

**Motivation-oriented Scenario-based Gamification Design Method
using the User Requirements Notation Modeling**

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M.Sc. thesis
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June 2017

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M.Sc. thesis, 75 pages, 6 index and appendix pages

June 2017

Abstract

Gamification, defined as the use of game design elements in non-game contexts, has been a trending in both academic and in a variety of industrial domains for around half a decade. A number of empirical studies have showed the usefulness and effectiveness of applying gamification to enhance people's motivation and engagement in different activities. On the other hand, multiple design frameworks and methods have been proposed to guide the practice of gamification design and development. However, one of the key issues for gamification, which is being only focusing on using less essential game elements on motivating instead of providing genuinely meaningful gameful experiences, has not yet been addressed fully. Furthermore, the existing gamification design frameworks contribute limitedly in providing constructive and easily applicable design methods or tools that to facilitate the motivation and behavior analysis and ideation of gamification projects. Therefore, in this study, the author proposes the Motivation-oriented Scenario-based Gamification Design method in order to address the issues mentioned above. The method is an adaption of the User Requirement Notation to the modeling of system goals, gamification motivations, system user behaviors, existing gameplay, and the mapping between them. The new method aims to provide not only an innovative way of specifying gamification designs on the mechanic and dynamic levels, but also a possibly insightful perspective towards improving gamification experiences and effectiveness with meaningful plays. In addition, a case study is conducted by applying the proposed method to a real-life language learning system, WordDive, with the method validated and evaluated via an interview with an expert from the WordDive company.

Key words and terms: Gamification, Design method, User Requirements Notation, Scenarios, Motivation, Gamification Design, Modeling, Game Dynamics, Meaningful Play

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1. Introduction

Gamification has been a permeating trend in both the industrial practice and the academic domain during the past six years. The term “gamification” was not widely adopted right after its first adoption in 2008 [1], despite the fact that similar parallel terms had been constantly used. Many of the parallel terms have been introduced and applied in industry, when this concept, whatever was called by then, started to draw attentions [2]. Starting from the year 2011, gamification has become one of the most hyped concepts according to the Gartner technology hype chart, and reached the summit in 2013 [3]. Despite of the fading hype of gamification in trends after that, the concept, as well as the relevant research on its theory building and application, is still drawing significant attention.

Within this period, studies from various domains were conducted verifying the effectiveness of gamification in those domains [4] – [8] [12] [35]. Meanwhile, multiple gamified web applications and mobile applications were developed providing innovative ways of solving common problems [11]. Though the excitement over gamification has surpassed its summit, the market of gamification is still growing sharply [9] with academic research on gamification related topics still growing steadily towards maturing [10]. The focus concerning gamification in academic research during the past six years encompasses three major directions, including the theory-driven empirical study, the design studies and the studies on the extension of application contexts [10]. Tremendous number of seminal research works have been done in these three major perspectives, contributing to building the foundation of gamification studies.

The pillar of the theory-driven empirical studies on gamification is still “What is gamification?” The most common answer, i.e. the definition of gamification, was given by Deterding et al. stating gamification is the use of game design elements in non-game contexts [2]. This definition situates gamification in a position where it is a derivative from games and gamefulness, instead of plays or playfulness (e.g. toys), and the use of game elements, instead of using full-fledged games (e.g. serious games) or extending games (e.g. pervasive games). Another well-acknowledged definition was given by Huotari & Hamari from the perspective of service marketing, stating gamification is a process of enhancing a service with affordances for gameful experiences in order to support user’s overall value creation [13] [137]. They emphasize that gamification shall focus more on the user experience instead of the form. Many other studies also provide similar definitions with their unique perspectives, such as [17] [18]. Thereafter, a standardized emerging definition is given by Seaborn & Fels summarizing the studies above, stating gamification is the intentional use of game elements for a gameful experience of non-game tasks and contexts [19].

On the other hand, empirical studies on gamification have been focusing on verifying the effectiveness of gamification in general to answer the question “Does gamification work?” An exceptional study answering the exact question was conducted by Hamari et al. via a literature review on peer-reviewed empirical studies [12]. Their conclusion is that gamification does work but with some caveats, as in most of the quantitative studies, only part of the relations between gamification elements and outcomes are concluded positive. Thereafter, the sequential studies started to focus on questions, such as, “Does a certain element work?” [14] – [16] and “Why does it work” [20] [21]. Meanwhile, many other studies convert the focus towards tackling those questions in specific domains, i.e. the extension of the application contexts.

Amongst those studies focusing on applying gamification in specific domains, education is one of the prevailing contexts where gamification is considered as an effective and appealing approach. In fact, even before the emergence of the gamification concept, using games facilitating educational purposes had been widely studied, and conceptualized as game-based learning [22] – [24] and serious games [138] [139]. Compared to games, gamification can provide an efficient facilitating mechanism in achievement system, narratives and quests, emphasizing the individual concepts of achievement and assessment, but lacking a situated nature [25]. Nonetheless, many studies have obtained positive results in showing the effectiveness of gamification in educational contexts, at least in a specific practice of a segmented domain within, such as, [26] – [32]. According to Dicheva et al., despite of the lack of proper evaluation, most of their reviewed studies share the opinion indicating that provided designed and used properly, gamification has the potential to improve learning [33]. Meanwhile, many studies also show positive or partially conclusion concerning applying gamification in other contexts, such as health, commerce, work and engineering practices [6] – [8] [34] [35].

However, compared to the prosperous amount research done in the empirical studies of gamification concerning its psychologic and sociological perspectives, limited research has been done in terms of gamification design, especially pertaining to the techniques and tools that facilitate the design activities. In addition, they tend to comply more with industry designs, which are not validated in game research, and game design [10] [36]. Amongst the previous studies on gamification design methods and frameworks, the authors tend to provide empirical guidelines rather than offering methods or techniques that facilitate the design process or quality, such as, the 6D framework [62], the framework for success [59], the lens of intrinsic skill atoms method [36], the Octalysis complete gamification framework [66], and so on. All these frameworks, which will be further introduced hereafter, try to provide practical experience-based guidelines but lack of methodological insights.

Therefore, one of the current issues in gamification design practice is the disconnection between the gamification design ideas from the domain experts and the

implementation practice of the developers [108]. Besides, the lack of adaption of genuine gameplays from games to gamification and the use of prevailing straightforward “point-badge-leaderboard” combination with some graphics added as machine-made gamification design is also problematic [57]. Compared with the studies on game design and development, the domain of software engineering provides a variety of methods that ease the design efforts for software design and implement [42]. Hence, using the modeling languages in software engineering domain shall provide unique insights in explicitly delivering the design concepts from gamification experts to developers. Despite of the difference between game products and software, the design and development process can be identical [55]. Especially for the design of gamification systems, activities, such as eliciting and analyzing the users’ requirements, analyzing users’ motivation/goals, and prioritizing the requirements, can also be found in the practice of software requirements engineering [72] [121]. Furthermore, using the same modeling language in designing the gameplays shall also facilitate the practice of enhancing the effectiveness of gamification systems towards increasing gameful experiences and motivational affordances. Therefore, this study aims to research on the use of a modeling language as design method in gamification design to facilitate the free-formed and error-prone gamification ideation process [36] and the use of such method in integrate gameplay into gamification as well.

To facilitate the process of gamification design, this study proposes a motivation-oriented scenario-based gamification design method adapted from the semi-formal modeling language of User Requirements Notations (URN) [74] – [76]. The URN modeling language provides a quick and straightforward design method for illustrating the hierarchy connection between user goals and the specified scenarios representing user behaviors. By using this modeling language, the gamification designers and system developers shall be enabled to acquire the desired user behaviors in the form of visualized scenarios, as well as the motivation analysis model in the context of gamification. This method shall largely ease the research and ideation steps, as well as the activities of translating user activities into behavior chains and the identification of user motivations, in the traditional gamification frameworks [36] [72].

In addition, the variation of this method shall provide insights in solving the critical issue for gamification of how to provide gameful experiences in the dynamic level [56]. Currently, nearly the design of all existing gamification system remains in the “mechanics” level instead of providing game “dynamics” [56]. It is also the reason why gamification in general has been criticized for “not being real games” [57] [58]. Hence, despite creating innovative game dynamics is time-consuming in both design and verification, adapting existing dynamics into gamification design is to some extent applicable.

Thus, aiming towards the previously mentioned goals, this study answers the following research questions.

RQ1. How to facilitate the ideation activity of gamification design by adapting goal-oriented and scenario-based requirements modeling?

RQ2. How to add gameful experience via game dynamics design to gamification systems by using the modeling method in gamification design practice?

The remainder of the thesis is organized as follows. Section 2 provides an overview on the previous research in gamification design, summarizing the highlights and flaws in the mentioned frameworks and methods. Section 3 introduces the basic concepts of goal and scenario in requirements engineering domain, and the related research, also specially introduces the URN modeling language, and meanwhile explains how this modeling language fits in gamification design. Section 4 proposes the motivation-oriented scenario-based gamification design method, with descriptions on how to use the method to solve gamification design issues. In addition, the method will be integrated in the bigger picture of the gamification design process. Section 5 presents a case study on the retrospective analysis on the existing mobile app WordDive¹, and the explorative use of the gamification design for it with the proposed method. The results will be also evaluated and validated via an expert interview with WordDive company. Section 6 provides further discussion on the relevant topics when Section 7 concludes the thesis.

2. Gamification Design: An Overview

Gamification has certainly become a research field of significance within the past six years with no sign of slowing [140] [141]. The predominant subdomains of previous gamification studies include the definitions of gamification, frameworks and taxonomies, gamification design methods, gamification effects, and user typologies and so on [39]. The previous research on gamification design frameworks and methods contribute mostly on providing guidelines and steps presenting suggestions reflected by experiences (e.g. [17] [40] [41] and so on). These studies apparently provide a meaningful direction to which the practitioners shall follow in order to design successful gamification projects. However, the lack of explicit techniques and methods that support the experiences is also obvious. Analogically, it resembles the fact that only introducing the steps of process models is never enough to support a decent software engineering project [42]. This section provides an overview on the previous studies in gamification design, including the existing gamification design frameworks and methods, as well as other relevant issues.

¹ <http://www.worddive.com>

2.1. Game Design and Gamification Design

The purpose of gamification design is to enhance engagement in different contexts when game design aims towards pure entertainment [43]. Despite such differences, game design has inevitable impact on the design practice of gamification systems. Argued by Deterding et al. as part of their work on defining gamification [2], gamification relates to *games* instead of *play*, where the activity designed shall contain or resemble the characteristics of games, which are structured by rules and competitive towards goals, instead of those of plays, which are more free-form, expressive, and improvisational [44] – [46]. In such way, the experiences created by the design of gamification shall thus resemble more to the gamefulness than playfulness [47], though designs towards playfulness has also been studied in certain domains [142]. Nevertheless, the activity and thinking of game design is still seen as core references to gamification design, where, the elements of game design are the core of gamification as well.

Rules are one of the key elements of all games, which has been emphasized in many studies that provide definitions to games [45] [46]. The rules of games have to be sufficiently well defined that they can be programmed on a computer or in the way that the players do not have to argue about them every time they play [48]. Seen as a crucial element in game design, game rules shall be designed in such ways that they define the game objects, restrict and allow players' actions, and determine the according effects [49]. The popular game design elements or ingredients [50], such as, narratives, reputations, ranks and levels, teams, economies, and so on, can all be defined in the form of game rules. The gameful experience is thus essentially invoked by the powerful connection between the rules and the play that they shape [46]. Comparatively, when the game design elements are used in non-game contexts as for gamification, it can thus be understood as a set of gameful rules are added to the non-game activity. On the other hand, game is also made for interactions. The game designers create an artifact that players interact with, where the gameful experience takes place, when it is then something they enjoy [51]. Considered as part of the larger picture of human-computer interaction (HCI), game interaction can be seen as the special case of interactions between the players and the game system via the structure of rules [52].

Digital games are fundamentally software products, when the processes and methods of designing and developing digital games is different from those for regular software products, which are mostly referred to as software engineering [53]. The difference herein is that digital game design is not only to implement the functional requirements but also to incorporate those elements of functions/rules in order to provide gameful experiences [54]. Many game-design-related publications introduce guidelines in the forms of lens, ingredients, or atoms [46] [49] – [51], when the lack of formal methods somehow results in the gap between game design and game development [55]. A widely recognized formal model for game design is the MDA framework (M – Mechanics, D – Dynamics, A – Aesthetics) [56]. According to the definition, mechanics

are the various actions, behaviors and control mechanisms afforded to the player within a game context, which means the functionalities provided by the games seen as a formal system. However, the system functionalities of games cannot guarantee their dynamics, which is why digital games, despite of being software products, cannot be simply implemented through pure software engineering methods. On the other hand, a proven game dynamic can always be implemented via implementing a finite set of mechanics (i.e. features) based on the specified requirements of the game system.

Compared with game design for the large scaled AAA games or other graphic based games on various platforms, gamification design is, to some extents, less effort-demanding without taking into account gameplays that appeal to players [144]. Mostly the gamification products focus more on the motivation created by the mechanics when less on the gameful experiences. That is also the reason why gamification has been widely criticized due to taking the least essential elements of games and being not genuine games at all [57] [58]. It seems most of the gamification products only provide mechanics for motivation that are also decorated with aesthetics, but lacking the designed “fun” compared to what is provided by games [144]. Therefore, it is necessary to investigate lack of the gameful dynamics design in the previous gamification design frameworks.

2.2. Gamification Design Frameworks

One of the earliest framework for gamification design is the framework for success provided by Di Tomasso [59], which is based on the classic self-determination theory [60]. By investigating into the meaning and path to the three elements of intrinsic motivation, autonomy, competence and relatedness, the author presents a framework for success stating the steps towards successful gamification design. The framework aims to extract the basic needs of the players, individual differences, combined with social influences, through the lens of interest, in order to reflect with fun, satisfaction, and meaningful interactions, so that the players will ultimately achieve the experience of flow-like engagement [61]. The steps provided by the author include discovering the reasons to gamify, identifying the profiles of players, setting up goals and objectives, describing skills and actions, defining lenses of interest and desired outcomes, and play-testing and polishing.

One of the well-known gamification design frameworks is the 6D framework presented by Werbach & Hunter [62]. The 6D framework includes the following steps: define Business Objectives, delineate target behavior, describe your players, devise activity loops, do not forget the fun, and deploy appropriate tools. Comparatively, these two frameworks resemble to each other in many ways, where the objectives, the target behaviors, the player profiles and the lenses of interests are the commonly agreed opinions. On the other hand, there are two aspects are respectively emphasized, which are the play testing and polishing, and the appropriate tools. Yet still, both frameworks are limitedly supported by the formal design methods and techniques, which results in their

lack of connection to design practices. For example, suggesting the designers not to forget the fun does not guarantee the outcome will be fun. Analogically, claiming software must be designed according to the clients' requirements does not prevent the software projects from failing to satisfy the clients' requirements, when the specific requirements elicitation, validation, and management methods and techniques do.

Similarly, De Paz also proposes a series of steps to gamification design as well as a set of guidelines [63], which are largely inspired by the previously mentioned frameworks, and Bartle's player types model [64]. Despite the steps being even more general and including three major phases, the author tries to embrace individual game elements into gamification designs. However, the stated game elements do not guarantee meaningful game dynamics as well as gameful experiences. On the other hand, adopting Bartle's player type model originally for MUD games in the context of gamification design is also questionable. It shall be more convincing to adopt the user type models for gamification proposed by Marczewski or Chou [65] [66].

A different six categories of gamification elements are presented based on the review of previous literatures in [67]. The six elements include general framing, general rules and performance framing, social features, incentives, resources and constraints, feedbacks and status information. To enrich the element-based framework, the authors also present the 42 individual elements to use within the six categories. Versteeg's study defines a simplified framework from the perspective of moral persuasive gamification design [68]. The steps introduced in this study include moral principle definition, conceptual investigation, stakeholder involvement, as well as, evaluation and iteration. The framework presented by Aparicio et al. consists of four individual steps, including, identification of the main objective, identification of the transversal objective, selection of game mechanics, and analysis of the effectiveness [38]. These three frameworks also focus on providing guidelines and comprehensive instructions on how gamification shall be designed and what the generic steps are. However, they still do not introduce a formal method on how the detailed features, mechanics, and dynamics shall be designed.

Furthermore, another study combines the ideas of using lens for game design from Schell [51] and the concept of skill atoms [69] into the lens of intrinsic skill atoms for gamification design [36]. The author proposes five steps in gameful design, including, Strategy, Research, Synthesis, Ideation and Iterative Prototyping. For each step, Deterding describes a set of sub-steps further illustrating the process. Meanwhile, the author also identifies two modes, innovating mode and evaluating mode, which represent the design work for creating a new system around target users' need and the one for improving an already-existing system. The gameful design process is then presented as the following table.

Innovating Mode	Evaluating Mode
1. Strategy	

<ul style="list-style-type: none"> a. Define target outcome and metrics b. Define target users, context, activities c. Identify constraints and requirements 	
2. Research <ul style="list-style-type: none"> a. Translate user activities into behavior chains (optional) b. Identify user needs, motivations, hurdles c. Determine gameful design fit 	
3. Synthesis <ul style="list-style-type: none"> a. Formulate activity, challenge, motivation triplets for opportune activities/behaviors a. Identify skill atoms of existing system for opportune activities/behaviors 	
4. Ideation <ul style="list-style-type: none"> b. Brainstorm ideas using innovation stems c. Prioritize ideas d. Storyboard concepts e. Evaluate and refine concept using design lenses (optional) a. Brainstorm ideas using design lenses 	
5. Iterative Prototyping <ul style="list-style-type: none"> a. Build prototype b. Playtest c. Analyze playtest results d. Ideate promising design changes <p><i>Repeat a-d until desired outcome is achieved</i></p> <p><i>Increase prototype fidelity as playtest results approach desired outcome</i></p>	

Table 1. Five Steps in Deterding's Gameful Design Method [36]

Similar to the previously mentioned gamification design frameworks, this design method also emphasizes the importance of objective and user needs analysis as the starting two steps of gamification design. On the other hand, the author indicates that translating user activity into behavior chains is a helpful way of identifying the targeting user behaviors, despite that he considers it as optional. The fourth and fifth steps of the design method is more similar to the description of an agile development process of Scrum, which contains identical activities of brainstorming, user story backlogs, user story prioritization, iterative development with sprints, and so on [70] [71]. The method is further evaluated through 19 design projects and training workshops with more than 300 participants, and validated with a case study.

Furthermore, another recent study by Morschheuser et al. provides a synthesis of the previous gamification design frameworks and develop a complete model of the gamify method [72]. The figure in Appendix 1 shows the complete model for gamification design, the activities of which can be divided into seven phases: Project preparation, Analysis, Ideation, Design, Implementation, Evaluation, and Monitoring. Described into a linear process model, this method provides a relatively more thorough description on the whole gamification project lifecycle. Via the interview on 10 gamification experts, the method is evaluated with several improvement suggestions raised by the interviewees. Based on the comparison of the findings from the literatures and the interviews, four general requirements for gamification projects are seen as critical.

These requirements include, understanding the user needs, motivation and behavior, as well as the characteristics of the context, identifying and defining project objectives, early gamification design idea testing, and following an iterative design process. A similar but less detailed process framework for gamification learning design is given by Mora et al., who clearly indicates iterative process and agile methods shall be applied in gamification design [73].

Many other gamification design frameworks have been also proposed [36] [43]. For example, Nicholson's "user-centered theoretical framework for meaningful gamification" emphasizes the needs and goals of the users over those of the organization, or gamification service providers [78]. Simoes et al.'s "social gamification framework" provides the insights on using social game elements to promote desired behaviors and improve learning outcomes [79]. Gears & Braun's "role-motivation-interaction" takes into account the 16 basic desires given by Reiss and articulates the interactions and motivations for each user role in business, which guides the choices of fitting game design patterns [80] [81]. On the other hand, industrial methods for gamification design, such as "smart gamification" by Kim [82], have been also presented [83] [84].

2.3. Summary

The review of previous studies shows that the core activities through gamification design process are very similar throughout the proposed gamification design frameworks and methods. These activities include:

- Objective Analysis (why to gamify, for what reasons)
- Behavior Analysis (what are the wanted behaviors from users)
- User Profiles (what are the different types of users)
- Ideation/Game mechanics selection (How, what elements to use, how to connect)
- Prototyping & playtesting
- Implementing & Releasing
- Maintenance (repeatedly)

The previously reviewed frameworks mostly cover all the given activities or state them in alternative fashions (shown in Figure 1). However, most of these studies lack of the instruction on how the design requirements are specified into requirements that are easy understanding for developers. Furthermore, the specification of the user goals and the connection between such goals and the desired user behaviors also require further discussion. The designers need a straightforward way of displaying such critical design information, which shall also be open to further adjustment and enhancement. These design concepts shall be more straightforward to the developers. On the other hand, most of the frameworks presented above resembles the waterfall model in software engineering

[85]. Similarly, the crucial flaw of the waterfall model is that the project will largely lack of flexibility towards changes in requirements. Considering gamification projects accordingly, when adopting the waterfall-like linear framework, the cost for changing functions in the implementation phase will be costly, which might result in the failure of the whole project. This is the reason why many studies indicate iterative development process or prototyping is of great importance [36] [72].

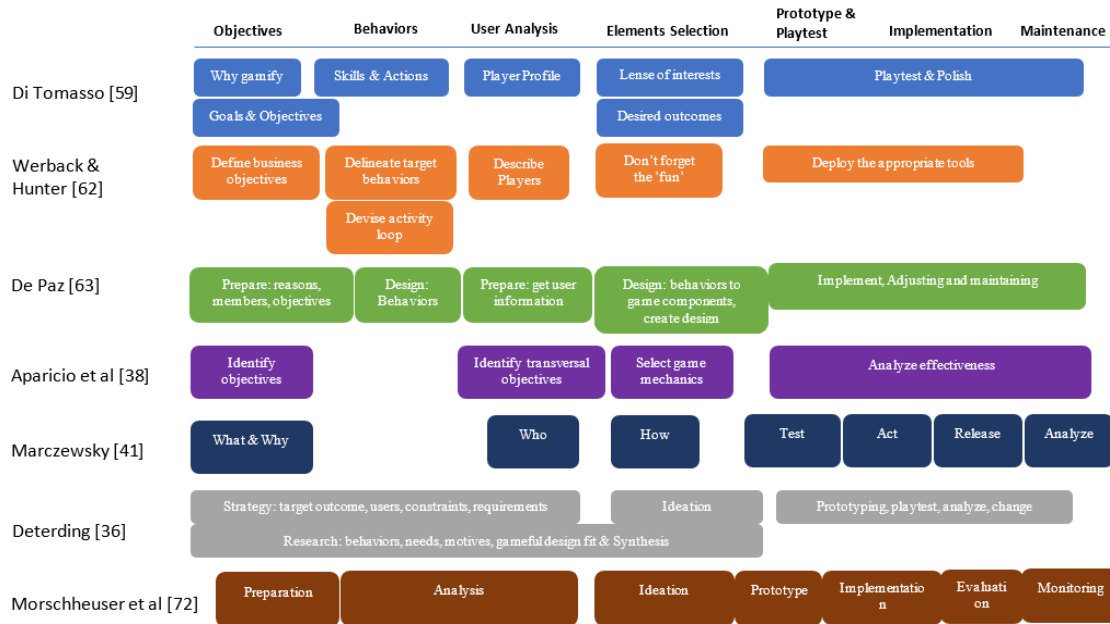


Figure 1. Common Pattern of Gamification Design Frameworks

Therefore, this study focuses on proposing a specification method using modeling language that facilitating the process of gamification design in the critical user goal analysis and behavior analysis. A thorough analysis in these aspects shall to a large extent help the designers in the ideation activities where the connection between users' motivation and their behaviors can be more intuitive and adaptive. Furthermore, using a well-designed modeling language shall also facilitate the developers' translation from design concepts into implementable requirements.

