

THESIS / THÈSE

MASTER IN BUSINESS ENGINEERING PROFESSIONAL FOCUS IN ANALYTICS & DIGITAL BUSINESS

Gamification vs satiation

Using game mechanics for a better long-term effect on engagement and motivation

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Award date:
2019

Awarding institution:
University of Namur

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GAMIFICATION VS SATIATION

USING GAME MECHANICS FOR A BETTER LONG-TERM EFFECT ON ENGAGEMENT AND MOTIVATION

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Mémoire présenté
en vue de l'obtention du titre de
Master 120 en Sciences de gestion,
à finalité spécialisée

ANNEE ACADEMIQUE 2018-2019

Université de Namur, ASBL
Faculté de Sciences Économiques, sociales et de gestion - Département des Sciences de gestion

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Abstract

For years now, gamification had become a more common managerial initiative, as well as a “hot topic” in literature. However, even if its definition seems to be generalized in the research community, the methods of application and design are still far from standardized, leading managers to many mistakes when they implement such initiatives. These mistakes are not without consequences, as implementing a gamified application can be costly, and can generate reactions from the company employees. Consequently, this kind of managerial decision requires a more precise knowledge of topic of gamification, to ensure that it brings the expected result.

The approach of this thesis focuses on gamification as an experience consumption for the user. It means that this process is subject to the several constraints that this implies, including the presence of a satiation effect. This is not without consequences, because it drastically limits the long-term effects of such an initiative, namely an increase of motivation and engagement from its users. In order to limit the externalities of satiation, this thesis investigates various game design elements that could potentially reduce its effects

Following an extensive review of the literature about these two topics, two hypotheses were presented:

- 1) The context of the gamification platform has an impact on satiation. As people tend to satiate more when they consume an experience in groups than alone, they also tend to satiate less when they consume in a competitive context in comparison with a cooperative one.
- 2) The variety in reward in the game design also has an impact: the fact of having several different types of rewards can reduce the effects of satiation when compared with a context where only one type of reward is accessible to the user.

These two hypotheses were explored through experimentations with realistic gamified application inspired on several real-world gamified experiences used by companies such as Lays or Starbucks. For the most part, these hypothesis were confirmed by these experiments, although some difficulties with the context of measuring satiety effect have been problematic for measuring certain variables such as engagement.

In conclusion, with this thesis and potential future research on the subject, managers will know better how to ensure the effectiveness of their gamified platforms in the long term, by providing

its users with a less boring and more satisfying experience, thus ensuring à better engagement on their part.

Acknowledgement

First of all, I would like to thank all the people who contributed to the realization of this thesis. Namely:

- Miss Wafa HAMMEDI, my thesis supervisor for her guidance over the whole redaction of the thesis, and her insightful ideas about the theme presented in this thesis and the suggestion of several article of literature about satiation and gamification.
- Miss Nadia STEILS, for her help about the design of the several studies presented in this thesis and for her suggestions.
- Mr. Thomas LECLERQ, for his help about the design of those studies, his help on the methodology to follow, his guidance on the use of the SAS software to analyze the data, and for his enlightening doctoral thesis about satiation.

I would also like to thank all the people that have participated to the experiments presented in this study, even if most of them preferred to remain anonymous. My thanks also goes to all the academic team of the University of Namur, that have helped me a lot over the years, especially with their teachings about market studies and the methodology to follow.

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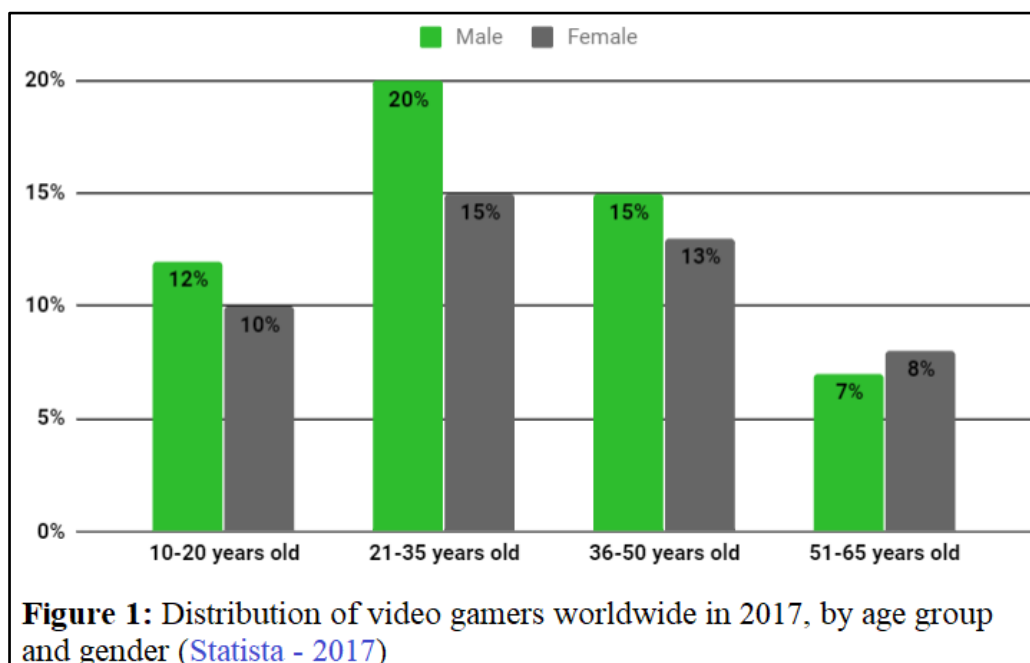
CHAPTER I: AN INTRODUCTION TO GAMIFICATION

I.1) Context – The trend of Gamification and changes in companies environment

Gamification is a concept that has trendy for a few years in the marketing world, as well as in human resources and other managerial applications. The first known use of the term was in 2008, in a start-up named Conundra Ltd. Since then, this term has been used quite widely in the managerial world since mid-2010, popularized by various conferences and industries ([Deterding Khaled, Nacke & Dixon - 2011](#)). Currently, we even see possible applications in education ([Zichermann - 2011](#)) and politics ([Angelovska - 2019](#)).

This trend is not so surprising and follows the success of video games: According to the European Mobile Game Market, in 2016 there were more than 2.5 billion of gamers all over the world. Moreover, according to BestTheNews 2016, we can expect the game market to weight over 90 billion USD in 2020, a growth of at least 14.48% in a period of three years ([WePC – 2019](#)).

Also, this trend seems to impact people from most generations and gender, especially people between 21 and 35 years old which represent 35% of the total share of gamers). Female represents almost 43% of gamers in this particular sample ([Statista - 2017](#)).



In terms of platform or media used for gaming, mobile phone seems to be the most successful; smartphone games representing alone 41% of the total 2018 global game market ([Newzoo's 2018 Report: Insights Into the \\$137.9 Billion Global Games Market](#)).

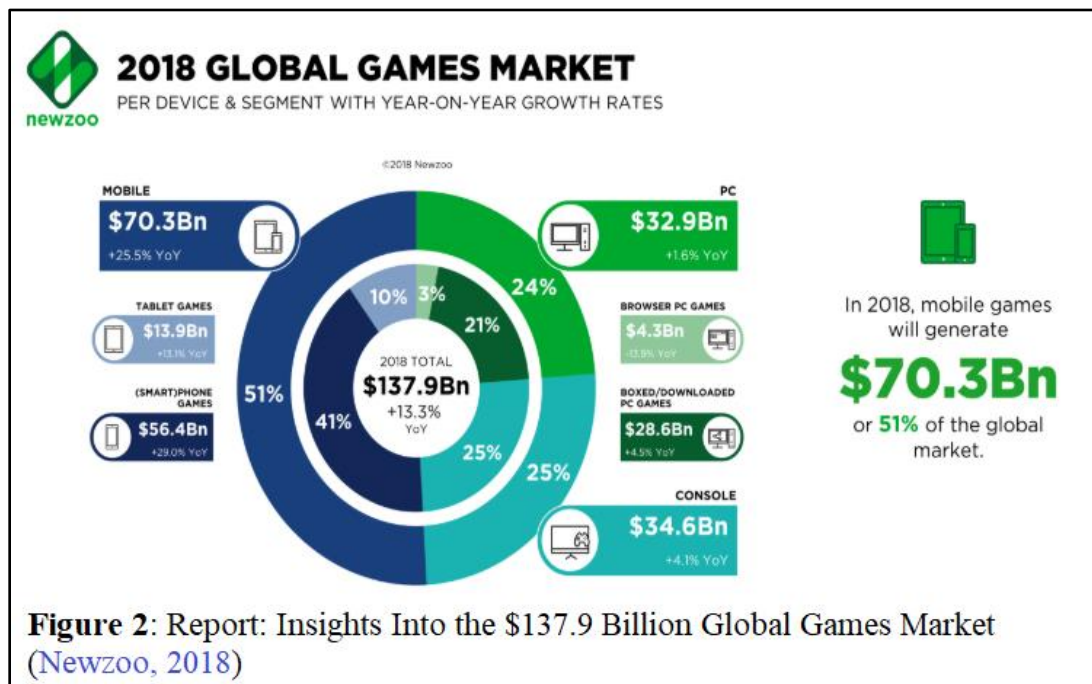


Figure 2: Report: Insights Into the \$137.9 Billion Global Games Market ([Newzoo, 2018](#))

Crossing all these elements about the growth of gaming industry and growing interest in games among most people, we can clearly see the sheer potential of gamification. This can explain the reason why other market not linked with games or more extensively, recreational activities can find an interest or even application of games in their activity. As such, several elements, initially perceived as serious, features more and more gaming or entertaining elements. This trend is called “Gamification”; a change in product, services or design of organizational activities to make them features more game-like elements and experiences, in order to bring changes in people behavior ([Navarro- 2018](#)).

