VRIJE UNIVERSITEIT BRUSSEL

Graduation thesis submitted in partial fulfilment of the requirements for the degree of Master of Science in Applied Sciences and Engineering: Computer Science

INVESTIGATING THE USE OF PERSUASIVE TECHNIQUES IN A MOBILE LEARNING ENVIRONMENT TO TACKLE SCHOOL BURNOUT

HASSAN HADDOUCHI

Academic year 2017–2018

Promoter: Prof. Dr. Olga De Troyer
Advisor: Jan Maushagen
Faculty of Sciences and Bio-Engineering Sciences

VRIJE UNIVERSITEIT BRUSSEL

Afstudeer eindwerk ingediend in gedeeltelijke vervulling van de eisen voor het behalen van de graad Master of Science in de Ingenieurswetenschappen: Computerwetenschappen

INVESTIGATING THE USE OF PERSUASIVE TECHNIQUES IN A MOBILE LEARNING ENVIRONMENT TO TACKLE SCHOOL BURNOUT

HASSAN HADDOUCHI

Academiejaar 2017–2018

Promoter: Prof. Dr. Olga De Troyer
Advisor: Jan Maushagen

Faculteit Wetenschappen en Bio-ingenieurswetenschappen

The goal of education
is to enable individuals
to continue their education.

JOHN DEWEY

Abstract

A playful learning environment can be used to educate while playing in order to support the learning process of a user. A challenge in this context is to engage the user and keep him using the environment. This is especially the case when the target audience is composed of youngsters suffering from school-burnout or being early school leavers. There may exist different ways to achieve this, but in this thesis we investigate the use of persuasive techniques for this. This means that we will seek for an approach that persuade the target user to start using the environment and motivates him to continue to use the environment. The work is performed in the context of the Tickle project. The Tickle research project uses the principles of unconscious learning and informal learning, in this way adopting an approach that differs from traditional and formal learning. Moreover, it aims to use persuasive techniques and strategies to engage the target user in the learning environment. It is argued that such an approach can increase the intrinsic motivation and learning capacity of a user. The ultimate goal of this work is to set a first step in the direction of a persuasive strategy that is adapted to the target audience of Tickle.

In this thesis the different steps to realize the persuasive aspect of Tickle are described. The focus of the thesis lies on the study on how users can be persuaded to continue explore new challenges in the playful learning environment of Tickle and stay motivated to get involved in that same environment. The work starts with an investigation of related work and background that could be relevant for our case, followed by collecting relevant elements regarding persuasive techniques and strategies taking into account the characteristics of our Tickle environment and its target audience. This resulted in a selection of relevant persuasive techniques and a first design of a persuasive strategy for Tickle. In a pilot study, the results were evaluated with a mixed group of youngster, i.e. early school leavers and students still going to school. The results of this pilot study were promising. The participants considered the proposed techniques as acceptable, and we could see which ones were more favorable than others.

Samenvatting

Een speelse leeromgeving kan worden gebruikt om te leren tijdens het spelen om het leerproces van een gebruiker te ondersteunen. Een uitdaging met betrekking tot de ondersteuning van dit leerproces is om de gebruiker te betrekken en hem te laten werken met de omgeving. Dit is met name het geval wanneer de doelgroep bestaat uit jongeren die lijden aan burn-out of wanneer de doelgroep vroege schoolverlaters zijn. Er kunnen verschillende manieren bestaan om dit te bereiken, maar in dit proefschrift onderzoeken we het gebruik van overtuigingstechnieken hiervoor. Dit betekent dat we een aanpak zullen hanteren die de doelgebruiker overtuigt om de omgeving te gebruiken en hem motiveert om de omgeving te blijven gebruiken. Dit werk wordt uitgevoerd in het kader van het Tickle-project. Het Tickle-onderzoeksproject maakt gebruik van de principes van onbewust leren en informeel leren, waarbij op deze manier een aanpak wordt gevolgd die afwijkt van traditioneel en formeel leren. Bovendien beoogt het om overtuigingstechnieken en strategieën te gebruiken om de doelgebruiker in de leeromgeving te betrekken. Men kan vaststellen dat een dergelijke benadering de intrinsieke motivatie en leervermogen van een gebruiker kan vergroten. Het uiteindelijke doel van dit werk is om een eerste stap te zetten in de richting van een overtuigingsstrategie op maat van de doelgroep van Tickle.

In dit proefschrift worden de verschillende stappen beschreven om het overtuigingsaspect van Tickle te realiseren. De focus van dit werk ligt op de studie over hoe gebruikers kunnen worden overgehaald om nieuwe uitdagingen in de speelse leeromgeving van Tickle te blijven verkennen en gemotiveerd te blijven om betrokken te raken in diezelfde omgeving. Dit proefschrift begint met een onderzoek van gerelateerd werk en achtergrond die relevant zou kunnen zijn voor ons onderzoek, gevolgd door het verzamelen van relevante elementen met betrekking tot overtuigingstechnieken en strategieën, rekening houdend met de kenmerken van onze Tickle-omgeving en haar doelgroep. Dit resulteerde in een selectie van relevante overtuigingstechnieken en een eerste ontwerp van een overtuigingsstrategie voor Tickle. In een *pilot study* werden de resultaten geëvalueerd met een gemengde groep jongeren, d.w.z. voortijdige schoolverlaters en studenten die nog steeds naar school gaan. De resultaten van deze *pilot study* waren veelbelovend. De deelnemers beschouwden de voorgestelde technieken als aanvaardbaar en we konden zien welke gunstiger waren dan andere.

Declaration of Originality

I hereby declare that this thesis was entirely my own work and that any additional sources of information have been duly cited. I certify that, to the best of my knowledge, my thesis does not infringe upon anyone's copyright nor violate any proprietary rights and that any ideas, techniques, quotations, or any other material from the work of other people included in my thesis, published or otherwise, are fully acknowledged in accordance with the standard referencing practices. Furthermore, to the extent that I have included copyrighted material, I certify that I have obtained a written permission from the copyright owner(s) to include such material(s) in my thesis and have included copies of such copyright clearances to my appendix.

I declare that this thesis has not been submitted for a higher degree to any other University or Institution.

Acknowledgements

First of all, I would like to thank my promoter Prof. Dr. Olga De Troyer and advisor Jan Maushagen for their guidance and support during the accomplishment of this work.

I would like to thank my parents for supporting my studies and ambitions.

I also would like to thank the persons who participated in the evaluation for their time and willingness.

Lastly, I would like to thank my friends and my family for giving me the moral support during the heavy and long work days.

Thank you all.

Hassan Haddouchi
June, 2018

Abbreviations

PLE	Playful Learning Environment
FBM	Fogg's Behavioral Model
CAPT	Computer As Persuasive Technologies
ESL	Early School Leaving
HHC	Household with children
TOP	Time-Oriented Persuasion
SOP	Social-Oriented Persuasion
AIOP	Achievement and Improvement-Oriented Persuasion

List of Figures

List of Tables

Contents

1 Introduction

This study is situated in the Tickle research project. The main goal of the Tickle research project is to reactivate youngsters who are experiencing school burnout in order to prevent school dropout or remediate its effects (De Troyer & Vlieghe, 2017). This will be done by the use of modern technologies along with the popularity of digital media. In fact, prior research has indicated that the use of such technologies and media forms provide many advantages in the learning processes of children, youngsters, and adults (Vlieghe, 2014). Moreover, the learning processes have a positive effect on the self-confidence and the intrinsic motivation of the involved target audience. This boost in self-confidence and intrinsic motivation can have a positive impact on the reduction of school burnout (De Troyer & Vlieghe, 2016). However, in order to achieve its purpose, youngsters should be willing to use the Tickle environment. Therefore, in addition to digital media, Tickle will also resort to the use of persuasive technology to stimulate the youngsters to use the environment.

Investigating the target audience of the Tickle research project and taking into account its focus on school burnouts and prevention of school dropout, we conclude that the research project targets teenagers. This is a very important aspect that we will use in our study, as the effectiveness of persuasive techniques may depend (among others) on the age group.

The goal of this thesis is to investigate which persuasive techniques are

applicable and how we can provide such a mechanism of persuasive techniques in the playful environment developed in the Tickle project. This playful environment is a location-based card environment that youngsters can use to collect cards. To collect a card, the youngster has to perform a so-called challenge, which is a small learning activity. The goal is to motivate the youngsters to start collecting cards and to keep them engaged over a longer period to collect as many cards as possible. The aim is to achieve this through the use of gamification and persuasive techniques.

1.0.1 Motivation

School burnouts and school dropouts may be the result of several and different causes, such as lack of motivation and self-confidence, personal insecurities, socio-economical situation and many others. In the Tickle project, the focus is on the lack of motivation or self-confidence. In order to tackle these causes, Tickle opted for a strategy that allows to counter these causes. One may argue that a new educational approach may challenge this particular aspect. In the Tickle project, the aim is to do this by showing the youngsters that learning can also be an enjoyable experience and achieved in an informal way. Therefore, a framework that can be applied for informal learning activities targeting youngsters who are confronted with school burnouts and school dropouts is under development in the Tickle project. This framework allows to create location-based digital environments that youngsters can use to explore the corresponding physical environments and at the same time learn by collecting the card associated to certain locations. Collecting a card is only possible by performing a so-called challenge, which is a small learning activity.

Introducing such a new educational environment may lead to new perspectives when it comes to education of youngsters. This new environment could be one in which fun activities and learning activities meet. Such a combination could increase the motivation of youngster to engage in the environment. However, it may take a while before youngsters perceive the environment as enjoyable. Therefore, a strategy needs to be added that stimulates youngsters to use the environment and keeps them using the environment until they have sufficient intrinsic motivation to use the environment without external motivator.

1.0.2 Research Goals

The goal of the thesis is to explore the topic of persuasive techniques and strategies in the context of the Tickle project. Therefore, the research questions can be formulated as follows:

RQ1: Which persuasive techniques are suitable for in the context of the Tickle project?

RQ2: How can we apply these persuasive techniques into a suitable persuasive strategy to convince youngsters who are experiencing school burnout to start using the Tickle environment and to keep them using the environment?

1.0.3 Methodology

The research methodology that was used in this work consisted of several steps. First, the related work and background were investigated and discussed to see how gamification in general motivates and how existing persuasive techniques work. The next step consisted of examining Tickle's target audience and the ethical aspects of persuasion in relation to Tickle. The next step was to come with a first answer to the formulated research questions. We discussed the proven persuasive techniques and selected important and useful elements for the case of Tickle. Then a persuasive strategy was designed for Tickle's playful learning environment. Next, the Tickle Simulator was developed to allow for experimenting with persuasive presentations, a technique that we included in our persuasive strategy. Finally, an evaluation was conducted to verify the validity and the acceptability of different elements of the persuasive strategy in relation to the target audience.

1.0.4 Outline of Dissertation

The first chapter of this dissertation gives a general introduction to the work together with the motivation, the research goals and the research methodology that was used. The second chapter focuses on the background information necessary to fully comprehend the rest of the thesis. Chapter 3 starts the requirements and constraints for the Tickle persuasive model, followed by the ethical consideration in relation to Tickle's goals, and this is followed by a discussion on what persuasive elements and techniques known from the literature might be relevant for Tickle. Chapter 4 discusses the Tickle Simulator and describes a possible persuasive strategy for Tickle. In chapter 5

the results of the evaluation are discussed. Chapter 6 concludes the thesis with a summary of the work that was accomplished.

2 Background

2.1 Playful Learning Environments and Gamification

Playful learning environments (PLE) are engaging environments that combine different playful elements with learning elements in an environment (Kangas, 2010). Gamification on the other hand uses elements of games in non-game contexts in order to encourage and motivate users (Deterding, Dixon, Khaled, & Nacke, 2011). Gamification is part of the study and design that focuses on increasing the human motivation in a certain process. In fact, we can situate gamification in a framework based on Human-Focused Design, as opposed to Function-Focused Design (Chou, 2015). Extracting fun and engaging elements of a game and applying them to productive activities forms the core of gamification. Whereas function-focused systems focus on the actual task in a given process, in a gamification-based system one tries to understand the feelings, insecurities, and reasons why people want to or do not want to do certain things. Taking into account these elements, we can design an activity that is optimized for their feelings and motivation.

Digital games nowadays have emerged in an advanced way and have demonstrated their capacity for learning. By extracting useful, interactive, and exiting features and components from game play and using these in

another environment, we can benefit from the power of play. The Tickle research project aims to combine gamification and playful learning in order to build an engaging environment to increase the intrinsic motivation for learning of an individual.

However, in order to optimally benefit from these features and provide the target audience with exiting and engaging elements, we need to be careful in our design of a playful learning environment. It is argued that only extracting engaging elements from game play and including them in a new experience will not automatically result in an engaging playful environment (Chou, 2015). This means that the process of gamification should not start with game elements, but it should start with the question: how can we motivate the core drive of the target audience, in our case youngsters?

Yu-kai Chou explains that we can make a distinction between eight core drives (Chou, 2015). These core drives are the ones that motivate us to do what we do. Based on these core drives he defined Octalysis, an octagon gamification framework (illustrated in the figure below).

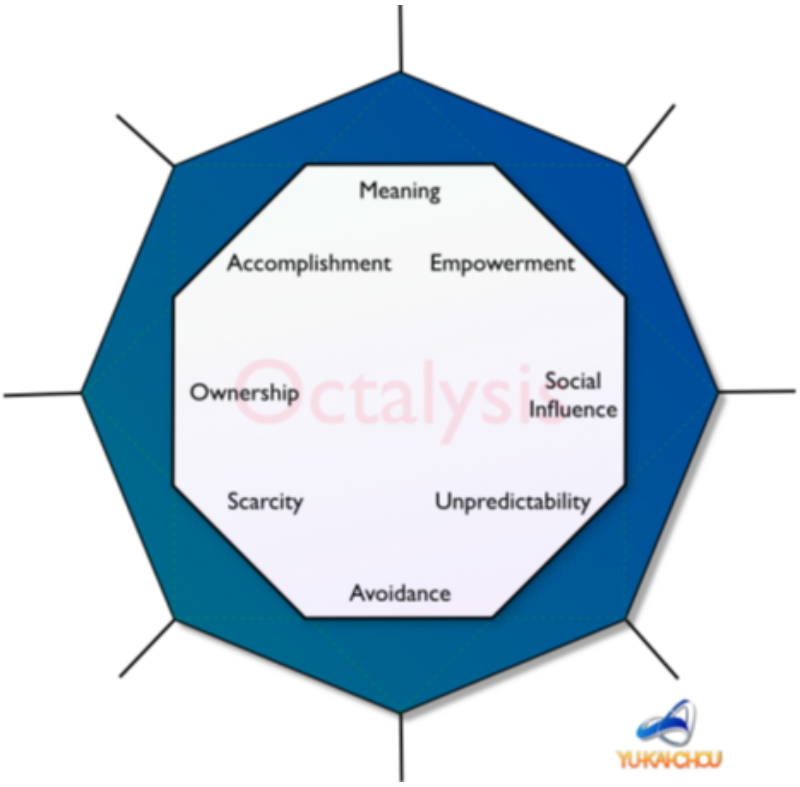

Figure 2.1: The Octalysis Framework
(Chou, 2015)

The first core drive in the Octalysis framework is **Epic Meaning**. This core drive means that an individual is motivated because he feels that he is part of something that is bigger than himself. When this drive is activated, participants choose to be members of the system and will take action not because it necessarily benefits them directly, but because it turns them into the heroes of the company's story. The system should inspire people and gets them excited about being part of a bigger purpose.

The individual may also feel that he is the right person to do this certain activity. Games use this feature to give meaning to the user's role in relation to what he needs to do. For example, there might be a situation in which the user needs to save the world and that he is the only one who indeed can achieve this operation. The main idea of this core drive is to make the user bigger than he is.

Accomplishment and Development is the second core drive in the Octalysis Framework. One can be motivated because he feels that improve-

ment and mastery is achieved. In this, the user is provided with information about his achievements in the few last activities. He sees that his scores are going higher and so motivation grows.

The third core drive is **Empowerment of Creativity**. Here, the individual is provided with a task in which he can be creative in order to come up with a possible solution. Feedback plays an important role here, as the user might find it interesting to receive useful feedback while being creative, which results in a very engaging process.

Core drive number four is **Ownership and Possession**. When someone feels he owns something, this person will be motivated to improve it. Moreover, he feels that he needs to protect it and even get more of it. This is not only true in the physical world, but also effective with virtual goods.

The next core drive is **Social Influence**. An individual may consider his social status when making a decision. In addition, it is also based on what other people think, do or say.

The sixth core drive is **Scarcity and Impatience**. Sometimes people want something just because they cannot have it (Klaff, 2011). The sense of urgency is very important here, indicating that at a certain moment, the user needs to seize the opportunity in order to grab more points or execute another activity.

The next core drive is **Unpredictability and Curiosity**. Because the user does not know what is going to happen next, he will be always thinking about it. This core drive is heavily used in the gambling industry, but also in our personal lives, when we want to finish reading that book.

The final core drive is **Loss and Avoidance**. It is when one does something to avoid a loss. This core drive is used in a lot of survival games, in which the user needs to avoid several obstacles and dangerous elements in order to survive.

2.2 Persuasive and Motivational Techniques

In this section, we will take a detailed look into the studies and models introduced in the context of research on persuasive techniques and motivational techniques. In particular, we discuss the Hooked Model developed by Nir Eyal, followed by BJ Fogg's Behavioral Model that explains elements for behavioral change. In addition, Cialdini's Science of Persuasion is also studied, extracting important elements concerning how people make decisions.

2.2.1 The Hooked Model

A lot of products we are using changing our behavior. If we take a look at the past few years and we think about the rise of personal technologies like Facebook, Slack, Twitter, Google Email, and Snapchat, we see that these products managed to keep their users checking their products several times a day. These technologies are implemented with respect to the art and science of habits, i.e. behavior done with little or no conscious thought. About 40% of what we do is done purely out of habit (Eyal, 2014).

In the book titled Hooked from Nir Eyal (Eyal, 2014), a design pattern to build habit forming products is described. This model (i.e. pattern) is called the Hook, which basically is an experience designed to connect the users problem to the solution with enough frequency to form a habit. In general and as mentioned in the book, hooks have 4 parts: a trigger, an action, a reward, and an investment. Every hook starts with a trigger. Figure 2.2 illustrates the Hooked Model. We will explain this model based on the description given in (Eyal, 2014).

Figure 2.2: Hooked Model of habit formation
(Eyal, 2014)

The Trigger Phase

The first part, which is the **trigger**, is an object in our environment. An example of a trigger is a button in a user interface that perhaps says 'Click here'. Since a trigger forms the first step of the process, it is this element that tells the user what to do next. The art of such a trigger lies in the fact that it provides us with some information contained in the trigger itself. However, we can make a distinction between external and internal triggers. Whereas the external trigger is something like the earlier explained button with some external information, an internal trigger is crucial for forming long-term habits. An internal trigger also tells us what to do next, but the information is not contained in the trigger itself but instead in the form of an association or a memory in the user's brain. For instance being hungry will trigger somebody to eat.

When we experience certain emotions, it dictates what we do next. We turn to an unknown unconscious thought. Another example is when we are in a certain situation that is part of a routine. Indeed, such a situation will dictate what we do next. For instance, after lunch some people will always drink a coffee. The main question here is: "what will we do next?". It is argued that people will for example go online to check their email in order to boost their mood and get out of a negative state.

Having explained this situation, we can describe an answer to the question on what to do next. When a user is in a negative state, he will unconsciously go online to check his email or social media. As a result, it is stated that people use products to change their mood. Our emotions dictates the technology that we turn to next with little or no conscious thought.

It is known that people will visit certain popular online communities when they feel inattentive. Examples of these online communities are YouTube, Pinterest, Facebook, and many others. On these platforms, people can read news, sports scores, etc. When one feels uncertain and even before scanning the brain to see if he knows the answer, he executes a search on Google. The same counts for the early mentioned technologies with their specific services. These are solutions people use to alleviate the internal trigger of boredom.

The Action Phase

Once the trigger told the user what to do next, it is followed by the **action**. The action phase of the hook is the phase where the habitual behavior occurs. It is defined as the simplest behavior done in anticipation of a reward (Eyal, 2014). An example is pushing the play-button on YouTube. Such an action is indeed very simple. Fogg stated that there exist elements that must

converge at the same moment in order for a behavior to occur (B. J. Fogg, 2009). Fogg provides a behavioral model that contains a formula to predict the likelihood of these behaviors. The hypothesis is that for any given human behavior B, three elements (indicated as MAT) must be present: Motivation, Ability, and Trigger. The user must have sufficient motivation and ability and the trigger must be present. As we already explained what a trigger is, we will take a closer look at what motivation and ability mean and link it to Fogg's behavioral model.

Motivation in this context is how much we want to do a particular behavior, whereas ability describes how easy or how difficult something is to do (Eyal, 2014).