3. Goals, Scenarios, and URN in Requirements Engineering

Despite of being software products, digital games are seldom developed in the same fashion as in software development [144]. Developing a game is not only to implement the functionalities but also to provide the targeted gameful experiences via the combination of those functionalities. Therefore, it seems that the differences between software and game development activities results from the essential differences between utilitarian software and digital games as hedonic systems [86]. However, gamification is neither a pure utilitarian software, nor a genuine hedonic system, which suggests there is

a certain gap between game design practice and gamification design, which could be the design and development methods for the “utilitarian parts” of gamification and their connection towards the hedonic parts where game design elements are used. Meanwhile, both game design and gamification design activities has limitedly applied the formal or semi-formal methods from the software engineering domain [145].

Formal methods are the mathematical techniques often supported by tools, for developing better software and hardware systems [87] [88]. The vital first step in a high-quality software development process is requirements engineering. Formal methods can be useful in eliciting, articulating, and representing requirements [87] [89]. Therefore, when designing the utilitarian features of a gamification software, the developers and designers could certainly benefit from adapting the formal methods from requirements engineering in the elicitation and specification of the gamification system requirements. On the other hand, using formal methods and formal specification in game design and game development has also been studied [90]. A formal method in software engineering is “a set of tools and notations (with a formal semantics) used to specify unambiguously the requirements of a computer system that supports the proof of properties of that specification and proofs of correctness of an eventual implementation with respect to that specification” [91]. As said in this definition, using formal method is to unambiguously specify the requirements of computer systems, which provides better means of communication between the designers and the engineers, or similarly, that between the domain experts and the IT experts.

On the other hand, semi-formal methods, such as the Unified Modeling Language (UML), are also playing critical roles in the software engineering practice [77]. The reason why UML is defined as a semi-formal method is due to its lack of formalized semantics. However, being not as formal as other methods has not been hindering UML from becoming one of the most popularly adopted software engineering modeling languages, as it shares the traits of semi-formal methods including being model-driven, intuitive, graphical, and good at abstracting details [92] – [94]. Furthermore, the integration of semi-formal methods to formal methods, as well as the formalization of UML has also been long studied [95] – [97].

For requirements engineering, goals and scenarios have been adopted facilitating the requirement elicitation and specification [98] [99]. However, game design and development, as well as gamification design, despite of requiring also eliciting and specifying the needs of the players and other stakeholders, has not been adopting such artifacts or other related requirements engineering methods. This section will provide a brief introduction on the use of goal analysis and scenario based modeling in the contexts of requirements engineering. In addition, the section will specially introduce User Requirements Notation (URN), a semi-formal modeling language used in both goal and scenario specification for requirements elicitation, specification, analysis and validation [72]. This modeling language shall be then adapted to facilitate the requirements

identification and gamification ideation steps in the proposed gamification design method [74].

3.1. Goal-oriented Requirements Engineering to Gamification

A goal, in the context of requirements engineering, is an objective the target system shall achieve, explaining why the system is implemented this way [110]. And goals have been recognized as an essential component in the theory and practice of requirements engineering for a long time. According to Ross & Schoman [111],

“Requirements definition must say why a system is needed, based on current or foreseen conditions, which may be internal operations or an external market. It must say what system features will serve and satisfy this context. And it must say how the system is to be constructed.”

Therefore, the goal-oriented requirements engineering is to address such issues where limited attention has been given in understanding why a certain feature of the system is needed and how the certain feature satisfies the needs of various stakeholders [112]. Thus, using modeling techniques facilitating analyzing goals in the requirements engineering practice is important, as goal modeling can provide a convenient way towards describing the environment of the system, the sufficient completeness of requirements specification, the requirements pertinence, traceability, the structuring of complex requirements documentation, managing conflicts among viewpoints, etc. [110] [112]. The main goal-oriented requirements engineering approaches include the non-functional requirements (NFR) framework [113], the i* [114], the Knowledge Acquisition in automated Specification (KAOS) [115] [116], the Goal-Based Requirements Analysis Method (GBRAM) [117], and so on.

Considering the domain of gamification design, identification of the goals of the target system can be important as well, as gamification is to use game design elements in non-game related systems in order to motivate the users to achieve both their goals in the utilitarian features of the system and the ones in having fun with the gamification features. Therefore, analyzing the goals and motivation of the stakeholders answering the design questions of “why these people need this feature from the system” or “What they can get by using this feature” is critical. Thus, the goal-oriented analysis from the requirements engineering domain shall provide certain guidance to the designers of gamification systems on how to systematically and effectively obtain the goals of the various stakeholders.

3.2. Scenario-based Requirements Engineering to Gamification

A scenario is defined as an informal description of a situation in a system’s environment and of a way in which the system can be used, or a temporal sequence of interaction

events between the target software and its environment (other systems or humans) in the restricted context of achieving some implicit purposes [100] [101]. To simply put, it is a story about the users of a target system and their actions [102] [103]. A typical scenario consists of four key elements: the system's environment setting, the user, the user's goal, and his/her action to achieve the goal using the system [98] [104].

Scenarios are used to support the analysis of the use of a target system in requirements acquisition and validation, in order to gather stories, search for generalities identify and analyze the needed behavior of software [99]. They describe an existing system and its environment including the behavior of the users and the context information to allow discovery and validation of software requirements [98].

The textual scenarios could contain the redundant amount of information for more than one features in multiple situations, where one sentence can also contain all the related key elements. For example, this short sentence extracted from a large textual scenario paragraph, “... *After his morning class, Antti sits at his desk and feels bored. He then opens WhatsApp to send a message to Anna in order to have a chat. ...*”, contains the mentioned key elements, which describes the actions (i.e. *sits, opens, and send*) of a user (i.e. *Antti, an end user*), the context/settings where the user is situated (i.e. *morning class, feeling bored*), and his/her goals (i.e. *to have a chat with Anna*). The scenarios could also include more details concerning how the user's interaction with the mobile app proceeds. For example, the original textual narrative “*opens the app and sends a message*” can then be further described as

“clicks the app icon on the phone screen, clicks the contact list tab, scrolls down the list of contacts and finds Anna's profile image, clicks that image or the username besides it, entering the conversation panel, taps the text bar below and types the text content, and then clicks the send button.”

By doing so, the requirements for the target system shall be specified, where the developers then have more information concerning how the feature of “sending message” shall be designed and implemented. Furthermore, ideally, from a set of scenarios, the designers (or requirements analyst) shall be able to elicit the full set of requirements for the target software system.

According to Glinz [105], the key advantages of using scenarios in requirements engineering are summarized as follows.

- **Taking a user's viewpoint** – viewing a system from the viewpoint of users, giving user a feel for what they will get.
- **Partial specification.** – providing a decomposition of a system into functions from a user's perspective with each function treated separately.

- **Ease of understanding** – providing an easy way of understanding and discussing requirements for both users and requirement engineers.
- **Short feedback cycles** – allowing short feedbacks between users and requirements engineers.
- **Basis for system test** – test cases can be directly derived from scenarios.

Thus, similarly, it is not hard to imagine by adopting the same method, gamification designers shall also be able to obtain a better perspective on how the target gamification system shall be designed. These advantages could be also shared for gamification system design, especially for the digital gamification applications. According to Morschheuser et al.'s description concerning the gamification design method [72], users' goals and motivations, understanding of the contexts, and the behaviors specification in the current system are very important to the success of gamification design. Hence, not only do scenarios contain such critical information on how gamification system shall be designed, but also it shall also provide the advantages of understandability between users and designers, as well as the short feedback cycles that addresses the needs for agile iterative design process, and early play testing with proper test cases [72].

3.3. The URN Modeling Language

The User Requirements Notation (URN) is a modeling language, designed to support the elicitation, analysis, specification, and validation of requirements within the practice of software engineering [74] – [76]. It is a semi-formal, lightweight graphical language for modeling and analyzing requirements of software systems in the form of goals and scenarios. It is the first international standard to address software requirements and their links using scenarios and goals explicitly in a graphical way and in one unified language [76] [106]. This modeling language focuses on the descriptions of certain user behaviors through scenarios, which provide the structure and view on the features and capabilities the target system provides, and the specified reasons for such behaviors and functions. Meanwhile, it omits certain operational details of the components interactions, which allows designers and engineers to concentrate on high abstraction design [76].

The URN contains two sub-languages, including the Goal-Oriented Requirement Language (GRL) for modeling the hierarchy of the scenario actors' intentions and motivations, and the User Case Map (UCM) notation for describing the scenarios.

Goal-oriented Requirements Language (GRL)

The GRL, based on the *i** modeling language and the non-functional requirements framework [107], is a visual modeling notation for analyzing intentions and goals of multiple stakeholders, and facilitating the decision making. The essential elements of a GRL graph include the following elements [76].

- **Actors** – the stakeholders of a system, or the system itself.
- **Softgoals** – the goal without clear objective measure of satisfaction.
- **Goals** – the quantifiable goal in binary way.
- **Tasks** – the solutions to softgoals or goals.
- **Resources** – what is needed to achieve or complete softgoals, goals and tasks.
- **Links** – the various relations between the elements.

By using GRL, the designers shall be able to obtain the intentions of various stakeholders, most importantly, the users of the target system. In addition, the designers shall also acquire a clear mapping between the goals of stakeholders and how these goals can be achieved with resources and tasks.

An example of using GRL illustrating the simplified goal-oriented relation for a city commuting system is shown as follows.

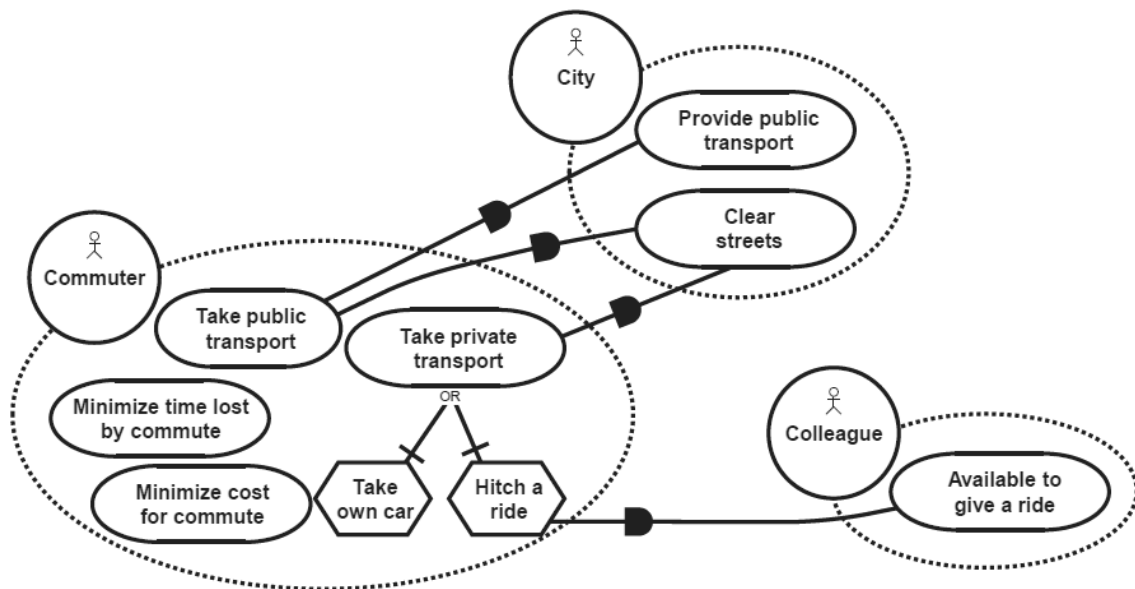


Figure 2. An Example GRL Graph: The Commuter Goals

In this GRL graph, three individual actors are displayed, including the commuter, the city and the commuter’s colleague. The goals of each actors are shown within the dotted-line-ellipse. For instance, the commuter has four goals/intensions, including “*take public transport*”, “*take private transport*”, “*minimize time lost by commute*”, and “*minimize cost of commute*”. However, these goals might not be fulfilled simultaneously. Meanwhile, the intensions of different actors might depend on one another or conflict mutually. For example, the commuter’s intension of “*taking public transport*” complies with the city’s intension of “*provide public transport*”, while on the contrary, the commuter’s intension of “*take private transport*” will contradict with the city’s intension of “*clear streets*”. On the other hand, for each goal/intension, multiple tasks can be connected to it, demonstrating that the specific intension is fulfilled by completing the

task. For example, either “*take own car*” or “*hitch a ride*” fulfills the commuter’s goal of “*take private transport*”.

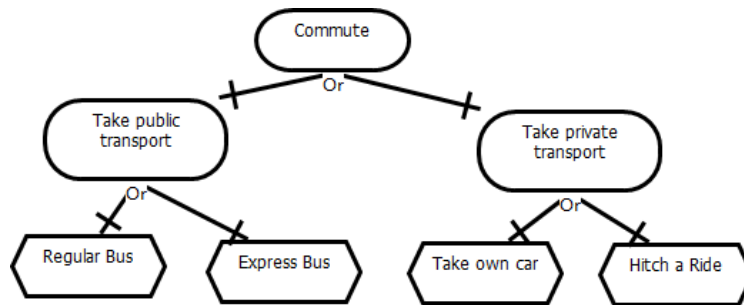


Figure 3. The Connection of Goals and Tasks in GRL

In GRL, goals/intensions can be decomposed into sub-goals. Shown in the above figure, the goal “commute” of the commuter can be decomposed into two sub-goals with a OR relation, indicating that the goal “commute” shall be achieved by fulfilling either of the sub-goals.

User Case Map (UCM)

The UCM, as a visual scenario notation, focuses on demonstrating the flow of behaviors. UCM intends to illustrate the interaction relations between architectural entities using visualized diagrams abstracting redundant textual details [76]. One of the disadvantages of using scenarios in requirements elicitation is the redundant details in the original textual narrative which largely hinders the efficiency. UCM, on the other hand, can solve the problem via simplified visual demonstration of the behavioral sequences.

The key elements of the UCM notation include the following [76].

- **Map** – a diagram containing a set of paths and components.
- **Paths** – casual sequences illustrating one possible behavior.
- **Start points** – indicating the start of paths.
- **End points** – indicating the end of paths.
- **Responsibilities** – describing the required actions or steps to fulfill a scenario.
- **OR-forks/OR-joins** – indicating the alternatives.
- **AND-forks/AND-joins** – indicating the concurrency.
- **Waiting places/Timers** – indicating the location on the path when scenario stops until a condition satisfied.
- **Static stub** – indicating one existing further interpretation of a behavior
- **Dynamic stub** – indicating multiple further interpretations of a behavior
- **Component** – the structural aspects of a system
- **Process** – a component that has its own thread of control
- **Object** – a component that does not have its own thread of control

By using the UCM, the designers shall be able to detect the possible behaviors of the target system via the displayed set of paths/scenarios on the set of maps. When understanding the semantics, both the designer and the developers shall easily understand the scenarios and then know the features to be implemented.

An example of a UCM scenario describing the behavior sequence of a person going to work is shown as the following figure.

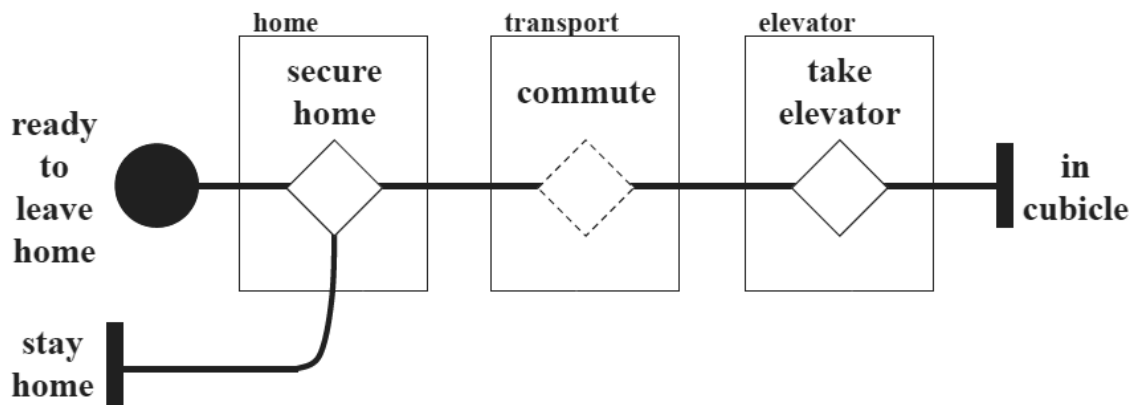


Figure 4. An Example of UCM: The Go-to-work Scenario

This UCM graph contains the process of a person from home going to his/her workplace, starting from the status where he/she is “*ready to leave home*”. The first component of the scenario path is the person’s home where his/her behavior is to secure home, where the person has options for multiple out-paths. Amongst, the person can continue his action of going to work by proceeding to the next behavior node, which is to commute, or choose to stay home when the secure home system fails. As shown in the figure, the secure home is denoted as a static stub, which indicates one extra level of scenario specification, which is shown in Figure 5.

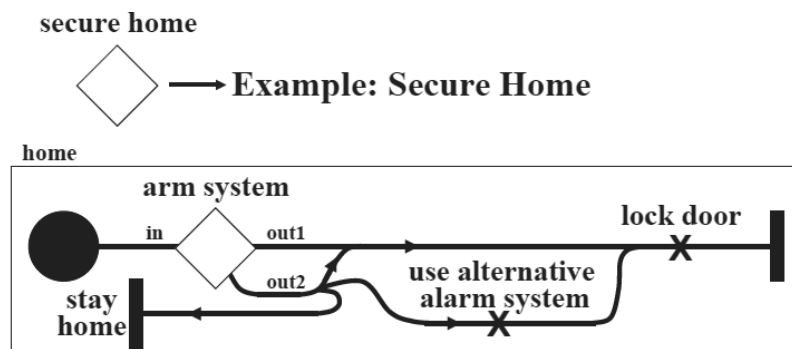


Figure 5. The Plug-in Map for Securing Home Scenario

In Figure 5, the map denotes the behavior of the person securing his/her home. The starting point is where the person operates the arm system, which has two out paths, i.e. success or fail. When the arm system successfully secures his/her home (i.e. out1), the person can then just lock the door and proceed to the next action (e.g. commuting

according to Figure 3). On the other hand, when the arm system fails (i.e. out2), the person has then three options, including staying home, using alternative alarm system and then locking the door to proceed, and directly locking the door to proceed.

Moreover, one of the advantages of URN is that the goal/intension graphs of GRL can be linked with the scenario graph of UCM, where each task element of GRL graphs can be denoted by a UCM graph. Taking the previous Figure 3 as an example, the scenario of the task “*taking a regular bus*” can be denoted as the following Figure 6.

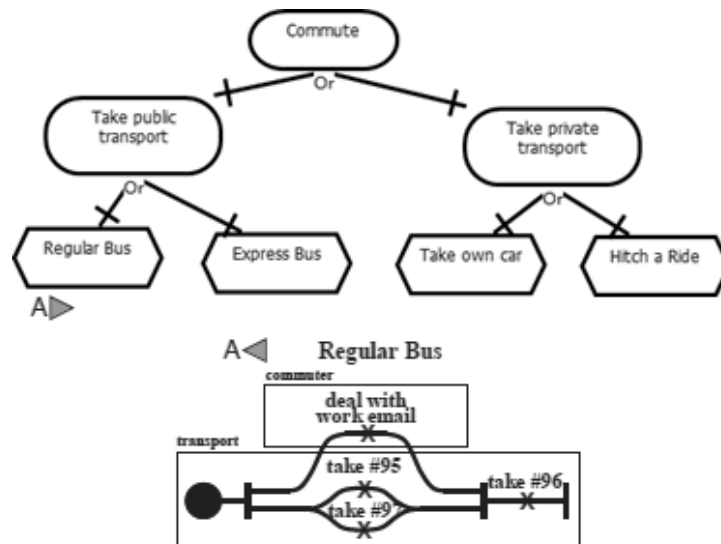


Figure 6. The Connection between GRL and UCM

The previous brief demonstration on the fundamental features of the URN modeling language shows that the URN is a useful tool in depicting the scenarios of the set of interactions certain users can engage with the system, as well as the connection between the users’ interactions and their goals and motivations. This shall help the designers and developers to better understand the requirements from the users’ perspectives and ease the communication between themselves.

Similarly, in gamification design practice, understanding the user needs and understanding the different stakeholders is one of the key requirements for gamification projects [72]. Furthermore, designing user journeys and translating user activities into behavior chains (the scenarios) has also been emphasized as a key step in gamification design [36] [72]. Thus, the URN can certainly facilitate the gamification design in such ways.

3.4. Existing Modeling Languages for Gamification

Despite of gamification system mostly being software system, the process of gamification system design and development resembles limitedly that of software engineering. Gamification design tends to imitate the practice of game design instead of the practice of software engineering, when modeling languages, such as the UML, are a common

technique in software design but not common in game and gamification design [77]. Currently, as mentioned in the previous chapter, the prevailing gamification design frameworks provide limited insights in using modeling language to solve design related issues.

One modeling language for gamification is presented by Herzig et al., which is named GaML [108]. This modeling language is developed to solve the error-prone task of information transitions from domain experts of the design phase to the IT experts of the implementation phase. The GaML provides a set of syntaxes that contains the hierarchy of gamification feature element classes, the instance of which is denoted as a set of pseudo-codes which the IT experts (developers) shall better understand. However, this modeling language falls short in addressing the perspective of users' motivation and their connections to the interactions. Thus, it provides only ways for the developers to ease the understanding curve but not the ways for the designers to obtain a better picture in how the gamification system shall be designed and why the system shall be designed in this way in the first place.

3.5. Summary

The review of previous studies on the gamification design methods or frameworks shows that most of related studies focus on proposing a process defined with steps of activities, accompanied with many suggestions of expertise towards gamification design. However, very limited studies have specifically addressed the issues in gamification design practice concerning what features are needed and why. Current gamification design tends to the use of game design guidelines and heuristics in order to gamify the target system with the gameful experience these guidelines and heuristics offers, while overlooking the effectiveness of using formal or semi-formal methods from the software engineering domain to facilitate the gamification software design.

From the requirements engineering perspective, analyzing goals of the system and other stakeholders helps in the specification and validation of the requirements, so that the system will be implemented to be the one needed. Meanwhile, using scenarios as artifacts to elicit, specify and validate requirements is also very useful to the software designers and developers. Comparatively, gamification designers, in the same way, need to elicit, specify and validate the requirements of gamification systems, in order to satisfy the needs of various stakeholders. Therefore, formal or semi-formal methods in requirements engineering shall help in gamification design practice when used adapting to the contexts.