I.2) Defining Gamification

Defining Gamification is not an easy task, considering that this phenomenon is quite recent, and that there was no real consensus in its definition until a few years ago. Several definitions had come up in the academic field:

Deterding definition is maybe the most recognized, as it shares the same common idea among all definitions: *“An informal umbrella term for the use of video game elements in non-gaming systems to improve user experience and user engagement.”* The title of his article summarizes it as the use of *“Game Design Elements in Non-Gaming Contexts”* ([Deterding Khaled, Nacke & Dixon, 2011](#)).

The same idea of increasing user engagement is mentioned by Zichermann in his book “Gamification by Design”: *“The process of game-thinking and game mechanics to engage users & solve problems”* (Zichermann & Cunningham, 2011).

Several other authors mentions give more hints about how it increases user’s engagement. For example, Thom mentions that it *“(…) aims to create a sense of playfulness in non- game environments so that participation becomes enjoyable and desirable.”* (Thom, Millen & DiMicco, 2012). Therefore, enjoyment seems to be a key factor in gamification. In another study made by Huotari & Hamari, who describe gamification as *“A process of enhancing a service with affordances for gameful experiences in order to support user's overall value creation.”*, the focus is mostly on value creation through resources, such as personal, tools, service setting or information available (Huotari & Hamari - 2012).

One of the most recurring element mentioned in literature is enjoyment, or fun. However, a distinction has to be done between “Fun in work”, which focus on the enjoyment of the experience at work, such as the task and the membership in the organization, and “Fun at work” : which rather “cover” the boring or tiring aspect of the affective experience at work, in order to make it more bearable. The latter, to some extent, is one of the main goals of gamification (Mollick & Rothbard - 2014).

However, it should be said that gamification is not about building a game in itself, but more about understanding and adapting game mechanics and design to apply them in companies. (Zichermann & Cunningham, 2011). It is also quite different that a simple contest, since there is a presence of a structure and design that create, in the mind of users, a “feeling” similar to the ones in games, rather than a simple setting of rules and goals in a competition context (Mollick & Rothbard - 2014).

I.3) several examples of gamification

Such gamified applications were tried, for example, by Starbucks, through loyalty programs such as the possibility for customers to suggest new ideas, against a feedback that benefits for both parts; the company gain insights about customers’ needs, while customers learn how to make better suggestions and earn some recognition by the company. It is not their only gamification mechanic, since they also rely do promotions by inciting customers to scan QR codes on Starbucks products to win coupons and promotions (Negrusa, Toader & Sophica - 2015, Leclerq – 2017).

One of the most famous gamified applications is the Nike+ program, and often mentioned in literature. This application provide customers with daily challenges & goals, the possibility to

compare results with friends and progress over time, rewards, feedback through boards and graphs and so on (Richter, Raban & Rafaeli - 2015).

I.4) Problem statement

“As Gartner stated in 2012, many gamification based solutions would fail to meet their business objectives primarily because of the absence of a clear and formal design process. The obvious conclusion of Gartner’s point of view is that: a clear design strategy is the key to success in gamification.

However, as ascertained by many game designers, there is a lack of systems of design framework within which we can explain what makes gamification effective or not. Or better still, there are a lot of design frameworks available now in the literature, but each of them are characterized by different features and there is a lack of consent about their effective validity, probably due to the fact that gamification is still a relatively new and experimental strategy.” (Navarro - 2018)

This sentence mentioned in this research is partially the kick start of my thesis. As mentioned by the author, elements defining under which conditions and elements gamification could work or not seems to be still lacking and requires more researches. Also, since the topic is so recent, it seems that there is again too few literature review on the long time effects of gamification.

The focus here would not be about demonstrating if gamification works or not. We know, thanks to several examples and applications that it can work. But the main problem about it is that since the effects of gamification have been proven, it is often taken for granted that applying gamification would increase the user’s engagement, as if by magic. However, it seems we’ve forgotten that gamification is actually, in fact, a consumption of an experience. And every consumption, from physical goods such as food and drinks, to experiences such as watching movies or listening to some music, is hit by a phenomenon that generates a decrease in consumption and a search for alternatives to the current consumed items. This effect is called “satiation”.

In this thesis, we will try to identify the effects of satiation concerning gamification, try to determine which elements could reduce or induce the possibilities of a satiation effect which would definitely decrease the desired effects of gamification and through which means it could be possible. As gamification can be perceived as an experience of game-element in a non-gaming context, we can fear that a repeated exposure to a gamified task could be less enjoyable and thus, less effective.

This study will be mostly based on scientific review on the marketing, management and psychological field, but also through several experiments, in order to understand which variables are significant and to which extent they contribute to satiation reduction and to the potential performance of gamification.

I.5) Research Motivation – Gamification as a response to several managerial problems?

As we know, for some years now, gamification is explored and presented in some studies through different contexts for which applications are possible directly in a company. The goal, even if quite similar, depends of the goal and type of activities in which gamification is focused on:

- With customers in a B2C context, gamification will be used in order to induce hope (A desire for an outcome which is compatible with the goals) in order to generate enhance customer engagement and thus, increase sales ([Eisingerich, Marchand, Fritze & Dong - 2018](#)). I will also generate value co-creation and a positive and fun experience related to the game experience in itself ([Leclerq – 2017](#)).
- With customer in a B2B context, it can also be used to some context in B2B markets, as engagement, value co-creation and spirit of competition inducer¹. This context will then work as a cooperative gamification application.
- Inside companies, it helps to motivate its employees to engagement (or re-engagement, if people are already facing a disengagement phase in their task), increase satisfaction, improve performance at work through motivation, and support HR practices ([Navarro E.C. - 2018](#)).

However, even if most of these gamification features are common in these 3 specific cases, it would be a mistake to implement gamification for employees as it would be done in the two other cases.

Also, as previously mentioned, we can easily induce that gamification is still overestimated or is still simply in lack of a clear understanding concerning its effects in the long run. Knowing which design elements could reduce a potential satiation effect could be very potent, since it would grant more long-term results and less requirement to change the design of the satiation application over time. For example, since gamification at the workplace is mentioned as a good response to boring, redundant or overly complex tasks, we can fear that satiation effect can affect management decisions concerning gamification. Therefore, it would require less cost for companies that want

¹ Contineo Labs, my previous internship company, intend to apply such a strategy in the future and is already thinking about its potential effects.

(or have already) applied gamification to their business, and it would ensure that these investments remain profitable in the long run.

I.6) Academic Motivation – A better insight about the effects of gamification mechanics on satiation

A multitude of studies and scholar articles cover separately the effects of satiety and gamification. Nevertheless, as far as can be sought, no study has placed these two subjects in parallel so far. This is a gap that must be filled in order to have a better understanding of the effects of satiation on engagement and motivation.

In order to understand its effects, we will need to analyze the relationship between several types of gamification mechanics and design elements with its effects on satiation on its several aspects (Time, satisfaction about the consumed experience), in order to see the role played by satiation in the relationship between gamification and engagement.

I.7) Approach of the thesis

In order to fulfill those objectives, since there is a lack of coverage about this particular topic, this thesis will be based on many articles and books on these two topics separately:

Literature about the satiation effect will help to get a better understanding on the elements that can influence it and its impact on consumption.

Literature about gamification will help to identify several game mechanics.

By crossing several findings about both topics, we intent to identify some of them that could have a positive or negative impact on satiation, in order to know which elements should be or not included in future gamification initiatives. The suggested hypothesis will then be explored and analyzed with experiments on individuals, in order to confirm or infirm their effects on satiation.

CHAPTER II: LITERATURE REVIEW

II.1) Conceptual background

First and foremost, it seems quite necessary to understand what satiation is, what its consequences are and what variables could induce/reduce its effects. Fortunately, satiation is a well-known effects and a lot of previous researches were done to understand its factors and patterns. These will be analyzed in the next part.

Also, now that we have defined gamification, we will further analyze what are the potential design factors used in satiation and try to understand which ones could eventually reduce or induce satiation, in order to avoid them for future applications.

II.1.1) Satiation effect & its components

First and foremost, you'll notice in this literature review that most of the models, observations and experience done on the field of satiation were done about physical goods, mostly food, as it is one of the most used stimuli in researches on that particular field. The oldest reviewed papers here mostly focus on physical goods, to give a clear definition and first insight about satiation.

In literature, the common and globally accepted definition of the satiation effect is “a drop of enjoyment with repeated or prolonged exposure to a stimulus” ([Galak, Kruger & Lowenstein – 2013](#)). This definition can be applied to food, music or experience.