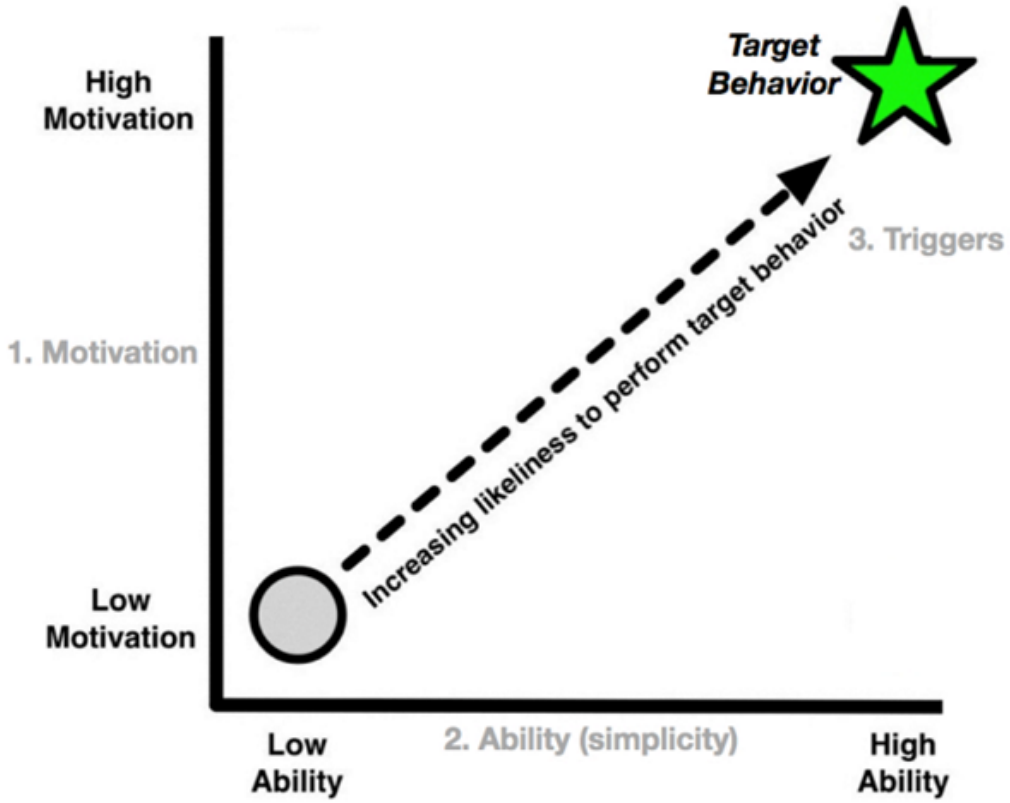

Figure 2.3: The Fogg Behavior Model with its three factors (B. J. Fogg, 2009)

Figure 2.3 shows the Behavior Model as provided by Fogg. The motivation is on the y-axis and the ability on the x-axis. If something is easy to do, it is placed on the far right. The same counts for a behavior that is hard to do, which is placed on the far left. When the user has sufficient motivation and sufficient ability, he crosses the threshold and if the trigger is present, the behavior will occur. Note that the likeliness to perform the behavior increases with the level of motivation and the ability. The Behavior Model is further explained in section 2.2.2.

The Reward Phase

After this behavior, for example opening an app or scrolling over a page, it is time for the **reward** phase, which basically means that we will give the users what they came for. As giving rewards is an important part of the process, we need to examine it in more detail. Our human brain has a region that is called nucleus accumbens. As we crave something, this special area in our brain becomes active. In our context, the most interesting part about this area in the brain is that it becomes most active in anticipation of a reward. However, when we actually get the element we think we want, the same part of the brain becomes less active.

We conclude that the way the brain gets us to act is by creating something like it was an itch that we seek to scratch. Moreover, we can find ways to supercharge that itch in order to stimulate the craving. As the reader is reading this particular part, he will be curious to know how we can indeed stimulate this craving. He will be asking himself what techniques could be used to activate desire. In fact, while reading the past two sentences, the unknown has achieved the exact same thing by stimulating the craving. This is because the unknown is fascinating.

Before going into detail about how Eyal describes rewards, we will first mention the use of variable rewards. It is important to have a mechanism in which variable rewards form the heart of the persuasive model. There exist several reasons for using variable rewards, some of which are to focus attention, provide pleasure, and infatuate the mind. We humans struggle to find patterns. Moreover, variability is our brain's cognitive competitor. It keeps the brains occupied, which provides an opportunity to plant new habits. In addition, our brains perceives this activity as fun, since they are wired to search endlessly for the next reward. We can say that in this logic, our brains are never satisfied.

A variable reward works on two different dimensions: both the moment and the size of the reward must vary. This will reinforce the behavior and in addition, it will make it resistant to extinction, i.e. it will become a habit.

After all, using variable rewards is not just about pleasure, but also about anticipation of pleasure. Knowing how a certain pattern works will result in the fact that our novelty seeking brains get bored. However, when rewards are unpredictable, our brains stay on edge. In addition, we can manufacture desire by increasing the variability of the reward.

Furthermore, Eyal gives a description of such rewards and divides them into three types: *rewards of the tribe*, *rewards of the hunt*, and *the rewards of the self*.

The first category, the **reward of the tribe**, contains factors that feel good. They have an element of variability. Some examples are cooperation, competition or partnerships. All these examples have one thing in common: seeking empathetic joy. When we think of an example online, we immediately think of social media. When one opens the Facebook app, one never knows what one is about to see, what are the comments stating or how many likes a certain post get. As a result, there is a high degree of social variability, which is in fact a powerful instrument that social media use.

The next category of rewards is the **reward of the hunt**. This reward is all about the search for resources. Examples of this reward can be found in the field of gambling and slot machines with the variable reward that is the money one might win. It is basically playing a game of chance. In fact, it is this part that makes gambling habit-forming if not addictive. But what fascinates us here is that we see the same dynamic online. Let us consider the feed in many apps. Nowadays, the feed is so prominent that many products and social media are implementing this mechanism in their technologies. If we take a look at the Twitter timeline, we could draw a scenario in which one opens the Twitter app and reads the first item. That might not be an interesting item, but how about the second item? Furthermore, how about the third item? And it goes on. To get more of this reward of the hunt, the user has to do only one action: to scroll down. We might say that the scrolling in fact uses the exact same psychology as pulling on a slot machine searching for the next reward of the hunt.

The third and last reward is the reward of the self. In general and as described by Eyal, these are things that feel good, have an element of variability but do not come from other people and in addition, they are not about material or information rewards. Thus, this category contains rewards that are intrinsically pleasurable. They are in fact more about the search for master, competency, control, and completion. An example online is gameplay. Here, it is not about necessarily winning anything or even playing with other

people. However, the habit-forming here is more about getting to the next level or the next accomplishment. Very interesting about this category is the fact that this reward does indeed apply also to people who do not consider themselves as gamers.

Some examples are the unread email messages in one's inbox, the to-do list items that need to be finished or the notifications mobile apps use to notify you about a certain action or activity. The purpose of these examples, which all are examples of the reward of the self, is to give the user what he came for and at the same time having a mystery on what he might find the next time.

The Investment Phase

As we already discussed the first three parts of the hook model, we will now take a look at the last part of the hook model, which is the investment phase. The purpose of the investment is to increase the likelihood of the next pass through the hook. Investments accomplish this by storing value. This is a very important element in this phase. If we think of products in the physical world, such as a chair or clothing, we can state that such products actually lose value and depreciate. However, habit-forming technology does the opposite, they appreciate.

Habit-forming technology gets better and better with use exactly because the principle of investing in stored value. For example, the more content one adds to Google Drive, the better it gets as the one and only cloud storage solution for that particular user. In general, the more data a user provides a data app, the more he can do with it. Note that here the user invests with data in order to get better a service. Such data that is invested in the service, is the early mentioned stored value. The same counts for the content on the cloud storage solution. Another stored value is reputation. Nowadays platforms such as eBay, Upwork and Airbnb use a mechanism that stores the reputation of its users. This reputation determines what users can charge to goods or services. Moreover, how likely is that a user leaves one of these services after gaining such a positive reputation? Indeed, not very likely. Even if a better competing service comes along.

This leads to a surprising conclusion: there is no rule that states that the best product necessarily wins. Instead, it is the service that hold on to the monopoly of the mind that wins (Eyal, 2014). It is through the successive cycles through the hook (see figure 2.2) that user's preferences are shaped, that tastes are formed, and that habits take hold.

2.2.2 BJ Fogg's Behavioral Model (FBM)

In the previous section describing the Hooked Model, we mentioned BJ Fogg's Behavioral Model (FBM) that describes three elements (motivation, ability, and triggers) that must converge at the same time for a behavior to occur. In this section, we will further discuss these three elements in order to be able to determine whether this model could be applied in the Tickle project. It will help us to identify what could stop our users to perform the behavior we seek. It is stated that FBM is useful in analysis and design of persuasive technologies (B. J. Fogg, 2009).

The aim of FBM is to get knowledge on the psychological element that is lacking when a user is not performing the target behavior. Having this knowledge, we can respond to that. As mentioned earlier, FBM defines three elements that control whether a behavior is performed. In order to effectively understand and encode experiences that change behaviors, we need a rich yet practical understanding and insights into the factors that drive human behavior.

In figure 2.3 we see that FMB has two axes, the vertical axis for **motivation** and the horizontal axis for the **ability**. If a user has low motivation to perform the target behavior, he would register low on the motivation axis. On the contrary, high on this axis means high motivation. Concerning the ability axis, we can state that if a user has low ability to perform a target behavior, he would be marked toward the left of the axis. This means that the right side of the axis is for high ability. In addition to the two axes, there is the third factor: **triggers**. Notice the placement of the word. It is close to the target behavior star. This is to show that the trigger must be present to make sure the target behavior will occur.

Motivation & Ability

An example of such a target behavior is submitting a form to subscribe on a website. In general, we can state that submitting a form is easy. This means that in FBM, the ability for the target behavior is high. However, this is not always the case for the other element, which is the motivation. It can be that users will have no motivation to enter the information needed in the form. In this case the star will be placed in the lower right part of the framework. Here, it means that ability is high, however motivation is low. In contrast, there might be users that have high motivation to submit the form. In this case, the star will be placed in the upper right hand corner.

In our form example, we noticed that the ability is high for the user. However, there might exist cases in which the ability is low. An example could be a situation where users need to solve a certain challenge, in order to proceed to the next step. In this case, some users might have difficulties completing the challenge. It means that even if a user is highly motivated to perform the target behavior, his ability is low. The star here will be placed in the upper left: high motivation and low ability. In this scenario, the behavior is not likely to occur. It is clear that motivation alone may not get a user to perform a behavior if he does not have the ability. Another conclusion arises as well: increasing motivation is not always the solution. Often, increasing ability is the path for increasing behavior performance (B. J. Fogg, 2009).

We described two situations (high ability —low motivation and low ability —high motivation). However, there exist additional situations in which the behavior might occur. When the motivation is high enough, we are able to do extraordinary things, even if they are difficult, to perform the behavior. In general, users have at least a modest level of motivation and ability (B. J. Fogg, 2009). Developing a persuasive technology, we can respond to this in order to boost either motivation or ability or both. For example, one can make a certain action simpler in order to boost the ability.

The Trigger

Having explained the motivation and the ability and the relation between these two elements, we still need to take another important factor into account: the trigger. Even if both motivation and ability are high, the target behavior will not occur: a trigger is needed. Fogg notes that every successful trigger has three characteristics: we first notice the trigger, then we associate the trigger with a target behavior, and finally the trigger happens when we are both motivated and able to perform the behavior (B. J. Fogg, 2009). We notice that the first two characteristics are very important, as they will result in the third characteristic if motivation and ability are high. It also means that the combination of motivation and ability will place a user above the behavior activation threshold. As a result here, the trigger will cause the user to perform the target behavior. On the contrary, if the user is underneath the threshold, a trigger will not result in the occurrence of the target behavior.

FBM in practice

Fogg's framework provides us with the ability to learn more about existing

systems by viewing them through the FBM lens. This way, we can extract elements on how the activity is motivating people, giving them the ability to perform the action, and triggering their behavior. In a similar way, we can use it to find out which elements are not taken into account when designing system that is missing some of the foundations for a behavioral change mechanism. In addition, the FBM provides also a way to prevent certain behavior. Although this might be less interesting for our study in relation to the Tickle project, we have to note that one can stop a behavior from occurring by taking away one of the earlier mentioned elements.

We stated earlier that one could create or improve motivation if this element is the one that prevents a certain behavior to occur. It means that when a user has high ability but low motivation, we need to increase motivation in order the user crosses the behavior activation threshold. However, there is need to understand what motivation is, in order to be able to improve this element. In his paper, Fogg makes a distinction between three core motivators, each with two sides. The first core motivator in the FBM is a dimension that has two sides: **pleasure and pain**. This kind of motivation functions adaptively in activities related to self-preservation and propagation of our genes. Notice that both pleasure and pain are powerful motivators. When we as designers seek to boost levels of motivation, we can look further in the science on how pleasure and pain can be embodied. However, we have to note that this type of motivator, especially pain, may not be the ideal approach.

The second motivator is **hope and fear**. When having hope, and on the contrary fear, we seek for an outcome. This is how this motivator is characterized. Notice that as a result, this dimension is often more powerful that the first motivator. However, it does not mean that hope/fear is not always more motivating that pleasure/pain. As designers, we should consider each core motivator and apply it to our work as appropriate. The third dimension is **social acceptance/rejection**. This core motivator basically controls much of our social behavior. We can say that people are motivated to do things that win them social acceptance. A lot of social networks, including Facebook and Instagram, motivate and influence users mostly because of this motivator. People are driven significantly by their desire to be socially accepted (B. J. Fogg, 2009).

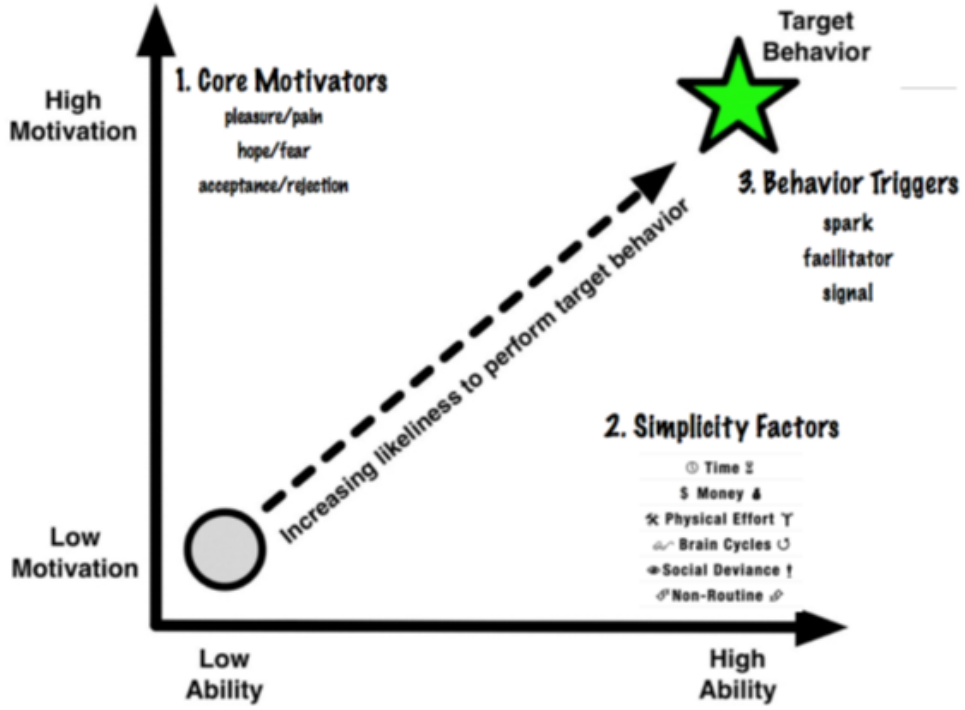

Figure 2.4: The three elements in the FBM framework with their subcomponents

(B. J. Fogg, 2009)

In figure 2.4, we notice that all the three known elements in the FBM framework have subcomponents. As we already covered the importance of the subcomponents of motivation, we will briefly explain the rest of the subcomponents that belong to the other two elements.

Ability, which is the second element, is also important to change behavior. Optimizing this factor can move users across the behavior activation threshold. Therefore we need to have some knowledge on how to increase ability. In general, it could be laziness that results in the fact that a user is not able to execute a certain activity or action. This laziness could on its part be a result of an action that is perceived as difficult. It means that we should take simplicity in account when designing a persuasive strategy. Indeed, this is what we see nowadays in several technologies such as bol.com and Amazon. They make use of the 1-click shopping action in order to ensure the users are able to buy a product easily.

In addition, Fogg describes another framework in which he includes six elements to understand simplicity (B. J. Fogg, 2009). This framework will help us understand how the elements work together. The first element is **time**. If a target behavior requires time and the user does not have time available, then the behavior is not simple. The second element of simplicity is **money**. If financial resources are limited, a target behavior that costs money will be difficult to be executed. **Physical effort** is the third simplicity element. We can say that when a behavior requires effort, the behavior might be difficult. One can travel in a car crossing a continent to reach his destination. Instead this person can also take a plane and make less effort to reach the destination. The next factor is called **brain cycles**. This has to do with thinking hard and results in the brain making an effort. The fifth factor of simplicity is **social deviance**. It basically means breaking the rules of society. When a behavior requires the user to break the rules of society, i.e. be social deviant, then that behavior might not be simple. People tend to take their social status into account when deciding whether to execute a certain behavior. **Non-routine** is the last factor of simplicity. When a behavior is routine, people tend to experience it as simple. On the contrary, when people face a behavior that is not routine, they might experience it as no longer simple.

As we described the six factors of simplicity, we mentioned that these could provide us with knowledge on how to provide a user with the ability to perform a certain behavior. Note that these factors are personal. They depend on age, on resources, on time, and other elements. One might have

time to perform a behavior, whereas another user might not have that much of time to actually execute the behavior. In this case, one of the elements has been decisive because the behavior will not occur.

We mentioned earlier that the third core element in the FBM framework is called triggers. In order to understand how we can apply this in the Tickle project, a brief explanation of what triggers could be is given.

There exist several examples of triggers, such as prompts and cues. However, the idea is always the same: a trigger should tell people to perform a behavior now. We can state that the trigger is the last part in the behavioral change process and is therefore a vital aspect in the whole operation. It is a fact that, when people are above the activation threshold, i.e. there is sufficient motivation and ability, a trigger is all that is required for the action to be performed. Despite the fact that the idea of all triggers remains the same in all situations, Fogg makes a distinction in the way triggers work (B. J. Fogg, 2009): **sparks**, **facilitators**, and **signals**. A spark is a trigger that motivates behavior. A facilitator makes behavior easier, whereas a signal indicates or reminds.

In what follows, a detailed description of these three types is given. In a later section, we will determine what type of trigger can be used in our study.

A spark should be used when a user lacks motivation to perform a target behavior. This type typically has a motivational element, for example a picture of video that inspires hope. A facilitator can be used to users with high motivation but lack ability. The goal is straightforward: it is to trigger the behavior while making that behavior easier to do. Also here, we can embody a facilitator in text, video, graphics, and more.

In addition, it is important that the facilitator tells the user that the target behavior is easy to perform. That it does not require a certain resource the user does not have at that moment. Again, also here the 1-click mechanism is often used. For example, many social networks have grown quickly by offering users the ability to upload their contacts, which in fact requires just a few clicks to connect with many friends. The third and final type of trigger is a signal. It is best applied when users have both the ability and motivation to perform the target behavior, as it just serves as a reminder, i.e. the signal does not seek to motivate users or simplify the task. A lot of media, especially mobile apps, use such well-timed reminders to tell people to perform a certain target behavior.

Summary

As we extracted very important information from the FBM framework, we will use this information and knowledge in a later section to determine what elements are important for the Tickle project. In this context, the FBM gives us the ability to think more clearly about behavior in order to see useful and meaningful potentials for persuading users. Using these potentials, we need to see beyond the surface to the underlying psychology, as we need to understand how motivation, ability, and triggers work together to produce the target behavior.

Another vital advantage of the FBM is that it will help us channel our creative energies more efficiently. When we, as designers of persuasive technologies, realize that ability is lacking, we can focus and elaborate on that. We can then take this aspect into account in our design and explore different ways to tackle the ability of the user. It helps us to see beyond the surface to the underlying psychology.

2.2.3 Cialdini's Science of Persuasion

Cialdini defines six universal principles for behavioral change (Cialdini, 2001). We believe these principles are useful to study in order to see how they can be used in relation to persuasiveness. Figure 2.5 shows the six principles.