4. Motivation-oriented Scenario-based Gamification Design Method

The review on the previous methods for gamification system design shows that most of the studies focus on the explicitly defined design process with the specifically described

activities within each step for various gamification design frameworks, such as, [59] [62]. Furthermore, nearly all the proposed gamification design frameworks fall short at presenting a specified way of using design techniques and methods, which ease the knowledge transition between designers and engineers, as well as the tools supporting such practice. On the other hand, the previous attempt on defining modeling language for gamification design (such as, [109]), seems to lose touch towards the empirical studies of gamification in general, provide only pseudo-code describing the gamification mechanics, and miss the solution in easing the communication between gamification designers and developers. Meanwhile, limited studies in the gamification domain has specifically designed methods or tools to facilitate the integration of the utilitarian functionalities and gamification designs with the validated and modeled game dynamics via unified language.

Therefore, to address the issue of lack of game dynamics in gamification design and to ease the communication between gamification design and development phase with visualized design language, this study provides an adaption of the URN modeling language for requirements analysis in software engineering to the gamification design practice. This section will introduce the modeling method in detail, and present its use in the requirements elicitation and gamification ideation activities.

4.1. Motivation Analysis by Adapting GRL

Motivation analysis in gamification design is of great importance, as gamification is defined as a process of enhancing services with (motivational) affordances in order to invoke gameful experiences and further behavioral outcomes [12] [13]. Thus, to achieve the effectiveness of gamification design, the system shall be designed to provide specified functionalities that are injected with potential motivation affordances. Hence, it is why most of the previous defined gamification design frameworks emphasize the design shall start with the analysis and verification of target users' objectives/motivations.

Many previous studies on gamification motivation have widely connected it to the Self-Determination Theory and the theory of intrinsic motivation [60]. Most of the studies have addressed the three basic psychological needs that consistently emerge as powerful and universal source of energy for motivation: *Competence/Mastery, Autonomy, and Relatedness*, as the key motivation affordances gamification systems shall focus on [110]. However, interestingly, nearly no gamification design related studies have indicated designing directly towards such motivational affordances. A predefined list of connections between the three needs of motivation and game mechanics has been presented by [38], which indicates that proper game mechanisms shall be selected to evoke the certain motivation of users based on the pre-identified main objectives.

The GRL provides the concrete way of analyzing and displaying not only the potential motivational affordances and the behavioral outcomes, as well as the connection between these motivations and the targeted features of the system. It shall largely help

the designers in the decision making towards selecting the functionalities of the system and the gameful mechanisms to implement.

To the specific, the elements for gamification design motivation modeling language are adapted from those of GRL, which are specified in the following table.






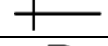

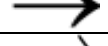

Elements	Description
 Actor	A stakeholder of a system, or the system itself.
 Softgoal	A goal without clear objective measure of satisfaction.
 Goal	A quantifiable goal in binary way.
 Task	A solution to goals or softgoal.
 Resource	What is needed to achieve or complete softgoals, goals and tasks.
 Decomposition link	Allows elements decomposed into sub-elements
 Dependency link	The dependency relationship between actors
 Contribution link	The desired impact of one element on another
 Correlation link	The side effects of one element on another

Table 2. Elements of the GRL and Descriptions

The first step of the modeling is to identify the stakeholders of the target system, which shall be denoted as the actors in the graph. The most important actor in designing the gamification system is the end users. On the other hand, for some gamification system, the company and the development team, or the individual developers can also be identified as stakeholders, as the development of the system shall influence them. Meanwhile, based on the understanding of the scope and vision of the target system, a set of initial goals/motivations of each stakeholder shall be added. Taking the example of an exercise mobile application (such as, FitStar² and 7 Minutes Workout³), the actors and the initial motivations of the application can be identified as the following figure.

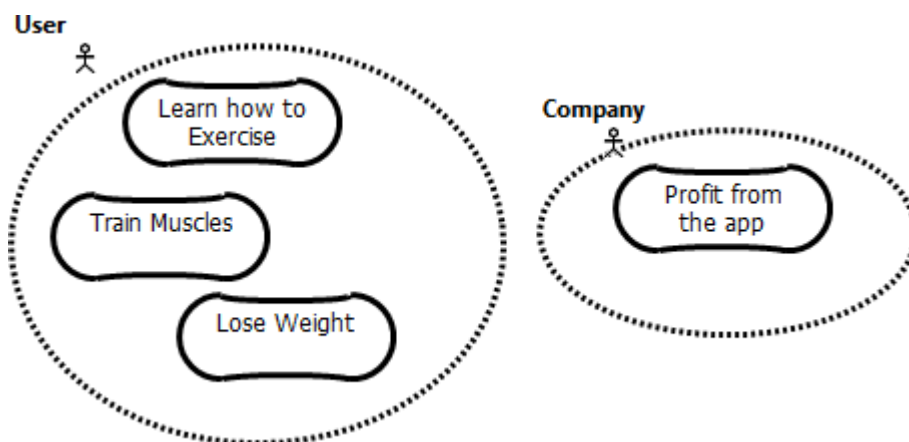


Figure 7. An Example of Stakeholders and Basic Goals for an Exercise App

² <http://fitstar.com/>

³ <http://7-min.com/>

Provided the target system does not need any gamification mechanism, the decomposition of the initial goals can be quite easy. The requirements analysts shall then analyze firstly decompose the goals into sub-goals, and detect the tasks and resources needed to achieve these sub-goals and further to achieve the main goals. According to the previous example, the decomposed goals and tasks of the user's goal of "learn how to exercise" can be denoted as the follows.

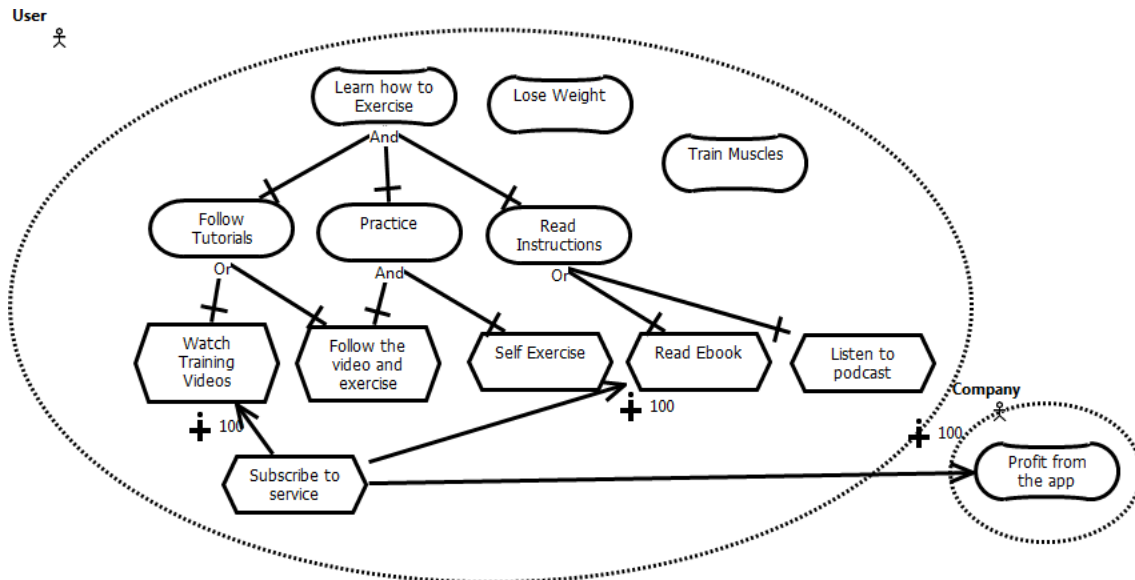


Figure 8. Decomposed Goals and Tasks

In Figure 8, the softgoal "learn how to exercise" is decomposed into three individual goals, including "follow tutorial", "practice", and "read instructions". It is assumed that the user must achieve all the three goals in order to learn how to exercise. Furthermore, in order to achieve those three sub-goals, the according tasks shall be executed by the user. For example, the user can choose to just watch the video or to follow the video and exercise. Meanwhile, the behavior of "follow the video and exercise" contributes to the goal of "practice" as well. Moreover, the user must subscribe to the service in order to watch the videos, when subscription also makes the profit of the company.

Therefore, by obtaining the main goals of stakeholders and decomposing those goals into sub-goals and tasks, the designers shall be able to acquire the user requirements of the target system. Depending on the abstraction level of the requirements, the decomposition level can be different. For example, the "subscribe to service" task can be still decomposed into "select packages" and "select paying methods", depending on the understanding of the tasks from the developers' perspective.

When the utilitarian goals and tasks of the target system has been identified, in order to gamify the system, the gamification designers shall analyze the goals/motivations of the stakeholders in terms of gamification. Thus, the motivation analysis towards

gamification can start from the basic intrinsic motivations as well as extrinsic motivations from Ryan & Deci's study [60], shown as the following figure.

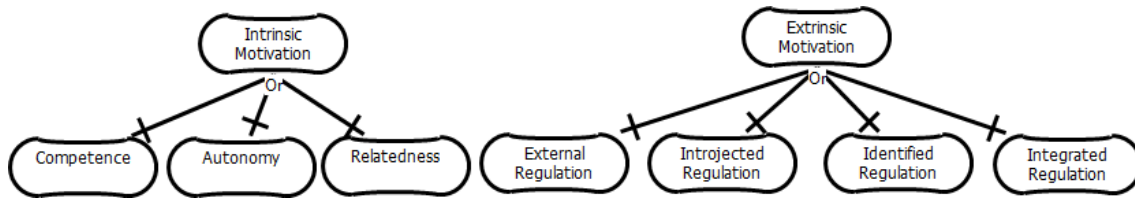


Figure 9. Basic Intrinsic and Extrinsic Motivations

Like the previous goal-oriented analysis, the gamification motivation can also be decomposed into a set of sub-goals of certain game mechanics. Some examples of the game mechanics and their connections to the basic intrinsic motivations are given by [38]. Taking the “competence” intrinsic motivation as an example, the game mechanics related include positive feedbacks, optimal challenges, progressive information, intuitive controls, points, levels, leaderboards, and so on. Therefore, the motivation modeling for gamification can be denoted as follows.

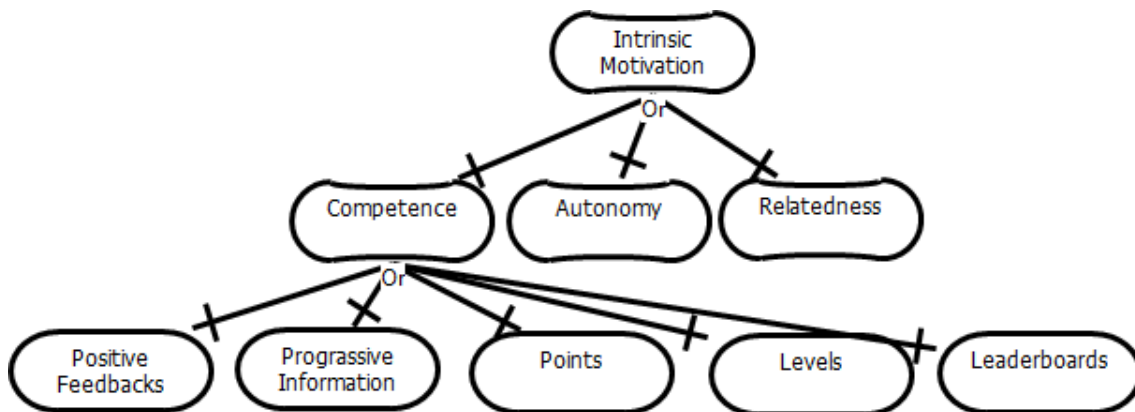


Figure 10. Decomposition of Intrinsic Motivation to Game Mechanics

Furthermore, based on the game mechanics the designers selected, each sub-goal of game mechanics can be further decomposed into tasks, which represent a set of instances of behaviors and interactions based on the understanding of the scope and vision of the target system. Thus, in the example, the given sub-goals can be further decomposed, considering the mobile application of exercise, into the following Figure 11. This figure shows the connection between certain tasks that the user can take in order to achieve the sub-goals and then achieve the main motivation. To be noticed, the task “*receive virtual items when leveling up*” is not a “must have” task, which only helps (25/100) in achieving the goal of “*leveling up*”.

When both the goal analysis of the target system features and the motivation analysis for gamification have been done. The designers shall then consider merge the two individual GRL graph into one, which shall denote both the utilitarian features and

the gamification mechanics. When obtaining the graphs, the designers shall have already understood the requirements for the target system, and have known the mechanics to be used to gamify, especially when the client and end users participating in the process of modeling. Provided the team aims to pursue the efficiency in design, followed by quick prototyping and quick playtesting, the mapping of features and mechanics can be simplified into pure enumeration via brainstorming. However, the designers can further specify the tasks in the two graphs with UCM.

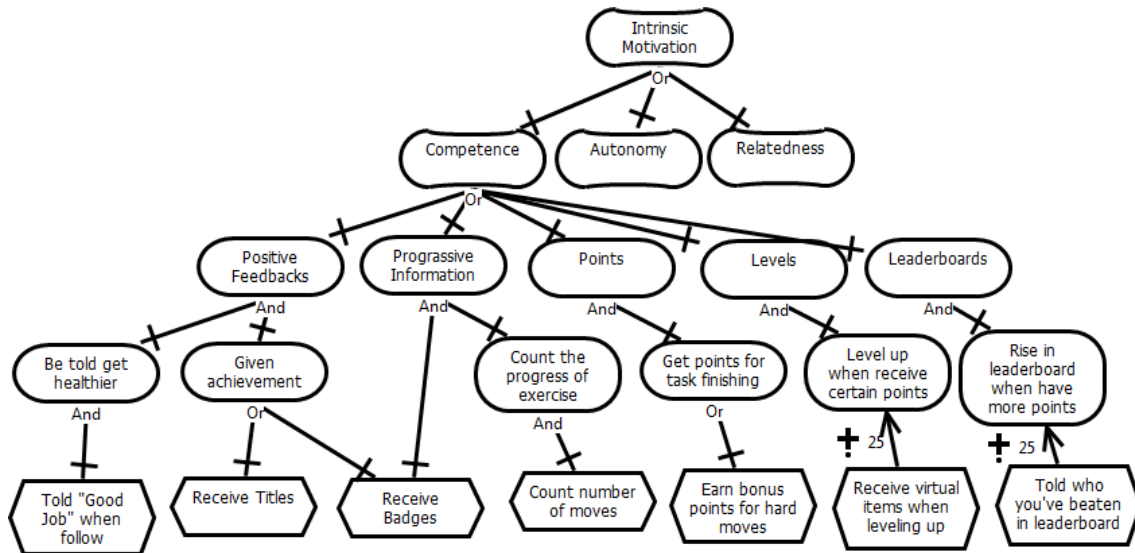


Figure 11. Gamification Motivation Further Decomposition

To sum up, the motivation analysis of gamification design with GRL encompasses the following steps.

1. Stakeholder analysis and identification
2. Non-game context goal analysis and decomposition
3. Gamification motivation analysis and decomposition
4. Quick mapping (or proceed to ideation with UCM)

This motivation analysis method complies with the activity of user analysis step in gamification design process proposed by Morschheuser et al. [72], where the aim of the user analysis is to create user personas. The proposed motivation analysis method can subsequently use the user personas obtained and categorize them into user types, when the motivation analysis can be different for each user type. In this step, it is also suitable to take into account the predefined gamification user types instead of user personas, such as, the ones proposed by [65] [66]. On the other hand, this method can also be seen as a requirement specification step for the previously elicited requirements in the project preparation step. Furthermore, this method shall largely ease the process of ideation and brainstorming in the next step of Morschheuser et al.'s method. Therefore, when using

the GRL-based motivation analysis method, the user analysis step of Morschheuser et al.'s method can be adapted as Figure 12.

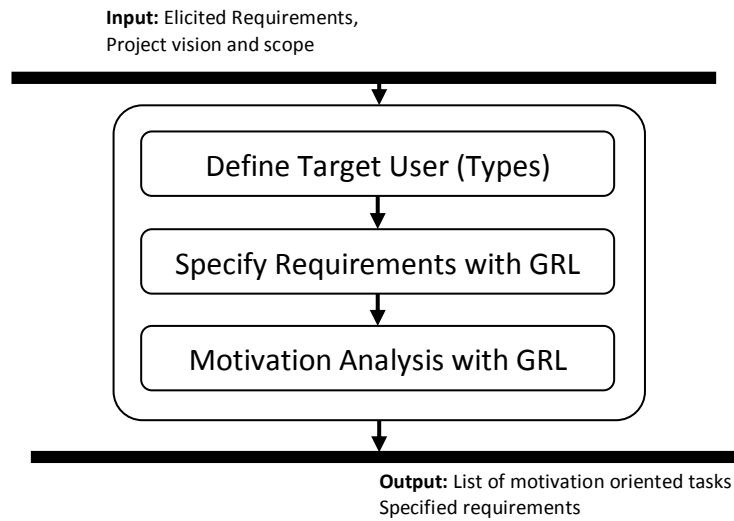


Figure 12. The Adapted User Motivation Analysis Step

4.2. Scenario-based Gamification Modeling by Adapting UCM

When the gamification designers have completed the motivation analysis with GRL and obtained the gamification motivation graph and the feature goal graph, they shall be able to quickly start the ideation of integrating the two parts and specifying the requirements. However, analyzing the potential behavior of the users or different types of users will help the designers knowing more specifically how to design certain features and how exactly the features can be gamified. This sub-section will present how to use UCM to model user behaviors and how to integrate the previously obtained features and gamification mechanics effectively.

First of all, the basics of the original UCM semantics are introduced as follows.










Elements	Description
 Start	The starting status of a scenario path.
 End	The end status of a scenario path.
 Responsibility	A responsibility the actor shall act to proceed the scenario path.
 Static Stub	A single-choice behavior which contains sub-scenarios
 Dynamic Stub	A multiple-choice behavior with sub-scenarios.
 Direction Arrow	Denoting the direction of actions
 OR-fork/joint	Denoting the selective paths of scenarios (alternatives)
 AND-fork/joint	Denoting the simultaneous action paths of scenarios (concurrency)
 Timer	Where scenario stops until condition is satisfied.

Table 3. Elements of UCM and descriptions

The process of creating behavior scenarios with UCM shall be seen as a top-down activity, where the designers shall start with the most obvious scenarios, such as, the one shown in the following figure.



Figure 13. A Fundamental Scenario for the Exercise Mobile App

This scenario is only to provide an obvious use of UCM denoting the behavior chain, with the emphasis of starting status, ending status and the actions in between. In order to genuinely facilitate the design of the target system, the scenarios shall at least denote the features of the system regardless of the detailed interaction steps. Still taking the example of the exercise mobile app, a typical scenario of a mobile app user using the “*watch training video*” feature (shown in Figure 7) shall be modeled as Figure 14.

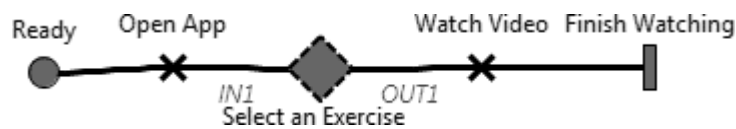


Figure 14. A Scenario of Using the “Watch Training Video” Feature

In this figure, the dynamic stub of “*select an exercise*” indicates that there are multiple alternatives as the user deciding which video to watch. Furthermore, similar to the textual scenario decomposition mentioned in Section 3.2, the action “*watch video*” can be further decomposed into functional requirements level user behaviors, which is not necessary in this example. Considering the fact that most of the users shall choose to follow the moves of the instructors in the video while they are watching, the scenario shall be modeled as follows.

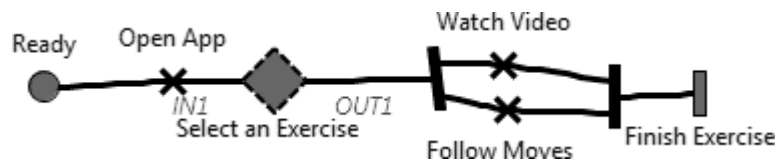


Figure 15. A Scenario of Users Following Video to Do Exercise

In the scenario of Figure 15, after the user selects an exercise, he/she needs to watch the video and follow the moves in order to finish the exercise and achieve his/her goal in “*follow the tutorial*” and then the goal in “*learn how to exercise*” (shown in Figure 8). In this way, by modeling the scenarios of different stakeholders with UCM and connecting them with the GRL graph created in the previous step, the designers shall be able to specify the tasks (or user requirements) elicited from the previous motivation analysis

and be more familiar to how those features shall be designed and implemented. Therefore, accompanied with the system goal analysis, for each task in the system goal graph, a UCM scenario path shall be created indicating the user is supposed to accomplish the behavior chain to finish the task and further achieve the goals.

On the other hand, similar modeling with UCM can be created based on the previous gamification motivation analysis. The elicited gamification mechanics shown in Figure 11, such as, “receive badges” and “receive points” can be modeled into the following scenarios.

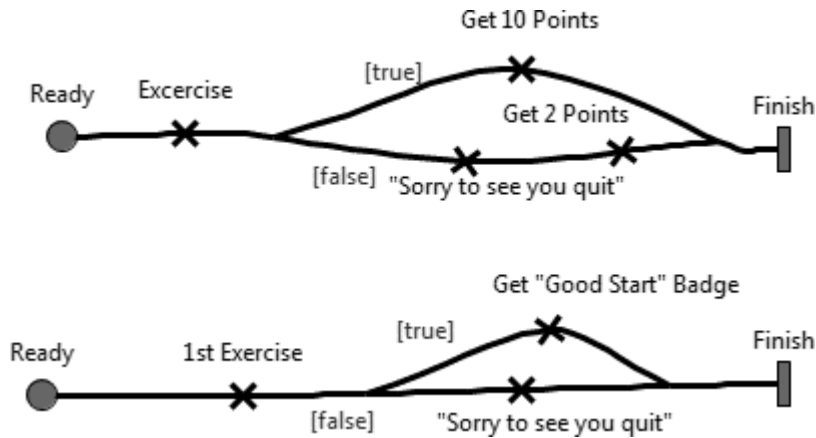


Figure 16. The Examples of the Gamification Mechanic Scenarios

In Figure 16, there is an “OR-fork” for each UCM graph, indicating the user shall choose either of the two options to complete the behavior. Taking the above graph as an example, the user can choose either to finish the exercise (condition [true]) or quit in the middle (condition [false]). When the user finishes the exercise, he/she will get 10 points. On the contrary, when the user chooses to quit, he/she will receive a notification saying, “Sorry to see you quit” and receive only 2 points. The user choosing different condition results in different paths of scenarios. Together with the previous modeled system feature of “watching tutorial video and follow the move”, a gamified system feature scenario can be modeled with UCM as the following figure.

