personas can be found in https://goo.gl/XNF1RB.

Creation of personas for the design of software-based motivation with regards to social and mental well-being of its users aims at identifying groups of users with similar personalities and preferences. Thereupon, a customised setting of software-based motivation can be mapped to each identified group. This contributes to the BIS to satisfy preferences of different groups of people. It is noteworthy that we do not advocate a fixed, ultimate set of personas. Various factors, such as environment changes or technological advances, may result in a need for an update in the present personas. Furthermore, appearance of new personalities in the BIS or changes in people's preferences may create the need for adding a new persona to the system. Software designers need to use the identified personas to create respective system behaviours that fulfils the preferences of personas. Users can be mapped to a persona that is more

relevant to their preferences and have a system behaviour assigned to them as a default setting with the possibility of altering the assigned setting.

IV. Personas in Action

In order to illustrate how personas can help software designers to identify a setting of software-based motivation aligned with the preferences of personas, we use a scenario where a software engineering company has decided to use software-based motivation in order to increase its employees' motivation. Then we analyse the scenario with the constituents which are important for users. Finally, we use the personas of Mary and Ben to propose settings of software-based motivation that is aligned with the preferences of the personas.

A. Scenario

A software engineering company is trying to increase motivation in their employees. In this company, the HR department works closely with all departments and line managers to make sure that policies are being followed. They also administer payrolls, maintain employees' records, and undertake regular salary reviews. They are responsible for recruitment and analysing training needs.

The marketing department assures that the company is following the trends and is not behind the competitors in terms of offering new technologies and products.

The development team is responsible for understanding the customers' needs and deliver a web product according to what customers are looking for. It is important for them to deliver the projects on-time, with good quality, and also meet the requirements of the clients.

The company decides to use software-based motivation in order to increase employees' engagement and motivation. To this end, the company will start to give points to employees for the tasks they successfully finish. These points can represent the performance of employees and can be used in monitoring employees' performance with higher accuracy. A leader-board will be introduced to illustrate the top performers in the company according to the received points. Also, based on the achieved points on various areas of expertise, employees can receive badges when they master specific skills. Moreover, a progress bar is going to be introduced. This will help others to keep track of tasks they are relying on as well as individuals and managers to use it as a monitoring mechanism. The progress bar needs to have tasks broken down into several sub-tasks in order to make it feasible. In addition, some tangible incentives will be provided for employees in order to increase their motivation and engagement. Finally, the HR department, in conjunction with the managers, will use the features of software-based motivation to give feedback to the employees and also decide whether an employee should be given a promotion or not.

The company is hoping for a fairer decision on promotions and an increase in employees' productivity, engagement, and quality of work after this software-based motivation is added to the environment.

B. Analysing the Environment

In this section, we analyse each software-based motivation element that the company is trying to introduce by the use of constituents we provided in Fig. 3.

The company is trying to introduce software-based motivation elements, such as points, virtual badges, leader-boards, progress bars, tangible incentives, and feedback. We analyse the important aspects for each of these elements in the following.

Points could be considered the core of software-based motivation as most of the other elements rely on the information gathered by this element. There are a few aspects about the points that have to be taken into account before this element is applied to a user. One important aspect of this element for some users is the method used to give points to employees. It should be considered that some users prefer to have a human touch in the assessment of their points and have the quality of their work considered while earning points. Some others prefer to have it pre-defined and generated by computers only to prevent biases that humans may have in their decision making processes. Another important aspect of the points is the visibility of them to other employees. Some would agree for their points to be visible to others. However, some others may only agree to make it visible to certain people in their environment.

Virtual badges are a popular element in the application of software-based motivation. They mainly guide the way employees need to perform, e.g., for training purposes, or represent the strengths and skills-set of employees in various areas. Various strategies may be used for giving badges to employees. A company may provide virtual badges for employees by making them available and known to all, with guidelines on how they can be achieved. In addition to these available badges, the company may decide to provide some hidden badges to add the element of surprise and excitement to the working environment. In order to achieve these hidden badges, employees need to explore and try different actions to gain them. Another important aspect for some users related to the badges is the visibility of achieved badges to others. Some would have no problem for others to access their achieved badges, and they may even find it helpful, i.e., in finding people based on their skills-sets, while some others may find it as a source of stress.