Thanks to some research, we can have a clear pattern about the effects of satiation in consumption and the several dimensions that compose it. Thanks to these lecture, three large dimensions have been highlighted concerning satiation, with each of them influenced by several variables. A global presentation of the model can be found thereafter:

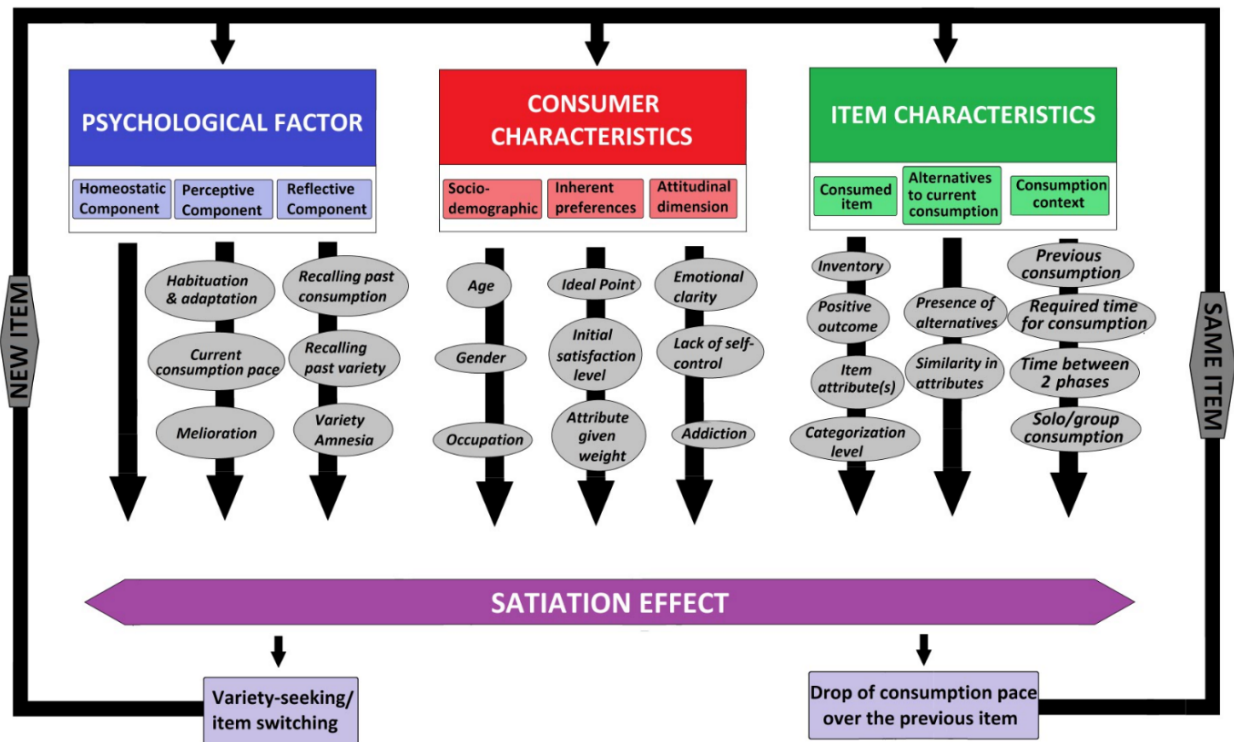


Figure 3: Model summarizing the literature review about satiation effects

A) Psychological factors

These factors are regrouped here because they share a common trait by their link to psychology. They are factors that are common to every consumer and that we can find in every consumption situation and are often referred to as bias that can be commonly found in every people's habits.

Note that most of these following effects are difficult, if not impossible to avoid in themselves, since they are psychologically carved into the consumer's mind. Therefore, it seems hard at first glance to act on this factor to reduce satiation.

They were mostly explored in several studies made by Galak, Redden, Kruger & Lowenstein. One of these, made by Redden in 2014, mentioned the presence of three sub-components:

A.1) Homeostatic Component

This component considers the fact that the human body has an internal set of value and when it deviates from this value, it generates a signal showing that the stimulus doesn't satisfy a need anymore. In this case, pleasure shows the usefulness of the stimulus to reach a state of balance (Redden – 2014). In other words, in every consumption, there is the idea of an internal value that, when reached, make further consumption unable to bring anymore satisfaction, since a balance in consumption has been met.

This element is particularly true when we speak about physiological goods, such as food or drinks, also called “ingested stimuli”, but also apply to non-physiological ones like boredom with a task that imply a cognitive fatigue or effort. Another point to mention is that, when the user decide himself about his own consumption rate without any external or internal imposed constraints, he will more likely satiate faster than someone with limited consumption (Galak, Kruger & Lowenstein – 2012).

However, something should be mentioned: the homeostatic component, as well as satiation in itself, is not only about the physiological limit your body has toward food, or the amount of calories your body could consume. In fact, some experiences in the past have proven that it is more linked with psychological aspects, since that even with food, flavor has a bigger impact over satiation than hunger. Therefore, satiation could take place with non-ingested consumption items, such as experiences (Redden - 2008).

A.2) Perceptual Component

This element take into account to other sub-components that are often mentioned in most of these authors reviews:

- **Habituation**; which is the reduction of attention to a stimulus if its use is repeated (Redden - 2014).
- **Adaptation**; which is a decrease of sensory intensity of an experience, as it deviate less of a referent that rise when faced with recent exposures. (Galak, Kruger & Lowenstein – 2012, Galak, Redden & Kruger - 2009, Redden - 2008, Redden - 2014). However, this last factor seems less significant for experiences that it is for goods such as food for example. (Redden – 2014)
- **Inaccurate or underestimated effect of the pace of consumption over satiation**: further research shows that people are often unaware of the effect of satiation, or simply don’t act to oppose to its effect it in terms of their product consumption. It comes from the fact that they cannot identify to which extent a longer inter-consumption interval could reduce satiation. It is possible for long periods of time, however the effect is more unclear for smaller ones. One of the consequences of this variable is that people tend to rather choose variety for future consumption over that for the current one, inducing an effect which is called the “diversification bias”. (Galak, Kruger & Lowenstein – 2012).
- **Melioration**: Melioration is the fact that, when a user faces a choice, he’ll tend to ignore or underestimate the effects of the current choice over the value of future options (Galak, Kruger

& Lowenstein – 2012). This effect can be opposed to maximization, as neglecting future options often lead to a lesser utility level. (Herrnstein, Lowenstein, Prelec & Vaughan - 1993). In fact, it leads people to consume more rapidly than they should, and thus induce satiation.

These effects, mentioned in different studies, can be easily considered as part of the same component since they rely mostly on consumers' perceptions over their consumption.

A.3) Reflective Component

For these following elements, you'll notice that they mainly focus on the customer cognitive aspects and thinking process. Three of them can be considered as having an impact on satiation:

- **Recalling past consumption:** If people are in a condition where they think about past consumption, then they will satiate more, as they'll get the impression to get or to do the same thing over and over again. The inverse phenomenon is also true, as people that are less reminded of past consumption or having less memory of it, as they'll infer that they consumed less than in reality. Being distracted during consumption will also induce a reduced effect of satiation, as people will have less focus on their consumption level. (Redden – 2014)
- **Variety Amnesia:** Variety Amnesia mean that people, while in the context of consumption of a material good or experience, would remind only about previous consumption of this item and “forget” the existence of other alternatives. (Galak, Redden & Kruger - 2009).

This potential variety amnesia could be an explanation to the “diversification bias” described by Galak, Kruger & Lowenstein, as it was what would induce the effect of an underestimation of the effect of consumption pace over satiation. Indeed, not thinking about variety for present consumption could explain this “preference” for future variety and the auto-satiation inflicted by people. (Galak, Kruger & Lowenstein – 2012)

- **Recalling past variety:** Variety can be perceived as a way to overcome satiation. It can be perceived as a solution (Galak, Kruger & Lowenstein – 2012), but also as a logical consequence of it (McAlister – 1982, Yu & Lang - 2017). However, it isn't necessarily something that should be considered as negative to a managerial point of view, because it also leaves doors opened to potential solutions to overcome the effects of satiation.

In a study realized by Galak, Redden & Krueger, it was proven through several researches and experiences about several stimuli and items that satiation could be reduced with a simple mind technique consisting of recalling past variety after (or even before to some extent) feeling satiated with any kind of consumption experience. These can be either physiological

(Experienced here with food), or not (Music, meeting with friends ...). The obtained results were overall quite consistent over the several studies done by these researchers, and can be easily done through the use of a “virtual” reminder, as it was done during these experiences. (Galak, Redden & Kruger - 2009).

The reduction of satiation level resulting in a reminder or past consumption seems to work in every case, but it still requires several conditions that must be met to insure its effects:

- ❑ ***The recalled items must have been already consumed in the past:*** It was observed, for example, in the study about satiation during friend meetings: the effect of satiation reduction could be observed for people already met a few weeks ago, not with celebrities.
- ❑ ***The recalled items must be linked with the satiated item to some extent:*** In the second study about satiation in music listening experience, it was shown that the effect was present only when the recalled experience was also related to listening music.
- ❑ ***The observed effect of satiation drop only apply for the satiated item:*** It doesn't take place for a whole category of stimuli.

In every case experience, it was observed that while satiation can be reduced over time, the effect is not instantaneous, meaning that their level of appreciation toward the stimuli doesn't come back at his initial level before a more or less long amount of time without consuming it. Since satiation is mentioned as being “*a fluid and contextual phenomenon*” (Galak, Redden & Kruger - 2009), it seems it is also quite logical that it would also be gradual and vary over time and through the help of moderators such as this one.

An important aspect that must be mentioned is that, in the context of this research, the goal was to find a way to recover from satiation after it is faced, and not to prevent it, as it was done in most previous studies. But still, recalling past consumption before consuming an item could still have a preventing impact (Galak, Redden & Kruger - 2009).

It is one of the few mind techniques that could be used against these psychological factors, since the insertion of a “virtual” reminder of past variety to the consumer mind would in fact, generate an opposite reaction to Variety Amnesia, by reducing satiety or, as the researchers said, “*increase satiation recovery*”. In our current context with gamification, it could therefore give us some keys to prevent satiation in a pre-consumption phase or recover from it more rapidly after satiation has occurred.