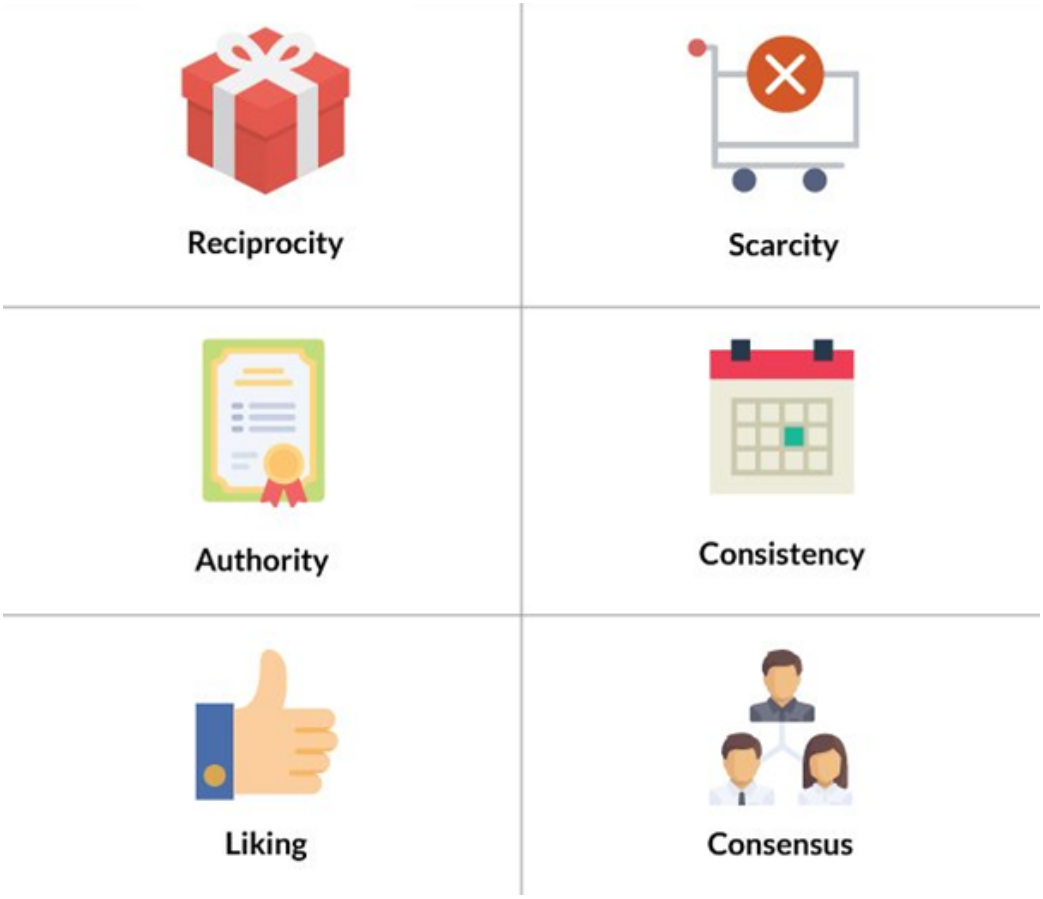

Figure 2.5: The six principles of persuasion
(Cialdini, 2001)

The world in which we live, especially the digital one, is overloaded by information. Devices such as mobile phones and tablets provide people with a lot of information. Making a decision that is related to all available information might be time-consuming. This results in the fact that people will not consider all the available information in order to guide their thinking. They are using shortcuts or rules to guide the decision-making. Cialdini identifies six of these shortcuts that guide human behavior (Cialdini, 2001). The issue is to understand these shortcuts and to apply these in an ethical manner, in order to increase the chances that the user will be persuaded to perform the requested action or activity. In what follows, a brief description of the six shortcuts is given. In a later section we will make a connection between these shortcuts and the Tickle project, in order to establish rules that will guide us to a proper behavioral change mechanism.

Reciprocity, which is the first shortcut, basically means that people in general tend to give back to others the behavior or service that they have received before. It is known that one owe the other after providing that person with a service. In this context, and especially when it comes to social obligations, people are more likely to say yes to a person they owe. Perhaps the most important aspect for this principle is to be the first to give. In addition, it is important to ensure that what is given is personalized and unexpected.

The second principle is **Scarcity**. It means that people want more of the things they can have less of. If something becomes a scarce resource, people want it more. For this principle, the science is clear: it is important to point out what is unique about the proposition and what the user stand to lose if he fails to consider the proposal. In the context of the Tickle project, the proposition could be a card to collect or a certain challenge in the learning environment. The principle of **Authority** is the third shortcut. Here, the idea is that people follow the lead of credible, well-informed people. For example, a doctor is able to persuade his or her patients to eat more healthy because he is perceived as an expert in his or her field. In the case of this principle, we can add that it is important to signal to others what makes you (or somebody else) a credible, well-informed authority.

In general, people tend to be consistent with those things they have already said or done. We can activate **consistency** by looking for small commitments that can be made. These small commitments make sure consistency exists, and therefore what was not possible before, could be a possibility after a certain amount of completed commitments. This means that an initial

commitment can result in a much bigger but still consistent change. The fifth principle is **Liking**. People tend to like other people that are similar. In this sense, it is important to look for areas of similarity that one shares with the user.

The sixth and final principle is **Consensus**. In some cases, and especially the case of uncertainty, one will look to the actions and behaviors of others in order to determine his or her own behavior. This principle is very powerful, as minor changes in expressions can increase the persuasion rate significantly. In the context of the Tickle project, we could point to what many other users are already doing, especially many similar users, making a link to the fifth principle as well.

These shortcuts or principles are very powerful. However, some might be applicable in our playful learning environment, other will not, unless additional elements are added to Tickle's activities. As mentioned, we will describe and motivate the decisions in a later section.

2.2.4 Summary

We discussed several models and frameworks that seek to change behavior or implement habits. These models often form the basis of a persuasive technology, i.e. the used persuasive technique stands often close to these models and frameworks.

Taking a closer look at the Hooked Model, we can say that the explained process describes a cycle of events that is engineered to keep users coming back. Every stage in this cycle has its purpose, and all together they achieve the goal of this model, changing behavior in a certain environment.

Fogg's FBM framework reminds us of the fact that motivation is categorized in 3 different motivators. One of these motivators is hope/fear. Taking a closer look at this dimension, we note that a lot of persuasive technologies indeed use this characterization. We are all motivated by fear when we install anti-virus software on our devices in order to prevent virus infection. On the other side, there is the motivator hope. In our opinion, this is the most ethical and empowering motivator in the FBM.

Last, the six principles of persuasion give an overview of some powerful aspects based on decision-making. As mentioned earlier, some of these aspects could be applied in Tickle's playful learning environment as they have a big impact.

2.3 Ethics

As we focus in this work on persuasive techniques and frameworks, one may question the ethics part of such an approach, i.e. is it ethical to persuade people to do certain things. In general, we can refer to ethics as a rational scheme for determining right and wrong, usually in the context of a certain activity (Berdichevsky & Neuenschwander, 1999).

In order to have a clear view on the ethics of persuasive technology in general and the ethics part in our study in particular, we have to backtrack and investigate the influence of technology through the past decades. Technologies have always influenced our lives and how we lead them. Moreover, technologies always had their effects on our attitudes and behaviors. However, only recently we see that technologies have emerged that are actively persuasive in their own right. In order to deal with the ethics of such technologies, we first should understand how technologies try to persuade its users. For this, a distinction is made between passive and active persuasive technologies.

Whereas passive technological media, such as billboards, facilitate persuasion without altering their pattern of interaction in response to the characteristics or actions of the persuaded person, active persuasive technologies are in some degree under the control of or at least responsive to the persuaded party (Berdichevsky & Neuenschwander, 1999). Using this distinction between active and passive persuasive technologies, we can state that our study is situated in the active part of persuasive technologies.

In terms of designing a persuasive strategy, we could take an approach in which we view the design principles as risk factors. Having this view, we can state that the more of these design principles are violated, the greater the risk the resulting strategy will be ethically problematic (Berdichevsky & Neuenschwander, 1999). Note that in our work we focus on ethics of persuasive techniques, instead of the ethics of captology, which is the study of persuasive technology and was defined by Fogg (B. Fogg, 1997) from an acronym: Computers As Persuasive Technologies = CAPT. Captology is itself neither ethical nor unethical, though the design of persuasive technologies might be valid areas for ethical inquiry.

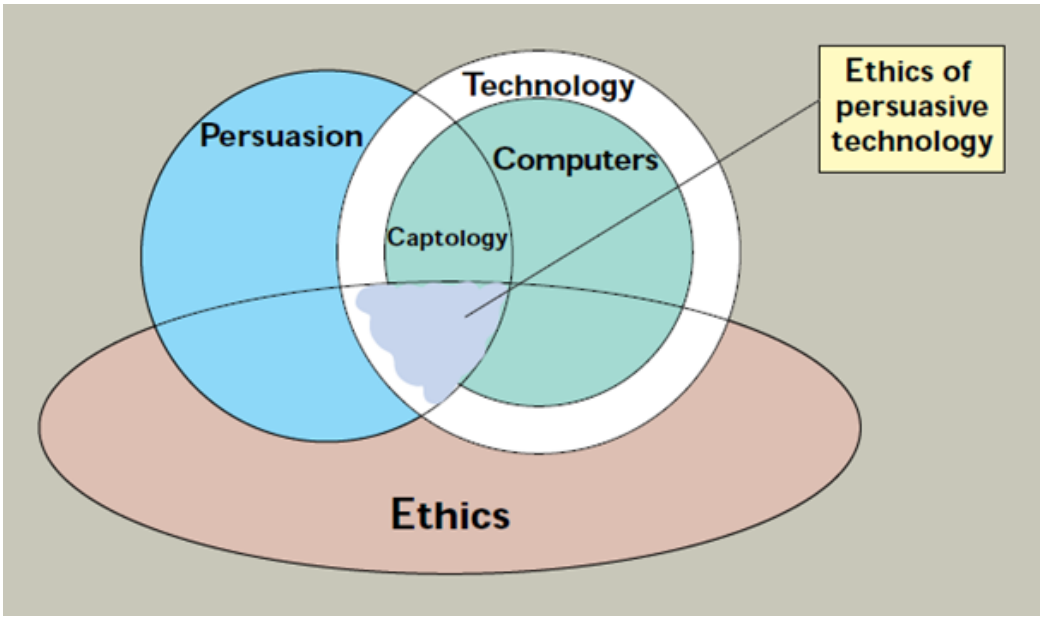

Figure 2.6: Convergence of ethics, persuasion, and technology (Berdichevsky & Neuenschwander, 1999)

In figure 2.6, we see the convergence of ethics, persuasion, and technology in general. Note that ethical concerns extend to all forms of persuasive technology. Taking this into account, we can state that persuasion distributes responsibility between the persuader and the persuaded. Ethicist Kenneth E. Andersen argued that all involved parties in fact share full moral accountability for the outcome (Andersen, 1978). This is an important element especially when we speak about the most simple case, i.e. where one person is persuading another.

Later in this work, we will analyze the ethics of our specific persuasive act. In order to be able to provide such an analysis, we will take a look at how persuasion works and extract elements that will help us to understand the overall process. In general, we can state that the process begins with the persuader who has certain motivations to persuaded another person. To achieve this task, the persuader implements a persuasive method which will be applied on the persuaded person. Once the persuaded person is affected by the persuasive act, it will result in the outcome of persuasion.

Having described the process, we note that it involves two parties, the persuader and the persuaded. As a result we observe that persuasion distributes responsibility between these two parties. Undoubtedly this is self-evident, as

computers until the date of today have neither the capacity to form an intention nor the ability to make a choice. Therefore they are not free moral agents (Friedman & Kahn Jr, 1992). This means that when computers make any mistakes, their programmers are often the first people blamed, followed by the users (Shade, 1999). We can use the same principle for the persuasive technology itself. We cannot attribute responsibility for the persuasive act to the persuasive technology. This leads us again to our conclusion that the whole process involves responsibility of both the persuader and the persuaded.

In a persuasion process, there will be always the intent, which is basically the start of the whole process. In addition, we also have the motivation for the persuasive act. Note that there exist a difference between these two elements. In general the intent is a constant element, whereas the motivation may vary. Speaking in ethical terms, both the intent and the motivation are important items to determine the ethical question of a persuasive act. Another element that is important as well in this determination is the method or methods through which a persuader persuades. Note that this element, as well as the earlier mentioned ones are decisive.

Last, we believe that we must also take into account the outcome of the persuasive act. If we consider a certain activity as unethical to ourselves, it is equally unethical to the persuaded. However, here an exception arises: the case of unintended outcomes. In order to have a decision whether the persuader is responsible or not, we take another element into account, which is predictability. If the unintended outcome was not reasonably predictable, we cannot held the persuader responsible for the outcome. However, if the unintended outcome was predictable, we can then conclude that there is room for questioning the responsibility of the persuader.

We have to mention that some persuasive methods use a methodology in which the persuaded parties not realizing they are being persuaded. And therefore, their possible responsibility can be questioned. In fact, we aim to define a persuasive strategy that indeed uses such methods. It is argued that when knowledge of the presence of persuasive elements in a technology is expressed, it can influence users in an opposite way and as a result decrease their efficacy. We therefore note that in such cases as described, such knowledge might reduce the effectiveness of what should be a positive persuasion.

As a result, we can argue that when a persuasive technology is created, the creators should disclose the persuasive character of the technology to its

users, except when such disclosure would expressively undermine the actual goal which in fact is ethical on itself (Berdichevsky & Neuenschwander, 1999). In addition to this principle, we believe that the creators of a certain persuasive technology should never seek to persuade people of something they themselves would not consent to be persuaded of. In a later section, we will evaluate these principles in the case of our work.

2.4 Conclusions

In this part we discussed the concepts of playful learning environment, gamification, and reviewed different motivational and persuasive techniques. We described several models in detail that are interesting for our study. In what follows, we will investigate how we can design a persuasive model that is suitable for the Tickle project. In that manner, we will subtract meaningful elements from earlier developed persuasive models and map them to the information we have about Tickle, in order to be able to design a persuasive model that takes into account the characteristics of our project.

In addition, we also explored the topic of ethics in persuasive technology. We saw that different and important aspects need to be taken into account when designing persuasive and habit-forming products. However, we also saw that responsibility is different in many cases depending on the technique that is used to build a persuasive technology. Later in this work we will evaluate our persuasive model on this topic.

3 Applications to Tickle

In the previous chapter detailed introduction was provided about models and techniques related to persuasive techniques. When planning to apply persuasive technology in a project, such as the Tickle research project, it is important to investigate carefully the target audience and the purpose in order to ensure that the strategy will work. In addition, in the Tickle project it is also important that in the end the used strategy results in the increase of the intrinsic motivation and learning capacity of the youngsters.

In this chapter, we extract applicable elements from the earlier explained models and persuasive techniques. We will discuss these elements and investigate how we could use them in favor of the Tickle project. The chapter starts by collecting the main requirements and constraints for the development of an effective persuasive model for the aim of Tickle (section 3.1). It then continues with describing the ethics for Tickle (section 3.2), before proceeding formulating the possible applicable elements from the discussed persuasive techniques (section 3.3). We conclude the chapter with a short overview of the findings (section 3.4).

3.1 Constraints and Main Requirements

Crucial to be able to design an effective persuasive model for Tickle is the identification of the requirements and constraints. It is argued that cer-

tain persuasive techniques are applicable only to a certain group of people, relating them to age, interests, etc. (Eyal, 2014). During our analysis of the different persuasive techniques, we indeed noticed that some techniques might be age-related, whereas elements such as the mood of the user also play a crucial role in the process of persuasion. Collecting the requirements, examining their importance and matching them with the limitations of the different persuasive techniques will allow us to define a customized persuasive model for Tickle.

The first constraint to be discussed in relation to our case is the age. Because our focus is on early school leave (ESL), our target audience is in the age category of 14 to 18.

It is shown that these ages are crucial in the rationalizations of ESL (De Troyer & Vlieghe, 2016). In addition, we should also consider the characteristics of our specific target audience: youngsters suffering from school burnout. It is very likely that youngsters with school burnout have little intrinsic motivation for classical learning (i.e. school way of learning).

Another important requirement is the use of digital media and devices. As Tickle's playful learning environment will be a digital platform, we need to take into account that the used persuasive techniques will need to be digital. Related to this are requirements concerning the connectivity to the Internet and the type of devices supported. About 90% of the Belgian households with children (HHC) have an Internet connection at home, of which about one in two HHC use a mobile broadband connection. Therefore requiring Internet connection should not impose a problem. Furthermore most youngsters have a smartphone, which is bought and used solely by the youngsters themselves (De Troyer & Vlieghe, 2016).

Concerning the digital competences of youngsters, we can state that these youngsters in general have more experience than the average citizen when it comes to using mobile devices and digital media. About 94% of youngsters use smartphones on a daily basis, with nine out of ten connecting to the Internet (De Troyer & Vlieghe, 2016). Although the main activity on these smartphones is calling and sending text messages, lot of information gathering and interactions are also made using these devices.

In summary, we can conclude that the selected persuasive techniques should be:

1. suitable for youngsters between 14 and 18;

2. suitable for youngsters suffering from school burnout;

3. suitable for integration into a digital online environment running on smartphones.

3.2 Ethic Considerations

As academics and designers of a persuasive model and a habit-forming product, we need to think about the ethical aspects of our model. More in particular, we need to think about how to build such a habit-forming product in an ethical manner.

Earlier we explained ethics in persuasive technologies in general. In order to determine the ethical level of a habit-forming product, and create a persuasive model for the target audience in such a manner that is honest, fair and right, we need to take a look at the conclusions of what makes a habit-forming product truly ethical. Examining ethical aspects to be taken into account when designing a persuasive model provides us with the possibility to exclude unintended immoral conditions and forms in our persuasive system.

In general, ethics can be described as a rational scheme for determining right and wrong. This is usually done in the context of a certain system or activity (Berdichevsky & Neuenschwander, 1999). In the case of the Tickle project, the activity is engaging youngsters in playful learning. Referring to our study on ethics in persuasive technologies, our activity is active rather than passive. As a result, the whole persuasive model for the Tickle research project situates in the domain of active persuasive technology.

We could view the design of such a persuasive model, which may consist of design principles and a strategy to apply them, as a pool of risk factors. The larger the pool and the higher the risk to violate the factors, the greater the risk of having an ethically problematic habit-forming product (Berdichevsky & Neuenschwander, 1999).

In chapter 2 we defined three decisive elements to determine an answer on the ethical question of a persuasive act. These were: **the intent or motivation**, **the method or methods through which a persuader persuades**, and **the outcome of the persuasive act**. We consider each of them in more detail for the Tickle case:

The intent

It is argued that the act of persuasion always begins when the persuader implements a persuasive strategy that will be applied on the persuaded (Berdichevsky & Neuenschwander, 1999). Behind this act lies the intent. In the case of Tickle, we can state that the motivation of the persuader is to engage the persuaded in a playful learning environment and motivate him for learning.

The method

In our persuasive strategy we will use a method in which the persuaded parties do not realize that they are being persuaded, in order to maximize the effect. It is stated that knowledge about the existence of persuasive elements may influence the persuaded parties in an opposite way and expressively undermine the actual ethical goal of our persuasive system. In such cases, not disclosing the ethical persuasive act of a system is acceptable (Berdichevsky & Neuenschwander, 1999).

The outcome

Correspondingly, the user will be affected by the persuasive act, resulting in the outcome of persuasion. The outcome of a persuasive act can be determined by asking ourselves a question: do we consider the act as unethical to ourselves? If yes, then it is equally unethical to the persuaded. However, we would not consider it as unethical to be persuaded to learn. Therefore, we can agree that persuade youngsters to execute learning activities in a playful learning environment is ethical acceptable.

3.3 Relevant Persuasive Elements for Tickle's Persuasive Model

In this section, we will extract useful and relevant elements from the discussed persuasive models. These elements will be extracted taking into consideration the formulated requirements and constraints. In addition, we will describe ways in which Tickle could apply these elements in its environment in order to engage youngsters and allow them to benefit from an effective persuasive strategy.

To extract those relevant elements we use the different frameworks and models discussed in the previous chapter as the starting point. We start

by investigating how we could implement the core drives defined by the Octalysis Framework (section 3.3.1), next we investigate how we can integrate the Hooked Model into the Tickle environment (section 3.3.2), then we consider Fogg's Behavioral Model (section 3.3.3), and finally we extract useful elements from Cialdini's Science of Persuasion (section 3.3.4).

3.3.1 The Octalysis Framework

In chapter 2 we described the Octalysis framework through its eight core drives. It is stated that these core drives are the ones that motivate people to what they do (Chou, 2015). In this section, we examine these core drives and investigate how we can apply in Tickle's playful learning environment.

Epic Meaning

Epic Meaning in the first core drive in Octalysis. In Tickle's environment, we could activate this core drive by making the youngster part of a bigger society and let him play an active role in realizing the purpose given to this society. This way, the youngster will be more motivated since he or she feels that he or she is part of the environment.

On his website (Chou, 2013c), Chou mentions five game mechanics that can be used to incorporate epic meaning:

1. **Narrative**: in general the narrative provides some context to the activities. In Tickle, a true narrative is not foreseen but the context could be formulated as the goal to collect as many cards as possible, possibly of a certain type of topic, within the community to which the youngsters belong.

2. **Humanity Hero**: this game mechanic implies that one incorporates a world mission (e.g. helping poor people). For the moment, and given the target audience we think that this is less relevant.

3. **Elitism**: elitism instills group pride, which means that each member tries to secure the pride of the group by taking specific actions. In Tickle this could be achieved through introducing competition between groups.