Leader-boards are one of the highly used elements in software-based motivation. This element tries to list top performers of an environment based on their performance. Leader-boards can follow different strategies. Main concerns of users are focused on the competitive nature of such element and the privacy issues it may create. Some users may find it motivating and helpful. Some others may find it motivating but at the same time, they may be concerned about their privacy. Some others may not like the competitive nature of such element and dislike its presence in the environment. One other concern is the frequency of updates and also the time intervals a leader-board uses to compare employees with each other.

Progress bars are mainly used to track the performance

	Name: Ben	**Age:** 28	**Gender:** Male	**Job:** Programmer
	Overall statement: Ben enjoys competing with the people he knows and are doing similar jobs. It is important for him that the quality of his work is considered in the software-based motivation. He is an explorer and likes to have surprises in his work. He likes to share his achievements with the people he knows and have a friendly competition with them. It is important for him to win big at the end, he thinks that it is not fair for the top winners to receive the same prize as the others.			
	Setting: Method (Conditioning, Tailoring, Suggestion, Tunnelling), **Privacy** (Detailed Info: Managers, Self – General Info: Peers, Managers, Self – Progress Info: Peers, Managers, Self), **Collaboration Nature** (Competitive), **Performance** (Real-time), **Feedback** (Human generated, Monthly), **Incentive** (Higher Value, Lower Chance)			
	Name: Clara	**Age:** 31	**Gender:** Female	**Job:** Data Analyst
	Overall statement: The quality of work is important for Clara, however, it is important for her to not fall behind her colleagues. Therefore, she may decrease the quality of her work if she can receive the same points. She is an explorer and wants to have surprises in her work. She is concerned about her detailed work details, however, she finds it helpful for others to be able to access her skills set.			
	Setting: Method (Conditioning, Tailoring, Suggestion), **Privacy** (Detailed Info: Managers, self – General Info: Everyone – Progress Info: Managers, Self), **Collaboration Nature** (Collaborative), **Performance** (Weekly), **Feedback** (Human generated, Monthly), **Incentive** (Higher Value, Lower Chance)			
	Name: John	**Age:** 48	**Gender:** Male	**Job:** Accountant
	Overall statement: John is a collaborative person who finds elements introduced by software-based motivation interesting, he likes to share his detailed working information with his relevant colleagues and his skills with everyone within his workplace.			
	Setting: Method (Conditioning, Reduction, Tunnelling, Tailoring), **Privacy** (Detailed Info:Managers, self – General Info: Everyone), **Collaboration Nature** (Competitive), **Performance** (real-time), **Feedback** (Human generated, weekly), **Incentive** (Higher Value, Lower Chance)			
	Name: Mark	**Age:** 42	**Gender:** Male	**Job:** Technology Analyst
	Overall statement: Mark cares about the quality of his work and will not decrease the quality if he can get points with lower quality. He is collaborative and doesn't like social recognition. He will keep his points low enough so that he does not attract any attention to himself.			
	Setting: Method (Reduction, Tunnelling, Tailoring, Conditioning), **Privacy** (Detailed Info: Managers, self– General Info: Everyone, Progress info: self), **Collaboration Nature** (Competitive), **Performance** (real-time), **Feedback** (Human generated, Monthly), **Incentive** (Lower Value, Higher Chance)			
	Name: Paul	**Age:** 41	**Gender:** Male	**Job:** Recruiter
	Overall statement: Paul does not like software-based motivation, however, if he has to use it, he will get very competitive in order to do his best and be amongst the winners. He just wants to be told what he has to do and doesn't like to make decisions.			
	Setting: Method (Reduction, Tunnelling, Tailoring, Conditioning), **Privacy** (Detailed Info: Peers, Managers, self – General Info: Everyone), **Collaboration Nature** (Collaborative), **Performance** (real-time), **Feedback** (Computer generated, daily), **Incentive** (Lower Value, Higher Chance)			
	Name: Mary	**Age:** 24	**Gender:** Female	**Job:** IT Engineer
	Overall statement: Mary is a collaborative, hard-working, privacy sensitive person. She doesn't appreciate elements introduced by software-based motivation and does not find them motivating.			
	Setting: Method (Reduction, Tunnelling, Tailoring), **Privacy** (Detailed Info:Managers, self – General Info: Peers, Managers, Self), **Collaboration Nature** (Collaborative), **Performance** (real-time), **Feedback** (Human generated, weekly), **Incentive** (Lower Value, Higher Chance)			