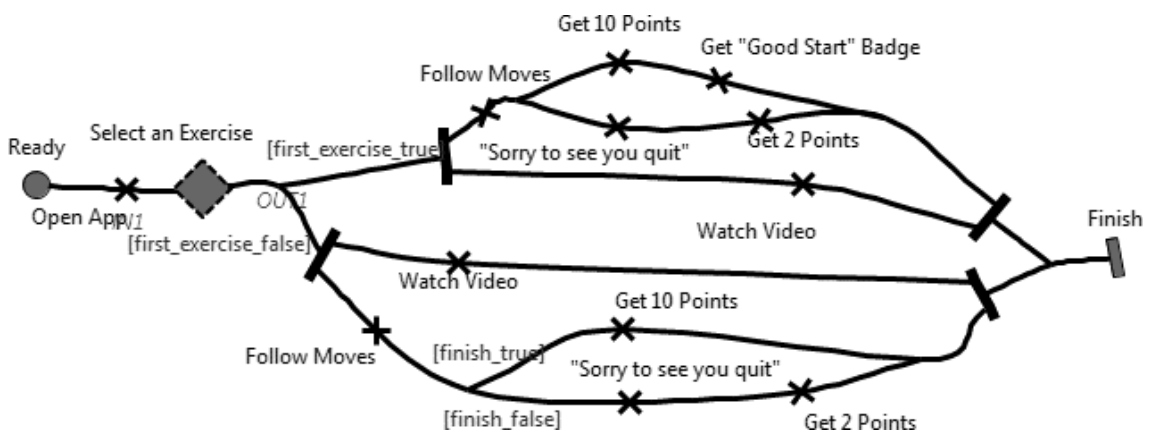


Figure 17. Integrated Feature Scenario with Gamification Scenario

By doing so, the designers shall be able to specify both system features and gamification mechanics from the GRL modeling into scenario-based UCM modeling. Through the process of creating these models, the designers shall obtain a better perspective on what gamification mechanics shall be adopted with which system feature, and what the potential user behaviors are supposed to be like.

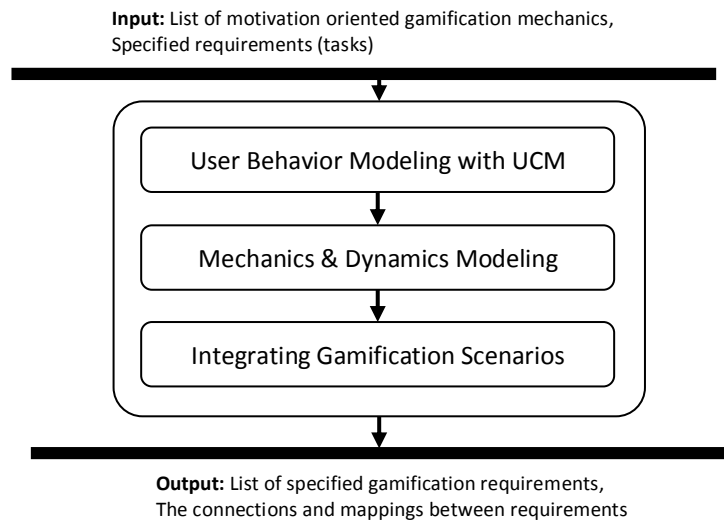


Figure 18. The Adapted Ideation Step

The use of UCM and the scenario-based modeling shall greatly facilitate the ideation step of Morschheuser et al.'s method [72], in terms of effectively generating ideas of how to gamify system features, according to the motivation these gamification mechanics lead to. Meanwhile, by further integrating the obtained scenarios, the designers shall be more explicit concerning how the gamification mechanics mutually connect. Therefore, the adapted process of ideation based on Morschheuser et al.'s method can be demonstrated as Figure 18.

4.3. Introduce Game Dynamics to Gamification Design

Morschheuser et al. mention in their study [72] that a number of gamification experts suggest playing of games and discussion of game mechanics can stimulate the mindset and support ideation. However, the connection between the understanding of the game dynamic and the application of such dynamics in gamification is mostly vague. According to previous research in gamification design frameworks, most of the studies suggests that there shall be an individual step of the design process where the designers shall consider or brainstorm what game mechanics shall be adopted in the target gamification system [59] [62] [72]. The intangibility design suggestion and intuitive proposal, to some extents, results in the current dilemma of the most existing gamification systems, where game mechanics are applied separately and can provide limited gameful experiences. It is also

the reason why gamification in general has been criticized for “not being real games” [57] [58].

Therefore, investigating the difference between individual game mechanics and game dynamics is of great importance. A well-recognized study on this topic is from Hunicke et al. proposing the structure of the “*Mechanics – Dynamics – Aesthetics (MDA)*” approach of game design [56]. According to [56], the description of these three components of games are given as follows.

***Mechanics** – the particular components of the game at the level of data presentation and algorithms.*

***Dynamics** – the run-time behavior of the mechanics acting on player inputs and each other’s output over time.*

***Aesthetics** – the desirable emotional responses evoked in the player when she interacts with the game system.*

Comparatively, the current gamification systems adopt mostly various game mechanics, such as, the most famous points, badges and leaderboard combination, where very limited game dynamics can be found in gamification systems. Taking the same example given in [56], the classic Monopoly game is fun mainly because of its dynamics of competition in using strategies to earn more money than the opponents and make them bankrupt. However, the individual mechanics, such as, rolling the dice and move the piece, paying the “money” and buying the territories, or going to the “jail”, etc. provide very limited fun. Similarly, moving pieces from one place to another does not make chess fun, but the conflicts in strategies towards winning over opponents do. Thus, creating or adapting game dynamics to gamification design is the way of providing more gameful experience. Therefore, provided modeling the run-time behavior of the mechanics of players’ move using UCM is possible, accompanied with the motivation analysis and scenario-based modeling, the designers shall be able to create an integration of modeling gamification system with game dynamics with UCM.

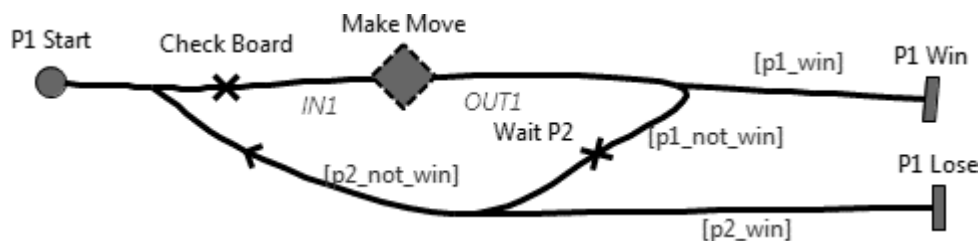


Figure 19. The Scenario Modeling for Tic-Tac-Toe Game

As creating new dynamics, despite being profitable, is time-consuming and unpredictable, the easy way to start is to take the existing games as example to modeling the dynamics of them. In this section, I select the classic Tic-Tac-Toe game as the

example. Then the first step of all is to model the features of the game, when considering the game as a software system. Therefore, as a player/user of the game (Player 1), the scenario can be modeled as Figure 19. On the other hand, for the opponent (Player 2), the scenario shall be identical.

However, designing these features does not necessarily means creating game dynamics. More importantly, these features shall be able to provide meaningful play to the players in order to create gameful experiences [118]. According to Salen & Zimmerman [46] [119], play comes from the way that players interact with the game in order to play it. Thus, it is not the collective set of features provided by the system that create meaningful play but the interaction between players and the game system, and the contexts where the game is played instead [119]. Therefore, taking into account such interactions while design the game features is of importance when the designer aims to create meaningful game dynamics. The interaction between the player and the game system can be seen as the inputting and outputting from both sides. For example, when the player places a move to the board, the interaction means the player inputs a data (piece shape and position) to the system and receives feedbacks from the system (the change of the board status). Meanwhile, from the system's perspective, the interaction can be denoted similarly via its received input and provided outputs. Thus, from the system's perspective the scenario can be modeled as the Figure 20.

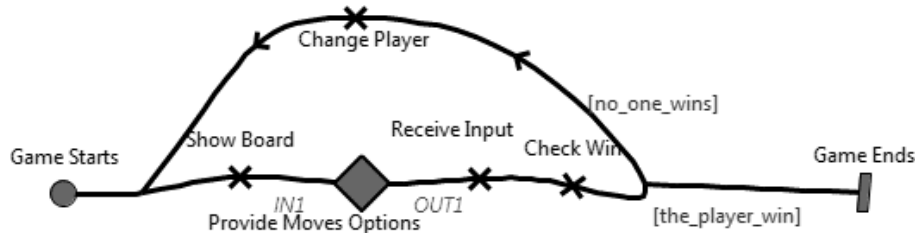


Figure 20. The Tic-Tac-Toe Gameplay Scenario from System's Perspective

As the Tic-Tac-Toe game is played by two players, the identical scenarios from the two players can be adapted into one (shown as Figure 21).

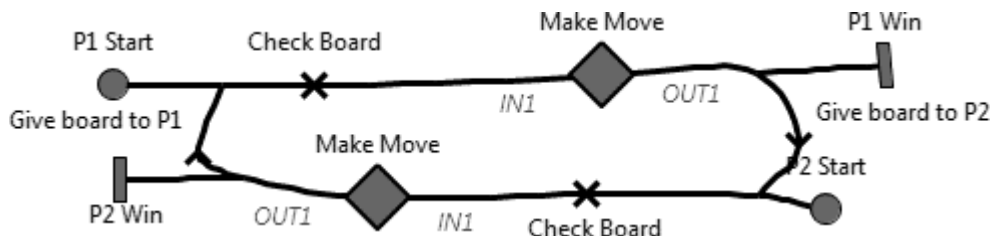


Figure 21. Combined Scenario for the Two-Player Tic-Tac-Toe Gameplay

On the other hand, the scenario from the game system's perspective can be also adapted towards two-player gameplay (shown as Figure 22).

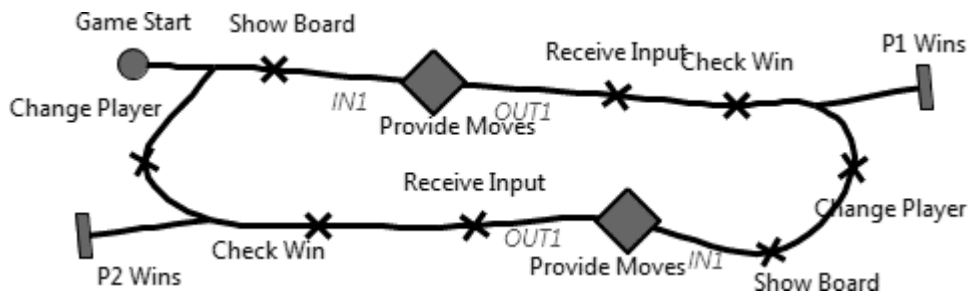


Figure 22. Adapted Scenario for the Two-Player Gameplay from System's Perspective

Furthermore, these two scenarios can be synthesized where the interactions between players and the game system can be shown from the scenarios (shown as Figure 23).

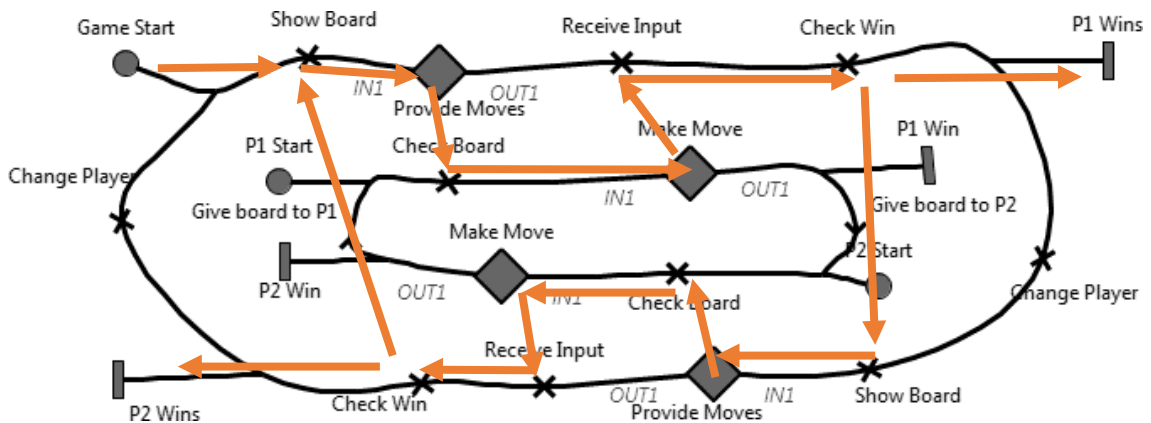


Figure 23. A Synthesized Scenario with Interaction Flow Detected

In Figure 23, the game dynamic of Tic-Tac-Toe is shown as the alternate interactions to the game system from two players competing for the winning status. Meanwhile, for every single interaction between the player and the system, the player will receive the updated board situations and the static rule set and put effort in order to seize advantages to win, which enables the meaningful play for both players.

Therefore, Figure 23 shows that it is possible to adapt UCM modeling language to model the scenarios of game dynamics that provide meaningful play. Accompanied with the previous system feature modeling and the gamification motivation analysis, the designers shall be able to integrate the modeled game dynamics to the system features so that the target system will be gamified accordingly. Still taking the previous exercise mobile application as an example, the designer can adapt the Tic-Tac-Toe game dynamics to the modeled feature shown in Figure 17, by simply replacing the “*get 10 points*” gamification mechanic into “*play a move on Tic-Tac-Toe with another player*”, and replacing the “*get 2 points*” with an external regulation of “*quit the Tic-Tac-Toe*”. Then the competitive dynamic of Tic-Tac-Toe shall motivate the user of the exercise app to finish the exercise moves in order to keep playing. The integrated scenario for adopting Tic-Tac-Toe game dynamics in the exercise mobile application can be denoted in the following UCM graph (shown in Figure 24).

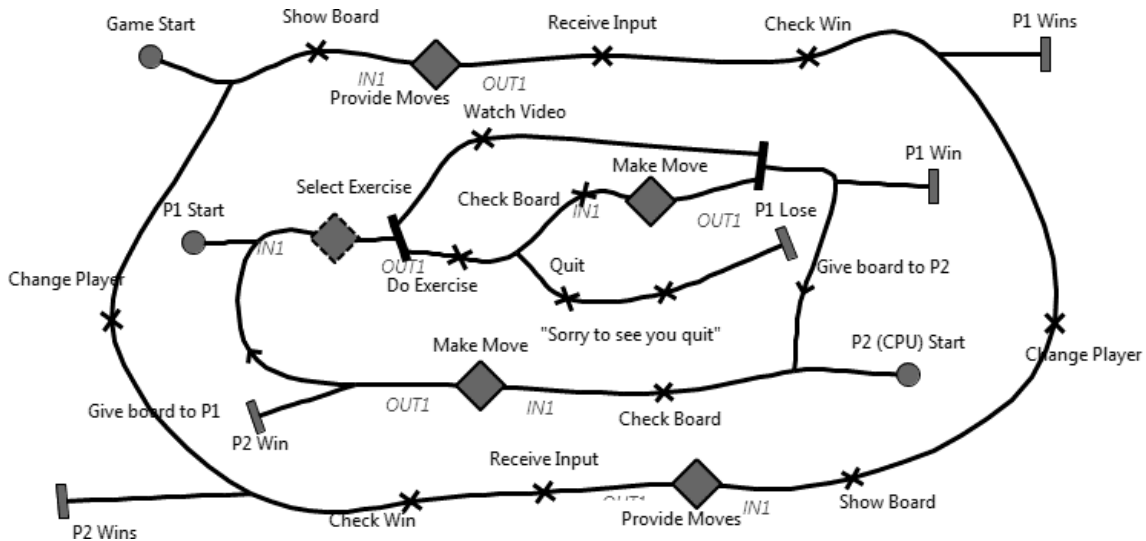


Figure 24. The Scenario of Adapting Tic-Tac-Toe Dynamic in Exercise App

Furthermore, there are more than one way of integrating the game dynamics into system features, considering the fact that the gameplay can remain the same when the rules are changed slightly. For example, the traditional Tic-Tac-Toe can be transformed into a similar game of calling numbers between 1 and 9 [45]. In this way, the user can then start with “selecting the number” which will be used in to game, when he/she must finish the exercise assigned to this number in order to get this number. Otherwise, the user will forfeit the game by quitting the exercise.

4.4. Adapted Design Process

Based on the explanation on the use of URN, which includes the goal analysis language GRL and the scenario modeling language UCM, it is clear that using these modeling languages can facilitate the process of gamification design by analyzing the motivation and goals of the target user, specifying the requirements of the utilitarian features of the system via scenarios, modeling potential game mechanics and dynamics and gamifying the system features through integrating the obtained models. However, it is still important to integrate these modeling methods in the process of gamification project.

In this study, I adopt the gamification design process proposed by Morschheuser et al. [72], as the proposed process gives a detailed instruction on each major step of the process specifying the input and output of each step. The method proposed in this study shall be adopted as an approach to enhance the “User Analysis” and “Ideation” step of the method in [72]. Hence, the major steps of the adapted process of gamification design are shown in Figure 25.

In this adapted process, the step of requirements analysis is emphasized here, as the processes proposed by Morschheuser et al. and many other scholars [59] [62] [63] [72] concerning gamification design are mostly linear similar to the traditional waterfall model of software engineering [85]. The importance of requirements engineering in the traditional software engineering process shall never be over emphasized. On the other

hand, an explicitly specified system requirement shall largely ease the following steps of analysis and ideation.

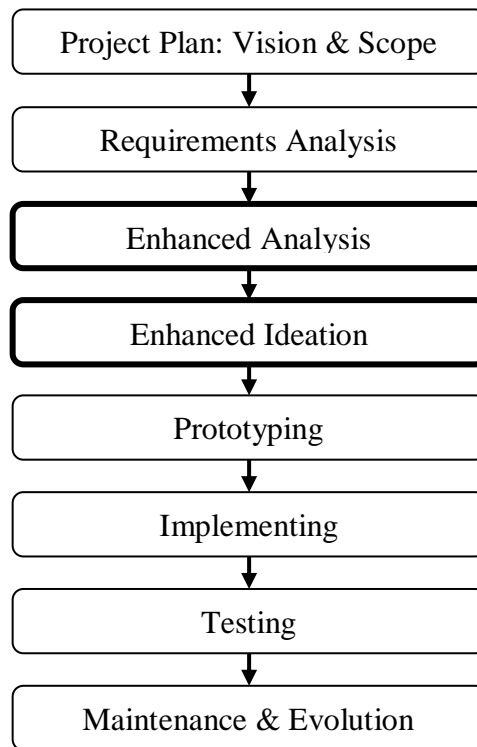


Figure 25. The Positioning of the Proposed Method in Gamification Design Process

Furthermore, the two critical steps in the process, the “Enhanced Analysis” and “Enhanced Ideation” steps will be further specified as Figure 12 and Figure 18. However, as mentioned previously in Section 4.1, it is always possible for the designers to skip the complicated effort in modeling scenarios of game dynamics in the Step 4. Thus, the designers can choose to stick with the brainstorming and mapping the existing gamification mechanics (such as the ones mentioned in [38]) to the elicited features. Therefore, the specified process of the motivation-oriented scenario-based gamification design method is shown as Figure 26. On the other hand, this linear process can be further enhanced together with the agile principles and process, such as Scrum or XP [70], which will be further discussed in Section 6.

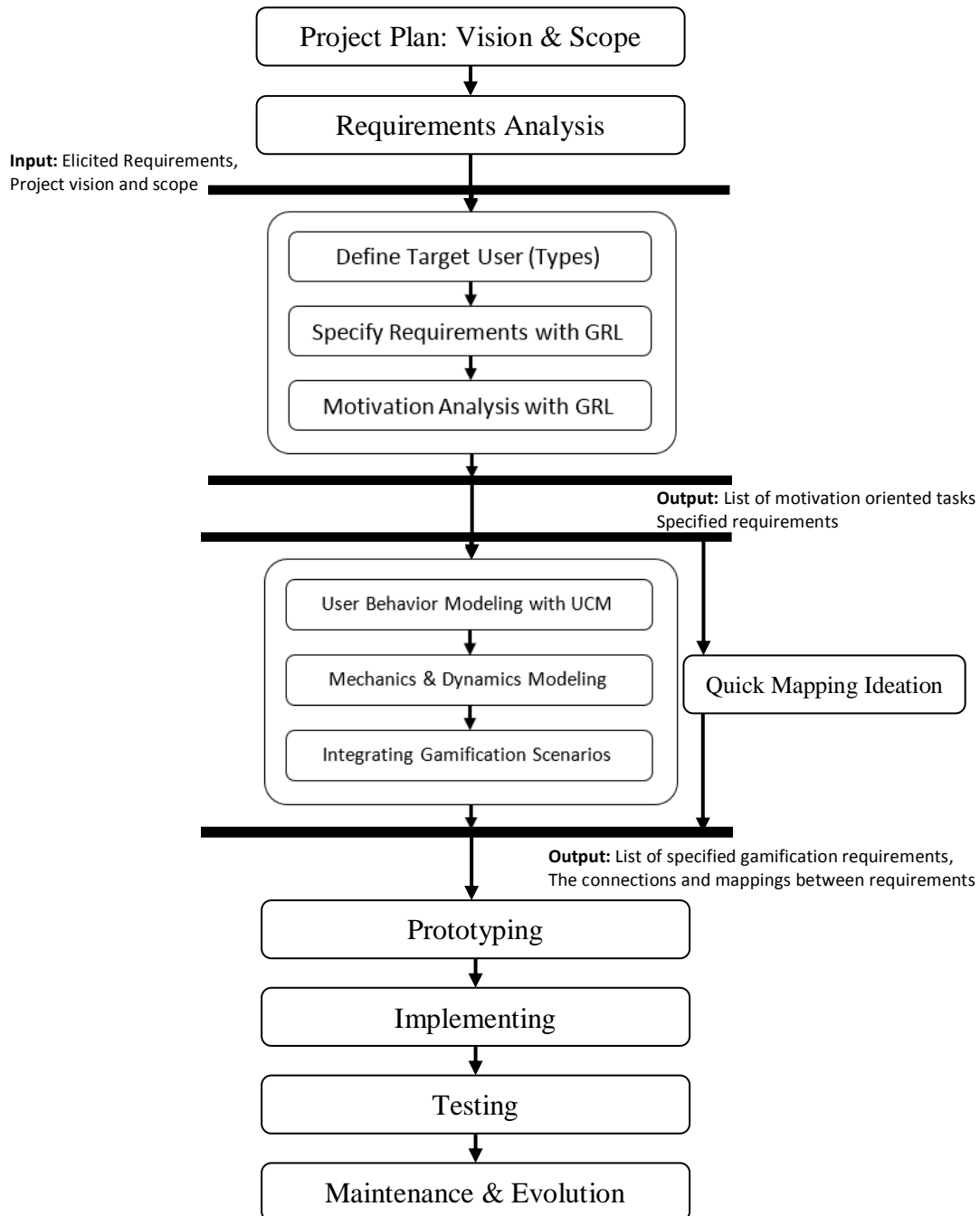


Figure 26. The Process of Motivation-oriented Scenario-based Gamification design

4.5. Summary

This section provides a brief introduction on how to adapt the URN, a modeling language for requirements engineering domain, to design gamification systems with systematic goal analysis, motivation analysis and scenario-based user behavior analysis, which answers the first research question. On the other hand, the introduction in this section also verifies the possibility of using UCM to model game dynamics and meaningful gameplay, so that by integrating the UCM models the designers shall be able to create more enhanced

gameful experiences to the target system, which answers the second research question. The limitation of this method and relevant ideas will be further discussed in Section 6.

5. A Case Study: WordDive

In this section, in order to validate the motivation-oriented scenario-based gamification design method proposed in the previous section, a case study is conducted. In this case study, I choose the WordDive web application as the target system, analyze the existing features and use the proposed method to gamify the application with different game mechanics and dynamics. In this way, the case study will present how the proposed design method be applied to gamification design practices effectively.