4. **Beginner's Luck**: with Beginner's Luck, people feel like they have been one of the few chosen to take an action. In Tickle this could be realized by providing the youngster some special card giving them the feeling that they are special.

5. **Free Lunch**: with Free Lunch, the target user receives some freebies that normally cost money. However, the Tickle environment will be free of cost, therefore this mechanics is not applicable.

Another way in which Tickle can give meaning to a youngster is by giving him the feeling that he is the only person qualified to complete a given challenge within the given context/community. To achieve this a Tickle card could contain information about a challenge in which the youngster is personally addressed. Addressing the youngster personally can be done in two ways: either using the youngster's name, or using the word *you*, i.e. the second-person singular. Both types of addressing may be very powerful.

Accomplishment and Development

According to this core drive, people are driven by a sense of growth towards a goal and accomplishing it. To realize this usually gamification techniques such as points, badges, leaderboards, etc. are used. However, according to Chou, it is not because somebody sees progress towards the goal that he also feels accomplished. It is important to make sure that users are overcoming challenges where they can be proud of. So earning points or badges should not be too easy. Making the youngster proud of his achievements is also important for achieving the purpose of Tickle: reactivating youngsters for learning. Therefore, it is important to carefully design the challenges that the youngsters need to perform. They should not be too easy but also not be too difficult.

Furthermore, the Tickle environment could show the youngster information about his or her achievements. Accordingly, the youngster may feel that improvement and mastery is achieved. In addition, the environment could provide the youngster with the possibility to achieve short-term accomplishments which will result in short-term gratification. Such accomplishments should be relatively easy to achieve and prepare for the accomplishment of more complex challenges. To further drive the feeling of levelling up, Tickle's environment could work with levels when collecting cards. This will provide the possibility to address the youngster on his or her achievements and to increase the feeling of improvement and mastery achievement.

Another way for Tickle to emphasize accomplishment is by comparing the number of completed challenges of the current week with those of one week before, or with the number of challenges done by peers. If there is indeed an increase, then the youngster should be addressed on this: *"compared to*

last week, you completed x more challenges this week!". The same mechanism could be used in order to motivate to complete even more tasks. This means that a record should be tracked of the youngster's accomplishments.

Yet another way to motivate youngsters and bring in status based on accomplishment is the use of leaderboards. This mechanic is a rank of users based on a set of criteria that is influenced by the user's behavior towards the desired actions (Chou, 2013a). However, when using leaderboards in Tickle's playful learning environment, its design should be considered carefully, as incorrectly designed leaderboards may result in an opposite outcome than intended. In order to have properly designed leaderboards, we take into account that the youngster needs what is called urgent optimism, where the youngster feels optimistic that he or she can accomplish the task, but also urgent as he or she needs to act now (McGonigal, 2011).

In Tickle's environment we could use a leaderboard in the way of positioning the youngster in question right in the middle between a better performing youngster and a less better performing youngster (Chou, 2013a). This presentation is incredibly motivating as the youngster will eventually see the youngster who used to be below him suddenly surpasses him.

Empowerment of Creativity & Feedback

In order to use this core motivator, the environment should include activities and challenges that activate the youngster's sense of creativity. According to Chou, creativity is the evergreen formula to continually engage us at all moments in our lives but is also the hardest core drive to achieve. On his website (Chou, 2013b), Chou mentions different game techniques that could be used for implementing this core drive, such as Boosters, Milestone Unlock, Choices, but these are less applicable in the Tickle environment because Tickle is not a true game.

However, to realize this core drive, it is important to give the youngster freedom in searching and finding a solution for the given challenges. In such a scenario, the environment could provide the youngster with the basic building blocks to begin the challenge. At the same time it is important to provide the youngster with some useful feedback as he or she is performing the challenge. Another way to achieve creativity is allowing the youngster to create cards that can be made available to other users.

Ownership and Possession

This core drive is based on the principle that if somebody owns something, he or she wants to improve it, protect it, and get more of it.

Collecting cards is the mechanism used in Tickle to giving ownership to its youngsters. Another way is providing a system of virtual currency in the environment. When completing a challenge or a whole level, the youngster could earn a certain amount of coins of that virtual currency. Yet another recommendation is related to providing the youngsters with the possibility to create their own cards already mentioned in the core drive Empowerment of Creativity. Once the youngster reaches a certain level, he or she will have sufficient knowledge of the concept of a card. The youngster could then create own cards and provide it to Tickle's playful learning environment in order that other youngsters can collect those cards. This will also provide ownership. Using one or multiple mechanisms will give the youngster the feeling that he owns something, which will motivate him to improve it and get more of it.

Social Influence

This core motivator also appears in the other models that we will consider and therefore it wil be discussed in a later section in the form of motivation and ability. This core drive is based on the inevitable human desire to connect and compare with one another.

Here, we consider the fact that a youngster may think about his social status when making a decision. In section 3.3.3 we describe the idea behind this core motivator in more detail.

Scarcity and Impatience

This core drive is based on the fact that we are more motivated to get something that we are either unable to obtain immediately, or because it is scarce.

Tickle's environment could have a mechanism in which messages concerning invites to challenges are carefully formulated to create a sense of scarcity or to foster impatience (Goldstein, Martin, & Cialdini, 2008). Choosing a proper formulation of the challenge may activate the sense of scarcity and impatience. Perhaps, when the environment will make a new challenge available to the youngsters, this could be announced. For example: *"In 2 days a new challenge about ... will be available for you to perform"*. In addition to the activation of the sense of scarcity and impatience, this mechanism could

counteract the feeling of abundance. This feeling is not very motivating to our brains (Chou, 2013e). Having too many challenges available could result in disinterest.

By simply placing a limit on something, people may become motivated towards obtaining it. This is the nature of scarcity: by drawing the limits, it draws us towards the limit (Chou, 2013e). For Tickle it means that we could place a limit on the amount of challenges to be performed. However, this limit should not make Tickle's environment lose its key characteristics. Therefore a balance should be found in which the sense of scarcity could be activated by placing a limit on the challenges but does not necessarily limits the behavior.

Unpredictability and Curiosity

The Tickle environment already deals with this core drive as the challenge is only revealed when the player decides to collect the card. The card itself should not provide too much information on the challenge but enough to make the player curious. Unpredictability could be added by providing variable rewards as recommended in the Hook Model (see section 3.3.2). There might be information provided about winning a reward, getting extra points or levelling up, but not in terms of the content of a coming activity or challenge. This way, the youngster will be curious about what will happen next and this will make him or her wanting to complete the challenge or even the whole level.

Loss and Avoidance

This core drive is based on the fear of losing something or having undesirable events happening.

In the case of Tickle, this core drive can be implemented as follows. The target user could lose cards already collected (or points collected) if he is not active for a certain period of time, or he could lose the possibility to collect a certain card if he is not performing the challenge within a certain time period. Another possibility is that the youngster must collect a minimum amount of points within a certain period of time in order to survive (i.e. keep) the level he is in at that moment. Also, as suggested by Chou, the game mechanic Evanescent Opportunity can be applied. An Evanescent Opportunity is an opportunity that will disappear if the user does not take the desired action immediately (Chou, 2013d). In Tickle this could be a card that will disappear if the youngster does not directly decide to collect the card.

Summary

Note that in our opinion, the first three core motivators, Epic Meaning, Accomplishment & Development, and Empowerment of Creativity, are the most positive core motivators. These core motivators may give the youngster the feeling that he or she is being a part of something and therefore improvement grows using creativity. Along with the core motivators Social Influence and Ownership & Possession, we believe that these core drives are very powerful for the case of Tickle. This does not mean that the remaining three core drives are insignificant. These are very powerful motivators, but their effect may not be for the long-term. The use of these three core motivators, Scarcity and Impatience, Curiosity and Unpredictability, and Loss and Avoidance, should therefore be concentrated in specific situations during the card collection process.

3.3.2 The Hooked Model

The book Hooked describes a design pattern for building habit-forming products (Eyal, 2014). The idea is to connect a users' problem to a solution with enough frequency in order to form a habit. As mentioned, the Hook has four parts: a trigger, an action, a reward, and an investment. As we would like that using the Tickle environment becomes a habit for the youngsters, we believe that this model is relevant for the Tickle research project. For this reason, we discus how the different phases of the Hooked Model can be supported in Tickle.

The Trigger Phase

The first part in the hooked process is the trigger. In order to engage a youngster, we need a trigger to prompt the youngster to take action. In the case of Tickle, this can be done by sending invitations. This is the external trigger. This invitation could contain a button to start an activity in Tickle. It is important that this button clearly states what will happen next. When a youngster clicks on the button, he or she should already know what he or she will do, which is e.g. subscribe to a Tickle group, or browse cards, or receive some offers.

On the long-term, the youngster will immediately know the precise location of the button to engage and start an activity. This means that when the youngster feels the need to interact with Tickle's playful learning environment, he or she will select the corresponding button with little or no conscious thought. Thus, the information that the button presents is no longer impor-

tant. It is the emotion, formed by an association in the youngster's brain, that dictates what he or she will do next, which should be being engaged in Tickle's playful learning environment and start a challenge in order to collect the next card. This feeling good emotion should be Tickle's internal trigger.

Note that it is not required to have both external and internal triggers. It can be that an external trigger is sufficient for a certain product, though Tickle as a digital platform can benefit from both types of triggers to engage youngsters. Furthermore, we strongly recommend the use of internal triggers since they are slightly more persuasive than external triggers as they create an association in the youngster's brain, which is very powerful to form a long-term habit, as mentioned in the example above.

The Action Phase

Once the trigger presented the youngster what to do next, it is followed by the action. It is here where the habitual behavior occurs. As mentioned in chapter 2, the action is the simplest behavior done in anticipation of a reward. Here, Fogg's Behavioral Model (FBM) provides us with the likelihood a behavior will occur. For Tickle, this action phase will include browsing the cards and collecting cards. It is important to consider motivation and ability in this phase in order to increase the chances for a certain behavior to occur.

The Reward Phase

After the action occurred, it is time for the reward phase. We already stressed and motivated that variable rewards are of an important in a persuasive design, as variability causes people to focus and engage. This counts for Tickle too. One or several of the three types of rewards must be included in Tickle's playful environment in order to activate desire. The moment and the size of the rewards must vary in order to reinforce behavior. Increasing this variability during the whole process, will even manufacture more desire.

We discussed three types of rewards: rewards of the tribe, rewards of the hunt, and the rewards of the self. The first reward type, reward of the tribe (which is about seeking empathetic joy), is applicable in Tickle's environment. The environment might show who else is active at the moment; how many of the youngster's cards are collected by others, or which of the cards collected by the youngster are also collected by other youngsters.

A reward of the hunt on the other hand is about searching for resources. In Tickle the basic reward is the collection of a card, but this could also be

complemented with collecting points where the number of points collected could be variable. However, this type of reward can also be supported by allowing the target user to browse (possibly in different ways) for cards until he comes across a card that he would like to collect.

The third and last type of rewards is the reward of the self. These are rewards that are intrinsically pleasurable. We believe that this reward could be very powerful for Tickle, as it is about the search for mastery and control. However, these are rewards that do not come from other people and are not about material or information award.

The Investment Phase

The investment phase is the last phase of the hook model. Here, the aim is to increase the likelihood of the youngster's next pass through the hook. The idea is to make sure that the value of Tickle's environment to the youngster gets appreciated more and more. As we see in today's digital media, the more data a user provides to a certain data app, the more he can do with it. It means that the user invests with data in order to get a better service. For example, the more cards are collected by the player the more Tickle could unlock functionality. Also the performed challenges can be considered a form of investment, as well as the creation of own cards.

Another aspect useful in this phase is the value of reputation. Tickle's playful learning environment could include a reputation mechanism in which the youngster's actions, challenges and activities are reviewed and evaluated. These reputations should be accessible by other youngsters and therefore the target user would be inclined to protect his reputation. Moreover, once gained a positive reputation in an environment, one will not very likely leave such an environment.

3.3.3 BJ Fogg's Behavioral Model (FBM)

In this section, we look to Fogg's Behavioral Model (B. J. Fogg, 2009) in order to see whether we need to add extra elements to be in line with Fogg's theory.

Increasing Motivation

In the earlier explained Fogg's FBM model, we saw that motivation plays an important role in the process of persuasion. As explained, the aim is to cross the behavior activation threshold by increasing several elements, including

the user's motivation. In order to understand the concept of motivation, a framework with three core motivators was provided (see section 2.2.2). Of these three core motivators, i.e. Pleasure/Pain, Hope/Fear, and Social Acceptance/Rejection, we believe that both the second (Hope/Fear) and the third motivator (Social Acceptance/Rejection) are very useful for the Tickle environment. The first core motivator (Pleasure/Pain) is less applicable to Tickle's environment since it results in a primitive response, rather than having the user engaged in the environment with several interactions. This core motivator is mainly used in activities related to self-preservations (B. J. Fogg, 2009).

In the Hope/Fear motivator, hope is the anticipation of something good that will happen in the (near) future. On the contrary, fear is the anticipation of loss. It is stated that this dimension, i.e. Hope/Fear, is more powerful than Pleasure/Pain since it evidences in everyday behavior (B. J. Fogg, 2009). Regarding the BJ Fogg's FBM, we believe that hope is the most ethical and empowering core motivator in the framework. We noticed that hope and fear have long been powerful motivators in persuasive technology. For instance, people are motivated by fear when they install virus software, and they are motivated by hope when they join a certain community with other people of similar ages, interests, etc. (B. J. Fogg, 2009). Hope may be an important motivator for Tickle, as the nature of Tickle's environment is to be a platform where youngsters are challenged and where they can prove that they also have capabilities, something that may be important for the self-confidence of youngsters with school burnout or early school leavers.

Tickle's playful learning environment should be perceived by the youngsters as a community to connect and perform activities in a playful way. Especially the aspect of being a community could be very beneficial, as youngsters will then be motivated by hope for being recognized within this community.

Moreover, we could provide an interesting idea for Tickle's environment: assuming the achievements of the youngsters are tracked, a youngster could be presented a record of other youngster's points and achievements on challenges he also completed. This has a positive impact on both sides of the outcome of the comparison: if the other youngster's points are higher, the youngster will be motivated by hope to earn even more points in the future. If his or her points are higher, the youngster will feel improvement and will try to protect his or her status on Tickle's environment.

As for the third motivator, which is Social Acceptance/Rejection, we also look at the community that will be created by the Tickle environment. We

live in a digital era in which people tend to stay connected with friends and family using social networks. A lot of these social networks use mechanisms to control its user's social behavior. This is basically what this core motivator stands for: it is based on social acceptance and social rejection. A lot of social network users bear in mind their social status in the digital community. Users are motivated to do a certain effort or investment in order to win in social acceptance. The same counts for social rejection.

Therefore, this third motivator should also be included in Tickle's environment. Being part of a community is a powerful motivator, especially in the digital era we live in. Therefore, we believe that supporting the concept of a community in Tickle will be important.

Increasing Ability

According to Fogg's FBM, we also need to make sure that the user has the right level of ability to perform behavior. We can state that in general people, and our target audience in particular, show resistance to learning since it requires a certain amount of effort. For instance, providing a product that require people to learn new things to be able to use it will fail (B. J. Fogg, 2009). As a result, we need to make the activity or action easy in order to increase the ability of the user. This is fundamentally important for the Tickle environment. Furthermore, since learning activities will be included in Tickle's environment, we also need to make sure these elements are not difficult, but rather simple and enjoyable. This is in line with Mihaly Csikszentmihalyi's Flow Theory, which not only controls the amount, but also the difficulty of a challenge. There, it is stated that too much challenge in an activity may lead to anxiety. Too little challenge may lead to boredom (Nakamura & Csikszentmihalyi, 2014). This brings us to simplicity, which is a crucial ingredient for our persuasive design.

We already described six simplicity factors, i.e. time, money, physical effort, brain cycles, social deviance, and non-routine, which are crucial in designing persuasive products. We can state that each one of them should be considered in the design in order not to lose simplicity. In the next paragraphs, we will consider the six simplicity factors, also called resources, and relate them to the Tickle environment.

As designers of behavior change, we should seek to find what resource is scarcest for our audience. It could be time, or the ability, or any other discussed resource. In general, we can say that each person has a different simplicity profile. In some cases, we will observe that people have more time,

whereas some other people have more money. Some people can invest brain cycles, whereas other cannot. Thus, we see that these resources vary individually. However, they can also vary by the context. When a resource varies by the context, it means that a certain situation outside of the activity occurred that influence the resource. For example, one may, at a certain moment, have the time to perform a behavior. However, this person may find himself in lack of time due to some delay beyond his control. Subsequently, he lost the resource of time due to the context, which means that the behavior change may not occur. We can now state that simplicity is not just about finding a person's scarcest resource. It is about finding a person's scarcest resource at a given moment in time, namely the moment a behavior is triggered.

Once we found the person's scarcest resource, we can then focus on the barriers to perform the behavior and reduce them. Doing this, it is stated that persuasive succeeds faster when focusing on making the behavior simpler instead of trying to pile on motivation. People often resist attempts at motivation, but instead naturally love simplicity (B. J. Fogg, 2009).

We noticed that simplicity has different meanings based on a person's age. What simplicity means for a youngster is different than what it means to a much older person. This is because both have different resources in terms of the simplicity factors, i.e. time, money, ... Therefore we should strongly focus on the meaning of simplicity for youngster between the age of 14 to 18.

We should investigate every simplicity factor and check its relevance for the case of Tickle. This will help us determine what simplicity factors are more important than others. The first simplicity factor to examine is time. If a target behavior requires time and the user has lack of time, then the behavior is not simple. As time may also be context dependent, in general it is best to shape tasks and activities that do not take much of time to execute, making the behavior in general more simple. We recommend to consider time from the very beginning, when the youngster gets for the first time in touch with the playful learning environment of Tickle. Assuming the youngster needs to register and create an account, this process should not take more steps than necessary. Nowadays registering on a digital platform can be achieved in less than three clicks. As the youngster engages, this process of simplicity should be maintained in the whole Tickle experience.

Another aspect with respect to time is to make the youngster aware of the number of steps still to perform in order to complete the challenge, for example: "there are 2 steps more to ...". This way, if time is suddenly the

youngster's scarcest resource, the sentence above may motivate him or her to yet complete the challenge and collect the desired card since he or she knows the actual number of steps coming.

A youngster may misjudge the time needed to complete a challenge that requires displacement. It is therefore recommended to indicate the actual time needed to perform and complete the given challenge. The youngster will then be able to determine the possibility of performing the challenge and depending on the other resources, the behavior change may occur.

We believe that the resource of time could be decisive, especially with the involvement of a challenge that may require some more time as expected due to displacements. To exclude the resource of time, Tickle's environment could provide the youngsters with the ability to complete the current challenge at a later time.

Regarding the second simplicity factor, money, we can state that when a target behavior costs money and at the same time financial resources are limited, the target behavior is not simple. This simplicity factor is less relevant for our playful learning environment, as there will be no costs involved in order to use the environment.

The third discussed simplicity factor is physical effort. When a target behavior requires physical effort, it may not be simple. This factor is important for our case. Our playful learning environment may contain activities or operations that require the youngster to go to a certain place, such as a certain building or location. Here, we need to carefully investigate elements that could increase the physical effort. Such an element could be the distance the youngster will have to bridge, but also possible routes and transport manners for this factor.

The Tickle playful learning environment may introduce a mechanism in which challenges that require displacement are selected based on the current location of the youngster. Given that current location, the environment provides the youngster with the next location-based challenge that is located within a certain radius. Using such a mechanism, the youngster will never be presented a location-based challenge that is too far from the current location, decreasing physical effort and making the displacement easier.

Required brain cycles is another simplicity factor we explained earlier. A target behavior might not be simple if we require the user to think too hard. On the contrary, some people are very good at thinking and like

to be challenged. However, given our target audience, we should be very careful with this matter. In general, we should avoid activities that can be experienced by the youngsters as difficult. Instead, activities and challenges should be made simple and clear. In addition, the playful factor of Tickle's environment contributes to this manner.

The simplicity factor, called social deviance, is when someone goes against the social norm. This might prevent the target behavior happen. The playful learning environment of Tickle may contain an activity that challenges the youngster to execute an action in which the user might experience difficulties since there is a social price to pay, e.g. because the activity is not done in his or her social environment or because the user thinks that others will laugh at him. Therefore, we need to be careful in selecting activities. We should not provide activities for which the youngster has the feeling that there is a social price to pay.

The last simplicity factor is non-routine. When a behavior is done over and over again, it is experienced as simple. A non-routine behavior may be perceived as difficult. Subsequently, people will often stick to their routine in order to find simplicity. This does not mean youngsters should not be challenged to perform non-routine actions. But considering this simplicity factor it means that we should build up this experience step by step.

For example, there might be two successive activities that contain more or less similar actions to be carried out by the youngster. At the end of the second activity, an additional challenge could be added in order to prepare the youngster for the next challenges. Here, the current challenges as well as the next challenges will be perceived as simple by the youngster. At the same time the youngster is challenged by some additional actions as a preparation for the upcoming activities or levels. This implies that we should carefully consider the order in which the challenges are offered to the user.