B) Consumer's characteristics

This factor should be considered separately from the first one, since the observation that were and could be done here depends on the consumer himself and in group of similar people (In segment, to stay in the managerial lingo). Here again, considering the dimensions shown, little can be done to enhance or reduce the effects of satiation. However, unlike with the psychological factors, since these characteristics can be shared or not between several consumers, a simple “segmentation → targeting → positioning” method could overcome this aspect, in order to only target customers that are less likely to satiate early. But even then, this method seems to remain quite limited at a first glance...

For this particular aspect, several aspects can be also considered:

B.1) Socio-demographics

The only mention of a role played by such a component is about age ([Redden - 2014](#)), as it was proven that the more people tend to getting older, the less easily they satiate. However, we can also consider other possible variables, such as gender, occupation and so on, in order to track down other potential effects.

B.2) Inherent preferences

This aspect covers several variables used by McAlister in his “Dynamic Attribute Satiation” model, based on an experiment of consumption, in that case, of sodas.

The several sodas used for his experiment were rated and measured thanks to two attributes: the level of caffeine and fruit flavor (each different for every soda) that are “inventoried” and that can drop over time, meaning that these rated attributes increase depending on the chosen soda, and decrease depending on a time period (here, the chosen hypothesis was that half of the attribute effect disappear each day).

The noticed effect is that, when an attribute (In this case, caffeine level) is at his highest level, reaching a “ideal point”, the subject will rather choose a drink with much less caffeine in it (In the experiment, 7-UP) , while on the other hand if an attribute is very low, he'll rather choose a drink that have a high level of this lacking attribute (In this case, Coca-Cola). The model, build with this experience and called DAS (Dynamic Attribute Satiation), is the following:

$$DAS_{Tk} = \sum_{j=1}^J P_{Tkj},$$

With $P_{Tkj} = w_j * (I_{Tj} + X_{kj}) - X\lambda^2(-1)$ and where $I_{Tj} = \sum_{t=1}^T \lambda_j^{T-1} X_{kj}$

This model relies on several variables:

- DAS_{Tk} : preference for item k at time T assigned by this model
- J : number of attributes describing the compared items
- P_{Tkj} : contribution of an attribute j to the satisfaction level as a consequence of consuming an item k at time T
- w_j : Importance weight of an attribute, which is a degree of disutility for the subject with being a certain given number of units from its ideal level.
- I_{Tj} : Inventory of an attribute j at time t
- X_{kj} : Level of an attribute j for the item k
- λ_j : Inventory retention rate for an attribute j
- Ideal points: optimal level for the inventory of an attribute to the eyes of the subject.

In his study, McAlister compared this model with other where the notion of an “inventory” of attribute were not present and noticed the presence of a bias in the estimation of the ideal point by consumers ([McAlister – 1982](#)). This inventory will of course depends on of past consumption.

This experiment tend to prove that a pattern exist in consumption, depending on past consumption. The consumer tend to switch brands or rather choose a substitute products if his level of an inventoried attribute reach the ideal point ([McAlister – 1982](#)). To make it clearer, in his example, if a soda is rated according to the level of caffeine and fruity taste, and if a consumer reach the ideal point of caffeine level in his own opinion, he'll rather switch for another soda with a lesser level of soda and a bigger level of fruity taste. But the effect is also induced by the consumer preferences, which can be observed in the formula in the form of the importance weight given to an attribute (w_j)

These aspects can be linked with the homeostatic and reflective components as presented by Redden, since this “ideal point” can be considered as the internal set of value mentioned by Redden, and since only one day separate both consumption phases, the subject are able to recall their past consumption quite easily ([Redden – 2014](#)). However, it is considered as a separated effect here since the homeostatic component is a common rule to everybody, but the ideal point could differ from one consumer to another.

B.3) Attitudinal dimensions

This aspect englobe several elements such as:

- **Emotional clarity:** The fact that people can clearly distinguish the positive effect of consumption from the negative impact of satiation resulted from repeated consumption can reduce this negative effect (Redden – 2014)
- **Self-control and addiction:** People who consider themselves as having a good sense of self-control pay more attention to the quantity of food they eat for example, and thus, are more likely to satiate earlier than other people (Redden – 2014). To give a concrete example, when someone forces himself to follow a strict diet, he'll feel more the effect of satiation than other people.

However, it is true the other way round as well. A failure, or lack, of self-control can be the possible consequences of two driving forces opposing each-other:

- ❑ *Desire*, the drive of the user to feel pleasure right now (Galak, Kruger & Lowenstein – 2012).
- ❑ *Willpower*, the fact of restraining himself from consuming for a better pleasure in the future (Galak, Kruger & Lowenstein – 2012).

In this case, the first force overcome the second one, leading people to another result of consumption, which is mostly called “addiction”

Addictions can be considered as the opposite to satiation in this aspect that it would be another extreme result where, instead of dropping consumption pace and satisfaction with a repeated consumption process, it would accelerate, creating an inertia in the choice of an item, rather than switching items. In this case, such a consumption pattern can lead to a kind of dependence to the item, which could be perceived as a kind of vicious cycle, as people that can't control their consumption to the extent of reaching such a state are less likely to be able to stop themselves from consuming (Redden - 2014). Therefore, in this case, satiation is almost, if not totally, non-existent; the user would willingly, even if not consciously, go beyond the “ideal point” as shown in the DAS model by McAlister, up to the point that he would rather reach intoxication.

A failure in self-control can itself impact the vicious effect that can apply for example to obesity (Redden – 2014) or video games dependence (Dong, Wang, Du & Patenza - 2017, King, Herd & Delfabro - 2017, Yu & Lang - 2017). But even if addiction and satiation can be both mutually

opposite outcomes to consumption, addiction case are most likely exceptional while satiation is quite the common rule. As such, we'll mention it more like a possible parameter working against satiation, like some authors ([Redden - 2014](#), [Yu & Lang - 2017](#)) rather than a possible outcome to consumption.

C) Item's characteristics

Obviously this factor is, by itself, dependent on the consumed item. The big difference with the two previous factors is that this one seems quite easy to influence, because it directly or indirectly depends on of the item himself and not of the consumer or empirical psychological rules. The possible way to avoid satiation would be then to design the item in such a way that satiation could be avoided, or at least reduced. In our current case, we could imagine that if gamification is applied and designed in a certain way, the effect of satiation could be reduced, if not completely overcome.

The several dimensions it incorporates are the following:

C.1) *The consumed item*

These several sub-components are mostly related to the item itself, and can englobe several things

- **Consumption outcome:** It would describe the quality of the experience around a certain context of consumption.

It was one of the several aspects analyzed by Yu and Lang in 2017 concerning their study about variety seeking in context of online video games. According to these authors, when the consumption experience is positive (For example, they earned lots of points in a particular map), they will remain on the same map or simply choose a similar map the next time (thus, a map with similar attributes), while on the other hand if their experience was negative, they would rather choose a totally different map during their next game. As such, people who have a positive consumption outcome are less likely to satiate than those with a negative outcome, that are more likely to satiate and show signs of variety seeking attitude, because they will seek for the same attribute they enjoyed from their previous consumption. As previously mentioned, in the most extreme situation, it can even lead to some forms of addictions, as it was the case for some people in their experience ([Yu & Lang- 2017](#)).

- **The item's attributes:** This subcomponent was mentioned in McAlister study as one of the several influencers of satiation. To be more intelligible, attributes can refer to the items characteristics such as color, flavor, design and so on ([McAlister - 1982](#), [Yu & Lang - 2017](#)).

Attributes are what can define items and make them similar or different. Combined with individual preferences, they are what can define the Dynamic Attribute satiation (McAlister - 1982) and thus the probability of switching (Yu & Lang - 2017).

- **Categorization level:** The possibility and presence of a certain categorization level in a consumption process can reduce the pace of satiation. Indeed, people tend to satiate more on the aspects they used to categorize a consumption episode, especially if these items share common attributes. In a previous study, it was demonstrated that people can enjoy more a consumption sequence if they subcategorize the episodes, which is called the “specificity effect”, and therefore, can reduce the pace of satiation. This effect occurs because, when people focus on details that differentiate the episodes of consumption, they perceive less repetition.

This effect can be even easier to observe and apply depending on of the user’s degree of expertise. With wines for example, a common consumer will satiate easily, regardless of the type of wine he drinks, while on the other hand, an expert will be able to switch from one type of wine to another (For example, from a St. Amour to a Pinot Noir) to avoid satiation. This expertise can come over time thanks to repeated consumption

This strategy can be used in marketing by sub categorizing product (Create labels, narrowly define groups of product on stores shelves, and so on) in order to reduce the pace of satiation. (Redden - 2008)

- **Inventory:** Already mentioned in a previous part, the “Inventory” is considered as a kind of retention of a specific attribute resulting from past consumption of a particular item. This aspect can also be linked with the consumer characteristic but is directly linked with the item is the inventory from previous consumption, since they are related for one item or attribute in particular (McAlister - 1982).

C.2) Alternatives to current consumption

While the previous component focused mostly about the consumed item itself, this one will focus about its possible alternatives, given these following sub-components:

- **Presence & ability to consume alternatives:** Even if until then, no real article about satiation seems to mention it, it seems obvious that the presence of an alternative is firstly the presence of an alternative. It means that if consumer’s doesn’t have any other alternatives or are forced to consume the item regardless of their will, it could have an impact over the satiation effect

that has to be analyzed ([Mollick & Rothbard - 2014](#)). This will be further discussed in the gamification literature review section.