5.1. Introduction to WordDive

The WordDive company was established in Tampere, Finland, with their services launched in the year 2010. The service they provide is online language learning, with the methods of multiple senses, individual optimization and game-like elements^{4, 5}. WordDive has become the market leader in Finland since 2014, when till the recent year 25% of the Finnish high school seniors have been using the service from them. Ever since its launch, WordDive has won many awards, such as, the Best e-Learning Solution in Finland 2011 and the Best Mobile Service in Finland 2014. According to its official website, currently there are 300,000 users from over 150 different countries.

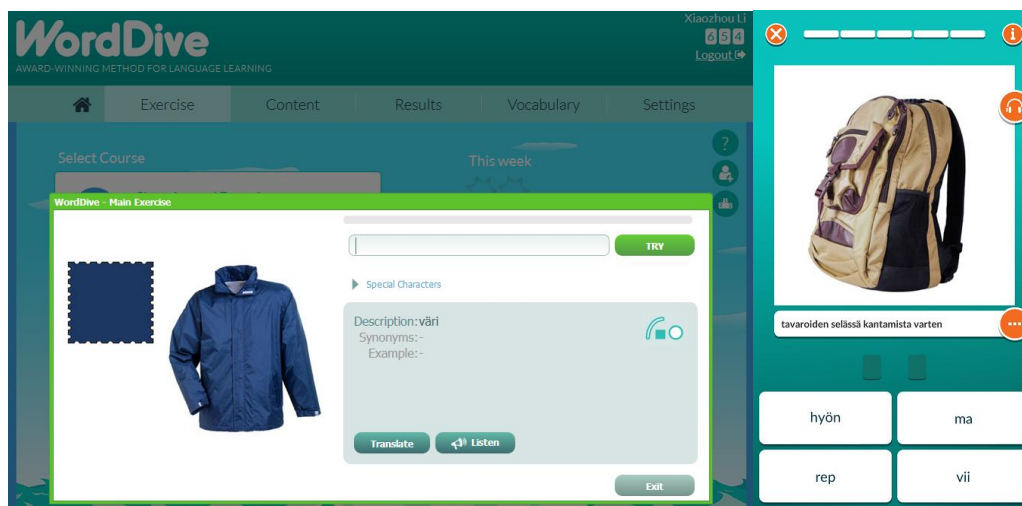


Figure 27. Screenshot of WordDive Web Application and Mobile App

In the above figure, the screenshots of the WordDive web application and the mobile app are shown. In both way of language learning, WordDive provides a multiple-senses-based learning environment. For each vocabulary or grammar item, the user can

⁴ <https://tampereallbrightmagazine.fi/articles/worddive-makes-language-studies-addictive>

⁵ <http://www.goodnewsfinland.com/feature/word-dive-created-a-clever-way-of-learning-languages/>

see a picture figuratively describing the item to learn, listen to the pronunciation of it, and try to choose the syllables in sequence to remember it or type the exact spelling of it based on the difficulty levels. On the other hand, WordDive adopted the basic gamification mechanics, such as, points, leaderboard and progression tracking. Despite that the basic features provided work decently for the language learners, there is still huge potentials for it to improve in terms of using better gamification design towards enhanced user engagement.

5.2. Retrospective Requirements Analysis

In order to apply the goal and motivation analysis, as well as scenario modeling for WordDive, it is important to acquire the requirements of the system via the retrospective analysis from the existing features of the application. As the WordDive company considers the requirement documents as confidential, the analysis will then be based on my personal use of the system for over five months.

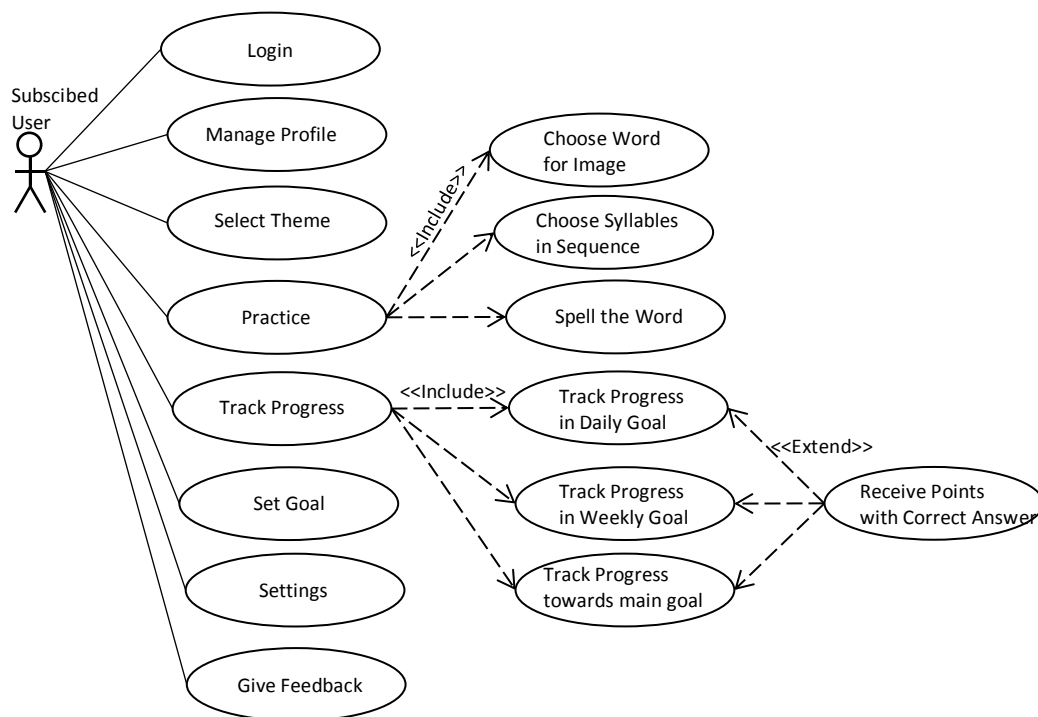


Figure 28. A Sample Use Case Diagram for WordDive

The main features of the WordDive application is shown in the use case in Figure 28.

5.3. Goal and Motivation Modeling

In order to analyze the goals and motivation of the users, the analysis must be positioned into the context of the main scope and vision of the target app. In this case, the main goal of the users of WordDive is to learn foreign languages efficiently and pleasantly. To further define the goal of “learning foreign languages”, this study adopts the concept of “communicative competence” from Rebecca L. Oxford’s seminal study on language

learning strategies [129]. In the context of language learning, communicative competence stands for the capability to communicate using a language concerning spoken or written language and all the four skills: listening, reading, speaking and writing. It was seen by Oxford as the main goal of language learning towards which all appropriate language learning strategies shall be oriented [129]. Furthermore, communicative competence can be also defined with a four-part model, including the four aspects of the follows [129] [130].

Grammatical competence – the degree to which the language user has mastered the linguistic code, e.g. vocabulary, grammar, pronunciation, etc.

Sociolinguistic competence – the degree to which knowledge of speech, e.g. persuading, describing, apologizing, etc. can be used and understood properly in various social contexts.

Discourse competence – the capability to combine ideas via multiple sentences to achieve cohesion in form and coherence in thought.

Strategic competence – the ability to user strategies to overcome limitation in language knowledge, e.g. gestures, talking around, etc.

Thus, by adopting this model concerning communicative competence, the GRL goal model can be illustrated as follows (Figure 29).

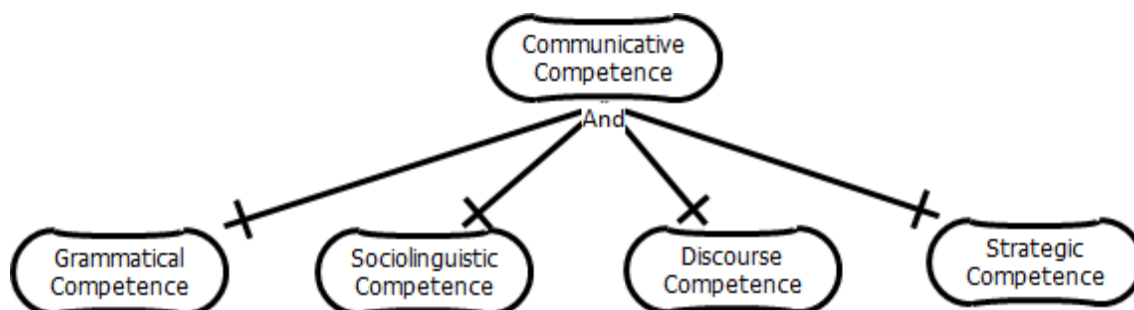


Figure 29. Main Goals of Language Learning in General

Hence, in order to achieve communicative competence for a language, the learner needs to achieve all the four mentioned aspects of competence, which also requires certain language learning strategies to facilitate the process of mastering. According to the study of Oxford, a system of language learning strategies is proposed as follows.

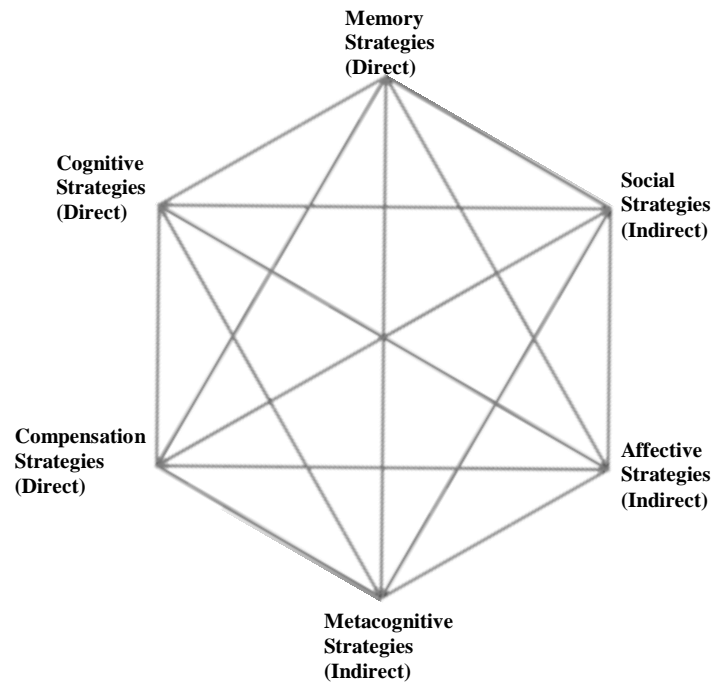


Figure 30. The Relation between Six Strategy Groups [129]

The learning strategy system contains six strategy groups categorized into direct or indirect strategies, which support each other closely. The meaning and aims of each individual strategy is described as follows.

Direct Strategies – dealing with the language itself in various tasks and situations.

Memory Strategies – remembering and retrieving

Cognitive Strategies – understanding and producing

Compensation Strategies – using language despite knowledge gap

Indirect Strategies – general management of learning

Metacognitive Strategies – coordinating the learning process

Affective Strategies – regulating emotions

Social Strategies – learning with others

As stated by Oxford in her study, the strategies can be adopted as approaches to foster four specific perspectives of the communicative competence, which was mentioned previously. The connection between the six learning strategies and the four perspectives of competence is given as follows [129].

Memory strategies, Cognitive strategies → Grammatical competence

Social strategies → Sociolinguistic competence

Compensation strategies, Social strategies, Cognitive strategies → Discourse competence

Compensation strategies → Strategic Competence

The metacognitive strategies aim to provide ways in guiding the learner to coordinate his/her own learning process, which facilitate the overall effectiveness of learning. On the other hand, the affective strategies facilitate towards the positive emotions within the learning process, which also contributes to the achieving of competences in general. Therefore, in the modeling, learning process and learning emotions are separately categorized as contributions to the main goal of communicative competence, when metacognitive strategies and affective strategies contribute to them respectively. Hence, the expansion of the previous GRL graph in Figure 28 can be illustrated as follows (Figure 31). In the figure, the contribution value is assigned as default (i.e. 25), as the quantification of such value is not possible at this stage.

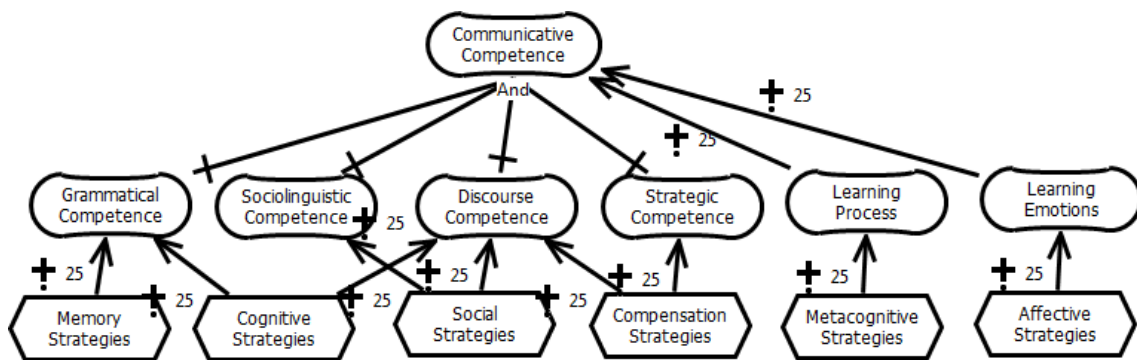


Figure 31. The Contribution Relation between Learning Strategies and Competences

Subsequently, Oxford provides a set of 19 sub-strategies based on the mentioned six strategies, and then a more detailed 62 strategies set based on that, in order to provide the specific practices to achieve the goals [129]. Each learning strategy of the six is thus illustrated using a GRL describing the sub-strategies proposed by Oxford (shown in Figure 32 - 37).

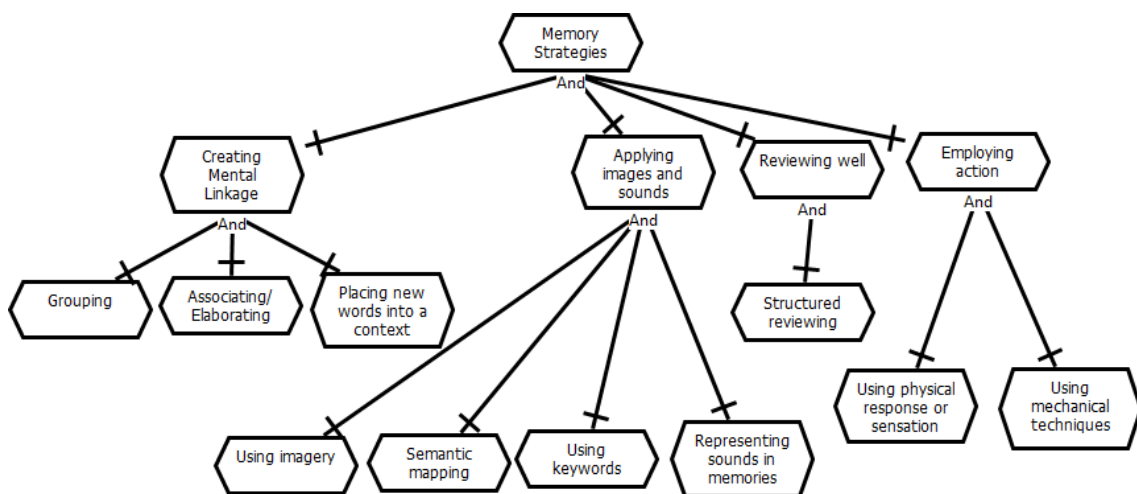


Figure 32. GRL Graph for the Memory Strategies Model

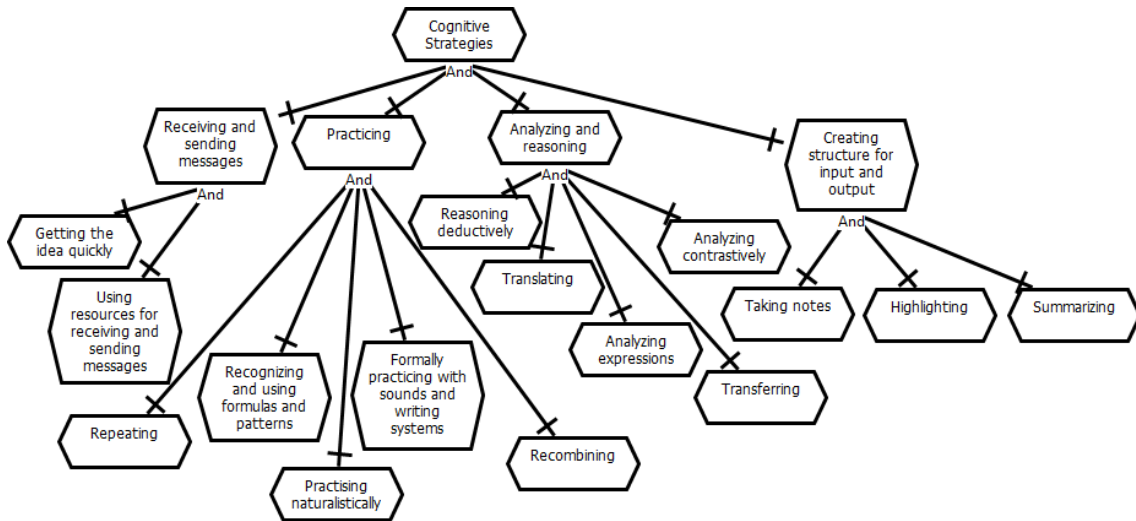


Figure 33. GRL Graph for the Cognitive Strategies Model

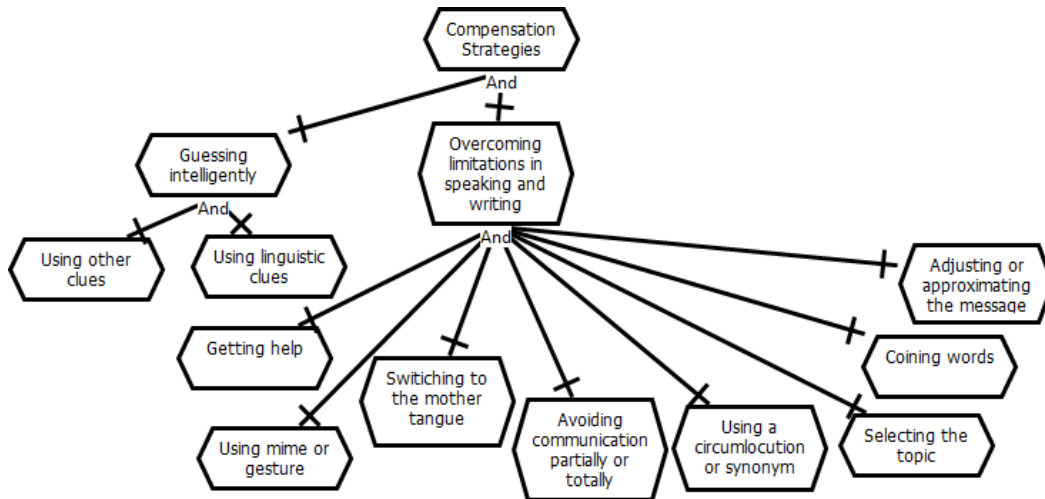


Figure 34. GRL Graph for the Compensation Strategies Model

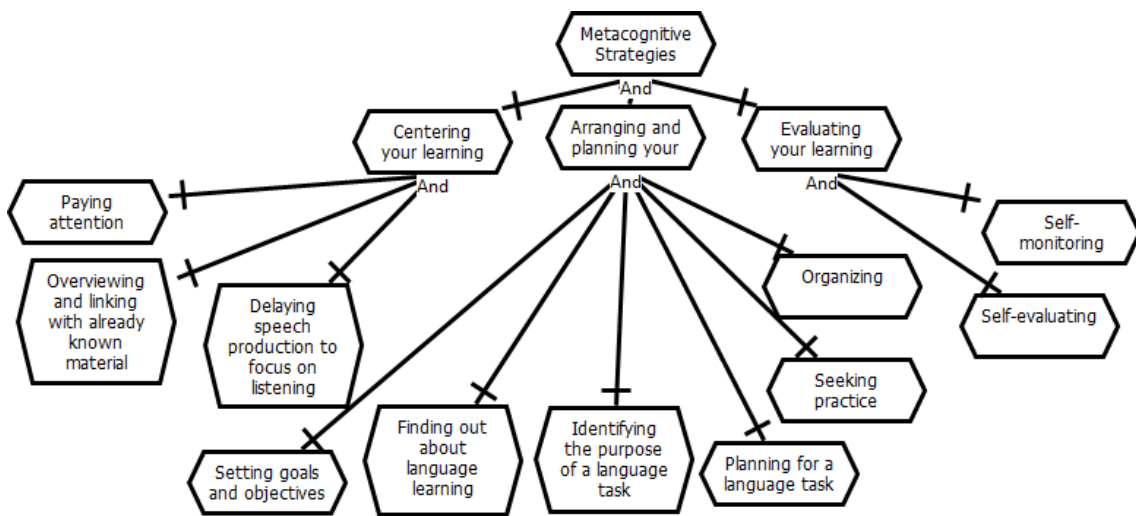


Figure 35. GRL Graph for the Metacognitive Strategies Model

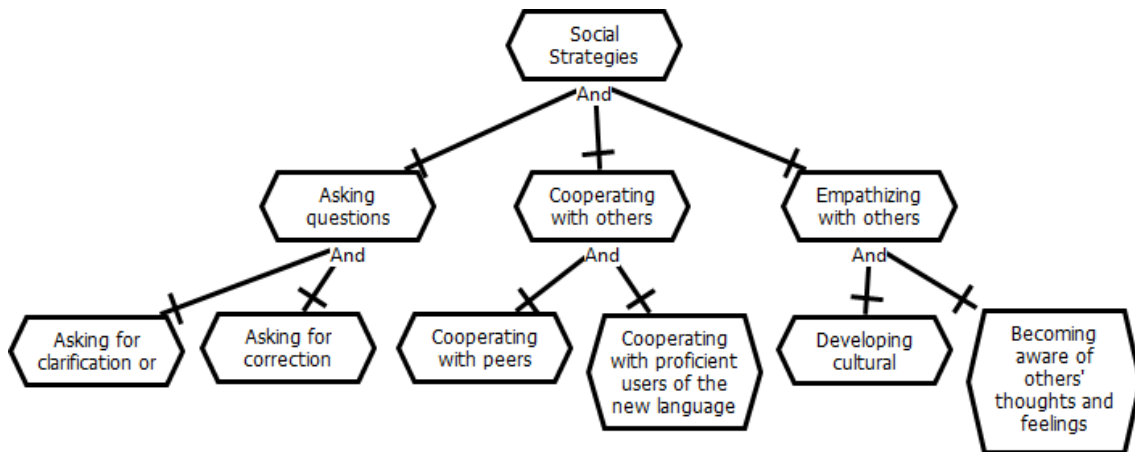


Figure 36. GRL Graph for the Social Strategies Model

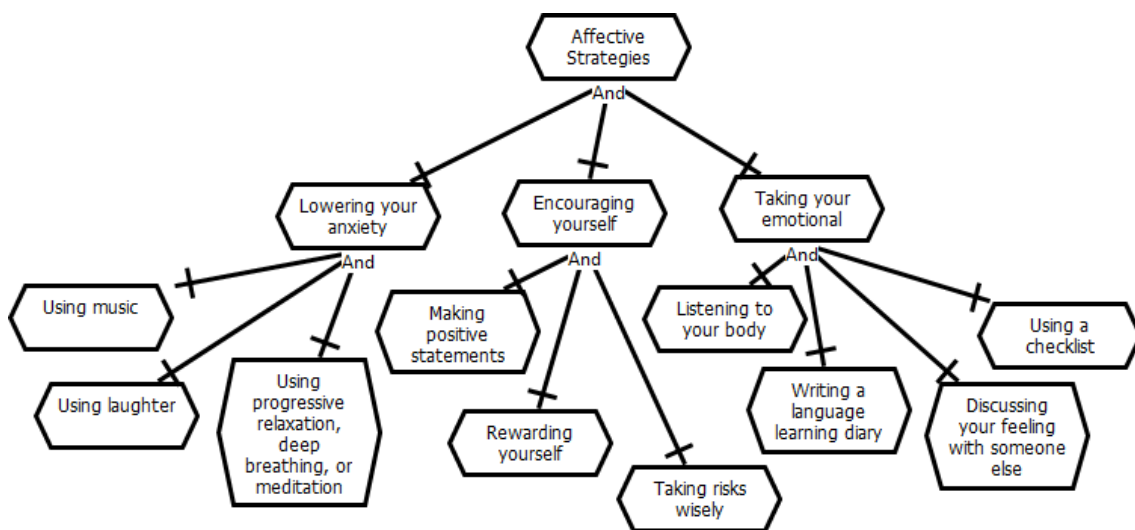


Figure 37. GRL Graph for the Affective Strategies Model

Based on the study of R. L. Oxford for language learning strategies, the connection between the main goal of language learning, i.e. communicative competence, and sub-goals, as well as the set of tasks that facilitating the learner to achieve such goals can be easily obtained in the form of GRL graph. The explanation of each sub-strategies and the possible ways of adaptation is provided with details in [129]. This strategy model is certainly not the only way of learning language, as many other studies also proposed other approaches of learning languages, such as [131] [132]. Hence, when mapping between the strategy-related tasks in other studies and the goals or sub-goals for learning languages, the GRL model can thus be expanded or varied. On the other hand, the other ways of modeling goals and motivation of language learning can be also based on the traditional four skills, writing, speaking, listening, and reading, according to the mapping between these skills and the strategies in Oxford's study [129].