Fig. 4: Summarised List of Personas

and progress of a user on a task. This element requires the target task to be broken down into sub-tasks and collects information about the status of these sub-tasks performed by the user. A progress bar may be used and set differently. It may force its users to follow pre-defined sub-tasks and monitor the performance of these sub-tasks. On the other hand, users may be given the freedom to choose their subtasks and choose how they want to fulfil their goals and given tasks. Also, it is important for some users to know who can access their progress bar and how often it is going to be used. On the other hand, some users may need to have access to another user's progress bar in case of a dependency relation between some tasks.

Tangible incentives could be considered as a strong motive for people. However, various people have different preferences on receiving incentives. There are several aspects of tangible incentives that can affect how people perceive them. Some are more interested in prizes high in value. However, it may mean lower chances of winning for everyone. On the other hand, some others find it demotivating and prefer to have higher chances of winning and lower value prizes. Also, it is important for some users to have a transparent decision

making policy and know how the decision on choosing the winner(s) is made.

Feedback given by managers or HR to employees about their work performance can be directly affected by the use of software-based motivation. The nature of software-based motivation demands collecting work related information about employees and it can give accurate and precise information about the work performance of employees to the managers and HR department. Feedback can be generated in a classic way that is by managers, or can be just a performance report of how a user performed based on the information gathered. Feedback can have different frequencies; it can vary from a daily basis feedback, to weekly, monthly, or longer periods of time. People have different preferences on how they want to receive feedback, from only computer generated to a mixture of human and computer generated feedback, and from daily feedback to less frequent feedback.

C. Designing the Settings for Personas

By using the constituents we introduced for personas, we can now analyse and see how the setting of software-based motivation should be adapted to each persona. We use the personas of Mary and Ben to explain the setting of software-based motivation that is aligned with each persona's preferences and to discuss the challenges of having these two personas in the environment. The final setting of motives for Mary and Ben are illustrated in Fig. 5 and Fig. 6.

1) Mary: Mary considers herself a collaborative hard working person. She is sensitive about her privacy and does not agree to compromise her privacy to obtain virtual or monetary goods. However, if software-based motivation is a part of her work routine, there are some preferences she has over the settings of software-based motivation.

Mary will not decrease the quality of her work just to receive some points quicker. However, she likes to know how many points she will receive prior to starting a task. She does not like the points to be calculated by a human and prefers *pre-defined* points for tasks. She thinks humans may have biases while assessing her performance.

As she is sensitive about her **privacy**, it is important for her who has access to her information captured by means of software-based motivation. She does not have any problem with her *managers and HR department* to have access to her points, as she considers them to be the decision makers. However, she finds it of no use for others to access her information and thinks it is meaningless.

Since she considers herself a collaborative person, a competitive setting of software-based motivation may cause tension and stress in her. She believes that in a professional environment, everyone will work as expected and a collaborative environment does not mean others will have to do another's job. Therefore, a leader-board may not be a useful tool to motivate her with respect to her social and mental well-being at her workplace since it is competitive and reveals information about the performance for a larger audience.

Mary does not appreciate receiving virtual badges as she believes that those who should know about her abilities already are aware of them. She also believes that virtual badges may encourage her to pretend to be someone she is not just to achieve certain badges. However, in case the presence of badges are a part of the system she is working in, she is tolerant of her badges to be available to her *relevant peers only*, as badges do not carry detailed information about how she works. She finds it a breach to her **privacy** if someone from the Marketing department could have access to her badges. In addition, she does not like to explore for new badges, and if achieving badges is a part of her work, she wants the *full* availability of all badges and to know how each of them can be achieved.