- **Similarity in attributes:** Also, similarity in attributes was shown as a dimension that can have an impact on satiation before consumption and as a recovery mean. In Yu & Lang model, it was used in order to compare items as being similar (The fact that in a video games, two level share some common traits with each other). In case of a positive consumption experience, it could induce inertia thanks to a drop (or total absence in case of an addiction) of satiation effect. It is true the other way round as well ([Yu & Lang - 2017](#)).

C.3) Consumption context

Here, the focus is about the consumption context, such as the timing and pace related to the consumed item, but also the number of people required to consume the item. From the several studies, these are the following sub-components that can potentially influence satiation:

- **Previous consumption:** First of all, the fact that the item was consumed previously in the past has an indirect and neutral impact : first, it will increase the current inventory and thus, induce satiation, but also it can be a very useful asset in order to recall past variety and thus decrease satiation ([McAlister - 1982](#), [Yu & Lang - 2017](#)).
- **Time between two consumption phases:** Also, time between two consumption phases give time for recovery and also decrease the rate of satiation. As such, the longest is the recovery time, the more satiation decrease. This variable itself depends on self-control, melioration and the estimation of the consumption pace over satiation, that were previously explained ([Galak, Redden & Kruger - 2009](#)).
- **Required time for consumption:** It wasn't clearly mentioned as a component of satiation in itself, but it could be interesting to also have a look at the effect of the required time to consume the item, or the length of the consumption phase, in order to see if any effect can occur on satisfaction and satisfaction rate.
- **Solo or group consumption:** Most literature about satiation mainly focus of consumption made by one person, but little was done about context where multiple people consume the same item.

In a study realized by Barghave, Montgomery and Redden, in 2018, another aspect of consumption was explored: the context, in terms of number of user consuming the same item. This case mainly apply to experiences, such as board games, online mobile games or others.

While past studies showed that co-experiencing affect the perception of a particular stimulus, in fact, a shared experience (and attention of this particular experience) would tend to intensify the experience of a person's stimulus. However, little was known about the effect of satiation on future shared consumption in this context.

Through their study and experiences, these authors demonstrated and confirmed several hypotheses. These can apply whatever the stimulus is; auditory (Listening to a music), visual (watching a movie, a picture), or even gustatory (eating candies with friends).

- ❑ In a context of collective experience, satiation would tend to be amplified, whatever if there is a way of communication between users or not. This can be explained because since, in a context of shared attention, people will not only think about the repetition of their own tasks, but also the ones of the others sharing the same experience. This repetition seems then more present, and in the end, hasten the satiation effect ([Barghava, Montgomery & Redden - 2018](#)).
- ❑ This effect is also mediated by the salience of repetition over the collective satiation effect. It means that the more the experience is repeated by others, and thus induce satiation, the more the rate of satiation will be increased for the user ([Barghava, Montgomery & Redden - 2018](#)).

D) Consequences of satiation

As mentioned in the definition, a global effect of satiation is a decrease of satisfaction after consuming an item, whatever if it is physical or experiential. This drop of satisfaction can itself generate two possible reactions from the consumer:

D.1) Drop of consumption pace

At this stage, it is quite obvious that as soon as satiation occurs, the “state of balance”, as mentioned earlier, is reached. Therefore, further consumption cannot bring anymore satisfaction and is therefore, a useless effort to the consumer. He would have to wait for some time before its satiation level drops to consume further to bring some satisfaction ([Redden – 2014](#)).

D.2) Variety-seeking behavior

Probably the most notable effect described in literature, an often-suggested way to avoid non-desirable satiation is to switch for other products or brands, in case of consumer goods ([McAlister](#)

– 1982), but also for experiences such as listening music or playing video games (Galak, Kruger & Lowenstein – 2013).

The closest reference about satiation in the online gaming industry, as well as about the variety seeking attitude was done in research by Yu and Lang in 2017, even if the focus was mostly made on consumption outcome and variety-seeking rather than satiation in itself. This research concluded with an interesting outcome that can help in this research : a positive consumption outcome can lead to inertial preference, meaning that instead of showing variety-seeking attitude, the user or consumer will stick to his current choice, or choices that shares similar attributes with his initial one, while on the other hand, a negative consumption outcome would lead to variety-seeking attitude.

Variety seeking can also be generated for these reasons mentioned in previous researches:

- **External factors:** Marketing decision taken by companies, such as price promotions suggested to the consumer (Khan, 2015) :
- **Satiation on products/experiences** (Khan, 2015) which is our current research topic.
- **Exploration of different options to avoid future preferences uncertainties:** (Khan, 2015) :

Their hypothesis was tested through the experience of online video game players. In case of poor outcome from the playing session, they would tend to switch to other maps in the game with different attributes than the previous one. In case of good quality of experience however, they would tend to remain on the same map over and over again, showing rather inertia than variety seeking (Yu & Lang - 2017).

The model developed for this research is the following:

$$P_{j|j} = \frac{\exp\{\beta x_j\}}{\sum_k \exp\{\beta x_k\} VS d_{ki}} \rightarrow \text{Probability of repeating the choice of option } j$$

$$P_{j|k} = \frac{\exp\{\beta x_j\}}{\sum_k \exp\{\beta x_k\} VS d_{ki}} \rightarrow \text{Probability of switching from option } j \text{ to option } i$$

With:

$VS[t] = \gamma_0 + \gamma_1 \text{Log}(t) + \gamma_2 \text{Satiation}[t - 1] + \gamma_3 \text{Outcome}[t - 1] \rightarrow$ Variety seeking parameter

$\text{Satiation}[t] = \sum I_{n,j} s_n[t] \rightarrow$ Satiation effect formula

And where $s_n =$

$\lambda s_n[t - 1] + 1 \rightarrow$ if attribute n is experienced at $t-1$ and

$\lambda s_n[t - 1]$ in other cases.

This model depends on several variables :

- i : choice of map at time $t-1$
- j : choice of map at time t
- VS : variety seeking parameter, $\in [-\infty; +\infty]$, positive when the player is variety seeking and negative otherwise.
- d_{ij} : distance between the previous choice i and current choice j
- s_n : Satiation effect for each attribute n
- λ : Factor of satiation reduction
- $I_{n,j}$: Weight of the attribute, supposed identical for each attribute.

According to the authors, this model can also apply to other kinds of experiences, (Watching movies on Netflix or dining at restaurants), and can also explain brand loyalty in general. Thus, we could infer that a similar pattern could be observed in the context of gamification.

Their observations were mostly observed in their experience, but one was quite different from expected : in fact, satiation had a negative impact in this model, meaning that the more player experienced the same attribute, the more they were willing to meet them again by playing the same map or similar ones in terms of attribute, resulting thus mostly in a habituation or even addiction effect, rather than satiation (Yu & Lang - 2017).

However, no real information is given about how such an observation occurred : it could come from the sample itself, the context (online video game) or another element. So we can't be sure such an observation could be done about satiation in a gamification context.

E) Last comments about satiation

These scholar articles were mostly giving a general insight about how satiation work and the possible variables that can be taken into account in such a model. However, the focus was mostly on products and material goods, and little on experiences. However, thanks several of these studies, we know that the satiation effect can apply to every kind of consumption context, and also to experiences in particular. However, some effects are stronger or easier to measure when we are in

context of material goods, such as the homeostatic component (Redden – 2014). Indeed, this “optimal level” of consumption can be easily considered with food or drinks, but is way less easy to demonstrate or quantify with experiences. But this effect is still considered nevertheless.

But the fact that not much previous research were done about experiences and none about satiation doesn't mean that satiation could not be present : Since satiation is always linked with a consumption context, we can be pretty sure it could exist in the context of gamification, since it is, to some extent, a consumption in an experiential context. Also, gaming itself can also induce satiation (Galak, Kruger & Lowenstein – 2012, Yu & Lang, 2017).

We have also previously mentioned that a common response suggested in previous reviews is to bring variety to reduce the impact of satiation. However, the goal of this thesis is to avoid people to switch to other alternatives, thus variety-seeking attitude could be perceived as a threat, as it could induce people to seek to other alternatives to gamification, and such changes in a company strategy would, induce costs.

II.1.2) Components of gamification

After a better understanding of the satiation phenomenon, the following part will mention several components of gamification that can be linked with the previous components of satiation, in order to have an insight of which ones could induce or reduce the effects or pace of satiation.

A) Cooperative VS Competitive gamification

One of the several aspects mentioned in literature is a common trait between gaming and gamification, which is the fact that a gamified context can be either cooperative, competitive or coopetitive.

A.1) Competition

In this context, each people act against each other to reach their own goal. By putting people in situations of contest, competition seems to be efficient, but also rely on the fact that one (or several) users would be winners while on the other hand, other would be losers. Indeed, the motivation of winning would have a positive impact on the user's results, since in this case, their participation would be stimulated and would lead them to do their best to provide a certain quality in order to compete with each other (Leclercq - 2018).

A.2) Cooperation

In this context, users act together to reach a common goal. This mechanism is considered as fairly potent to create social bonds between users (What is referred as “people fun”). In this case, the drive for users will be mostly linked with the application final objective and the opportunity to they have to build a community mindset around their interests ([Leclerq - 2018](#)).