As a language learning software, it is not common to cover all the mentioned features in the model, despite that more such features can likely improve the learning effectiveness. Considering the case of WordDive, most of the existing features of the application focus on the memory strategies, cognitive strategies and metacognitive

strategies. A connection between the existing features of WordDive and the strategies is shown in the following table (Table 4). The goal and motivation analysis with GRL modeling provides a general picture on the perspectives towards which WordDive can improve by providing more system features in terms of the given learning strategies.

Learning Strategies	WordDive Features
Grouping	The user can learn vocabularies that are grouped into themes
Placing new words into a context	The user can read a sample sentence attached to each word
Using imagery	The user can see an image attached to each word
Representing sounds in memories	The user can listen to the pronunciation of words and reading of the sample sentences
Structured reviewing	The user can review the learned words and grammar items in a defined pace
Repeating	The user can repeat the practices
Formally practicing with sounds and writing systems	The user can practice spelling based on listening
Setting goals and objectives	The user can set a goal when starting learning

Table 4. The WordDive Features Reflected in the Learning Strategies

Meanwhile, the gamification motivation analysis can be also done following the examples given in Section 4, starting with the Figure 10. According to the WordDive application, several fundamental gamification mechanics have been applied in the system. By connecting the existing gamification related features of WordDive application to the motivation analysis model in Figure 10, the previous figure is extended into Figure 35.

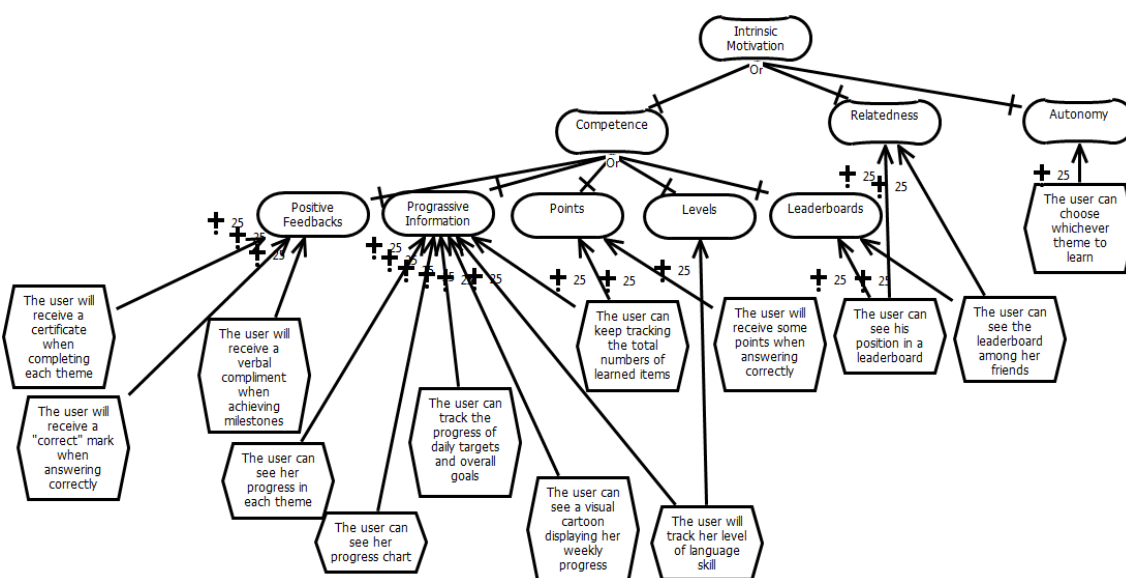


Figure 38. The Gamification Motivation Model with WordDive Features in GRL

The gamification motivation model shows that WordDive has already applied a set of fundamental gamification related features in the system, which to a certain extent enhance the competence motivation of the users. Additionally, the leaderboard feature also enhances the users' relatedness motivation. The autonomy motivation is enhanced

via the feature allowing the users to select whichever theme they like to learn without having to complete a previous theme. Currently, besides the motivation related features mentioned in Figure 35, WordDive uses cartoonish design providing a game-like learning environment. However, the design is basically on the aesthetic level when the features towards competence motivation are mostly on mechanics level. The game dynamics are missing in the system.

5.4. Scenario Modeling

When logging in the system and starting the WordDive application, for the first-time users, they are obliged to set a major goal for the whole language learning process. Otherwise, the user can access to the main screen where he/she can choose to do exercises, check leaderboard, change settings, track progress to the goal, or give feedback to the developers. Hence, the basic scenario of a user from opening the app to terminating the use can be modelled as follows.

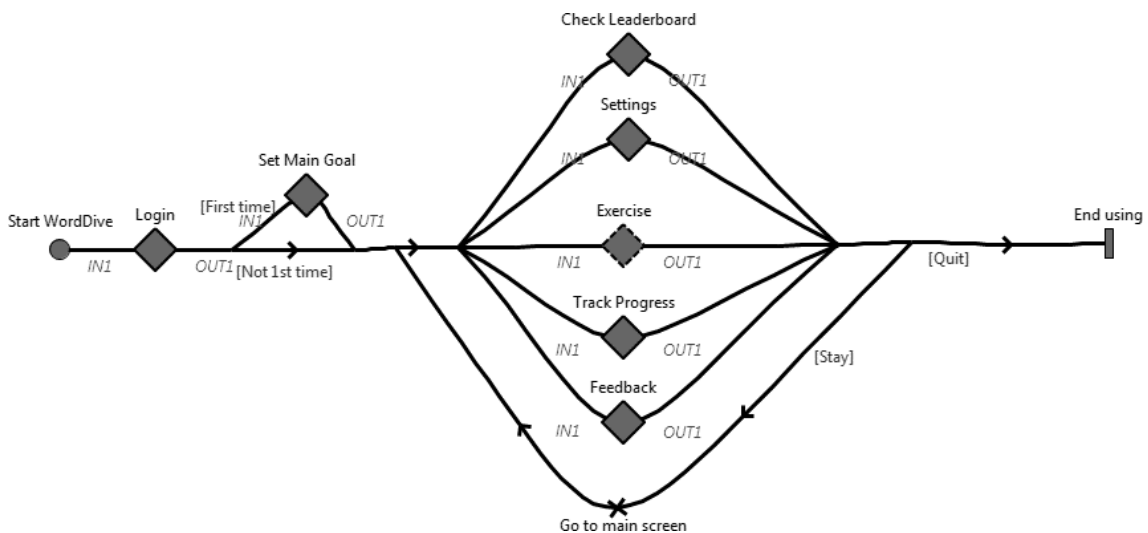


Figure 39. The Basic User Scenario for WordDive

The focus of this study will be towards the essential feature of WordDive, which is the language learning exercise feature. The modeling of the other features will be omitted, as it is easy to model and less important. The WordDive application contains the essential feature of providing the users vocabulary or grammar exercises in three difficulty levels, including:

Easy exercise – choose the right word based on image.

Medium exercise – choose the right syllables of the word in sequence based on image.

Main exercise – choose the right letters of the word in sequence (spelling) based on image.

For the easy exercise, there are five individual exercises in one learning session (or exercise set). For each exercise, an image is shown to the user who must reflect the word/grammar item according to the image and select the right answer from four options. When answering correctly, the user will get 2 points and move on to the next exercise, when provided answering wrongly, he/she will get 0 points. Whether answering right or wrong, the user will have the chance to review the word. After finishing each exercise set, the user can view the sum score he/she has for the set, as well as the progress towards daily goal. Based on the description of this feature, the scenario for the easy exercise can be modelled as follows.

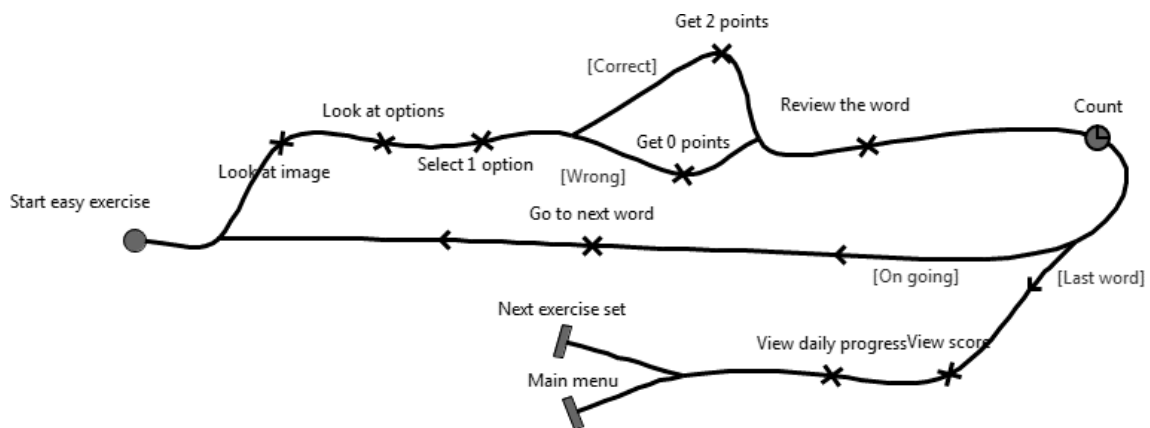


Figure 40. UCM Scenario Modeling for WordDive Easy Exercise

The medium exercise is slightly different. For the medium difficulty, the user shall choose the syllables of the target word in sequence instead of the word itself, based on the shown image. Furthermore, the user has one extra chance in case of answering wrong. When choosing the wrong syllable for the second time, the user will get 0 point. Answering correctly with one wrong selection will bring the user 1 point, when answering all syllables correctly will bring 5 points. Hence, according to the feature of medium exercise, the scenario modeling is expanded to Figure 41.

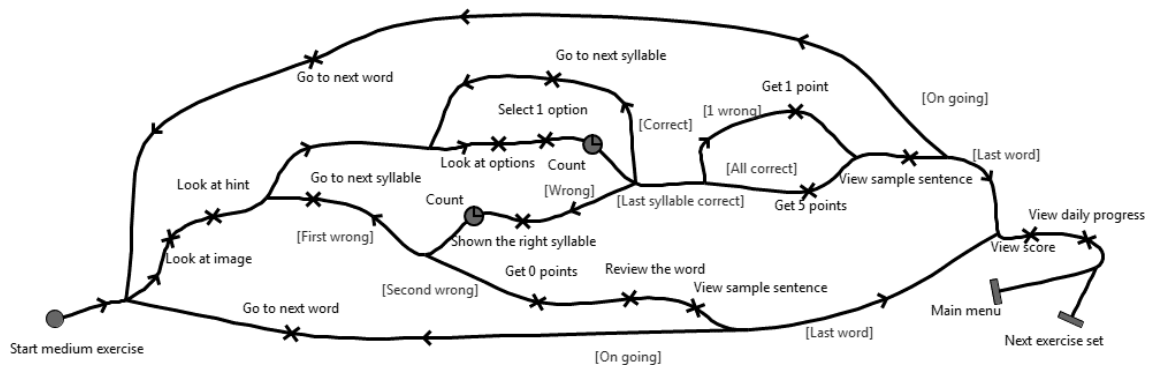


Figure 41. UCM Scenario Modeling for WordDive Medium Exercise

Similar to the other two exercise levels, the main exercise switches to selecting letters in sequence instead of words or syllables. The user will get 8 points when

answering all correctly and will get 0 points when select the wrong letter for the third time. Answering correctly with one wrong selection will bring 6 points while two wrong selections for 2 points. The scenario modeling for the main exercise is shown as Figure 42.

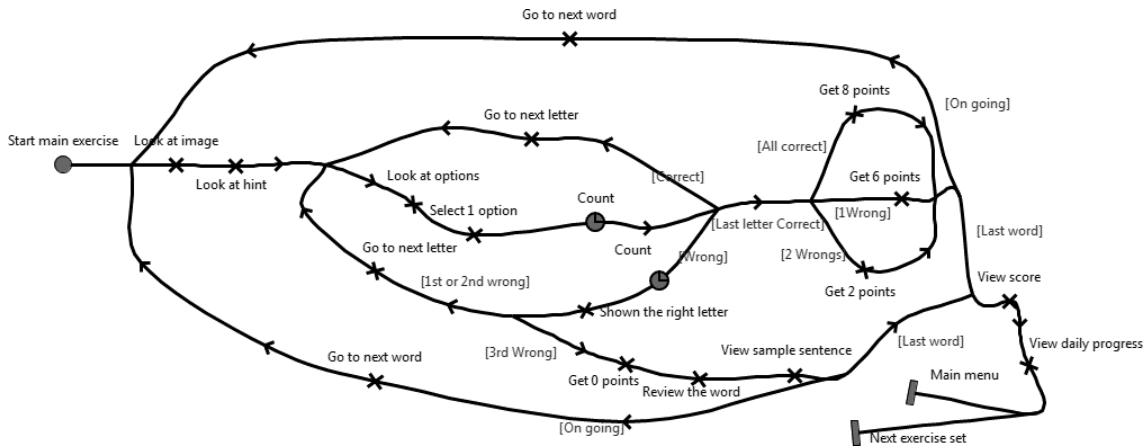


Figure 42. UCM Scenario Modeling for WordDive Main Exercise

Based on the scenario modeling, it is obvious that the gamification mechanics adopted in the WordDive exercises are points and progress. Accordingly, the interaction flow between the user and the system can be modelled as follows (Figure 43).

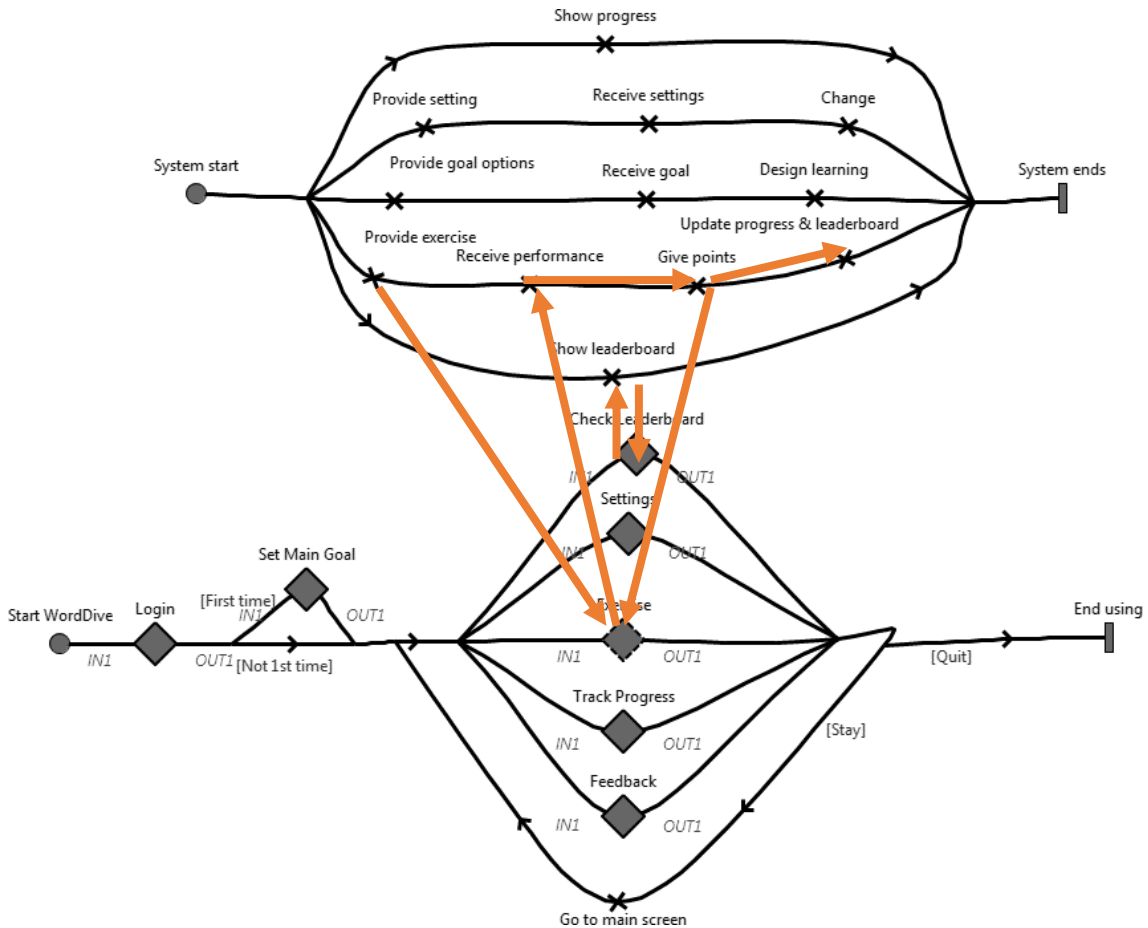


Figure 43. Interaction Scenario Modeling for WordDive

Figure 43 shows that interaction sessions between the system and the user are independent, e.g. the interaction with leaderboard and the interaction with exercise, and do not have impact on the system and its context. The changes in progress and the leaderboard provides certain motivation to the users to keep doing exercise indeed. However, the effort given by the users to compete in the progress and leaderboard challenge is dull and repeating. Back to Tic-Tac-Toe game, the game system is constantly updated via the players' interactions when during one game session, the challenges shift from situation to situation, which provides meaningful play experiences.

5.5. Game Dynamics Modeling: Scrabble/Words with Friends

In order to enhance the language learning service with game dynamics, the next step of the case study is to execute modeling with UCM for a selected game. According to the context of the WordDive system, the selected game shall be related to or tested within the domain of language learning. Furthermore, in order to reduce the effort in the complexity of modeling as well as the difficulty for understanding in the later evaluation activity, the selected game shall not contain overly complex rules or gameplay. Hence, I select one of the classic board game, *Scrabble*, to model, and also use the modern mobile application alternative, *Word with Friends*, as a reference. Because many studies have stated that Scrabble, as well as other vocabulary related games, such as Jeopardy, Bingo and Hangman, can facilitate the vocabulary recycling in language learning, as these games not only provide extra encounters with the words, but also have the advantages of being fun, competitive, and consequently, memorable [133] – [136].

Based on the official rules of Scrabble⁶, the process of a Scrabble game round can be described in the following steps.

1. Starting setup: 15 x 15 board with extra value marked, 100 tiles of letters marked with points.
2. Drawing tiles: 8 tiles per player (in Words with Friends 7 tiles per player)
3. Start the game: the player with letter closest to "A" will start, and must place the word on the center of the board
4. Replace tiles in hand: whenever placed a word on board, the player will replace the tiles of the word with the same amount drawn from the pile of tiles
5. Take turns: when one player places a word, and replaces the tiles in hand, the turn goes to the other player.
6. End game: Once all tiles are gone from the bag and a single player has placed all of their tiles, the game will end and the player with the highest score wins. (When

⁶ <http://www.scrabblepages.com/scrabble/rules/>

the game ends, each player will count all points that are remaining on their tiles that have not been played, which will be deducted from the final score.)

According to the rules described above, the concise Scrabble gameplay scenarios can be modelled in the following UCM graph.

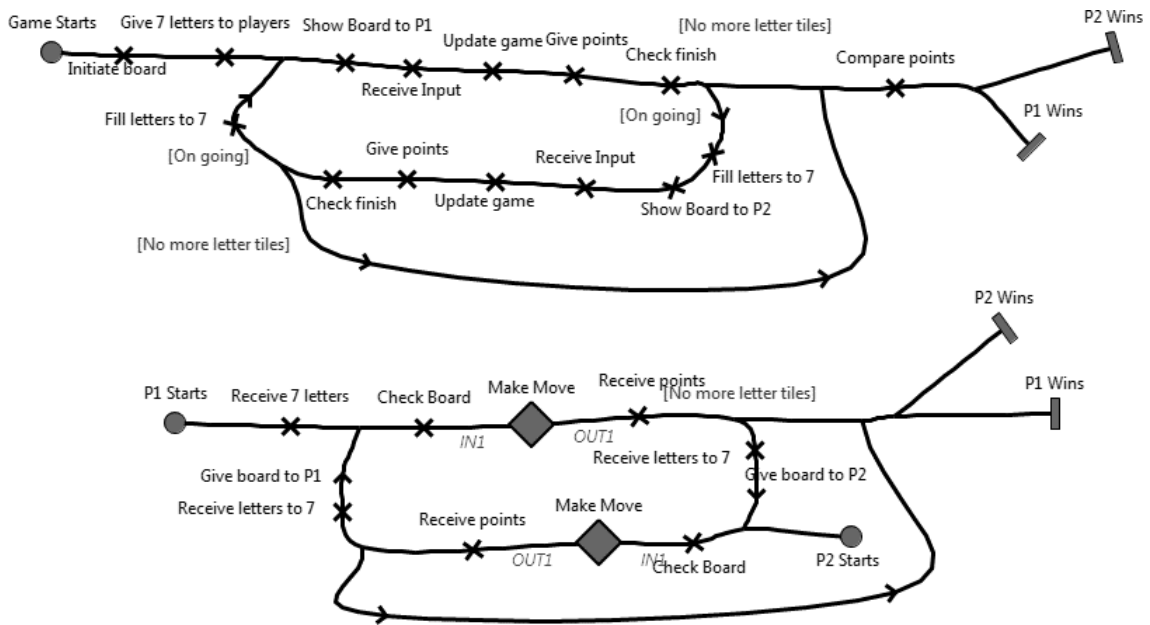


Figure 44. Scenario Modeling with UCM for Scrabble Gameplay

Similar to the previous example of Tic-Tac-Toe, the model contains both the scenario from the players' perspective and the game system's perspective, so that the interactions between the players and the system can be better displayed. In real-life modeling activities, as each player follows the same rules, the scenario for player can be simplified into Figure 45. Additionally, the model in Figure 44 also omits certain non-essential game rule related features, such as, checking the legitimacy of the words, in order to further simplify the model.