Mary shows interest in the goal setting feature of software-based motivation and the progress bar. She believes that knowing the steps that should be taken to fulfil a task is helpful, and the progress bar will help others to manage their times specially when their tasks rely on each other. However, she thinks that if the tasks are not relevant to some employees, then they should not have access to the progress status of her task. For instance, if the Marketing department is waiting for a task Mary is performing to be finished and prepare a report of the status to the client, Mary finds it normal for employees from Marketing to have access to her progress bar. However, she wants to be assured that *not everyone* from the Marketing department has access to her progress bar and it is limited to the *relevant employees* to the project only.

She is interested in knowing about her achievements, e.g., points or badges on a *real-time* basis and also likes to receive as **frequent** human generated feedback as possible. She wants the feedbacks to be *generated by her managers* and the HR department as they can feel the work whereas a computer is only following numbers and algorithms. She wants it to be *more frequent* as she finds it helpful in detecting her mistakes and improving her abilities with a faster pace.

Finally, Mary prefers to have a *higher chance of winning*, although it may mean that the **value** of the rewards will decrease due to this setting. She thinks that it is more motivating to have a *higher* chance of winning as not everyone can become a top performer in a working environment.

2) Ben: Ben enjoys competing with people he knows and are doing a similar job. It is important for him that the quality of his work is considered in the software-based motivation. He is an explorer and likes to have surprises in his work. He likes to share his achievements with the people he knows and have a friendly competition with them. It is important for him to win big at the end; he thinks that it is not fair for the top winners to receive the same prize as the others.

Ben wants to receive points according to the **quality** of his work and wants a human touch in calculation of the points he is receiving. He believes that it is unfair to have *pre-defined* points for the tasks regardless of the differences in the quality of outcome. He believes that quality of the task is missed in such situations and this will drive people to decrease their quality of work just to receive the points.