A.3) Coopetition

Coopetition is a kind of hybrid form of cooperation and competition; in this case, there is a collaboration between competitor users, in the hope of a mutually beneficial result. Thus, the goal here will be a mix of both cooperation and competitions objectives in the mind of users ([Leclerq - 2018](#)).

Considering what we have previously mentioned about satiation, we can consider that a competitive gamification application would work as a solo consumer experience, while a cooperation or coopetition gamification application would be considered as a group experience ([Barghave, Montgomery & Redden - 2018](#)). As such, we can expect that the previously described effects of satiation in a context of a group would therefore impact gamification applications following a cooperative design. Since group consumption tends to increase satiation, we can expect that users will tend to satiate faster with a cooperative gamification initiative.

But another aspect has to be taken into account on this particular aspect : as presented in Leclerq study and interviews with actors on the field, the efficiency of a gamified platform will also depend of the users profile ([Leclerq - 2018](#)). Therefore, it means that we have to determine in which case gamification will be the most salient, but also which user profile is the most prone to satiate easily.

B) Gamification: mandatory fun & consent

As previously mentioned in our literature review about satiation, one of the particular suspected aspect that could influence the effect of satiation is the lack of alternative, which can take place:

- If there is a lack of alternatives in terms of choices.
- When the item is only available for a short ([Sevilla & Redden, 2014](#))
- If the consumption of a particular item or experience is imposed by some acknowledged authority.

In the case of gamification in the context of internal platform in a company, it can be defined as a management-imposed game to the employees in order to improve their affective experience, or “fun” at work, in order to motivate them in their everyday tasks at the workplace. Overall, it seems

that consent moderate the relationship between gamification and its result, and the more the gamified application is consented, the more it increases the positive affect at work, and vice-versa.

In the case of gamification, this concept seems quite paradoxical, since the nature of the game itself is to offer “fun” to the user, while on the other hand, the fact that the gamified experience is imposed to employees generate an opposite effect. Therefore, it seems important that employees voluntarily consent to participate in the gamified platform, since gamification is, in comparison with other work games, not driven by employees themselves. So overall, the paradox comes from the fact that gamification is “top-down” rather than “bottom-up”.

The concept of consent is described by Mollick & Rothbard as composed of three elements:

- **A clear understanding of the rules of the gamified platform** : As in games themselves, rules are present and their understanding is key for the employees to consent to them.
- **A perceived sense of justice and fairness in the gamified platform** : This perception is required about the managerial initiative in itself, but also required during the whole process of the gamified platform.
- **An active engagement**: Engagement is defined there as going from the mere attention of the employees up to active participation. In this case, since the game is imposed by the management, employees have to cooperate with this initiative, as their participation would not be predisposed like in “bottom-up” initiatives.

Several hypotheses were mentioned and tested through this study.

- First and foremost, consent act as a moderator between gamification and the employee positive affect. It was supposed that, people who consent to the game, gamification does improve employee positive affect and vice-versa (Mollick & Rothbard - 2014).
- Similarly, consent moderates the relationship between gamification and employees performance. As such, consent is key for the gamification to generate a better performance in work tasks (Mollick & Rothbard - 2014).
- Also, it is supposed that a greater gameplay experience outside of work increases the probability that employees will consent the gamified platform, since if they are used to games will accept them more easily (Mollick & Rothbard - 2014).

- Finally, giving people enough influence about the games they chose to play increases their likelihood to consent ([Mollick & Rothbard - 2014](#)).

Another study goes in the same direction through the concept of “Hierarchy of player’s needs”. Similar to the Maslow model of needs, previous researchers have analyzed the hierarchy of needs for players. Moreover, the safety, belongingness and esteem needs are common in both models. But other elements are integrated in this one.

As previously mentioned, the presence of rules and the understanding of them is key for a game to be effective, as it is a key element to consent for the participation to the gaming experience.

The aesthetic needs is mostly about the appeal for good graphics and visual effects, which could be displayed, in the gamification context, to colors on dashboards, design of badges and so on. Finally, the self-actualization is the will for the user to feel in control, and able to do as he sees fit while keeping concern about the rules ([Siang & Mao, 2003](#)).

It is an important element to take into account, since a lack of consent could potentially lead to a failure in a gamification platform implementation, design and meeting objectives. Indeed, the lack of consent could lead to a bad cooperation from employees and therefore, impact the results at the end. This result would come from the fact that the work in itself would be perceived as poorly remunerated by the employees. The suggested way to avoid it is to provide employees with a control over the choice of the game experience and a certain legitimacy behind this managerial initiative ([Mollick & Rothbard - 2014](#)).

Therefore, what could be suspected is that, if a game is imposed by managers rather than freely chosen or consent by employees, the overall experience would be rather negative and thus, induce satiation.

C) Gamification & variety

Probably the most mentioned solution, variety, in terms such as “variety-seeking attitudes”, “recalling past variety”, “variety amnesia” or “alternatives”, is an unavoidable variable that we have to take into account to avoid or at least reduce satiation pace. As such, it seems necessary to analyze which kind of variety gamification can provide in its several dimensions.

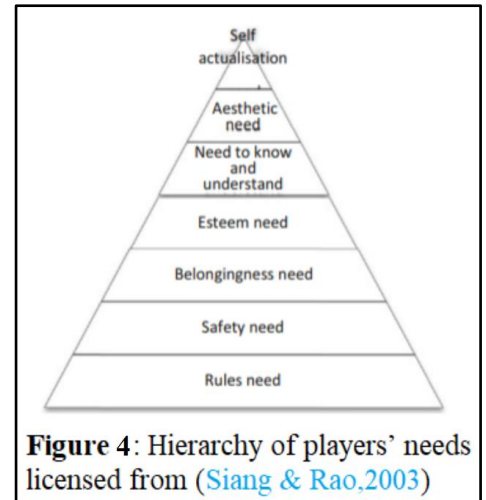


Figure 4: Hierarchy of players’ needs
licensed from ([Siang & Rao, 2003](#))

However, we have to remind that gamification is about creation, meaning that it have to be the development of a new environment with its roots in game mechanics, but also in the existing environment (Jacobs, 2013). As such, managers would not implement gamification and add variety without having to take into account the fact that the expected result meet its objectives, because adding variety will induce some costs.

C.1) Variety in reward mechanics

The principle of variety can be applied to game mechanics, such as the task where gamification is applied (Is it in a B2B, B2C or internal to the company context ?) or rewards. We can mention a few of them: Points, Badges, Leaderboards (Also known as PBL), but also Levels, Scores, Tokens and so on.

These rewards can be classified in several types (Richter, Raban & Rafaeli - 2015):

- **Ownership:** Points, tokens and badges. These are earned and accumulated by the user.
- **Achievements:** A representation of an accomplishment made by the user.
- **Status:** The display of a rank or level. A higher rank is a proof of an overall better performance.
- **Collaboration:** These are challenges that can be resolved by several users collaborating in the realization of a particular task.

C.2) Effects of rewards on motivation

We have to remind that gamification isn't only about these rewards, but mostly about the positive psychological outcome, in order to improve the global experience. To have a better understanding of the effect of this collection of rewards, we have to get a better insight of how these rewards work in the mind of customers.

First, the purpose of these reward will depend of the situation where it is applied:

- In the case of a gamification platform inside a company, the goal will be to provide a reduction of fatigue, boredom, or spending time to the employees with, in return, an increase in their engagement toward their company (Navarro- 2018).
- In the case of a gamification platform in a B2C (and to some extent B2B situation²), the aim of this initiative will be a co-creation process between the company and its customers, by

² My previous internship place, Contineo Labs, intend to implement such an application in order to increase their customers' engagement by providing them an increase in reputation through a given "title", as a reward for their collaboration in data exchanges with Contineo.

providing them with recognition and a positive experience through these rewards with, in return, an increase in their engagement ([Leclercq – 2017](#)).

Several other effects can be mentioned, such as repeat usage of the platform through the use of reward incentives, increase contributions (Co-creation, or engagement at work), and establish user reputations by granting them a certain status. But people can have some differences in what they consider as rewarding, depending on their intrinsic needs, values and goals : people who take interest in comparing themselves to other users will mostly fancy leaderboards, while people who are giving importance to a certain status and others recognition will take interest in levels and ranks. Collectible elements such as points and tokens and achievements will have effects on several elements; gaining recognition from others, reminding past achievements, and so on ([Richter, Raban & Rafaeli - 2015](#), [See Appendix I for more information](#)). This can be linked with what we've seen in our review about satiation, as an item (in this case, the reward) can have different attributes weight, which is one of the components of users preferences.

So, for this variable, we have to determine if, as we have seen in the literature review about satiation, this variety of reward mechanics in a gamification program can reduce satiation by adding several types of the rewards with different attributes linked to them.