The Trigger

Besides de importance of these simplicity factors, we also need to investigate the use of triggers in the case of Tickle. In section 2.2.2 we described several types of triggers (sparks, facilitators, and signals). The importance of a trigger is that it is recognized and associated with the target behavior. Important to note is that a trigger should be presented to the youngster at a moment when he can take action. Therefore, we must seek to design an appropriate use of triggers.

Since Tickle will use a device such as a computer or a mobile phone, triggers can be applied in a very direct way. As we use interactive technology, it is easy for the user to receive a trigger and perform the target behavior immediately. Note that this is not possible with traditional media such as a TV or newspapers, as the user then needs to change his context in order to perform the target behavior. This is the power of interactive technology. As designers of persuasive technologies, we need to take advantage of the possibilities interactive technology is providing us.

For instance, social networks such as Facebook and LinkedIn use email notifications to tell its user that he has been tagged in a certain post. The user can immediately click on a link in that email or notification to view the post. He is not required to change his context in order to perform the target behavior. It is this kind of trigger-behavior coupling that has never before been so powerful. Additionally, smartphones are becoming more and more context aware, resulting in the fact that the trigger-behavior coupling can go beyond what is possible on a desktop.

We must make a distinction between sparks and the other type of triggers. Fogg states that recipients will be most tolerant to triggers when they are signals or facilitators (B. J. Fogg, 2009). Sparks on the contrary may annoy the recipient because they seek to motivate and do something the user did not intend to do.

A youngster may receive an invitation in an email to join the community of Tickle's playful learning environment. Providing a link that redirects the youngster to the application in order to sign up, makes the whole process simple. Accordingly, the ability has increased.

Summary

In this section we discussed BJ Fogg's Behavioral Model (FBM). As a result, we identified certain elements that could be interesting to the realization of a persuasive model for Tickle. As for the motivation, we selected two core motivators: Hope/Pleasure and Social Acceptance/Rejection. For the ability, we concluded that the activity or action must be easy to perform. This led us to the six simplicity factors we discussed. Finally, we mentioned the importance of a trigger and the form in which it should be presented to the youngster.

3.3.4 Cialdini's Science of Persuasion

Another model we discussed in chapter 2 is Cialdini's Science of Persuasion (Cialdini, 2001). This model contains six principles for behavioral change. These are: Reciprocity, Scarcity, Authority, Consistency, Liking, and Consensus. We will further discuss each principle in relation to Tickle.

Reciprocity

The first principle, Reciprocity, is in our opinion a useful principle for Tickle. This principle means that people in general tend to give back to others the behavior or service that they have received before. The most important aspect here however, is to be the first to give. The environment of Tickle could start with providing some cards without the need to collect them first. This may increase the willingness of the target user to start collecting other cards.

Scarcity

Scarcity is the second behavioral change principle. It means that people want more of the things they can have less of. This principle and its possible applications in Tickle's environment has already been discussed in section 3.3.1.

Authority

The third principle is Authority. People get inspired by credible, well-informed people. We might think that this principle is less applicable in Tickle's environment. However, it could be useful to allow to add inspiring elements to cards. For example, a card might include a story of a famous person that already performed the challenge or a related challenge. This can inspire the youngster and subsequently convince him to collect the card.

Consistency

In general, people tend to be consistent with those things they have already said or done. Therefore, it might be interesting to show the youngster related activities that he already did in the past or to take a stand. Once a stand is taken, a natural tendency is activated to behave in ways that are consistent with the stand.

Liking

The next principle is Liking. People tend to like other people that are similar. In the context of Tickle, we need to look for areas of similarity that the youngsters share. Having this information, Tickle's environment should present a way to see similar users along with their interests and achievements. This may activate the user in order to perform additional actions or activities.

Consensus

The sixth and final principle is Consensus. This principle interfaces with the fifth principle, which is Liking. As mentioned, the presentation of interests and achievements of other similar youngsters may influence the user in determining his or her behavior. Pointing to other's actions and achievements is a powerful tool in persuasive design.

3.3.5 Conclusion

Different elements were considered for the design of an effective persuasive model. In this chapter, we started by identifying the requirements and constraints that are related to our target audience. Next we discussed the ethical aspects related to the use of persuasion in the context of Tickle and concluded that the use of persuasion is ethically acceptable. Next, we analyzed the different frameworks and models relevant for our persuasive model and identified several elements that can be applied in Tickle's playful learning environment and described ways to implement them in Tickle. An overview is given below.

Persuasive element	Possible way for implementation
Narrative Game Mechanic	Provide context on the fact that the goal is to collect as many cards as possible within the community to which the youngsters belong.
Elitism Game Mechanic	Introduce competition between groups.
Beginner's Luck Game Mechanic	Provide the youngster some special card giving him or her the feeling that he or she is special.
Meaning	Address the youngster personally

Balance in simplicity	Challenges should not be too easy but also not too difficult.
Achievement and Development	Show information about the youngster's achievements. Provide the youngster the possibility to achieve short-term accomplishments. Use levels for collecting cards. Provide the ability to compare the number of completed challenges of the current week with those of last week, or with the number of challenges done by peers.
Empowerment of Creativity and Feedback	Provide basic building blocks to begin a challenge. Provide the youngster with some useful feedback while performing a challenge.
Ownership and Possession	Provide a system of virtual currencies which a youngster could earn. Allow the youngster to create cards and make them available to other youngsters.
Scarcity and Impatience	Carefully formulate invitations to give a sense of scarcity or to foster impatience. Place a limit on the amount of challenges available in a given period of time.
Unpredictability and Curiosity	Provide variable rewards.

Loss and Avoidance	Losing collected cards when the youngster is not active on the environment for a certain period of time. Losing the ability to collect a special card if not completing a given challenge within a certain time period. Collecting a minimum amount of points in order to survive (i.e. keep) the current level. Disappearing card when not directly deciding to collect it.
Trigger	Send invitations to start a challenge. Provide a direct link in the invitation.
Reward	Show who else is active at the moment. Show how many cards were collected by other youngsters. Complement collecting cards with collecting variable points. Allow the youngster to browse for cards.
Investment	Unlock functionality when more cards were collected. Include a reputation mechanism.
Social Influence	Support the concept of a community in Tickle.

Ability	Provide a fast registration process. Make the youngster aware of the number of steps still to perform. Indicate the actual time needed to complete a challenge. Provide the ability to complete a challenge at a later time. Challenges requiring displacement should be selected based on the youngster's current location. Do not provide a challenge that gives the feeling of the existence of a social price to pay. Carefully consider the order of the challenges.
Reciprocity	Start by providing some cards without the need for collecting them.
Authority	Allow to add testimonials into the cards.
Consistency	Show the youngster the challenges he already did in the past.
Liking	Present a way to see similar users with their interests and achievements.

Table 3.1: An overview of identified persuasive elements for Tickle

Based on these techniques, a persuasive strategy should be designed for Tickle. In figure 3.1 we show Tickle's persuasive model map that was created in order to have an overview of the different persuasive elements of which Tickle's persuasive strategy should be composed.

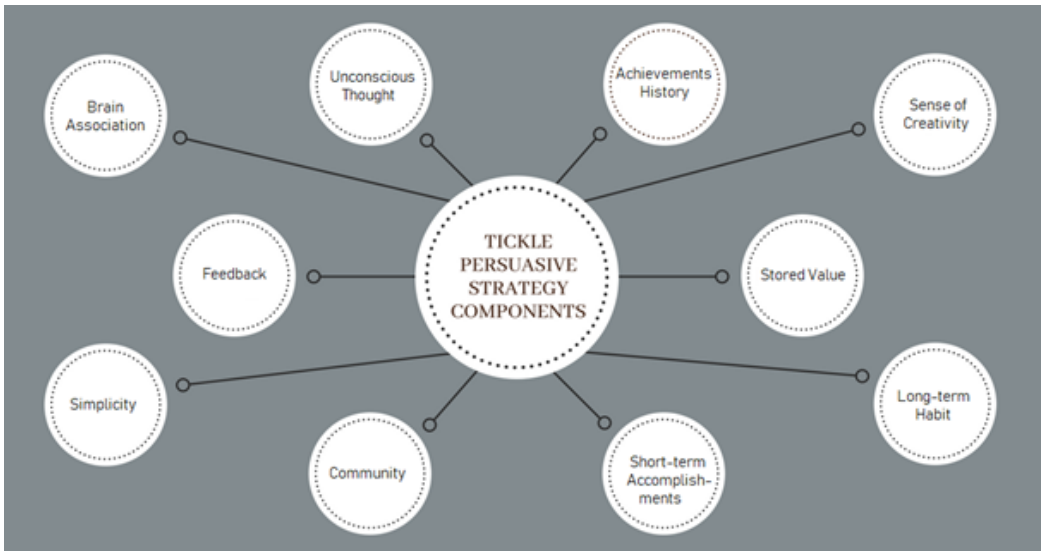

Figure 3.1: Tickle Persuasive Model Map

4

Towards a Tickle Persuasive Strategy

4.1 Introduction

The previous chapter we have identified different ingredients for a persuasive strategy for Tickle. To come to an effective persuasive strategy, these elements need to be combined and integrated into the Tickle card environment. Because the cards form an important aspect of the learning environment, we believe that in addition to the persuasive techniques we identified, we should also consider the way the cards are presented to the user in the persuasive strategy.

To be able to experiment with different presentation strategies, we developed a simulator. In this chapter, we firstly describe this simulator (section 4.2). Next, we explain different possible presentation strategies and how this simulator can be used for experimenting with those different presentations as part of a persuasive strategy (section 4.3). Finally, we present a first overall persuasive strategy for Tickle (section 4.4). We conclude the chapter with a summary (section 4.5).

4.2 The Tickle Simulator

Tickle's playful learning environment will contain cards containing learning activities and challenges to be performed by the youngsters. Once a challenge is completed, the youngster can collect the associated card. In principle, a large set of cards should be available to the youngsters. In order to be able to easily experiment with the presentation of such large card set and to allow to investigate the impact of different ways of presenting and offering cards, we developed the Tickle Simulator. This simulator generates different cards based on a finite set of information for every part of the card. This simulator is also useful to allow to experiment with different persuasive strategies for our set of persuasive techniques identified.

Since the simulator generates cards that show diverse information, we created data sets for each part of the card. The data used in the simulator relates to different locations showing information about the given region. Figure 4.1 shows an example of a used data set.

```
"links":
[
    ["Sister university", "Study at university"],
    ["University", "Brussels soccer team"],
    ["Art museum", "Brussels municipalities"],
    ["Touristic place", "Oldest monument", "Brussels municipalities"],
    ["Colourful garden", "Touristic place"],
    ["University", "Sister university"],
    ["Chocolate museum", "Instruments museum"],
    ["Highest point"],
    ["Highest point", "European Parliament", "European Commission"],
    ["Biggest park"],
    ["Touristic place", "European Commission"],
    ["Royal Palace", "Highest point", "River", "Biggest municipality"],
    ["Brussels Municipalities", "Highest point"],
    ["Brussels municipalities"],
    ["Brussels municipalities"],
    ["Sports center"],
    ["Touristic place", "European Parliament"],
    ["University", "Study at university"],
    ["Art museum", "Instruments museum"],
    ["Art museum", "Chocolate Museum"],
    ["education"],
    ["art"],
    ["art", "culture"]
]
```

Figure 4.1: Data set in the Tickle Simulator

In the course of creating a card different elements need to be gathered. This data is stored in several files as data sets. Every card has several parts of information. In terms of data storage, we created a data set for every part of information that can be represented on a card. These data sets are in the form of JSON files that are supported in the ReactJS environment in which the Tickle Simulator was developed.

It means that data sets were created that relate to the title or the description. This way, when using the simulator, an obvious distinction can be made between all the generated cards. It resulted in a practical representation of how the card could be represented in Tickle's playful learning environment.

We mentioned that several data sets were created. Below is an overview of data sets created in relation to their part on the card:

- A JSON file for descriptions of a card;
- A JSON file for mapping with the selected tags;
- A JSON file for mapping with the corresponding title;
- A JSON file that contains the card's metadata, such as the ID and type.

4.3 Persuasive Presentations

Tickle cards will form the basis of the playful learning environment. Cards will be collected by the youngsters after a small learning challenge has been completed. In order to stimulate the youngster to continue to collect cards (and thus perform learning activities), we believe that it is important that in addition to the persuasive techniques we identified for the Tickle environment in Chapter 3, we should also consider the way the cards are presented. This means that in our persuasive strategy we will also take into account the fact that Tickle's playful learning environment will consist of several forms of cards that can be collected.

We discuss two ways to implement a persuasive presentation in Tickle, on the level of an individual card (section 4.3.1) and on the level of the presentation of the card sets (section 4.3.2).

To explain the idea's we start by giving an example of a Tickle card (as generated by the simulator). Such an example is shown in figure 4.2. The starting point of the card is the title, followed by tags (e.g. art and culture),

a picture, and other components that contain information, like a description and some media.

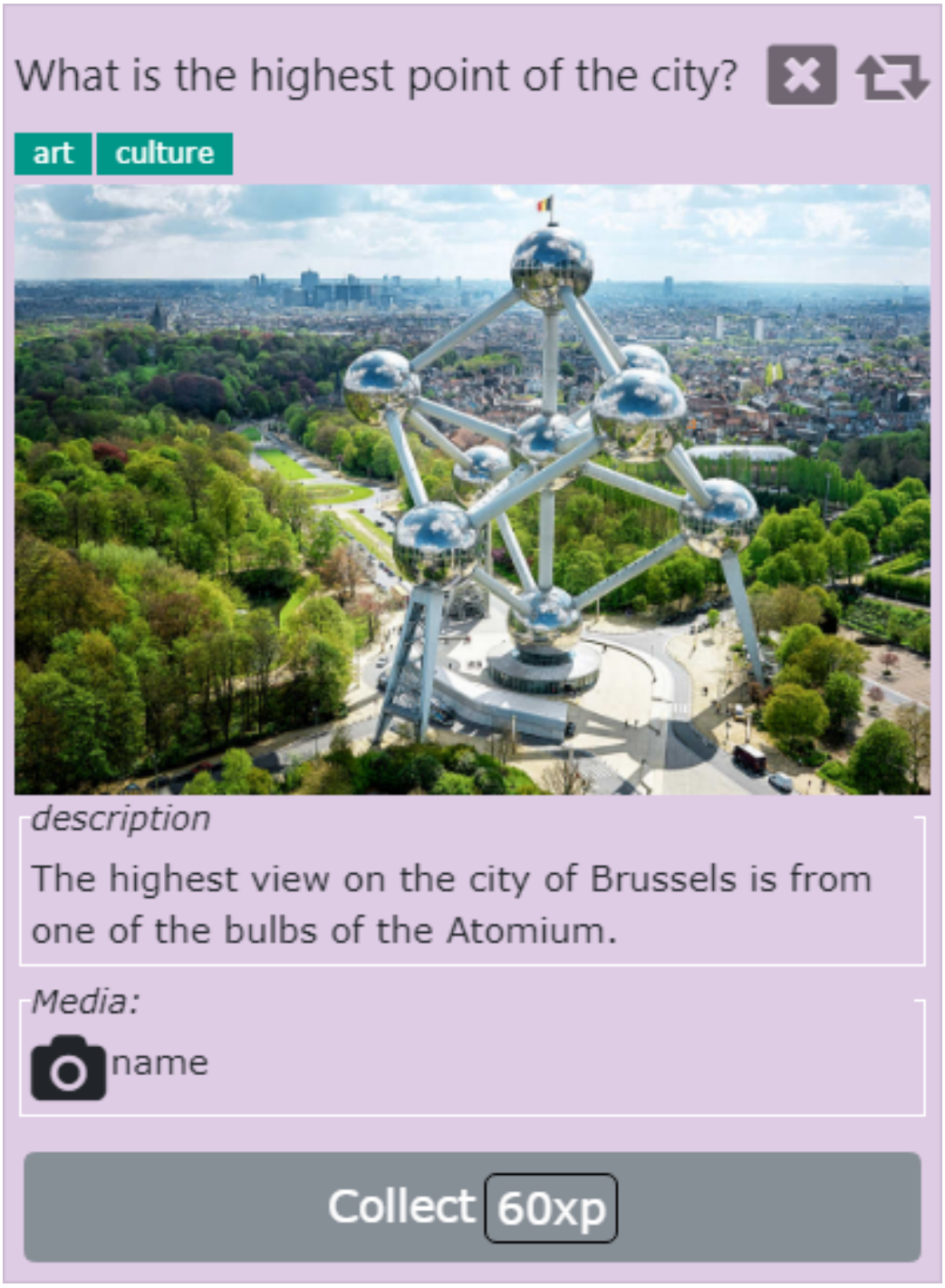

Figure 4.2: A Tickle card generated by the simulator

4.3.1 Persuasive Presentations of a Tickle Card

Adapting the card presentations

Taking into account the extracted persuasive elements in chapter 3, a mechanism could be implemented in which the card changes its presentation depending on the achievements of the youngster. Tickle's cards could be showed in different colors, each color with a given meaning. Perhaps the earlier mentioned levels can be expressed by the presentation of the cards. The higher the level, the more fancy the presentation of the card could be.

As the cards change, it is important to bear in mind the overall design of a card and the elements that show information. For example, the position of the title, the position of the page and the position of the description should stay the same. This is in order not to confuse the youngster. Since the card is to be collected, the information and its design should be clear to the youngster and at the same time appealing.

Designing own cards

At a certain level, the environment could make it possible to the youngster to design a Tickle card. This possibility is not just about creating own cards, but also having the tools to design it the way the youngster wants, within a given set of design principles. For this a template could be used where the youngster can enter the title, followed by the rest of the card's components: one or more tags, upload or select a picture from a given collection, and provide the card with a personalized design.

In relation to the possibility of designing own cards, a youngster could also be provided with the possibility to create a new tag. In first place, the obvious reason to create a new tag is because the new card does not relate to the available set of tags. In addition, the possibility to create new tags will result in a broad and diverse collection of Tickle cards.

This card creation functionality can result in three benefits: first, the youngster will feel he owns something as he created and designed a card. Secondly, the youngster will feel fulfilment as a result of the ownership feeling. Finally, as the youngster invested his or her time to design a card, he or she will have the feeling to protect and improve that card (Eyal, 2014).

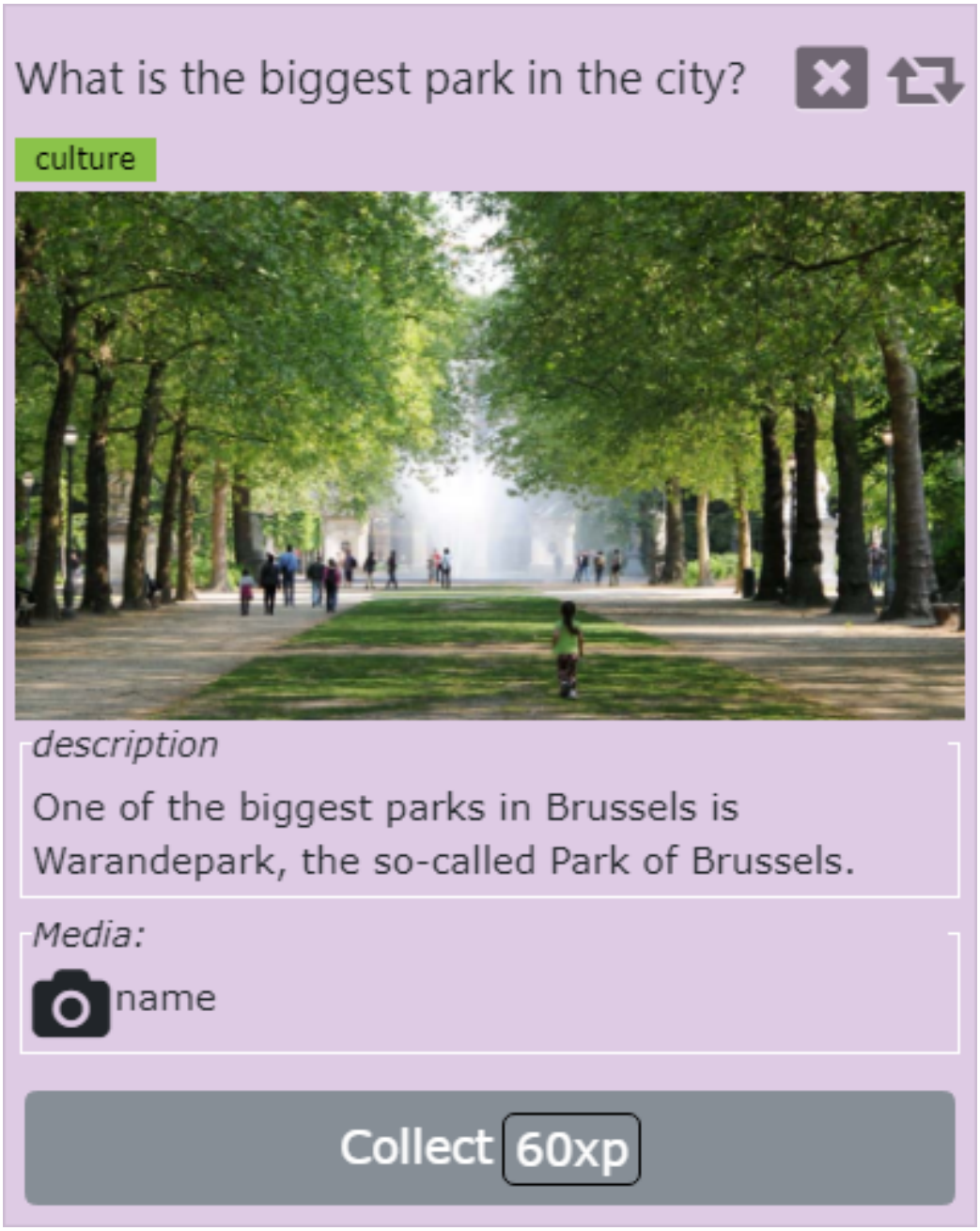

Figure 4.3: A Tickle card

Regarding this aspect, the environment should consider certain rules when providing the youngster with the ability to design own cards. Perhaps the youngster could select a picture of a given selection of pictures, the same as he or she can select one or more tags for the new card. This will not only draw borders of how a Tickle card is designed and avoid proliferation, but it will also guide the youngster during the process of the design.