Ben is *not much sensitive* about his **privacy** as long as he finds those accessing his information *relevant*. He finds himself a competitive person and likes to share his points with his *relevant colleagues* to fulfil his sense of competition.
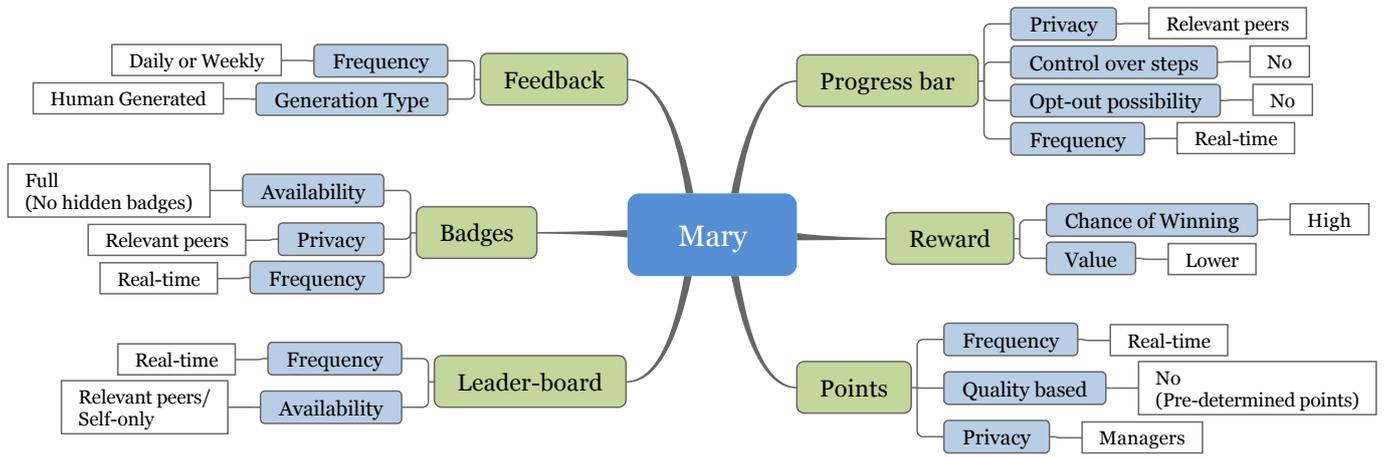
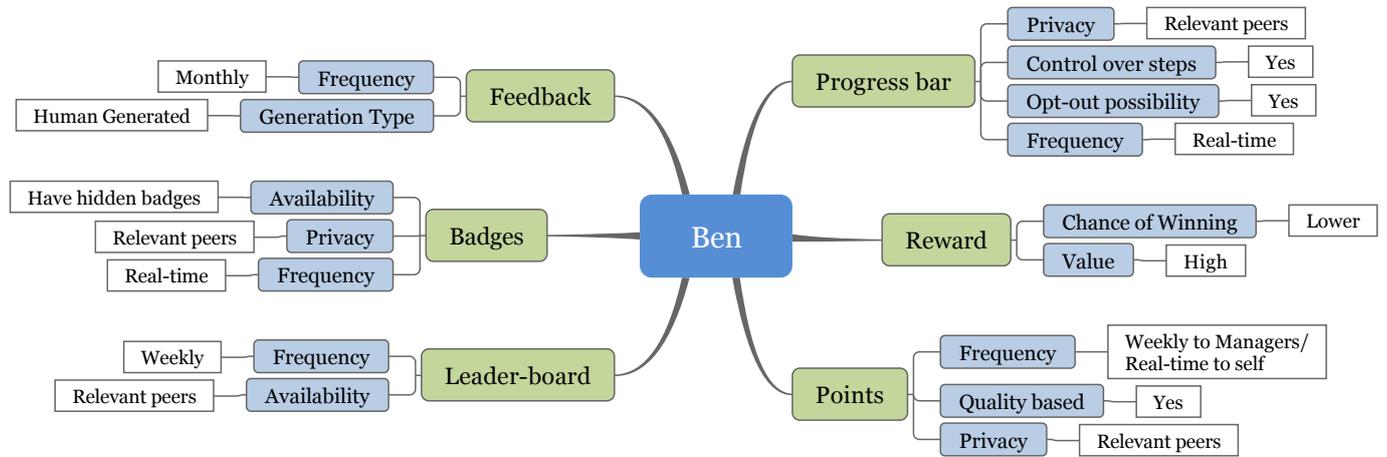Fig. 5: Software-based Motivation Settings for Mary

Fig. 6: Software-based Motivation Settings for Ben

This will make him work harder to appear in the leader-board. Therefore, a specific leader-board for his department where all *relevant employees* compete with each other would be of his interest. However, he finds it unnecessary if people from other departments, such as marketing, have access to his points or the leader-board.

Ben likes the idea of receiving badges for his skills or as a guide for training. He also finds himself to be an explorer and enjoys having an element of surprise and fun in his work. Therefore, he prefers to have some *hidden* badges that he is not aware of their presence. From a **privacy** point of view, he only wants his achieved badges to be available to his *relevant colleagues* and he thinks it is useless if someone from the Marketing department can see his achieved badges. He thinks that if an employee from Marketing needs to find someone with special skills-set, they need to ask his manager rather than being able to find him directly via his profile.

Ben thinks that it is helpful if there is a feature that enables a progress bar showing the status of his progress for specific tasks. However, he shows concerns about various aspects of this feature. He wants to be able to **opt-out** and do his work without the progress bar if he finds it as a source of stress and pressure. Then, he wants to be able to have **control over**

the steps and choose the sub-tasks by himself and have the freedom of deciding how he wants to achieve his goals and finish his tasks. He finds it working like a robot if he is told what to do and how to achieve certain tasks. He believes that progress bars carry detailed information and wants the progress bars to be available to *relevant peers* that is only those whose work rely on the fulfilment of the task he is working on. Since progress bars can help others to estimate when they can start their work, he does not find a *real-time* update of the progress bar as a source of pressure and stress.