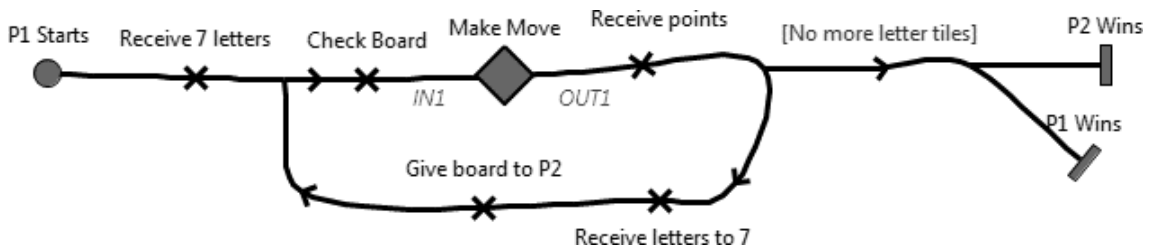


Figure 45. A Simplified Player Scenario

Similar to the Tic-Tac-Toe game, Scrabble is also a game providing meaningful play via the interactions between players and the game system, changing the context of the game with unique challenges for each play. The flow of the gameplay can be seen in the model below (Figure 46) when combining scenarios.

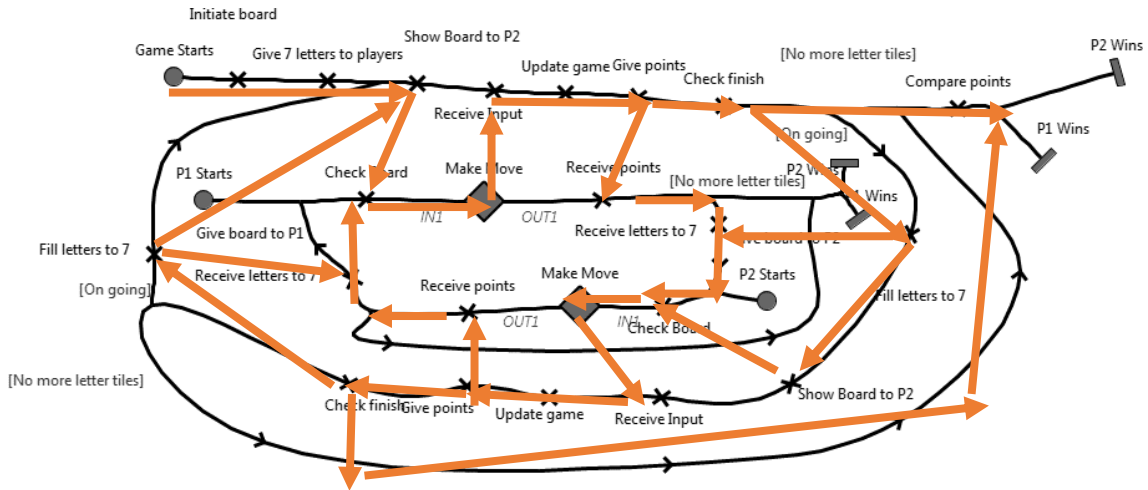


Figure 46. The Meaningful Play Flow for Scrabble with Scenario Modeling

5.6. Potential Designs based on Modeling

Based on the motivation analysis via GRL modeling, the designers of WordDive shall be explicitly aware of the users' main goal/motivation towards the system feature (communicative competence), as well as the main motivation for applying gamification (competence, autonomy and relatedness). When considering the ideation for gamifying the system feature, the designers shall be certain how the system features and gamification features shall be connected.

A set of system goal oriented potential new features can be proposed based on the GRL model in terms of the memory strategies and the cognitive strategies, shown in the following figures.

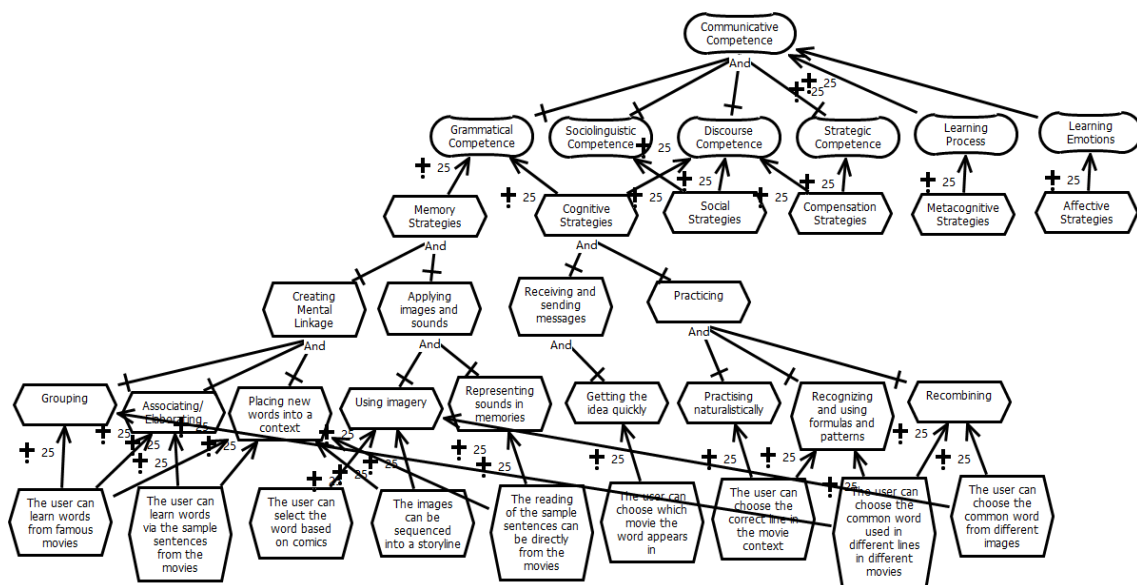


Figure 47. New Features Proposed based on the GRL Modeling for System Goals

On the other hand, a set of gamification motivation oriented potential new features can be also proposed based on the GRL model for gamification motivation, shown as the follows.

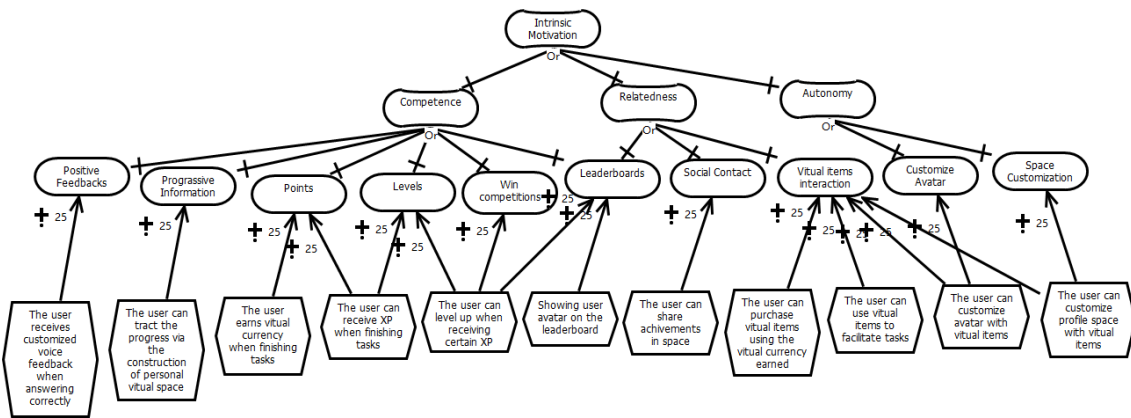


Figure 48. New Features Proposed based on the GRL Modeling for Gamification Motivation

Moreover, despite of the separate modeling between gamification motivation and system goals, the requirements elicited from the models can be connected, in many creative ways, based on the brainstorming of the designers. For example, the two requirements “the user can learn words from famous movies” and “the user receives customized feedback when answering correctly” can be connected and transformed into “the user can learn words from famous movies and unlock movie theme feedback voices when completing a set of exercises related to a certain movie”. Thus, for an instance, the user can use the voice of Mr. Spock as the customized feedback voice when he/she has learnt the “Star Trek” related words, and from then on, whenever he/she finishes one set of exercise, he/she will be greeted with “Live long and prosper!”. By doing so, the user not only feels the autonomy intrinsic motivation but also applies an effective memory strategy. What’s more, connecting the GRL to the UCM shall certainly be a more formal way of creating new gamification designs.

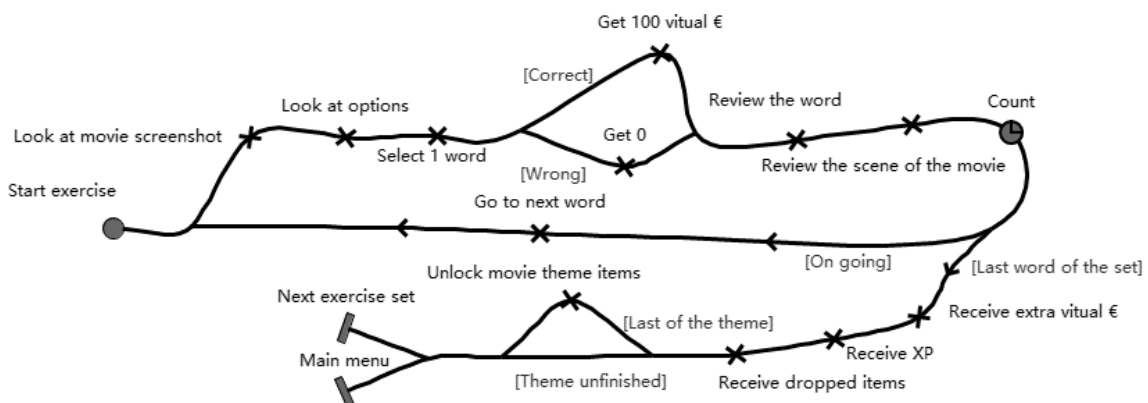


Figure 49. A New Exercise Feature Scenario with UCM

On the other hand, considering the combination of previously defined UCM models of Scrabbles and WordDive exercise features, as well as the newly proposed design above, some new UCM scenarios can be modelled. For example, the new movie theme exercise can be modelled as Figure 49.

Furthermore, a set of new designs can be derived from the main gameplay of Scrabble, such as,

- Learning each word from one exercise receive one random letter tile (in the word) into player's inventory
- Players choose 7 tiles from inventory to proceed with next move in Scrabble
- Compete with friends in Scrabble
- Bonus: All correct answers in one exercise set provides "magic cards"
 - E.g. *drop 2 tiles from opponents' hand; x2 points for each tile played for 3 rounds; etc.*
- Game ends when board is full and both players pass. Compare points
- Alternative gameplay: Unlimited board with endless moves. Points leaderboard + Daily Challenges

These new design ideas can be modelled based on the previous Scrabble gameplay scenario models into the following

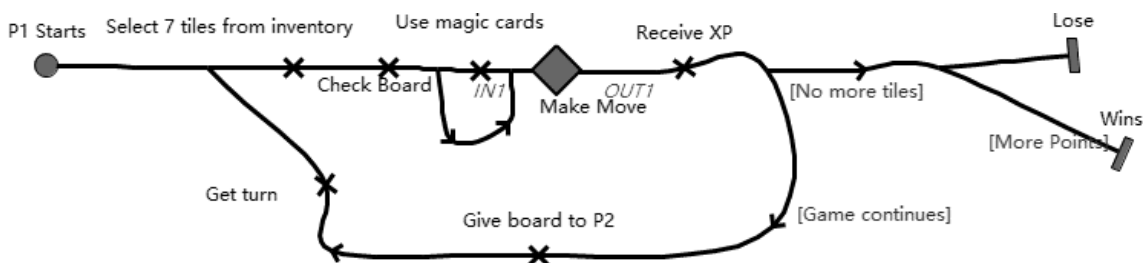


Figure 50. A New Scrabble Gameplay Scenario with UCM

Hence, the combination between the new Scrabble gameplay and the new exercise feature can be modelled as Figure 51. In Figure 51, the user starts with the language exercise with movie theme, which is identical to the Figure 49. However, some slight changes have been made to facilitate the gameplay of Scrabble, such as, receiving 1 random tile when finish one exercise, and receiving random "magic card" when finishing one exercise set, etc. When finishing one set of exercise, the user can choose to continue or start the Scrabble in either competition mode with friends or endless mode. In the competition mode, the user selects 7 tiles from the inventory in order to get more points with those tiles, and then observes the situation in board. Then making a move will not bring the user more tiles, when extra tiles shall be earned with more exercises. The unlimited mode is for the user to build and record the word he/she knows with the tiles.

The points obtained from building words in unlimited mode will be accumulated to promote the user in the leaderboard of worldwide or among friends.

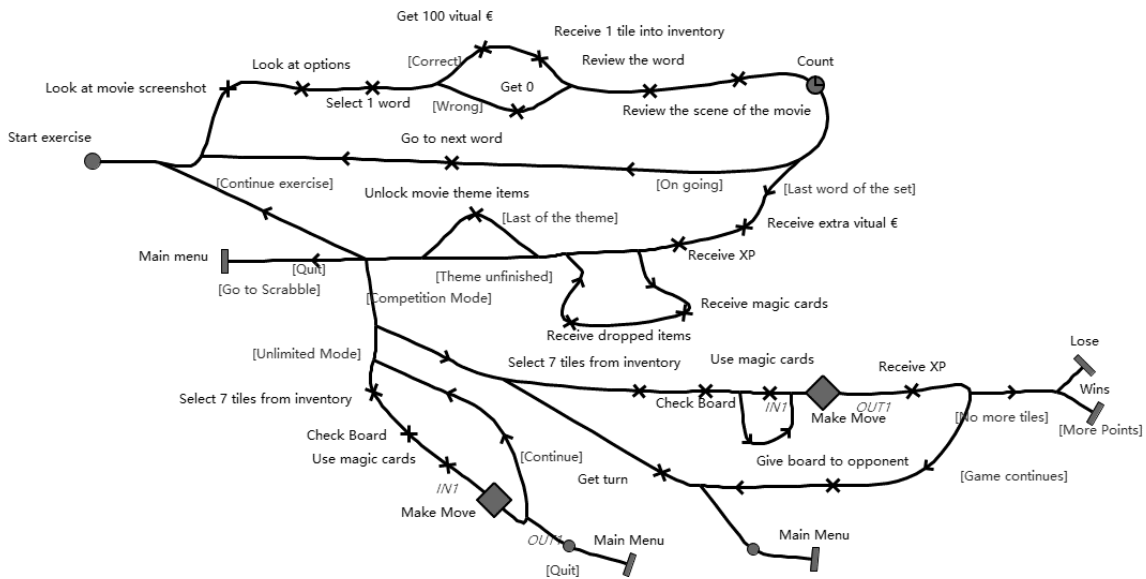


Figure 51. The Scrabble + WordDive Scenario with UCM

To be noticed, the scenario model has not yet contained all the potential functional features. For example, the user shall be enabled to track his/her progress in the unlimited mode of Scrabble, which is not specified in Figure 51. Meanwhile, the example only shows one possible way of design for the WordDive application, when slight changes in the details of the rules, as well as the model, or with the other gamification mechanics shall provide various alternative features and gameplays.

5.7. Evaluation & Validation

In order to evaluate the effectiveness and the feasibility of this gamification design method, I conduct a semi-structured interview with an expert in WordDive OY. The Interview contains three sessions, including background knowledge investigation session, method introduction session and method evaluation session. In the first session, the interviewer will ask the expert several questions concerning the general knowledge of the expert in terms of gamification and software development, as well as the situation with the design and development process of WordDive. Then, the interviewer will give a presentation concerning the proposed gamification design method. After the presentation, the expert will be probed with his opinions concerning the design method based on his expertise with gamification and specifically WordDive itself. The details for the interview is listed in the following table.

Place	WordDive premise meeting room
Time	31.5.2017 13:30 – 15:00 Background investigation: 30 mins Presentation of method and design: 20 mins Evaluation: 40 mins

Interviewee	Mr. Atte Hynninen
Interviewee Background	User experience and gamification expert. 9 years' experience with gamification design in WordDive. Experienced software engineering background.
Interview Language	English
Note	The interviewee was given the questions 1 day before the interview, as to get familiar with them. No information concerning the method or design is revealed within the questions until the presentation of the interviewer.

Table 5. The Details of the Expert Interview

Expert Qualification

According to the pre-signed confidential agreement, the interviewee allows his personal information revealed. The expert invited for this interview is Mr. Atte Hynninen, who is the user experience expert and project manager of WordDive. He has been working in WordDive for around eight years, and fully familiar with all the details of the WordDive app. Based on the background interview, he indicated that he focuses on the user experience related design and management when designing concerning language learning or linguistic related domain is not his strong suit. However, He is very confident about his experiences in both software engineering and gamification. I consider him as the perfect expert option, due to the fact that he is not only a software engineering expert, but also very experienced with gamification. Better than other experts in gamification, he is also very familiar with the situations in WordDive. So, his opinion concerning the design methods and the potential design for WordDive is certainly valuable.

Investigation on the Current Situation

The expert states that WordDive application has applied many prevailing gamification elements, including points, leaderboards, achievements/badges, levels, clear goals, feedbacks, and progress, out of the 10 types mentioned in [12]. For each gamification element, he explained explicitly how the element functions, although he is not certain about the "Story/Theme" element by stating there is a cartoonish underwater theme in WordDive but there is no story here. About the gameplay of WordDive, he stated,

I think the gameplay itself can be considered as some kind of a "guessing game", with certain randomness. What we try to do here is to make it simple for the user and fun.

In addition, he is very confident at the effectiveness of these gamification elements applied in WordDive as the current version. He states that when they added the achievement system to WordDive, there was a clear impact (about 30% increase) on some key indicators for user engagement, e.g. how much the user studies on the first day. He also indicated that the gamification system clearly works better for those who understand

how such system works and emphasized the content of the system (language learning content) matters by saying,

The gamification does not work if the actual content does not work.

Concerning the referencing theories or systems, the expert frankly stated that they did not turn to academic publications for inspiration when they started the system. Only people from a game company gave them advises on gamification, such as, it should be fun, and the usability is important. However, he mentioned they certainly heard of the “flow theory” from Csikszentmihalyi [61] and tried to create flow experience for the users. However, he also admitted it is hard to create the flow, as the difficulty of the language learning and that of the game could mismatch. On the other hand, they also tried to find inspiration from other popular games, but the wide range of users, to some extent, discourage them from implementing “hardcore” gameplays. However, certain design elements from those games, such as the level display from Super Mario, the 3-star evaluation from the Angry Bird, are adapted in WordDive.

Concerning the development and maintenance of WordDive, the expert indicated they use Scrum with 2-week sprints, where iterative delivery and constant testing is the key. However, he also indicated that there are no specific gamification-focus sprints, as they consider gamification user stories same to other stories too.

Furthermore, he also frankly pointed out that the gamification for WordDive requires improvement in certain ways. For example, he said,

We do have a point system, but the problem is that it's a bit abstract. And it's a bit hard to understand what the points really means (for some users).

He further explained that the impact of language learning is hard to be seen or just evaluated by the points. It can be seen when the user actually goes to a foreign country and orders a coffee with the language, which, however, is hard to be implemented in the system. On the other hand, he emphasized that the gamification features shall always be built on the satisfactory overall usability of the system with flow experiences, where WordDive still needs to be improved.

Concerning the understanding of gamification and games, the expert indicates,

If it works extremely well, it should be unnoticeable for a user that it's not a game. ... a good gamification product can be kind of a nice game. ... but it is also hard to do when you focus on language learning and also have to create a great game.

He considered the difference between games and gamification lie where gamification focuses on making things easy when games try to create challenges. Then

he added that WordDive tried to provide increasing challenges as well for both language learning and engagement reasons. On the other hand, concerning introducing gameplay or meaningful play as gamification, he stated that the main goal of WordDive is still language learning, when features like adding avatars can be a waste of time. However, he frankly admitted that it could get boring when doing the exercise repeatedly, where an optional mini-game could be a good motivator to implement, and it could be better that the mini-game provide features for users to communicate.

In summary, based on the background investigation, it is obvious that WordDive has intentionally applied many basic gamification elements as motivators for their users, and is fully aware of the effectiveness of gamification, despite that they have specific sprints planned for gamification design. However, they did not turn to academic theories or methods for practical solutions concerning gamification when they have been focusing more on the usability, user experiences, and the main goal of language learning. On the other hand, they did consider other popular games as references, when they only adapted certain individual design elements from them instead of any essential gameplays. However, despite of emphasizing on the main focus of language learning, the expert also admits that it could be better for the users when they will notice the system is not a game.

Expert Feedbacks on the Method and Designs

The presentation of the method lasted around 30 minutes, with many figures that are displayed in the previous sections are presented and explained. Despite the knowledge in both software development and requirements engineering, the interviewee did not encounter the URN modeling language before this presentation, which leads to a fairly justified evaluation on the understandability of the method itself.

The first impression given by the expert concerning the method is “extremely interesting” and “a good idea”. Concerning the following structured question about the understandability of the method,

Do you think the method is hard to understand?

A) Very easy

B) Fairly easy with some questions

C) Understandable but needs certain expertise and knowledge related

D) Very hard to follow with certain parts unclear

E) Impossible to understand, and/or makes no sense

The expert selected B and considered it “fairly easy to understand but with some questions”. He further stated that the general idea is very clear while the models created are also understandable despite the looks of complexity. As Scrabble is not that simple a game, then modeling it plus the language learning features will certainly look complex. Thus, to the expert, the idea and the models created are both very understandable provided

the designers give some time to it. However, the expert did point out that it makes the model hard to understand when the elements are crowded in one small chart.

On the other hand, the expert also indicated that the method can be easily applied to the practice of system and gamification design, by selecting E from the following question.

Do you think the method is applicable in practice?

- A) Nearly impossible to apply in practice*
- B) Very hard to apply due to some major flaws*
- C) Applicable but takes lots of effort*
- D) Can be apply with endurable efforts*
- E) Can be easily applied*

He also indicated that even the Scrabble design integration seems to be very doable for WordDive. He said,

It is a very working idea. And it does help language learning and fits the language learning needs.

However, he admitted that it will change the whole system if applying the whole design sets, but that could be seen as a different thing. And he also mentioned that learning the tools can take certain efforts. Additionally, analyzing the connection between goals, sub-goals and features could be not as easy as it seems. Provided there is not an easy way to access to the language learning strategies from R.L. Oxford, the effort in modeling motivations can be tremendous, which requires domain knowledge.

On the other hand, concerning the design ideas proposed, the expert said he thinks the ideas are great in general. However, as these designs have not yet been tested in any ways, it is hard to say whether it could be better than the current version of WordDive. Thus, despite selecting E from the following question, he emphasized it is not certain the design could be better.

How do you think of the effectiveness of the gamification designed?