Personalized cards in the Simulator

The simulator of Tickle already generates cards with a certain design (see figure 4.3). For the **adaptation of the card presentation**, we could implement a functionality in which the generated card adapts to a given design during the simulation. This will help us understanding the impact of presenting cards with different designs.

The proposed aspect of **designing own cards** could also be implemented in Tickle's simulator. This will help to understand what parts of the Tickle card we should consider when providing the youngster with the possibility to design own cards.

4.3.2 Persuasive Presentations of Tickle Card Sets

In figure 4.3, we also see that each card has one or more tags. In the Tickle simulator we worked with 11 tags:

- Architecture
- Art
- Culture
- Education
- History
- Library
- Nature
- Recreation
- Sports
- Tourism

- University

Locking tags

Regarding these tags, one could implement a structure in which at the beginning, most of the tags are locked. As the youngster is making progress by performing challenges and collecting cards, locked tags could get unlocked. This process should be visually supported. Note however that we need to be careful with such a system. When the youngster manages to unlock all the tags, it can give him or her the feeling that the challenges on Tickle's playful learning environment are all done, which in fact is not correct. Therefore, we need an effect that can counteract this idea.

This can be done by making sure that, once all tags are unlocked, another challenging mechanism comes in action. For example: *"You will be able to ... once all tags are unlocked"*. This is the concept of the reward, which will motivate the youngster and let him think what he might find the next time he engages with Tickle's environment. Note that the tags we used in the simulator are for testing purposes, i.e. for simulations. This set may change or can be extended in order to form the final set of tags for Tickle's playful environment.

Displaying by tag

Tickle's environment could have a mechanism in which the youngster is provided with the possibility to select a challenge based on a tag of the card. Perhaps the youngster notes that the cards he or she collected so far are from a limited collection of tags and prefers to expand his collections. In this case, the youngster will be motivated to further collect cards knowing that the card that will be collected will be of a certain preferred tag.

Presenting Card Sets in the Tickle Simulator

The aspect of **locking/unlocking tags** can easily be done in Tickle's simulator. In fact, after the development of the simulator, we generated cards based on a limited collection of tags. This was done by excluding the rest of the tags while generating a card (see figure 4.2, with tags art and culture). This could be assumed as the first part of the aspect, whereas the second part takes place in Tickle's environment as the youngster makes progress and manages to collect many cards from a certain tag.

The aspect of **displaying by tag** is similar to the locking of tags and can therefore easily be supported by the Tickle simulator.

4.4 A First Persuasive Strategy

In this section we describe a proposed persuasive strategy for Tickle's playful learning environment in terms of a process. We first define our strategic objective. Next, we describe the different steps of our proposed process that begins at the starting point where a youngster will be triggered to be involved into Tickle's playful learning environment and should be motivated to complete a challenge and collect a card.

4.4.1 Strategic Objective

To establish an effective strategy it is essential to formulate the strategic objective. Such a strategic objective is a long-term specific goal with a clearly stated outcome (Quezada, Cordova, Palominos, Godoy, & Ross, 2009). In the case of Tickle, the strategic objective it to activate the youngsters and keep them using the Tickle environment.

4.4.2 Persuasive Process

The persuasive process consists of the following steps:

Step 1: Inviting the youngster to Tickle's playful learning environment

The first step in our process of persuasion is involving the youngster in Tickle's playful learning environment. This can be done with an external trigger, such as sending an invitation to register on Tickle's environment. Once the youngster clicks on the invitation, he should be able to easily register on the environment.

Immediately after registering on the environment, a guide should be presented in which the most important aspects of the environment are explained, such as collecting cards, performing challenges, etc. This is called the Narrative Game Mechanic. As the youngster is registered on Tickle's playful learning environment, he can perform a challenge at any time and collect a card.

Step 2: Inviting the youngster to perform a challenge

The next step is to provide another trigger to stimulate the youngster to perform a challenge in the environment. Such a trigger could be a push notification, since the youngster is already known on the environment. Here, the aim is that the youngster will take the step to perform a challenge and collect a card. The goal is that on the long-term, such an external trigger is not needed anymore because it is replaced by an internal trigger.

If the youngster does not react on this trigger, the environment could present the youngster a card that can be collected without performing a challenge. Here, it is important that the youngster has to take an action in order to collect the free card, e.g. by going to the environment and actually select the card, instead of immediately storing the card on his record. In addition, the card to be given should be properly selected to catch the interest of the youngster.

Step 3: The process of performing challenges and collecting cards

In this phase we should try to create a frequent engagement of the youngster with the environment. Because it is then when the likelihood of forming new routines increases (Eyal, 2014).

As the youngster performs a challenge, he will be rewarded by a card. However, the card is not the only reward of Tickle, since collecting cards is the continuation of each challenge. This means that in addition to collecting a card, **a variable reward** must be implemented. Table 1 in chapter 3 shows several examples of such variable rewards. The place of such variable reward will vary in the process. It could be the type of card to be collected, or the comparison of achievements and points.

When the youngster does not collect many cards, there are 2 paths that could be followed.

- The first path is that of **scarcity**. This could be used to activate behavior change and may activate the sense of scarcity and urgency of the youngster (Goldstein et al., 2008). As mentioned, it can be applied on both the types of cards to be collected as well as the number of challenges than can be performed in a given period of time.

- The other path is that of **loss and avoidance**, where the youngster may lose collected cards or points.

Note that some of the elements and game mechanics we detailly described in chapter 3 are not situation-based, i.e. they can be used constantly during the process of performing challenges and accordingly collecting cards. This taking into account the balance between **abundance and scarcity**. Within the process, there could be moments of abundance of challenges to perform, and after a while a scarcity of challenges or cards to be collected. This way, after a moment of abundance, the feeling of scarcity will crawl up again, with new targets in challenges that the youngster cannot obtain yet (Chou, 2013e).

Figure 4.4 visualizes the roadmap followed to persuade a youngster to use the Tickle environment and to turn it into a habit. Phase 1 and 2 is realized by step 1; Phase 3 is covered by step 2. On a longer term this external triggering should result in Phase 4. Phase 5 and phase 6 are covered in step 3.

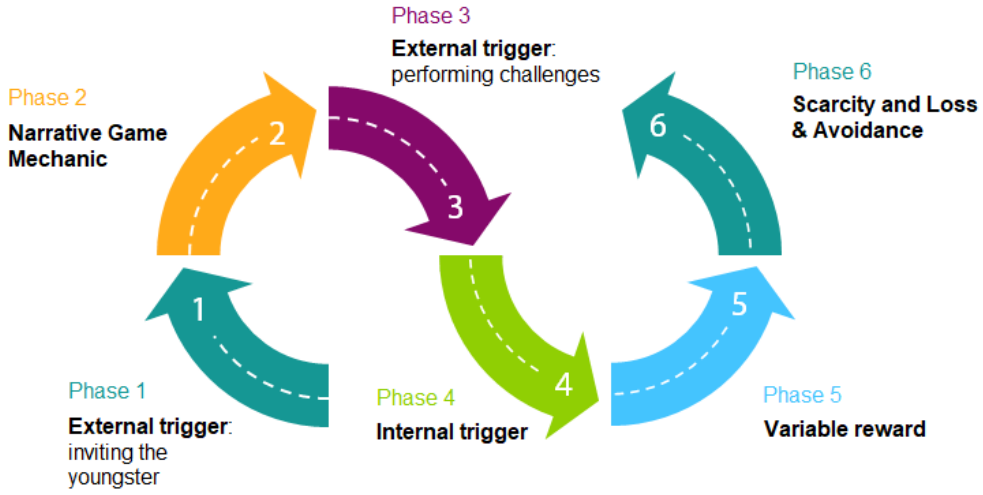

Figure 4.4: Tickle's Roadmap to hook youngsters on Tickle

4.5 Summary

An effective persuasive model allows for the design of a first persuasive strategy. In this chapter, the Tickle Simulator that is developed to allow to experiment with different persuasive techniques, especially persuasive presentations, was introduced. Next, we explained persuasive presentations in relation to a Tickle card and card sets. Finally, we described the design of a first persuasive strategy for Tickle in terms of a process that includes fundamental persuasive steps and taking into account the aim of Tickle.

5 Evaluation and results

In this chapter the evaluation of our persuasive strategy will be discussed. The purpose of this evaluation is to perform a first verification whether the different elements from the proposed persuasive strategy would be acceptable and effective for our target audience. It is argued in the literature that a pilot study is a useful tool to gain some first insights about how effective the described persuasive strategy could be. Pilot studies are often performed to gain insights in the feasibility of a given process or project, by performing a small scale study (Lazar, Feng, & Hochheiser, 2017).

The purpose of the evaluation is to gauge the opinion of potential Tickle users on the use of the different elements of the proposed persuasive strategy. The purpose is also to identify the elements that are most important to the facilitation of Tickle's persuasive strategy. To achieve this, a user study has been set up and a questionnaire has been composed. Section 5.1 describes the setup; section 5.2 explains the methodology, and section 5.3 gives the results. This is followed by a discussion (section 5.4)

5.1 Setup

To perform this evaluation, a user study with 7 participants was conducted. The age of the participants was between 14 and 18 years, corresponding with the target audience of Tickle. Also, 3 out of the 5 participants were ESL

youngsters at the moment of the study.

The study was performed in a closed setting and with the presence of an evaluator.

5.2 Methodology

The participant first received an in-depth presentation of the context. Then, the participant was invited to fill out a questionnaire. This was followed by an open discussion. In this way, the user evaluation was divided in two phases. As some participants speak Dutch and other speak French, both the in-dept presentation as well as the questionnaire were provided in the corresponding languages.

5.2.1 Explanation and presentation

The participant received a clear description of Tickle's playful learning environment in the form of a presentation. This presentation was done from a youngster's perspective and without going into the persuasive character of the system. Since the card forms a fundamental part of the environment, we also provided the participant with some cards that were generated by the Tickle simulator. It was explained that they should not only pay attention to the design of the card, but also keep in mind that the long-term purpose was to collect these cards after completing the associated challenge on the platform.

This phase took place individually in order to provide each participant with enough contextual information, in the proper language, and to give enough room for further questions. Then, the participant was given some questions to evaluate if he understood the context of Tickle (see next section).

5.2.2 Questionnaire and discussion

After the explanation, the participant was invited to fill out the questionnaire. Afterwards the participant was provided with the freedom to critique the matter in an open discussion session.

A set of statements was used to measure the opinion of the participant for different aspects of Tickle and its persuasive strategy. The participant

had to rate the statements on a scale from 1 to 5 (1 = strongly disagree; 5 = strongly agree).

The focus of the first set of statements is on assessing whether the participant had a good understanding of Tickle after the explanation. This was measured by the following statements:

- In order to be active on Tickle, I need to use a mobile phone
- I understand the role of the Tickle card in the whole process
- I understand the role of a challenge in the whole process
- It is clear to me what will happen if I complete a challenge

The second set of statements concerns the proposed persuasive strategy by evaluating it from different angles:

Time-oriented persuasion

- I would be demotivated if the registration process takes too much time before I can enter the environment
- A registration process should not take more than 3 minutes
- A small and clear explained purpose of a challenge will motivate me even more to complete the challenge
- When performing a small challenge I prefer to be able to complete the challenge in the same session
- It is important for me to be able to follow up on my challenge later if I cannot complete it at this moment

Social-oriented persuasion

- Having a feed on the platform on which I can browse for other's achievements is important for me
- I prefer to be able to relate my scores and achievements to other user's on the platform
- It is important for me to compare my achievements with my friend's
- It is important for me to be able to communicate with my friends through the Tickle platform

- A scoreboard will motivate me to surpass the youngster above me

Achievement and improvement-oriented persuasion

- It is important for me to be able to follow-up my scores and achievements on the environment
- It will motivate me if I have something on the platform that I created and can be used by other youngsters
- Playing with levels on Tickle's platform will motivate me to pursue higher levels
- I would like to have a challenge in which I can build something on my own, such as my own Tickle card

Open discussion

- What do you think of a daily overview of your achievements, such as the challenges you have performed or the cards you have collected?
- Do you want your achievements to be compared with those of other youngsters?
- What do you think about designing your own Tickle cards in the environment?
- How do you feel about a challenge in which you can help other youngsters?

5.3 Results

In what follows the results of the evaluation will be given. To check the consistency of the participants' answers, some of the questions were rephrased and also included in the questionnaire. No inconsistencies were found in the results for the questions that were rephrased.

The first set of questions was related to the use of digital media and mobile phone and the youngster's school attendance. All participants stated that they use digital media and a mobile phone multiple times a day. Four youngsters left school, i.e. ESL, and the remaining three participants still attend school at the moment of the evaluation.

On the first questionnaire that was taken after the presentation, the average result was 4,3 on the Likert Scale. These questions focus on the understanding of the concepts of Tickle's playful learning environment. See figure 5.1 for the results.

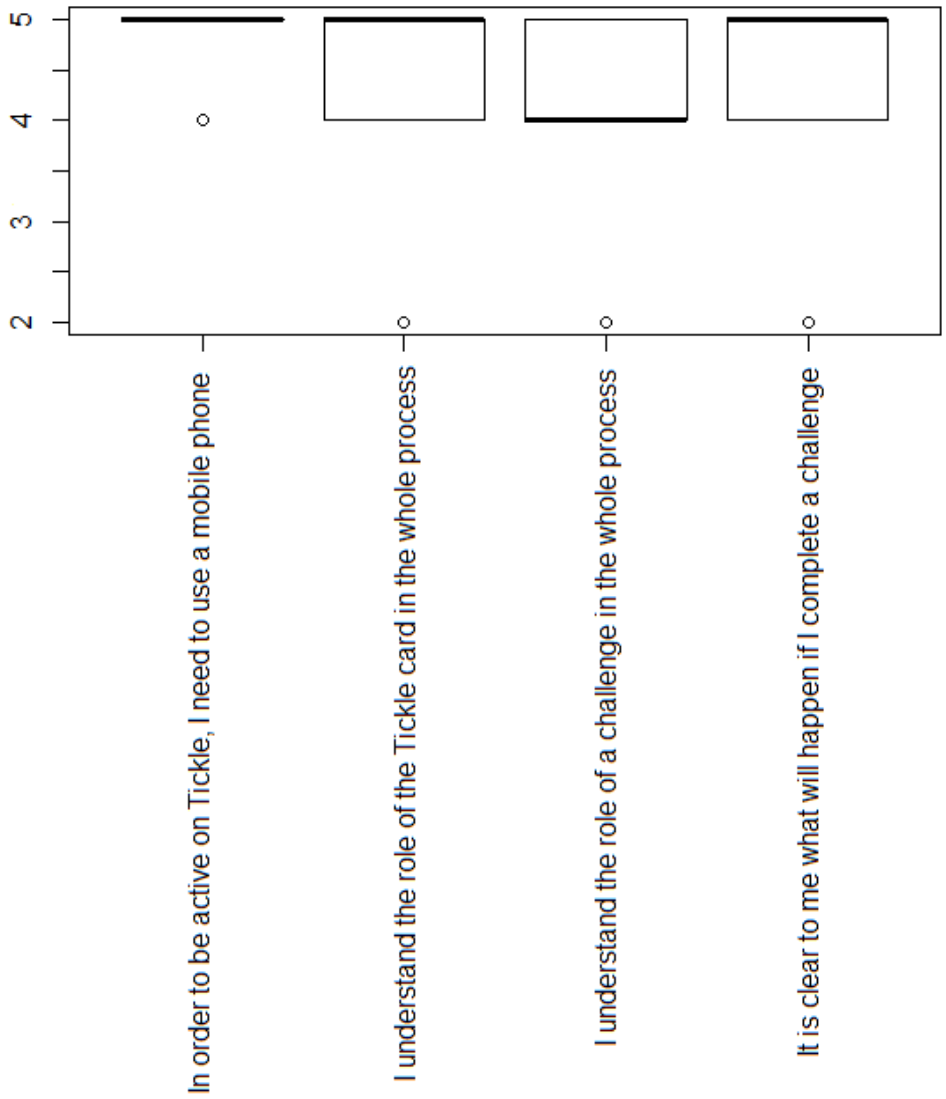

Figure 5.1: Box plot representation of the answers on the presentation questionnaire

In the second questionnaire the focus was on time-oriented persuasion. Here, the average score is 3.6. Figure 5.2 shows the results regarding this questionnaire.

The next questionnaire, with a focus on social-oriented persuasion received an average score of 3.5. A box plot representation of the answers provided for this questionnaire is shown in figure 5.3.

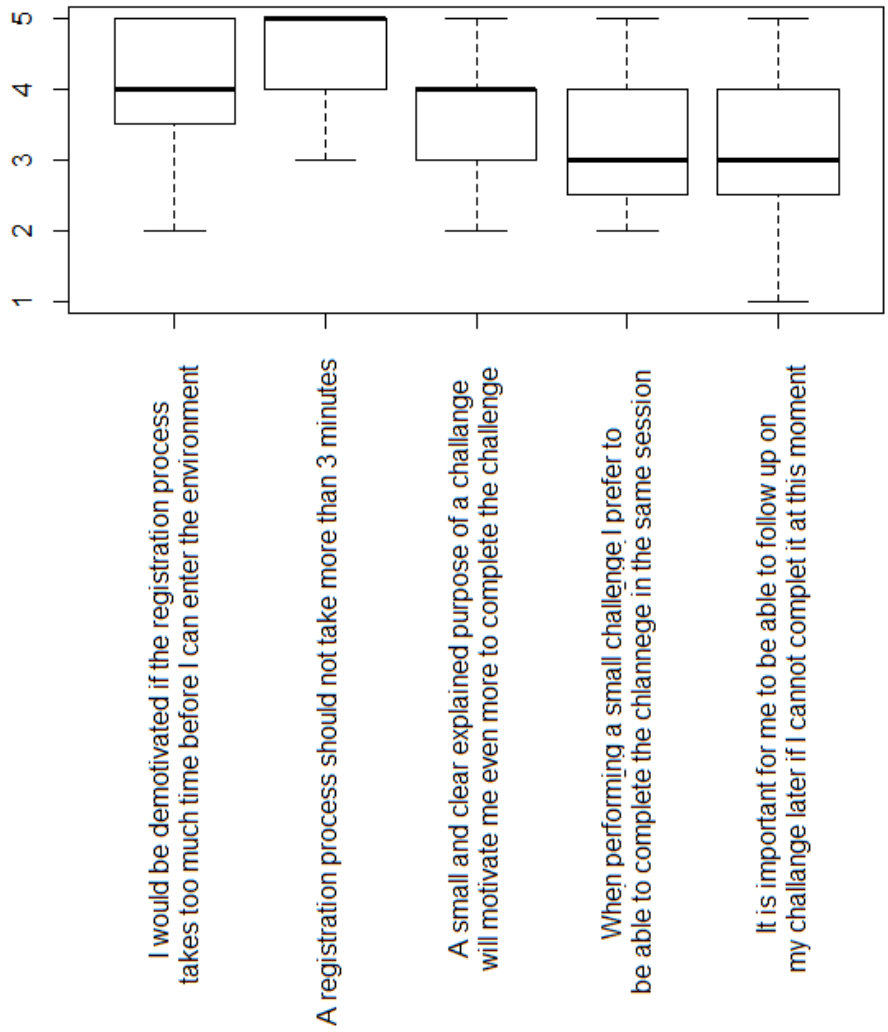

Figure 5.2: Box plot representation of the answers on the time-oriented persuasion questionnaire

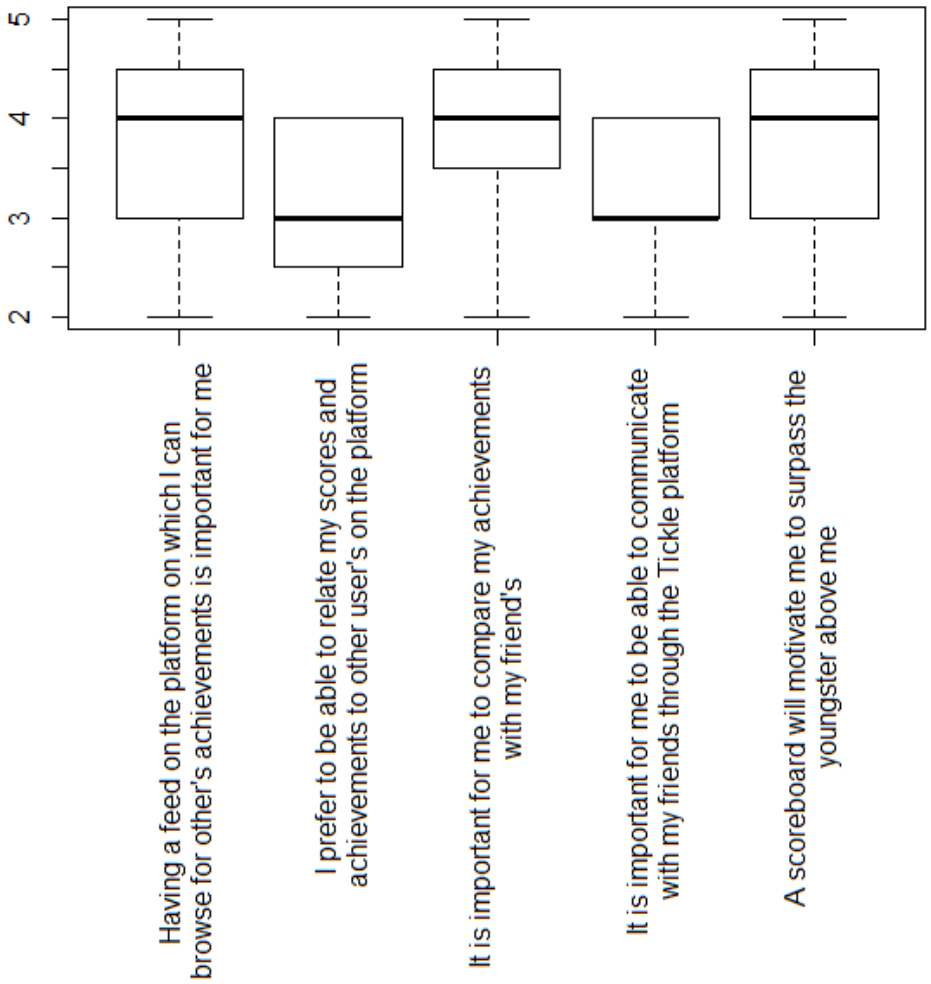

Figure 5.3: Box plot representation of the answers on the social-oriented persuasion questionnaire

The last questionnaire, which focusses on achievement and improvement-oriented persuasion received an average score of 4.1 on the Likert Scale. Figure 5.4 shows the boxplot representation.