With regards to the **performance and feedback** that Ben receives, he prefers to have access to the information about his performance on a *real-time basis*. He finds the self-monitoring feature of software-based motivation helpful and appealing. However, he prefers an accumulative performance of *a week* to be available to his managers and the HR. He finds a *real-time* access to his performance by his managers and HR to be intrusive since it is possible for them to extract his working habits through the information. For the feedback, he thinks that a *monthly human generated* feedback can be helpful as a month is enough time for him to prove his abilities. Also, one month gives him enough time to find his weaknesses and try to improve them before it is already late.

Ben believes that there should be a limited number of rewards, but *higher* in **value**. He thinks it is not fair for the person with the highest performance to receive a prize which is relatively similar to the prize for the 20th person. It will be demotivating for him and he will not try to become the best in this setting.

V. PERSONAS FOR SOFTWARE-BASED MOTIVATION DESIGN: CHALLENGES

Despite the benefits of using personas in the design of software-based motivation, developing and using them introduces some challenges. These challenges are selecting a representative sample of the users' population, eliciting users' preferences, developing personas based on the collected information, variations in personas preferences, and the evolution of software-based motivation. These challenges are described in details as follows.

A. Selecting a Representative Sample

In medium to large scale BISs, it is expected to have a large number of users. Therefore, it is not a practical solution to analyse the preferences of all users in the environment. One solution to this issue is the use of population sampling. Population sampling refers to the selection of a sub-set of users from the population in order to estimate characteristics of interest for the whole target population [26]. There are several methods that try to help in selecting a sample which can help achieving results closer to reality [27]. This could be a crucial stage, as a good sample, which is a representative of the population, can lead to a better design of personas. On the other hand, failure in selecting a representative sample can lead to missing a considerable proportion of users preferences.

B. Eliciting Preferences

Eliciting users' preferences is an important phase of the design. Since users may not know exactly what they want, it is important for the software designers to know what they should ask users in order to elicit reliable, actionable, and related preferences of the users with regards to the design of software-based motivation. In order to tackle this problem, in section III-C2, we elaborated on important aspects of software-based motivation that users may have different views on, with regards to their social and mental well-being within their workplace. These constituents can shape the questions that software designers need to ask from users in order to elicit proper and actionable preferences.

C. Developing Personas

Developing personas on its own is a challenging task and there is no one-size-fits-all approach available for creating personas [17]. However, it is believed that in order to develop personas, designers need to aggregate elicited data about the users into an actionable and meaningful story [18]. These can be achieved by following certain guidelines [17]. In general, this guideline suggests performing an empirical study, segmenting users into identifiable clusters according to their elicited preferences on software-based motivation, and developing personas for each segment.

D. Variations in Personas Preferences

Another challenge in employing personas in the design of software-based motivation is to design settings of software-based motivation for each persona. There are several challenges ahead of the design process, e.g., conflicts in the preferences of users with each other, or conflicts in the preferences of the users with the business goals of the BIS. It is difficult to satisfy the needs, requirements, and preferences of all users within a BIS. Designers need to provide settings of software-based motivation that balances between these conflicts and provide acceptable solutions for users. Failure in accomplishing this challenge can lead to adverse results, e.g., not satisfying business goals, ignoring social and mental well-being of a proportion of users, or creating a new source of tension and pressure without resolving the conflicts.

Although the preferences of users on software-based motivation are personal, some motives, e.g., leader-boards and rewards, impact users in a collective way and need to be designed with extra care so that preferences of involved users are not violated. In the following, we present some issues that may occur as a result of these variations in the preferences.

- Tangible rewards: Preferences of Ben and Mary are different in terms of how to receive a reward based on their performance. By following the setting of tangible rewards for each persona, the other persona is demotivated and will find the reward inaccessible (when Mary's preference is ignored) or of no value (when Ben's preference is ignored). Therefore, a setting should be followed that enables the fulfilment of both preferences where possible. In this case, the company can provide both high value prizes in a few numbers, and lower value prizes but in a higher number. However, it should be taken into account that the lower value prizes should be adjusted with the efforts needed to achieve them. Failure in providing a prize in accordance with the effort needed for its achievement will not motivate users to increase their productivity.