- A) The designs are meaningless and no better than the existing version*
- B) The designs are understandable but majorly flawed*
- C) The designs are interesting but does not seem to work*
- D) The designs are good but can be improved*
- E) The designs are great and MIGHT be better than the existing version PROBABLY.*

In addition, the expert also provides with some concerns about the designs with integrating Scrabble as gamification into WordDive. The major concern is that, as the focus of WordDive is still on language learning, then the Scrabble game might take certain amount time of the users from actual language learning, considering the total amount of the engaging time from the users is stationary. Then the design will certainly make the system less effective in language learning, despite the possible gameful experience enhanced. Furthermore, the design will make the system more complex which will to some extent make the usability and first-time experiences suffer. Meanwhile, the wide range of users might have different interests in different types of activities and gameplays, one specific game dynamic would interest some users while demotivate others as well. Finally, he also concerns that, as the game is competitive with winners and losers, it might frustrate the users.

6. Discussion

6.1. The URN Modeling Tool

The URN modeling tool that is currently used in the relevant research domains is jUCMNav⁷, which was originally developed in University of Ottawa, Canada, in 2004, as Software Engineering Capstone Project⁸. It has been constantly maintained and enriched ever since when the latest version of V7.0.0 was released in September 2016. The tool is a plug-in for Eclipse IDE⁹ (current version Neon 4.6.3), which was developed using Java language with 198,667 lines of code in the newest version¹⁰. Furthermore, the tool was developed as open source software under EPL-1.0¹¹, when the source code can be accessed in the SVN of University of Ottawa¹². A screen shot of the tool is shown as follows.

The jUCMNav tool is a graphic editor which enables designers to perform basic modeling by simply dragging and dropping with pre-defined elements. As an Eclipse plugin, the jUCMNav tool has the advantages of its extensibility and capability to integrate with source codes and other features of the famous Eclipse IDE. As an open source plugin, the jUCMNav tool can be further adapted with additional features, such as, the potential gamification design module. On the other hand, the disadvantage of this tool also lies in the use of Eclipse. For example, the maintenance of the tool shall, to a large extent, rely on the stability of Eclipse system, when it shall be adaptively updated while Eclipse updates. Furthermore, the user interface of the tool has also been largely limited by Eclipse without much room for further UI design. And the current version of

⁷ <http://jucmnav.softwareengineering.ca/foswiki/ProjetSEG>

⁸ <http://jucmnav.softwareengineering.ca/foswiki/ProjetSEG/SEG4910>

⁹ <https://www.eclipse.org/>

¹⁰ <https://www.openhub.net/p/jucmnav>

¹¹ <https://opensource.org/licenses/eclipse-1.0.php>

¹² <https://www.openhub.net/p/jucmnav/enlistments>

jUCMNav still contains some user experience related issues, such as, one of the most annoying problems is that it is nearly impossible to drag the paths in UCM back to straight lines when they are adjusted, which is why all the previous figures are not graphically satisfying at all.

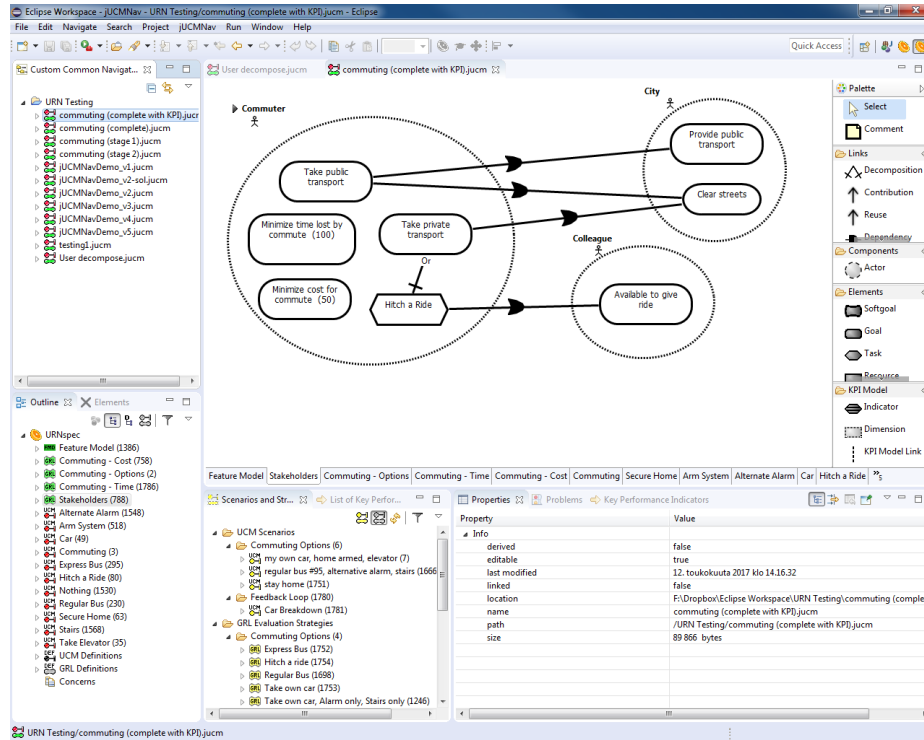


Figure 52. Screenshot of the jUCMNav Tool

6.2. Iterative Agile Gamification Design Process

According to many previously mentioned studies on gamification design process, the authors tend to adopt a linear fashion design process, such as [38] [60] [62] [72]. However, as discussed quite often in the software engineering domain, linear development process, such as, the traditional waterfall model, contains a high failure rate [42] [120]. One of the main reasons for the frequent software failure is that a fixed requirement analysis process can scarcely enable the requirements analysts to acquire fully the requirements from the clients, who might also have difficulties expressing what their real requirements are [121]. Meanwhile, changing requirements, which happens constantly in software projects, will result in extra efforts, disturbing schedules, lack of testing, or even the overall failures in delivery. In order to prevent such failure, the current software projects tend to adopt the lightweight iterative development process, i.e. the agile process.

The currently popular agile methods include Feature Driven Development [122], Dynamic System Development Method [123], Extreme Programming [124], Scrum, Kanban [125], and so on. These agile methods provide a way of breaking the project into

small increments that contains short term planning. Different from the traditional linear development process, each increment or iteration shall deliver a runnable product prototype with a list of pre-planned features implemented and tested. Hence, the risk of the overall project failure will be prevented due to the fact the iterative development fashion will guarantee at least some of the target features will be delivered to the clients. Furthermore, requirements can be changed, added or deleted in between these iterations, through the constant communication between developers and clients, which the clients have what they have ordered.

As mentioned in Morschheuser et al.'s study [72], an iterative ideation and design process with regular user testing is one of the critical factors of successful gamification projects, when, however, they still propose their method in a linear process. Considering digital gamification system development similar to software engineering, the similar failure of prefixed requirements resulting in features that are not what the users want shall occur, which makes the following ideation of gamification pointless. An effective iterative process of gamification design and development shall resemble the process of Scrum shown as the follows.

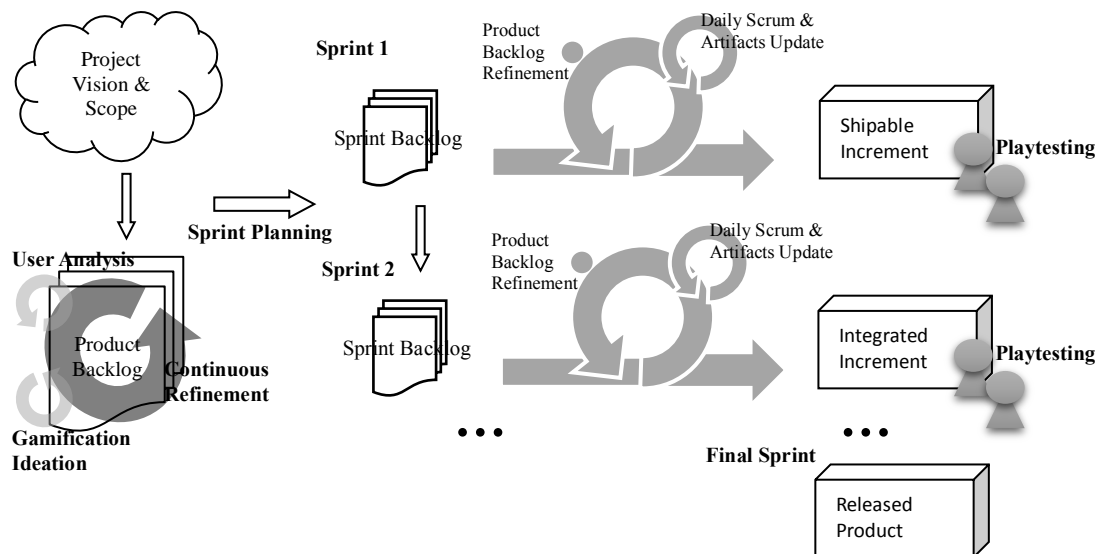


Figure 53. The Adapted Gamification Design Process towards Scrum

Compared to the linear process model, the agile process is more iteration-based and adaptive to changes. The elicited requirements/user stories will be recorded and prioritized in the product backlog. Meanwhile, the user analysis and context analysis activity shall be seen as facilitation towards the changes to the requirements and the prioritization of them. Meanwhile, the gamification mechanics designed in the ideation step shall be also integrated to the product backlog and prioritized. Via sprint planning, the first sprint (normally 1 – 4 weeks) will then cover the most important features from the product backlog when simultaneously the ones not selected to this sprint backlog can

be further changed and re-prioritized in order to guarantee the next sprint. For each sprint, the implemented increment shall be tested and reviewed by the users. Furthermore, artefacts like burndown chart and planning poker can also be adopted similarly [70] [71].

On the other hand, the motivation analysis and scenario modelling shall largely facilitate the process of backlog management with in the agile process of gamification design. Therein, for each user story obtained from the UCM based scenarios, it will be connected to the other user stories in the same map. This will certainly facilitate the user story mapping practice in terms of gamification design avoiding the situation, such as, implementing the gamification mechanics before the according system feature is done [126]. The sprint planning shall also use the modelled scenarios as references.

6.3. The Innovating and Evaluating Mode

As mentioned in Deterding's study on his method for gameful design with the lens of intrinsic skill atoms [36], the two modes shall be distinguished, including the innovating mode and the evaluating mode. Amongst, the innovating mode is for the designers to create a new system with gameful design based on the analysis of the users' requirements, when the evaluating mode aims to provide gamification mechanics to the existing system in order to improve its experience. Shown in Table 1, the main differences for these two modes lies in the synthesis and ideation steps. According to Deterding, when coping with the existing system, the designers shall identify the skill atoms of it and use design lenses instead of innovation stems to brainstorm [36]. Despite that both the skill atoms and design lenses are useful artefacts facilitating gameful design, the scenario-based modeling with UCM can also be used in both modes for the ideation activities. When the designers acquire the requirements of the existing system via retrospective analysis or from the requirements documents, modeling the requirements into user behavior scenarios shall be the next step in the evaluation mode. The design lenses brainstorming can also be facilitated with the modeling of game dynamics. Furthermore, considering the agile gamification process mentioned above, the product backlog for evaluating mode can be inherited from the development phase, as well as the scenarios modelled. Then the design lenses can be used as a tool to evaluate the design, when related to each sprint.

6.4. Meaningful Play and Meaningful Gamification

It is not hard not to compare the concept of meaningful gamification with the one of meaningful play, when, as a matter of fact, the meaningful gamification concept has very limited connection towards meaningful play. As mentioned in the previous sections, the definition of meaningful play was given by Salen & Zimmerman, who stated that meaningful play emerges from the relationship between player actions and system outcomes when it is the process of a player taking actions and the game system responding to the actions [46] [119]. In addition, meaningful play also occurs when the relationships between actions and outcomes in a game are both discernable and integrated into a larger

context of game [46] [119]. It means that within a game that provides meaningful play, the player shall be able to know not only the outcomes of his/her actions, but also be aware of how the actions affect the contexts of the game.

On the other hand, the concept of meaningful gamification is described by Nicholson as the design of gamification system that provides a variety of experiences and ways of engaging for the users to find something meaningful [127]. The author also provides a set of concepts that shall be taken into account when designing meaningful gamification, including, play, exposition, choice, information, engagement and reflection. Therein, the concept “play” means the freedom to deploy the system within boundaries, which, in my opinion, is similar to “choice”. The concept “engagement” and “reflection” means the relatedness with other users and the experiences of the user, when “exposition” and “information” means the stories and the concepts related to real-world contexts. Hence, the current concept of meaning gamification does not provide connection to meaningful play, which is, to a large extent, the current situation for most of the existing gamification systems, that they do not provide meaningful play for gameful experiences. It is surprising that video games, which provide genuine meaningful plays and are intrinsically motivating with the key elements of goals, uncertain outcomes, performance feedback, and self-esteem [128], have not yet been considered as a reasonable platform for gamification. Most of the gamification services provide only limited system feedbacks, such as, points and leaderboards, however, overlook the relation between users’ actions and the contexts of the system.

This study provides a design method to connect gamification with game dynamics, which can provide meaningful play. Designing gamification in such way shall be seen as meaningful, as the proven intrinsic motivating gameplays shall largely engage the users in the target activities. But, this study has not yet explicitly explained how to use the UCM modelling to represent meaningful play scenarios and whether the play in such gamification system is meaningful indeed. However, what this study has been trying to provide is to make sense with the way of adapting the existing game system that can provide genuine meaningful play experiences to gamification systems. In this way, when modelling various existing game dynamics is possible, designing gamification systems with the same modelling language and by adapting such recognized game dynamics is also possible to provide at least better gameful experiences, and motivational affordances.

6.5. Limitation and Future Work

As an explorative study, the thesis presents the adaption of a modeling language in requirements engineering to the domain of gamification design. Despite the obtained positive feedbacks from the expert of WordDive company, the design method still requires further validation. First of all, the feedback from one single expert is likely to be subjective, when no further validation is provided in this thesis to further verify the usefulness of the method in practice. Additionally, the design ideas proposed as the results

are not tested by the actual users of WordDive, due to the lack of time. Therefore, the validation of the design method still requires further investigation.

On the other hand, the concept of meaningful play as well as its adaption in gamification still requires further discussion. Given the definition of it provided by Salen & Zimmerman [46], the verification of a game dynamic being meaningful play has not yet been specified. Thus, the design adapting existing game dynamics into gamification is only based on the assumption that such dynamics are proven to be meaningful play to a certain extent, which is not further verified. Furthermore, based on the feedback of WordDive expert in the interview, the design and development cost for implementing such game dynamics shall increase sharply. The failure of such design will inevitably result in the loss of the company. Additionally, the focus of the users might be converted to such gameplays when less time will be allocated to the essential system features, which is certainly not what the company would like to see.

According to the limitation mentioned above, the future work of this study shall focus on the further validation of such design method in real cases. Empirical studies on the end users of the target systems shall be of great help towards such goal. Furthermore, the modelling language can also be improved towards a domain-specific design method for gamification design, and to suit more smoothly to an iterative gamification design and development process. Finally, the usability and aesthetics of the modelling tool shall be also improved.

7. Conclusion

Compared with the previous studies in gamification design framework and method, this study aimed to adapt the modelling language URN from the requirements engineering domain to facilitate the design of gamification systems via the motivation analysis with GRL and scenario modeling with UCM. Based on the result of motivation analysis, the designers shall be familiar with the general goals of the target users for using the system and the connections of such goals to the specific features. On the other hand, the motivation analysis on intrinsic motivation and gamification mechanics shall also provide a new perspective on how the mechanics, i.e. motivational affordances, are connected to the intrinsic and extrinsic motivations. This analysis approach shall lead to the better understanding of gamification designers on what features to design in order to fulfill the needs of the users and enhance their engagement in the same time. Furthermore, the scenario-based modeling for both system features and gamification mechanics provides a detailed perspective for the designer on designing gamification system. Via the scenarios obtained from the modeling, the designers shall have a better mapping between the user requirements and the detailed functional requirements. More importantly, the modeling language provides a new way of analyzing the dynamics of games, which can

be adapted in gamification designs. By doing so, the gamification designers shall be able to gamify systems with the existing game dynamics that provide meaningful plays, which shall deliver improved gameful experiences.

This paper aims to build the theoretical foundation on combining formal and semi-formal methods in software engineering to the domain of game and gamifications studies. The methods here will be seen as important tools to connect the future gamification design and the game study domain, so that the future gamification systems shall provide more than the engagement but better gameful experiences.

Acknowledgement

Hereby, I, sincerely, would like to thank my supervisors, Professor Juho Hamari and Ms. Jonna Koivisto. Their seminal works in the domain of gamification have been enlightening my study and been always motivating me to pursue contributions to this promising domain. I have been a lazy student with bad time management skills. Without them, this paper will not be done. I would also like to thank Professor Frans Mäyrä, who introduces to me the domain of game study and helps me greatly throughout the years. I would also like to thank Professor Daniel Amyot, a nice, enthusiastic and inspiring person, for his wonderful tutorial in RE16 and his exceptional contribution to the URN modeling language over a decade. Special thanks to Mr. Atte Hynninen and WordDive Oy providing the opportunity for the interview and the precious time he puts in helping me for the study. I sincerely hope the study can be of help to them in any ways.

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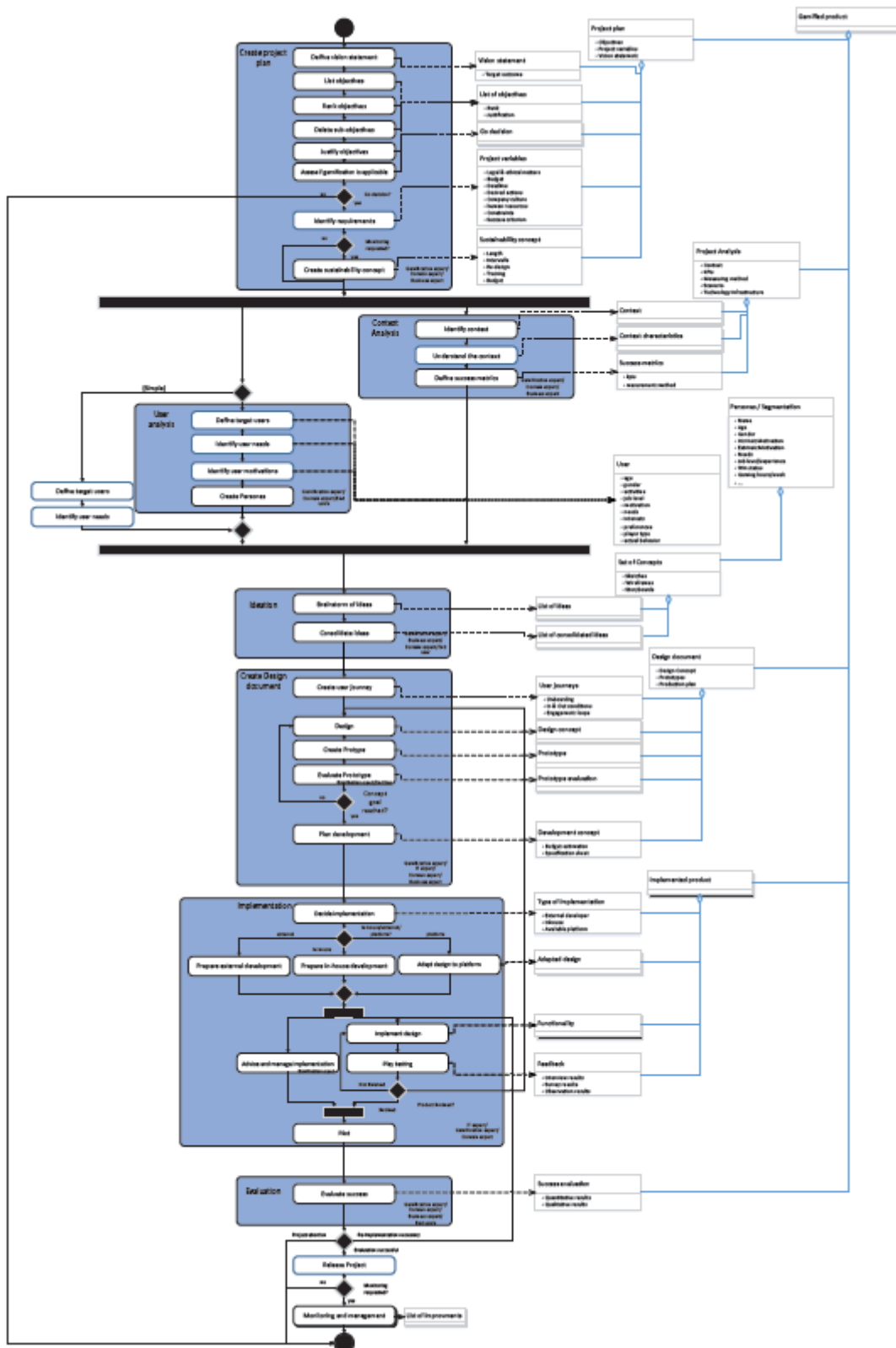
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Appendix 1. Complete model of the gamify method for designing gamification by Morschheuser et al. (2017)



See <https://www.researchgate.net/publication/308165108> Complete model of the gamify method for designing gamification for more details.

Appendix 2. The Expert Interview Questions

Background

Gender: A) Male, B) Female, C) Other _____

Age: _____

Position in WordDive: _____

Experience in Language Learning: A) Expert B) Experienced C) Mediocre D) Novice
Explain _____

Experience in Software Engineering: A) Expert B) Experienced C) Mediocre D) Novice
Explain _____

Experience in Gamification: A) Expert B) Experienced C) Mediocre D) Novice
Explain _____

Before the Method Introduction

1. Do you consider WordDive as a gamified system?
 - A) Yes (Question 2 - 9)
 - B) No (Question 10 – 13)

2. If yes, what gamification mechanics have WordDive applied?
 - A) Points
 - B) Leaderboards
 - C) Achievements/Badges
 - D) Levels
 - E) Story/Theme
 - F) Clear goals
 - G) Feedbacks
 - H) Rewards
 - I) Progress
 - J) Challenges
 - K) Others

3. How do you value the effectiveness of the gamification in WordDive?

4. What are the references used for the gamification? Academic publications or existing systems?

5. What is the overall software development process used for WordDive?

6. What is the position of gamification design in the whole software development process?

7. How shall the gamification of WordDive be improved?

8. What do you think of the difference between gamification and games in general?

9. What do you think of using genuine games to gamify WordDive? Pros and Cons?

10. If no, what shall WordDive look like if you'd like to gamify it?

11. What other gamification applications have you heard?

12. How do you value the other gamification applications?

13. What do you think of gamification in general?

Method Introduction (around 20 minutes)

After the Method Introduction

1. Do you think the method is hard to understand?
 - A) Very easy
 - B) Fairly easy with some questions
 - C) Understandable but needs certain expertises and knowledge related
 - D) Very hard to follow with certain parts unclear

E) Impossible to understand, and/or makes no sense

2. Which specific parts are hard to understand?

3. Do you think the method is applicable in practice?

- A) Nearly impossible to apply in practice
- B) Very hard to apply due to some major flaws
- C) Applicable but takes lots of effort
- D) Can be apply with endurable efforts
- E) Can be easily applied

4. What are the obstacles for the application of the method in practice?

5. What other similar design methods or frameworks have you heard or used?

6. What are the pros and cons of this method compared to those? If any?

7. How do you think of the effectiveness of the gamification designed?

- A) The designs are meaningless and no better than the existing version
- B) The designs are understandable but majorly flawed
- C) The designs are interesting but does not seem to work
- D) The designs are good but can be improved
- E) The designs are great and shall be better than the existing version

8. What are the pros and cons with the proposed gamification designs?

9. How do you think the method can be improved?