II.2) Model

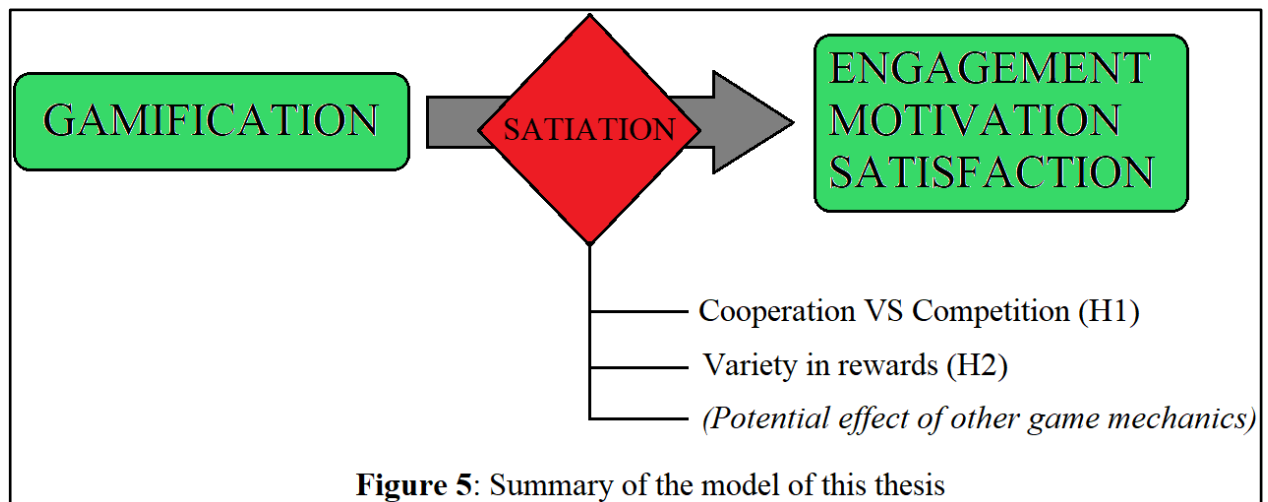
Now that satiation is clearly defined on most of its components, and that we have a clear idea of which components of gamification can have an impact on satiation pace, we can make several assumptions:

- ***H1: Users tend to satiate more and faster if they are in a context of cooperation than in a context of competition, as it is a consumption of a gamified experience in group.***

Thanks to our literature review about satiation, we know that people tend to satiate faster in a context of group consumption than in a solo consumption context. Concretely, we can expect that when the one of the users reach his limit in his own consumption, other people will tend to follow him and will see their own satiation rate increase, as the mere fact of imagining someone else in the group consuming repeatedly the same item will make them satiate faster. On the other hand, in a context of competitive gamification, a user will be against one or more users and therefore, will tend to satiate less.

- ***H2: The more a gamification program include different kinds of rewards, the less people tend to satiate about the gamification program and the more they are engaged in it.***

As previously mentioned, variety can be used to reduce satiation pace or increase its recovery. If a gamification platform include different types of reward (such as badges, tokens, levels, achievements and so on), people will tend to satiate less than if only one kind of reward is proposed.



CHAPTER III: RESEARCH DESIGN

III.1) Methodology

In order to confirm or disprove these three hypotheses, two methods will be used in this research : experimentations for testing H1 and H2. .The use of experimentations method is quite obvious, since it's the main tool used in literature about satiation, and it will be necessary in order to verify something for which no previous literature cover directly..

The ultimate goal of this methodology would be to collect observation and post-experimentation surveys in order to analyze them

III.1.1) H1 experimentation

The design here would be pretty simple : since it will mostly be a qualitative research, it would require mostly groups of minimum 30 people per context. The goal here will be to determine if cooperation leads to an accelerated satiation pace or not As such, two groups will be required : one where people are in a situation of competition (One-on-one), and the other where they will need to work in group to win (Group-VS-Group).

In order to make sure that no other element could impact the research, it would be required that both group participate in the same experiment, which would be in this case a gamified application. The one chose for this experiment will be “Submit your idea” (<https://ideas.starbucks.com/>), where people can suggest ideas to Starbucks about their product, service, delivery and so on. The idea itself can be about a fresh new offer, improving an existing offer or simply bringing back an offer that isn't applied anymore.

The main advantage of this application is that it's already a gamified app, with all the codes commonly used in gamification. As such, it requires only a little more implementations of mechanics for this study.

The experiment will be done during a period of 10 days, in order to collect enough people and also to make sure that an effect can be observed at the end of the study. There are 3 groups in which data will be collected:

- **A control group**, in which people simply do the experiment without any incentive or further implementation. The results of the two other groups will be compared to this one.

- **A competitive group**, where people compete against each other. Each suggested idea will give the user 100 points, and the one which gives the more idea is the one who win the contest. A ranking of all participants in this group will be done at the end of the experiment.
- **A cooperative group**, where people can also win 100 points per suggestion, but these points are pooled and communicated to all users at the end of the study.

However, except for this game mechanics, no other difference will be done in the organization of the experiment, in order to make sure to isolate the effects of cooperation/competition. After suggesting an idea, each participant will have to answer to a little survey in order to have an insight of their enjoyment and appreciation of the game.

For this experiment, the sampling was done by the users themselves, since they had the choice of the kind of experiment they were willing to participate. As consent was previously mentioned as a key element in gamification, it seemed to be a good idea to leave the choice to the user himself, even though there was a risk of potential bias. The fact of participating to one experience or another gives more liberty to participants, which is a good way to induce engagement (Mollick & Rothbard - 2014)

III.1.2) H2 experimentation

The design here would also be quite simple, but yet a bit different from the first hypothesis. In this case, what we have to find out is the link between variety in rewards and satiation.

In order to determine this, we would have to organize a gamified experiment with participants, as with did for the first hypothesis. Here, we'll use an experiment that was used in the past, called "Do Us A Flavor", by Lays

(<https://digital.hbs.edu/platform-digit/submission/crowdsourcing-your-next-chip-flavor-lays-do-us-a-flavor-campaign/>).

The objective is pretty simple: suggest a new chips flavor in order to win a prize. Here however, for the sake of this study, we'll adapt the context and the way the context works. Here, people can suggest as many possible new flavor as they want, and for each suggestion, they'll earn a reward (Except in the control group of course).

The contest had already be proven useful in terms of customer engagement, as such, it'll be quite easy to expect an impact on engagement. Also, as with the first study, the design here is very simple and redundant, as such, measuring satiation will be quite easy too.

The size of the sample would need to be the same, around 30 participants per context. However, since we are not simply comparing two opposite situations, in this case, we need three groups : one where after each session, a different reward is given (For example, first a badge, then a feedback, then a certain number of points, then a token, ...), another where only one kind of reward is given (Only a feedback dashboard for example), and a last one, a control group, where no reward are given between session. The need of a control group is necessary in order to make sure if the presence of a reward have at least an impact on satiation and the engagement. The difference between the two remaining groups will just make a difference in variety of rewards, to make sure if it has an impact on the pace of satiation and the level of engagement.

- **A control group**, in which people simply do the experiment without any incentive or type of reward. The results of the two other groups will be compared to this one.
- **A non-variety group**, where people do the experiment with the incentive of a “fixed” reward (For example, only 100 points per participation, as in the first study)
- **A variety group**, where people do the experiment with the incentive of a “variable” reward (For example, points, token for some particular suggestions, dashboards and achievements).

Again, after the game session and until a player decide to stop, data about their performance will be collected, and they'll have to respond to a survey, in order to gain some insight about their perceptions about their consumption outcome and other factors. The experiment will be done during a period of 10 days, in order to collect enough people and also to make sure that an effect can be observed at the end of the study.

One of the main difference with the previous study was that in this case, participants were attributed randomly in groups, depending on their birth month. This way of proceeding was more “academic”, as it reduce the risk of potential bias. However, no real improvements over the first study were observed.

III.2) Measures

With both experiment, various questions were asked, each of them corresponding to one or more variables. All these elements will be analyzed through statistical analyzes in order to confirm or infirm these hypotheses.

III.2.1) H1 experimentation

Most of the time, satiation scales are used in the context of food. For example, one of them is a 7-steps Likert scale going from “Very Hungry” to “Very Full” (Jönsso, Granfeldt, Erlanson-Albertsson & Ahrén, 2010). However, such a scale doesn’t seem to fit with our experiment, since we are not analyzing satiation over a physical good such as food, but an experience. Also, measurements like the ones in the McAlister model are unfit for such an experiment, since there is no way to know its retention rate for each individual, to know the ideal point and so on.

But it is not the only way to know about it. Satiation is indeed quite complex to analyze, since it can be observed by several aspects of the experience, such as the time spent doing the experience, but also the satisfaction rating and also the comments done by the participants. Also, in order to see if several other variables such as age and gender have an impact, those aspects were asked to the participants during the survey. The four main measures are the following:

- **The satisfaction rating:** Satiation can be perceived in a drop of enjoyment. As such, during the survey, participants are asked to rate their satisfaction toward the experience each time they repeat it. It is measured by an 11-step Likert scale, as it is the case with most perceptions measurements. In this case, the scale is indeed ordinal, but the distance between two points is always supposed as equal.

The number of step chosen was the highest possible by using Google Forms, in order to observe the smallest possible variations in satisfaction for each repeated experience, and to be able to measure the variation pace for each case with as much clarity as possible.

For this experiment, we can expect that the more an experiment is repeated, the more satisfaction will decrease.

- **The number of suggestions made by the participants:** To have an insight about satiation, we can also analyze the number of time the experience was willingly repeated by the 2 groups in the sample, and to compare it to the control group.
- **The timing and pace:** It was measured for each suggestion done during the experience, giving the idea of the total spent time during the experiment. If they spent more than 20 minutes without doing any suggestion, it is considered as an interruption, meaning that it could give them time to recover a bit from their previous satiation level.