- Leader-board: Mary finds herself to be a collaborative person and Ben likes to compete with his colleagues. Leader-board is a competitive motive and it needs to be designed carefully. None of the personas like a public leader-board for every employee of the company and find it unhelpful. However, Ben is interested in having a leader-board in his department so he can prove himself as a hard working person, whereas Mary wants to avoid leader-boards and competition as much as possible.
The company can make a decision on not using leader-boards as it may create stress and tension on Mary. However, this option will eliminate the chance of motivating Ben to a high extent. Despite this issue, the company can choose for an alternative design of the leader-board, which is adding the option of anonymity to the leader-board. This means that those who do not want to appear in a leader-board can choose to do this, and only their points will appear on the leader-board with their names anonymised. This setting can be used as a self-monitoring mechanism for Mary, without exposing her performance to others and creating the unwanted

competition. Moreover, Ben will benefit from this setting as it will satisfy his passion for competition with those who agree to appear on the leader-board.

E. Evolution

Similar to any other software system, software-based motivation needs to cater for evolution over the course of time. There are several reasons that may trigger the need for evolution in the design of a software-based motivation. The emergence of new technologies can result in the need for an adaptation and evolution in software-based motivation. Users may lose interest in available settings. For the sustainability of motivation, new settings should be introduced to users. Moreover, some users may change their preferences over time, and also the introduction of new users may create the need for adding a new persona to the design. Designers can adopt social sensing [28] and social adaptation [29] in order to monitor software-based motivation and detect the need for action.

VI. CONCLUSION

This paper argues that to cater for social and mental well-being of users, the design of software-based motivation needs to consider differences that users may have in their preferences on the various configurations of software-based motivation. This can be achieved by the use of personas as a mechanism to group users with similar characteristics. We proposed a set of constituents that can shape such preferences and attitudes and also their correlations in the form of personas. This leads to the development of personas which software designers can use to meet the requirements, needs, and preferences of the users to a large extent. We used a scenario to describe how these constituents and the created personas can be used to design a setting of software-based motivation for a persona. We then argued that employing personas in the design of software-based motivation can be challenging and if the challenges are not addressed thoroughly and properly, adverse results could be expected.

REFERENCES

[1] P. R. Kleinginna Jr and A. M. Kleinginna, "A categorized list of emotion definitions, with suggestions for a consensual definition," *Motivation and emotion*, vol. 5, no. 4, 1981.

[2] T. R. Mitchell, "Motivation: New directions for theory, research, and practice," *Academy of management review*, vol. 7, no. 1, pp. 80–88, 1982.

[3] R. L. Pardee, "Motivation theories of maslow, herzberg, mcgregor & mcclelland. a literature review of selected theories dealing with job satisfaction and motivation." 1990.

[4] A. Shahri, M. Hosseini, K. T. Phalp, and R. Ali, "Motivation as a supplementary requirement," in *The Poster and Demo Track of the 21st International Working Conference on Requirements Engineering: Foundation for Software Quality.* Springer, 2015.

[5] A. T. Adams, J. Costa, M. F. Jung, and T. Choudhury, "Mindless computing: designing technologies to subtly influence behavior," in *Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing*, 2015, pp. 719–730.

[6] E. N. Webb, "Gamification: When it works, when it doesnt," in *Design, User Experience, and Usability. Health, Learning, Playing, Cultural, and Cross-Cultural User Experience.* Springer, 2013, pp. 608–614.

[7] P. Herzig, M. Ameling, and A. Schill, "A generic platform for enterprise gamification," in *2012 Joint Working IEEE/IFIP Conference on Software Architecture and European Conference on Software Architecture*, 2012, pp. 219–223.

[8] J. Simões, R. D. Redondo, and A. F. Vilas, "A social gamification framework for a k-6 learning platform," *Computers in Human Behavior*, vol. 29, no. 2, pp. 345–353, 2013.