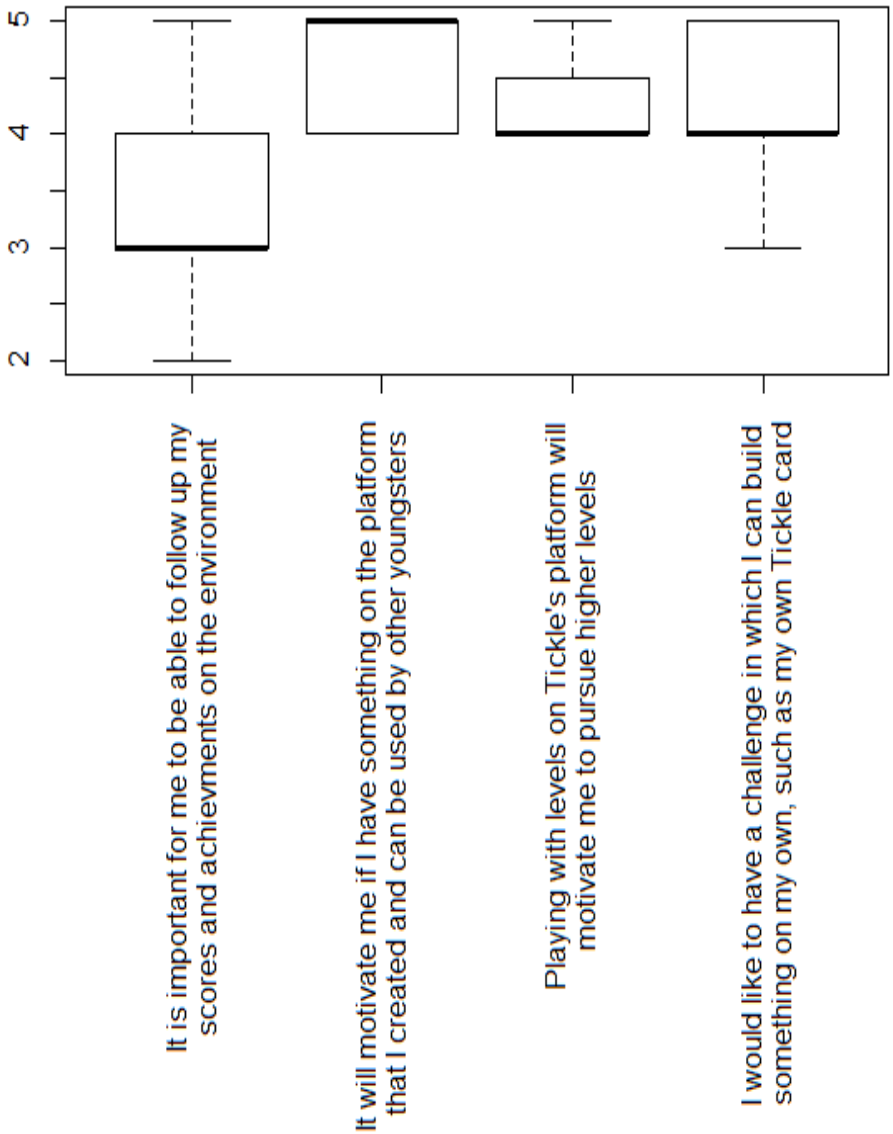

Figure 5.4: Box plot representation of the answers on the achievement & accomplishment-oriented persuasion

Regarding the four open questions, most participants answered that they would like to have a daily overview of their achievements, because they can then follow up their activities in the environment. On the question whether achievements should be compared with those of other youngsters, more than half of the participants replied positively.

The third open question relates to ownership with respect to designing own Tickle cards. Here, all participants showed interest in designing such cards on the environment and make these available for collection by other users. Finally, the last open question focusses on social influence & relatedness. Again, also here a majority wants to be involved in a challenge in which they can help other youngsters.

5.4 Discussion

The results of the questionnaire that was filled out after the presentation tell us that the participants had the feeling that they had a good understanding of Tickle's playful learning environment. The extra time that was made available after the presentation to offer room for further questions contributed to this.

The Time-Oriented Persuasion (TOP) achieved a relative good score (average of 3.6). We think it is mainly because processes that take more time than necessary may demotivate the user. Especially questions related to the time of registration received a convincing result.

The questionnaire regarding Social-Oriented Persuasion (SOP) received an almost similar score (3.5) as the TOP questionnaire. Questions that are related to comparisons between user's achievements scored very well, along with the question about the presentation of a scoreboard in the environment to motivate the user surpass the user above him, which received the best score.

Finally, the Achievement and Improvement-Oriented Persuasion (AIOP) questionnaire had the best score (4.1) of the four questionnaires. It shows that the use of levels, ownership in the form of designing own cards, and achievements in general are concepts that matter for youngsters to engage them in a community such as Tickle's.

In addition, we noticed a slight difference in the answers of ESL youngsters compared to the answers of youngsters that still go to school. The

biggest differences were noticed in the answers on questions about social aspects, in which ESL youngsters show more interest in being able to communicate through the environment and having the possibility to compare own achievements with other youngster's achievements. The questionnaire in which no line can be drawn between the answers of both categories is the AIOP questionnaire.

We also noticed that the participants were very devoted for participating in this evaluation. Despite the fact that these youngsters are ESL or in a phase that might result in being ESL, the youngsters showed enthusiasm and have a high reasoning ability. We believe that with enough motivation, these youngsters could achieve high marks in education. This is promising for Tickle, as this behavior could contribute to reaching Tickle's aim.

This pilot study provided us with useful information that show that the fundamentals of our proposed persuasive model could be a very powerful tool for Tickle. The result is encouraging because satisfying scores were obtained indicating what the proposed elements are applicable for Tickle's target audience. Of course further studies will be needed to confirm the findings.

6 Conclusion

6.1 Introducion

This final chapter concludes the dissertation by reflecting upon the work done for the design of a persuasive model for a playful learning environment, i.e. Tickle, and how an effective persuasive strategy could induce behavior change.

6.2 Summary

We started the thesis with a quote by philosopher John Dewey: *"The goal of education is to enable individuals to continue their education"*. This saying tells us that education is a process that should continue throughout the life of an individual. Education holds the key to a youngster's future, as it builds the foundations a youngster will rely on. It will enable the youngster to grow up in a strong, convincing, and successful way. Therefore, the way upon which education is brought to a youngster is of great importance.

Today's digital media and modern technologies enable us to further innovate regarding education and learning. In Tickle's playful learning environment, it is aimed to achieve this by using a playful environment in combination with the principles of persuasive technologies and gamification,

to increasing the intrinsic motivation and learning capacity of a youngster.

We live in a world full of persuasion. We are surrounded by attempts to change our behaviors, but we are not always aware of this. We believe that habit-forming technology can be used to help people live happier, healthier, engaged, and more productive lives. Especially for our target audience, youngsters with school burn out, we should apply a persuasive strategy in such a way that the users (i.e. the youngsters) are not aware of the fact that the environment is trying to persuade them to learn. Furthermore, we should use the persuasion in an ethical way and based on persuasion techniques that will be effective for our target audience. Only in this way, we can develop a platform for youngsters that they can use to enrich themselves with knowledge initially beyond their reach.

The first step of this work consisted of investigating related models and existing persuasive technologies. Some aspects were found to be interesting for Tickle. From the information we gathered during this research we extracted useful elements for the Tickle's case on which we would later on build our persuasive strategy. We opted to do this by describing the extracted elements in relation to the different aspects of Tickle's playful learning environment. For this purpose, we provided detailed descriptions on how the platform could use these persuasive techniques. This analysis part was followed by the design of a first persuasive strategy for Tickle, describing a process on how to combine the different techniques in a coherent strategy.

In addition to the elements extracted from our literature study, we also propose the use of persuasive presentations. We also describe the Tickle Simulator that we developed and which will allow us to experiment with different persuasive strategies in the future. Next, an evaluation was conducted to verify the validity and the acceptability of different elements of the persuasive strategy by the target audience. Most elements received a good score, giving a first indication that they could be effective. In addition, the evaluation shows which aspects of the strategy are of more importance than other aspects.

6.3 Limitations and Future Work

Despite the fact that the evaluation showed good results, the performed evaluation has its limitations. Only 7 participates were involved and no working system was available that the participants could use before giving their opinion. In order to evaluate the actual effect of the persuasive strategy and the

model in general on the target audience, the proposed strategy should be implemented in the environment and tested in a more large-scale experiment. Before doing this it could however be useful to first experiment a bit more with the proposed techniques by means of the Tickle Simulator as proposed in Chapter 4.

Although, we carefully analyzed the existing literature, it is also possible that we missed some relevant persuasive techniques while doing this literature study, and that we did not withdraw elements that could be relevant for the Tickle environment and its target audience. To check this, it would be good that peers review the work.

A Appendix

A.1 Source Code

A.1.1 Data Sets


```
{
    "tagged":
    [
        ["education", "culture"],
        ["education", "culture"],
        ["art", "culture", "education"],
        ["art", "culture"],
        ["art"],
        ["education"],
        ["art", "education"],
        ["art"],
        ["culture"],
        ["art"],
        ["culture"],
        ["culture"],
        ["education", "culture"],
        ["education", "culture"],
        ["culture"],
        ["culture"],
        ["education", "culture"],
```

```
        ["education"],
        ["art"],
        ["art", "culture"]
    ]
}
```

```
[   "The university is located in the district of Elsene.",
    "The sports center is located between building K and the
       university residences.",
    "The Royal Palace is located in the city center of
       Brussels next to Palais des Beaux-Arts, or Bozar.",
    "The highest view on the city of Brussels is from one of
       the bulbs of the Atomium.",
    "One of the biggest parks in Brussels is Warandepark, the
        so-called Park of Brussels.",
    "The university provides several places to study,
       including the library and the Center for Study
       Guidance.",
    "Several art museums are located in the city of Brussels.
        The main buildings are the Museum of Ancient Art and
       the Museum of Modern Art, both located in the downtown
        area on the Coudenberg.",
    "The Grand Place in the center of Brussels locates many
       historic buildings from the 17th century.",
    "The most touristic place in Brussels is the medieval
       square Grand Place.",
    "The most colourful garden in Brussels is the Floralia
       Park and the greenhouses at the castle of Groot-
       Bijgaarden.",
    "The name of the district that locates the European
       Parliament is called the European District.",
    "Brussels has a number of 19 municipalities.",
    "Brussels has a number of 1,139 million inhabitants.",
    "The name of the river that goes through Brussels is
       Zenne.",
    "The municipality Brussels-City is with its 32,6 kmÂš the
        biggest municipality of Brussels.",
    "The name of the most popular Brussels football team is
       RSC Anderlacht.",
    "The headquarters of the European Commission is called
       the Berlaymont Building.",
    "The sister university of the VUB is called ULB, short
       for UniversitÃĭ Libre de Bruxelles.",
    "The Chocolate Museum is located near The Grand Place.",
    "The museum of ancient music instruments is located
       between the Royal Palace and Bozar."]
```

```
{
  "nodes": [
    {
      "ID": "001",
      "title": "How can I reach the university",
      "location": {
        "latitude": "30.828797",
        "longitude": "7.352191"
      },
      "media": [
        {
          "type": "photo",
          "name": "reach the university",
          "src": ""
        },
        {
          "type": "sound",
          "name": "reach the university",
          "src": ""
        },
        {
          "type": "video",
          "name": "reach the university",
          "src": ""
        },
        {
          "type": "hyperlink",
          "name": "reach the university",
          "src": ""
        }
      ],
      "cardSets": [
        "study_material",
        "course",
        "reading"
      ],
      "linkedCards": [
        "",
        ""
      ],
      "date": "30/09/2017 10:00",
      "tags": [
        "University",
        "Library"
      ]
    },
    {
      "ID": "002",
      "title": "How to find the sports center",
```

```
    "location": {
      "latitude": "40.828797",
      "longitude": "9.352191"
    },
    "media": [
      {
        "type": "photo",
        "name": "find the sports center",
        "src": ""
      },
      {
        "type": "sound",
        "name": "find the sports center",
        "src": ""
      },
      {
        "type": "video",
        "name": "find the sports center",
        "src": ""
      },
      {
        "type": "hyperlink",
        "name": "find the sports center",
        "src": ""
      }
    ],
    "cardSets": [
      "sports"
    ],
    "linkedCards": [
      "",
      ""
    ],
    "date": "30/09/2017 10:00",
    "tags": [
      "Sports",
      "Recreation"
    ]
  },
  {
    "ID": "003",
    "title": "Where is the Royal Palace located",
    "location": {
      "latitude": "11.828797",
      "longitude": "5.352191"
    },
    "media": [
      {
        "type": "photo",
```

```
        "name": "find the Royal Palace",
        "src": ""
      },
      {
        "type": "sound",
        "name": "find the Royal Palace",
        "src": ""
      },
      {
        "type": "video",
        "name": "find the Royal Palace",
        "src": ""
      },
      {
        "type": "hyperlink",
        "name": "find the Royal Palace",
        "src": ""
      }
    ],
    "cardSets": [
      "culture"
    ],
    "linkedCards": [
      "",
      ""
    ],
    "date": "30/09/2017 10:00",
    "tags": [
      "History",
      "Art",
      "Architecture"
    ]
  },
  {
    "ID": "004",
    "title": "What is the highest point of the city",
    "location": {
      "latitude": "40.828797",
      "longitude": "20.352191"
    },
    "media": [
      {
        "type": "photo",
        "name": "find the highest point of the city",
        "src": ""
      },
      {
        "type": "sound",
        "name": "find the highest point of the city",
```

```
        "src": ""
      },
      {
        "type": "video",
        "name": "find the highest point of the city",
        "src": ""
      },
      {
        "type": "hyperlink",
        "name": "find the highest point of the city",
        "src": ""
      }
    ],
    "cardSets": [
      "explore"
    ],
    "linkedCards": [
      "",
      ""
    ],
    "date": "30/09/2017 10:00",
    "tags": [
      "Recreation",
      "Architecture"
    ]
  },
  {
    "ID": "005",
    "title": "What is the biggest park in the city",
    "location": {
      "latitude": "40.828797",
      "longitude": "17.352191"
    },
    "media": [
      {
        "type": "photo",
        "name": "find the biggest park in the city",
        "src": ""
      },
      {
        "type": "sound",
        "name": "find the biggest park in the city",
        "src": ""
      },
      {
        "type": "video",
        "name": "find the biggest park in the city",
        "src": ""
      },
```

```
      {
        "type": "hyperlink",
        "name": "find the biggest park in the city",
        "src": ""
      }
    ],
    "cardSets": [
      "sports"
    ],
    "linkedCards": [
      "",
      ""
    ],
    "date": "30/09/2017 10:00",
    "tags": [
      "Nature",
      "Recreation"
    ]
  },
  {
    "ID": "006",
    "title": "Where can I study at the university",
    "location": {
      "latitude": "40.828797",
      "longitude": "13.352191"
    },
    "media": [
      {
        "type": "photo",
        "name": "where to study at the university",
        "src": ""
      },
      {
        "type": "sound",
        "name": "where to study at the university",
        "src": ""
      },
      {
        "type": "video",
        "name": "where to study at the university",
        "src": ""
      },
      {
        "type": "hyperlink",
        "name": "where to study at the university",
        "src": ""
      }
    ],
    "cardSets": [
```

```
      "course",
      "exams"
    ],
    "linkedCards": [
      "",
      ""
    ],
    "date": "30/09/2017 10:00",
    "tags": [
      "University"
    ]
  },
  {
    "ID": "007",
    "title": "Where is the Art Museum located",
    "location": {
      "latitude": "22.828797",
      "longitude": "4.352191"
    },
    "media": [
      {
        "type": "photo",
        "name": "find the art museum",
        "src": ""
      },
      {
        "type": "sound",
        "name": "find the art museum",
        "src": ""
      },
      {
        "type": "video",
        "name": "find the art museum",
        "src": ""
      },
      {
        "type": "hyperlink",
        "name": "find the art museum",
        "src": ""
      }
    ],
    "cardSets": [
      "culture",
      "entertainment"
    ],
    "linkedCards": [
      "",
      ""
    ],
```

```
    "date": "30/09/2017 10:00",
    "tags": [
      "Art"
    ]
  },
  {
    "ID": "008",
    "title": "What is the oldest monument in the city",
    "location": {
      "latitude": "11.828797",
      "longitude": "17.352191"
    },
    "media": [
      {
        "type": "photo",
        "name": "find the oldest monument",
        "src": ""
      },
      {
        "type": "sound",
        "name": "find the oldest monument",
        "src": ""
      },
      {
        "type": "video",
        "name": "find the oldest monument",
        "src": ""
      },
      {
        "type": "hyperlink",
        "name": "find the oldest monument",
        "src": ""
      }
    ],
    "cardSets": [
      "culture"
    ],
    "linkedCards": [
      "",
      ""
    ],
    "date": "30/09/2017 10:00",
    "tags": [
      "Art",
      "Architecture"
    ]
  },
  {
    "ID": "009",
```

```
    "title": "What is the most popular touristic place",
    "location": {
      "latitude": "43.828797",
      "longitude": "15.352191"
    },
    "media": [
      {
        "type": "photo",
        "name": "find the most popular touristic place",
        "src": ""
      },
      {
        "type": "sound",
        "name": "find the most popular touristic place",
        "src": ""
      },
      {
        "type": "video",
        "name": "find the most popular touristic place",
        "src": ""
      },
      {
        "type": "hyperlink",
        "name": "find the most popular touristic place",
        "src": ""
      }
    ],
    "cardSets": [
      "entertainment"
    ],
    "linkedCards": [
      "",
      ""
    ],
    "date": "30/09/2017 10:00",
    "tags": [
      "Art",
      "Tourism",
      "Culture"
    ]
  },
  {
    "ID": "010",
    "title": "What is the most colourful garden in the city
       ",
    "location": {
      "latitude": "14.828797",
      "longitude": "18.352191"
    },
```

```
      "media": [
        {
          "type": "photo",
          "name": "find the most colourful garden in the city
              ",
          "src": ""
        },
        {
          "type": "sound",
          "name": "find the most colourful garden in the city
              ",
          "src": ""
        },
        {
          "type": "video",
          "name": "find the most colourful garden in the city
              ",
          "src": ""
        },
        {
          "type": "hyperlink",
          "name": "find the most colourful garden in the city
              ",
          "src": ""
        }
      ],
      "cardSets": [
        "culture"
      ],
      "linkedCards": [
        "",
        ""
      ],
      "date": "30/09/2017 10:00",
      "tags": [
        "Tourism",
        "Nature"
      ]
    }
  ],


{
    "links":
    [
        ["Sister university", "Study at university"],
        ["University", "Brussels soccer team"],
        ["Art museum", "Brussels municipalities"],
        ["Touristic place", "Oldest monument", "Brussels
```

```
            municipalities"],
        ["Colourful garden", "Touristic place"],
        ["University", "Sister university"],
        ["Chocolate museum", "Instruments museum"],
        ["Highest point"],
        ["Highest point", "European Parliament", "European
            Commission"],
        ["Biggest park"],
        ["Touristic place", "European Commission"],
        ["Royal Palace", "Highest point", "River", "Biggest
            municipality"],
        ["Brussels Municipalities", "Highest point"],
        ["Brussels municipalities"],
        ["Brussels municipalities"],
        ["Sports center"],
        ["Touristic place", "European Parliament"],
        ["University", "Study at university"],
        ["Art museum", "Instruments museum"],
        ["Art museum", "Chocolate Museum"],
        ["education"],
        ["art"],
        ["art", "culture"]
    ]
}


[   "In what district is the university located?",
    "How to find the sports center of the university?",
    "Where is the Royal Palace located?",
    "What is the highest point of the city?",
    "What is the biggest park in the city?",
    "Where can I study at the university?",
    "Where is the Art Museum located?",
    "What is the oldest monument in the city?",
    "What is the most popular touristic place?",
    "What is the most colourful garden in the city?",
    "What is the name of the district in which the European
        Parliament is located?",
    "Brussels consists of how many municipalities?",
    "How many inhabitants live in Brussels?",
    "What is the name of the river that flows through
        Brussels?",
    "What is the name of the biggest municipality of Brussels
        ?",
    "What is the name of the most popular Brussels football
        team?",
    "How is the building of the European Commission called?",
    "What is the name of the sister university of the VUB?",
    "Where is the Brussels Chocolate Museum located?",
```

```
    "Where is the museum of Ancient Arts located?"]
```