[9] S. Halko and J. A. Kientz, "Personality and persuasive technology: An exploratory study on health-promoting mobile applications," in *Persuasive technology.* Springer, 2010, pp. 150–161.

[10] B. J. Fogg, "Persuasive technology: using computers to change what we think and do," *Ubiquity*, vol. 2002, no. December, p. 5, 2002.

[11] J. Hamari, J. Koivisto, and H. Sarsa, "Does gamification work?–a literature review of empirical studies on gamification," in *47th Hawaii International Conference on System Sciences (HICSS)*, 2014, pp. 3025–3034.

[12] A. Shahri, M. Hosseini, K. Phalp, J. Taylor, and R. Ali, "Towards a code of ethics for gamification at enterprise," in *The Practice of Enterprise Modeling.* Springer, 2014, pp. 235–245.

[13] S. Nicholson, "A user-centered theoretical framework for meaningful gamification," *Games+ Learning+ Society*, vol. 8, no. 1, 2012.

[14] O. P. John and S. Srivastava, "The big five trait taxonomy: History, measurement, and theoretical perspectives," *Handbook of personality: Theory and research*, vol. 2, 1999.

[15] A. Cooper *et al.*, *The inmates are running the asylum:[Why high-tech products drive us crazy and how to restore the sanity].* Sams Indianapolis, 1999, vol. 261.

[16] M. Almaliki, C. Ncube, and R. Ali, "Adaptive software-based feedback acquisition: A persona-based design," in *Research Challenges in Information Science (RCIS), 2015 IEEE 9th International Conference on.* IEEE, 2015, pp. 100–111.

[17] S. Mulder and Z. Yaar, *The user is always right: A practical guide to creating and using personas for the web.* New Riders, 2006.

[18] J. M. Spool. Making personas work for your web site: An interview with steve mulder. (2007). [Online]. Available: http://www.uie.com/articles/mulder_interview/

[19] T. Miaskiewicz and K. A. Kozar, "Personas and user-centered design: How can personas benefit product design processes?" *Design Studies*, vol. 32, no. 5, pp. 417–430, 2011.

[20] J. Pruitt and J. Grudin, "Personas: practice and theory," in *Proceedings of the 2003 conference on Designing for user experiences.* ACM, 2003, pp. 1–15.

[21] G. A. Moore, "Crossing the chasm," 2002.

[22] D. Idoughi, A. Seffah, and C. Kolski, "Adding user experience into the interactive service design loop: a persona-based approach," *Behaviour & Information Technology*, vol. 31, no. 3, pp. 287–303, 2012.

[23] L. Nielsen, "From user to character: an investigation into user-descriptions in scenarios," in *Proceedings of the 4th conference on Designing interactive systems: processes, practices, methods, and techniques.* ACM, 2002, pp. 99–104.

[24] A. Canossa and A. Drachen, "Play-personas: behaviours and belief systems in user-centred game design," in *Human-Computer Interaction–INTERACT 2009.* Springer, 2009, pp. 510–523.

[25] A. Seffah, C. Kolski, and D. Idoughi, "Persona comme outil de design de services interactifs: principes et exemple en e-maintenance," in *Proceedings of the 21st International Conference on Association Francophone d'Interaction Homme-Machine.* ACM, 2009, pp. 333–336.

[26] P. Salant, I. Dillman, and A. Don, *How to conduct your own survey*, 1994, no. 300.723 S3.

[27] S. Lohr, *Sampling: design and analysis.* Cengage Learning, 2009.

[28] R. Ali, C. Solis, M. Salehie, I. Omoronyia, B. Nuseibeh, and W. Maalej, "Social sensing: when users become monitors," in *Proceedings of the 19th ACM SIGSOFT symposium and the 13th European conference on Foundations of software engineering*, 2011, pp. 476–479.

[29] R. Ali, C. Solis, I. Omoronyia, M. Salehie, and B. Nuseibeh, "Social adaptation: when software gives users a voice," in *7th International Conference Evaluation of Novel Approaches to Software Engineering*, 2012.