A.1.2 Cards

```
import React, { Component } from 'react';
import PropTypes, { bool } from 'prop-types';
import * as d3 from 'd3';
import styles from './index.scss';
import { Card } from '../cards';
import graph from './cardDataTest.json';
import titles from './cardTitles.json';
import descriptions from './cardDescriptions.json';
import tagmappings from './cardMappingTags.json';
import images from './cardImages.json';
import linkedCards from './cardLinks.json';
import { forceSimulation } from 'd3-force';

const tagCheckboxes = [];
let random = 0;
let tagArrayLen = 0;

class Generator extends Component {
  static propTypes = {
    children: PropTypes.node,
    className: PropTypes.string
  };

  constructor(props) {
    super(props);
    console.log('simulation links', graph);
    const width = 2100;
    const height = 800;

    const simulation = d3
      .forceSimulation()
      .nodes(graph.nodes)
      .force(
        'link',
        d3
          .forceLink()
          .links(graph.links)
          .id(d => d.ID)
          .distance(100)
      )
      .force('charge', d3.forceManyBody())
      .force('collide', d3.forceCollide().radius(12))
      .force('center', d3.forceCenter(width / 4, height / 2))
      .on('tick', () => {
        const nodes = graph.nodes;
        const links = graph.links;
        this.setState({ nodes, links });
```

```
      })
      .stop();

    this.onSubmit = this.onSubmit.bind(this);

    d3.range(0, 200).forEach(() => simulation.tick());
    const nodes = simulation.nodes();
    const links = graph.links;
    this.state = {
      nodes,
      links,
      width,
      height,
      hovered: null,
      myCardSetsFormData: [],
      myTagsFormData: [],
      explore: [],
      exists: true,
      newArr2: [],
      tagVar: 0
    };
  }

  onSubmit(cardSetsData, tagsData) {
    this.setState({ myCardSetsFormData: cardSetsData });
    this.setState({ myTagsFormData: tagsData });

    const newArr = [];

    for (let i = 0; i < tagmappings.tagged.length; i++) {
      let counter = 0;
      if (tagmappings.tagged[i].length === tagsData.length) {
        for (let j = 0; j < tagsData.length; j++) {
          if (tagsData[j] === tagmappings.tagged[i][j]) {
            counter++;
          }
        }
        if (counter === tagsData.length) {
          newArr.push(i);
        }
      }
    }
    tagArrayLen = newArr.length;
    this.setState({ tagVar: newArr[random] });
  }
  render() {
    const { nodes, links, width, height, hovered } = this.
       state;
    const color = d3.scaleOrdinal(d3.schemeCategory10);
```

```
    return (
      <div className={styles.simulatorDiv}>
        <div style={{ position: 'relative' }} />
        <Form onSubmit={this.onSubmit} />
        <div style={{ width: '400px', height: '600px' }}>
          {hovered && (
            <Card
              title={titles[this.state.tagVar]}
              tags={tagmappings.tagged[this.state.tagVar]}
              cardSets={this.state.myCardSetsFormData}
              description={descriptions[this.state.tagVar]}
              img={images[this.state.tagVar]}
              linkedCards={linkedCards.links[this.state.
                 tagVar]}
            />
          )}
        </div>
        <Graph
          width={width}
          height={height}
          nodes={nodes}
          links={links}
          color={color}
          hoverhandler={d => this.setState({ hovered: d })}
        />
      </div>
    );
  }
}

const Graph = ({ width, height, links, nodes, color,
   hoverhandler }) => (
  <svg width={width} height={height}>
    <g>
      <marker
        id="arrowhead"
        refX="13"
        refY="6"
        orient="auto"
        markerWidth="13"
        markerHeight="13"
      >
        <path d="M2, 2 L2,11 L10,6 L2, 2" />
      </marker>
      {links.map(d => (
        <line
          className={styles.link}
          x1={d.source.x}
          y1={d.source.y}
```

```
          x2={d.target.x}
          y2={d.target.y}
          markerEnd="url(#arrowhead)"
        />
      ))}
    </g>
    <g>
      {nodes.map(d => (
        <g
          className={styles.node}
          transform={`translate(${d.x}, ${d.y})`}
          onClick={() => hoverhandler(d)}
        >
          <circle r={10} fill={color(d.group)} />
        </g>
      ))}
    </g>
  </svg>
);

const options = ['Brussel-Centrum', 'Elsene', 'Etterbeek', '
   Evere'];

class Form extends Component {
  static propTypes = {
    children: PropTypes.node,
    className: PropTypes.string
  };

  constructor(props) {
    super(props);

    this.state = {
      explore: false,
      entertainment: false,
      reading: false,
      culture: false,
      art: false,
      education: false,
      value: 'Select a Location',
      random: '',
      myCardSetsFormData: '',
      sendThisCardSetsArray: [],
      sendThisTagsArray: [],
      testArray: []
    };
    this.handleInputChange = this.handleInputChange.bind(this
       );
    this.handleSubmit = this.handleSubmit.bind(this);
```

```
}

handleInputChange(event) {
  this.setState({ sendThisCardSetsArray: [] }); // empty
     the array after early submission
  this.setState({ sendThisTagsArray: [] }); // idem for
     this array
  const newCardSetsArray = [];
  if (this.state.explore) {
    newCardSetsArray.push('explore');
  }
  if (this.state.entertainment) {
    newCardSetsArray.push('entertainment');
  }
  if (this.state.reading) {
    newCardSetsArray.push('reading');
  }
  this.setState({ sendThisCardSetsArray: newCardSetsArray
     });

  const newTagsArray = [];
  if (this.state.art && !this.state.entertainment && !this.
     state.reading) {
    newTagsArray.push('art');
  }
  if (this.state.culture && !this.state.reading) {
    newTagsArray.push('culture');
  }
  if (
    this.state.education &&
    !this.state.explore &&
    !this.state.entertainment
  ) {
    newTagsArray.push('education');
  }
  this.setState({ sendThisTagsArray: newTagsArray });

  this.props.onSubmit(
    this.state.sendThisCardSetsArray,
    this.state.sendThisTagsArray
  );

  const target = event.target;
  const value = target.type === 'checkbox' ? target.checked
      : target.value;
  const name = target.name;

  this.setState({
    [name]: value
```

```
    });
  }

  handleSubmit(event) {
    random = Math.floor(Math.random() * tagArrayLen);
    alert(`Data: ${JSON.stringify(this.state)}`);
    event.preventDefault();
  }

  render() {
    return (
      <div className={styles.base}>
        <form onSubmit={this.handleSubmit}>
          <div> Card Generator for the Tickle Game </div>
          Cardsets:
          <div>
            <input
              type="checkbox"
              name="explore"
              id="explore"
              checked={this.state.explore}
              onChange={this.handleInputChange}
            />
            <label htmlFor="explore" className={styles.
                simulatorRightSpace}>
              Explore
            </label>
            <input
              type="checkbox"
              name="entertainment"
              id="entertainment"
              checked={this.state.entertainment}
              onChange={this.handleInputChange}
            />
            <label
              htmlFor="entertainment"
              className={styles.simulatorRightSpace}
            >
              Entertainment
            </label>
            <input
              type="checkbox"
              name="reading"
              id="reading"
              checked={this.state.reading}
              onChange={this.handleInputChange}
            />
            <label htmlFor="reading" className={styles.
                simulatorRightSpace}>
```

```
    Reading
  </label>
</div>
Tags:
<div>
  <input
    type="checkbox"
    name="culture"
    id="culture"
    checked={this.state.culture}
    onChange={this.handleInputChange}
    hidden={
      (!this.state.explore || !this.state.
         entertainment) &&
      this.state.reading
    }
  />
  <label
    htmlFor="culture"
    hidden={
      (!this.state.explore || !this.state.
         entertainment) &&
      this.state.reading
    }
    className={styles.simulatorRightSpace}
  >
    Culture
  </label>
  <input
    type="checkbox"
    name="art"
    id="art"
    checked={this.state.art}
    onChange={this.handleInputChange}
    hidden={
      !this.state.explore &&
      (this.state.entertainment || this.state.
         reading)
    }
  />
  <label
    htmlFor="art"
    hidden={
      !this.state.explore &&
      (this.state.entertainment || this.state.
         reading)
    }
    className={styles.simulatorRightSpace}
  >
```

```
    Art
  </label>
  <input
    type="checkbox"
    name="education"
    id="education"
    checked={this.state.education}
    onChange={this.handleInputChange}
    hidden={
      !this.state.reading &&
      (this.state.entertainment || this.state.
         explore)
    }
  />
  <label
    htmlFor="education"
    hidden={
      !this.state.reading &&
      (this.state.entertainment || this.state.
         explore)
    }
    className={styles.simulatorRightSpace}
  >
    Education
  </label>
</div>
<div className="form-group">
  <label htmlFor="location">
    Select a Location
    <select
      id="location"
      name="value"
      value={this.state.value}
      onChange={this.handleInputChange}
      className="form-control"
    >
      {options.map(option => (
        <option value={option} name={option}>
          {option}
        </option>
      ))}
    </select>
  </label>
</div>
<input
  className={styles.simulatorSubmit}
  type="submit"
  value="Enter"
/>
```

```
        </form>
      </div>
    );
  }
}

export default Generator;
```

```
.base {
  border: lightblue 4px solid;
}

.link {
  stroke: rgb(113, 40, 128);
  stroke-width: 2;
}

.node:hover {
  stroke: green;
  stroke-width: 5px;
}

.simulatorInput,
select {
  width: 100%;
  padding: 12px 20px;
  margin: 8px 0;
  display: inline-block;
  border: 1px solid #ccc;
  border-radius: 4px;
  box-sizing: border-box;
}

.simulatorSubmit[type="submit"] {
  width: 100%;
  background-color: #4caf50;
  color: white;
  padding: 14px 20px;
  margin: 8px 0;
  border: none;
  border-radius: 4px;
  cursor: pointer;
}

.simulatorSubmit:hover {
  background-color: #45a049;
}
```

```
.simulatorInput:focus {
  border: 3px solid #555;
}

.simulatorDiv {
  border-radius: 5px;
  background-color: #f2f2f2;
  padding: 20px;
}

.simulatorRightSpace {
  margin-right: 15px;
}

.cardTitle h1 {
  text-align: center;
  color: rgb(61, 59, 59);
  font-family: "Courier New", Georgia, Serif;
  font-weight: bold;
}
```

A.2 Evaluation Presentation

TICKLE

Een korte presentatie

Hassan Haddouchi

Wat is Tickle?

Een **app** waarop je leuke en eenvoudige **uitdagingen** kunt uitvoeren.

Wat heb ik nodig om Tickle te gebruiken?

Je hebt je enkel een **smart phone** nodig met een **internetverbinding**.

Wat gebeurt er na het uitvoeren van een uitdaging?

Dan krijg je een **Tickle kaart**.
Deze mag je dan bijhouden.
De bedoeling is om **zoveel mogelijk** kaarten te **verzamelen**.

Wie gebruikt Tickle?

Tickle is voor tieners die graag **nieuwe uitdagingen** uitvoeren om **kaarten** te **verzamelen**.

What is the highest point of the city?

art culture

description

The highest view on the city of Brussels is from one of the bulbs of the Atomium.

Media:

name

Collect 60xp

ZO ZIET EEN TICKLE KAART ERUIT

A.3 Questionnaire

Presentation Session

Name (optional):

Age:

Gender:

- Male
- Female

I use digital media and mobile phone:

- Multiple times a day
- Once a day
- Multiple days a week
- Once a week
- Less regularly

At this moment, I am a student attending school: Yes / No

If yes:

- I go to school with enthusiasm Yes / No
- I am not planning to leave school before I receive my certificate Yes / No

If no:

- I left school because the learning activities were not interesting to me Yes / No
- I left school because I don't like studying Yes / No

Additional comments (optional):

…….

…….

…….

	Strongly Disagree	Disagree	Neither Disagree Nor Agree	Agree	Strongly Agree
In order to be active on Tickle, I need to use a mobile phone.	1	2	3	4	5
I understand the role of the Tickle card in the whole process.	1	2	3	4	5
I understand the role of a challenge in the whole process.	1	2	3	4	5
It is clear to me what will happen if I complete a challenge.	1	2	3	4	5

Time-Oriented Persuasion

	Strongly Disagree	Disagree	Neither Disagree Nor Agree	Agree	Strongly Agree
I would be demotivated if the registration process takes too much time before I can enter the environment.	1	2	3	4	5

A registration process should not take more than 3 minutes	1	2	3	4	5
A small and clear explained purpose of a challenge will motivate me even more to complete the challenge.	1	2	3	4	5
When performing a small challenge I prefer to be able to complete the challenge in the same session.	1	2	3	4	5
It is important for me to be able to follow up on my challenge later if I cannot complete it at this moment	1	2	3	4	5

Social-Oriented Persuasion

	Strongly Disagree	Disagree	Neither Disagree Nor Agree	Agree	Strongly Agree
Having a feed on the platform on which I can browse for other's achievements is important for me.	1	2	3	4	5
I prefer to be able to relate my scores and achievements to other user's on the platform.	1	2	3	4	5

It is important for me to compare my achievements with my friend's.	1	2	3	4	5
It is important for me to be able to communicate with my friends through the Tickle platform.	1	2	3	4	5
A scoreboard will motivate me to surpass the user above me.	1	2	3	4	5

Achievement and Improvement-Oriented Persuasion:

	Strongly Disagree	Disagree	Neither Disagree Nor Agree	Agree	Strongly Agree
It is important for me to be able to follow-up my scores and achievements on the environment.	1	2	3	4	5
It will motivate me if I have something on the platform that I created and can be used by other youngsters.	1	2	3	4	5
Playing with levels on the Tickle's platform will motivate me to pursue higher levels.	1	2	3	4	5

I would like to have a challenge in which I can build something on my own, such as my own Tickle card.	1	2	3	4	5

Open discussion:

- What do you think of a daily overview of your achievements, such as the challenges you have performed or the cards you have collected?
- Do you want your achievements to be compared with those of other youngsters?
- What do you think about designing your own Tickle card on the environment?
- How do you feel about a challenge in which you can help other youngsters?

References

Andersen, K. E. (1978). *Persuasion: Theory and practice*. Allyn & Bacon.

Berdichevsky, D., & Neuenschwander, E. (1999). Toward an ethics of persuasive technology. *Communications of the ACM*, *42*(5), 51–58.

Chou, Y.-k. (2013a). *The 8 core drives of gamification (#1): Development and accomplishment.* https://yukaichou.com/gamification-study/8-core-drives-gamification-2-development-accomplishment/. (Accessed: 2018-07-30)

Chou, Y.-k. (2013b). *The 8 core drives of gamification (#1): Empowerment of creativity & feedback.* https://yukaichou.com/gamification-study/8-core-drives-gamification-3-empowerment-creativity-feedback/. (Accessed: 2018-07-30)

Chou, Y.-k. (2013c). *The 8 core drives of gamification (#1): Epic meaning and calling.* http://web.archive.org/web/20080207010024/http://www.808multimedia.com/winnt/kernel.htm. (Accessed: 2018-07-30)

Chou, Y.-k. (2013d). *The 8 core drives of gamification (#1): Loss & avoidance.* https://yukaichou.com/gamification-study/8-loss-and-avoidance/. (Accessed: 2018-07-30)

Chou, Y.-k. (2013e). *The 8 core drives of gamification (#1): Scarcity & impatience.* https://yukaichou.com/gamification-study/8-core-drives-gamification-6-scarcity-impatience/. (Accessed: 2018-07-30)

Chou, Y.-k. (2015). *Actionable gamification: Beyond points, badges, and leaderboards*. Octalysis Group.

Cialdini, R. B. (2001). The science of persuasion. *Scientific American*, *284*(2), 76–81.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining "gamification". In *Proceedings of the 15th international academic mindtrek conference: Envisioning future media environments* (pp. 9–15). New York, NY, USA: ACM. Retrieved from http://doi.acm.org/10.1145/2181037.2181040 doi: 10.1145/2181037.2181040

De Troyer, O., & Vlieghe, J. (2016). Tickle Report D2 : State-of-the-art on Early School Leaving and Dropouts. , 61. Retrieved from https://wise.vub.ac.be/tickle/wp-content/uploads/2015/12/TICKLE-Report-D2_final.pdf (VUB)

De Troyer, O., & Vlieghe, J. (2017). Tickle Report D3 : Literature study on Persuasive Techniques and Technology. , 46. Retrieved

from https://wise.vub.ac.be/tickle/wp-content/uploads/2015/12/Report-D3_final.pdf (VUB)

Eyal, N. (2014). *Hooked: How to build habit-forming products*. Penguin.

Fogg, B. (1997). Captology: the study of computers as persuasive technologies. In *Chi'97 extended abstracts on human factors in computing systems* (pp. 129–129).

Fogg, B. J. (2009). A behavior model for persuasive design. In *Proceedings of the 4th international conference on persuasive technology* (p. 40).

Friedman, B., & Kahn Jr, P. H. (1992). Human agency and responsible computing: Implications for computer system design. *Journal of Systems and Software*, *17*(1), 7–14.

Goldstein, N. J., Martin, S. J., & Cialdini, R. (2008). *Yes!: 50 scientifically proven ways to be persuasive*. Simon and Schuster.

Kangas, M. (2010). Creative and playful learning: Learning through game co-creation and games in a playful learning environment. *Thinking Skills and Creativity*, *5*(1), 1 - 15. Retrieved from http://www.sciencedirect.com/science/article/pii/S1871187109000704 doi: https://doi.org/10.1016/j.tsc.2009.11.001

Klaff, O. (2011). *Pitch anything: An innovative method for presenting, persuading and winning the deal*. McGraw-Hill.

Lazar, J., Feng, J. H., & Hochheiser, H. (2017). *Research methods in human-computer interaction*. Morgan Kaufmann.

McGonigal, J. (2011). *Reality is broken: Why games make us better and how they can change the world*. Penguin Group , The.

Nakamura, J., & Csikszentmihalyi, M. (2014). The concept of flow. In *Flow and the foundations of positive psychology* (pp. 239–263). Springer.

Quezada, L. E., Cordova, F. M., Palominos, P., Godoy, K., & Ross, J. (2009). Method for identifying strategic objectives in strategy maps. *International Journal of Production Economics*, *122*(1), 492 - 500. Retrieved from http://www.sciencedirect.com/science/article/pii/S0925527309002138 (Transport Logistics and Physical Distribution Interlocking of Information Systems for International Supply and Demand Chains Management ICPR19) doi: https://doi.org/10.1016/j.ijpe.2009.06.019

Shade, L. R. (1999). Morality and machines: Perspectives on computer ethics. stacey l. edgar. *Ethics and Information Technology*, *1*(1), 71–73.

Vlieghe, J. (2014). Literacy in a Social Media Culture: An Ethnographic Study of Literary Communication Practices. *Samenst. Ronald Soetaert*.

Retrieved from http://emsoc.be/wp-content/uploads/2014/11/Literacy-in-a-social-media-culture.-An-ethnographic-study-of-literary-communication-practices.pdf doi: 10.13140/RG.2.1.5149.9685