- **Their justification:** Also, in order to know when they decide to stop the experience, each participant was asked to mention if they intent to suggest another idea after each suggestion. As soon as they answer “No”, they have to justify why they decide to stop the experiment with a primary measurement scale. Three suggestion were possible to them, and they can choose more than one:
 - ❑ ***They don’t have any more idea to suggest:*** They have exhausted all their resources and feel unable to find another idea.
 - ❑ ***They find it boring or repetitive:*** They stop the experience because they find it unsatisfactory after one or several playing sessions.
 - ❑ ***Other suggestions:*** Since other possibilities could be taken into account, they could decide to stop for another reason (They are busy doing something else or other reasons)

III.2.2) H2 experimentation

Here again, to remain coherent from one study to the other, the measure that will represent satiation will be the same that were previously analyzed, since most of them and seems to capture the concept of satiation quite well. But in this case, since we are in an experiment with rewards, it is necessary to also take a look at the level of engagement.

The issue with engagement is that it is a quite complex phenomenon that can be analyzed and observed with multiple kinds of scales, depending on of the kind of engagement we are talking about. However, in our case, we are not talking about customer engagement over a brand or a product, but engagement over the experiment, which is, in this case, a gamified experience.

The other tricky aspect of this study is that most engagement scales are multi-items, which makes the survey longer, an aspect that could itself induce more satiation. Because of this, two engagement scales are needed for this study : a shorter scale, which will focus on the invested resources for one particular experience, and a longer one, which will take into account all the benefits linked with the experiment and that will consider not only one particular session, but the whole experiment in itself.

- **The repeated engagement rating:** The scale used here is a condensed version of the scale presented by Kumar & Raghavendran, which is a measure used for engagement in context of gamification. This measure consists in 4 items rated in a 7-steps Likert scale, with questions

focusing on their will to share this experiment with other people and their will to suggest more ideas for the contest (Kumar & Raghavendran - 2015)

- **The overall engagement rating:** Such an engagement is similar to an employee engagement to his company, as it is the engagement toward an asked task. As such, previously used scaling for this case will be the ISA engagement learning. This multi-item scale focus mostly on three aspects, which are the intellectual, social and affective engagement (Soane, Truss, Alfes, Shantz, Gatenby & Rees - 2012). Another scale which is very similar but more general, is the customer engagement measure suggested by Vivek, Daleda & Morgan (Vivek, Daleda & Morgan - 2015).

So overall, the scale that will be used to measure the engagement in this study will be very similar to these two scales, but the questions will be adapted to the context of this experiment. Both scales focus on these three dimensions:

- ❑ ***Intellectual engagement / conscious attention (3 items):*** This measure focuses on the extent to which people are intellectually absorbed in their task, or think hard about it.
- ❑ ***Social engagement / social connection (3 items):*** In the ISA model, this measure focuses on the degree to which people feel socially connected to their company and share its values with their co-workers. However, the problem here is that in this case, people are not colleagues with each other and the experiment is not about teamwork, but only a solo experience.

But the other model also take into account the social engagement, and can, in this specific case, be modified to get an idea about their will to share the experiment with their friends and other people.

- ❑ ***Affective engagement / enthused participation (4 items):*** This measure focuses on the extent to which people experience positive and motivating feelings about their task.

For each dimension of engagement, three questions are asked to respondents. Those items were measured on a 1-5 and 1-7 step Likert scale and the average score is calculated for the three items, giving us a score for each dimension. The overall engagement itself is the average of the three dimensions. In our case, since we will calculate the variation over the repeated experiences, we will use a 1-7 as we did for the satisfaction measurement.

- **The satiation effect:** Satiation will be measured the same way it was done with the first study, so we will use these several measurements:
 - ❑ ***Number of repeated experiences:*** This is again the number of suggestions made by the participants. This measure will be compared between the control group and the two other groups.
 - ❑ ***The satisfaction rating:*** There again, we'll ask respondents to rate their satisfaction score on a 1-7 Likert scale in order to analyze the variation of their satisfaction over time.
 - ❑ ***The timing and pace:*** Like in the first study, it was measured for each suggestion done during the experience, giving the idea of the total spent time during the experiment. If they spent more than 20 minutes without doing any suggestion, it is considered as an interruption, meaning that it could give them time to recover a bit from their previous satiation level.
 - ❑ ***Their estimated chances of winning the contest:*** Another factor that can be taken into account is the perceived chances of winning of the users, in order to see if it has any effect on other variables.
 - ❑ ***Their justification for stopping the experiment:*** There again, they have several suggestions, like the boring/repetitive aspect of the experiment, the fact that they don't have any more suggestions, or other reasons.

CHAPTER IV: RESULTS

IV.1) H1 Experiment

IV.1.1) The sample

This experiment was done with 96 participants; 32 in the control group, 33 in the competitive group and 31 in the cooperative group. Two participants from the competitive and one from the control group were dropped because they were outliers. The participants had the choice of the group they were going in. Overall, the sample is mostly composed of individuals between 18 and 37 years old (90.63% of the sample), with a small majority of women (53,13%)

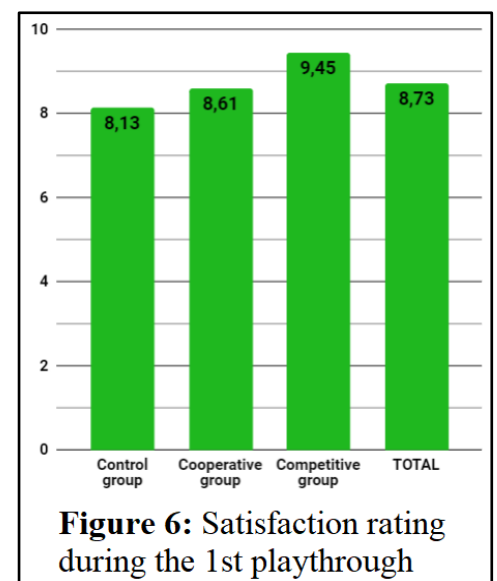
IV.1.2) Satisfaction rating

Satisfaction is one of the key elements of satiation, as it is based on an attitude toward the consumption process.

Comparing the average score for each group at each stage of the experiment (Which last 20 times at best). It can be seen that the average satisfaction score decreases over time with repetition, thus, confirming the general knowledge about satiation ([See Appendix II for more information](#)). Several variables linked with satisfaction, can show us several things.

- **Satisfaction rating at the first try.** It gives us information about the individuals first perception about their gamified experience in the different groups.

❑ **Descriptive statistics:** First of all, when we compare their initial satisfaction level (after their first participation), we can see that overall, people from the competitive group are overall more satisfied of the experience than the average. We can observe an average rating of 8.13/10 for the control group, with a difference of +1.32 for the competitive group, and +0.48 for the control group. It means that, the simple fact of being immersed in the gamified context shows already a difference between the groups in terms of satisfaction toward the experience ([See Appendix III for more information](#)).



❑ **ANOVA analysis:** An analysis of variance show that a difference of mean exists between those groups: this can be seen thanks to the P-value ($0.33\% < 5\%$) and the F-Value ($F = 6.11 > F(2,90) = 3,098$). As such, we could reject the hypothesis of equality in means.

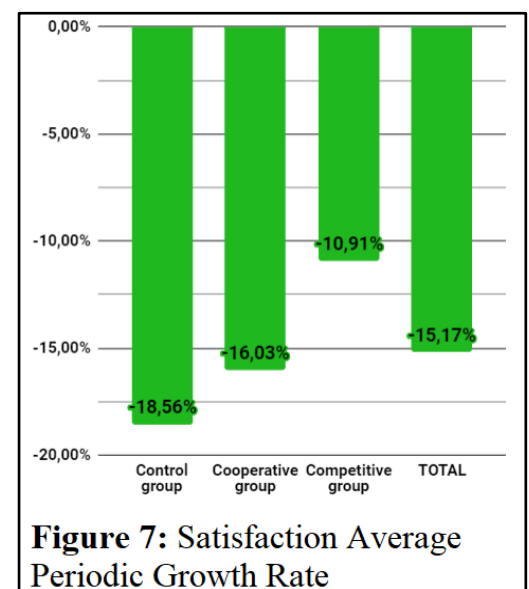
However, this isn't enough to make sure where the difference is actually located. In order to have such information, we need to do a post-hoc test such as the Bonferroni-Dunn test, that gives a two-by-two comparison. This test shows that there is indeed a difference between the competitive group and the control group, but no other significant difference. (See [Appendix IV for more information](#)).

❑ **Linear regression:** However, when we look at the linear regression for the first-step satisfaction rating, with $\alpha < 5\%$, only the difference generated by the competitive group is significant (P-value = $0.08\% < 5\%$ for the competitive group, $20.96\% > 5\%$ for the cooperative group). As such, we can conclude that only the competitive game mechanic have a significant impact over the 1st playthrough satisfaction rating. The R^2 statistic show that this model can explain 6,60% of the variance in this model, which seems quite low at a first glance, but since this is a model with binary variable, it still has some explanatory power (See [Appendix V for more information](#)).

- **Satisfaction APGR (“Average Periodic Growth Rate”) :** The Average Periodic Growth Rate (APGR) over the whole experiment shows how much, on average, the satisfaction score drops from one playthrough to another.

❑ **Descriptive statistics:** We can see that, on average the control group show a decrease of satisfaction of -18.56%, the competitive group show a decrease of -10.91% (+7,65%) and the cooperative group show a decrease of -16,03% (+2,53%). So overall, this decrease of the satisfaction pace over time during this experiment seems to be quite greatly reduced over time for the competitive group. (See [Appendix VI for more information](#)).

❑ **ANOVA Analysis:** By doing an ANOVA analysis, we can confirm our initial thought and see that there is indeed a difference of mean between the groups (P-value = $4,63\% < 5\%$, F-Value = $3,18 > F(2,90) = 3,098$). However, this doesn't give enough information to know where the difference

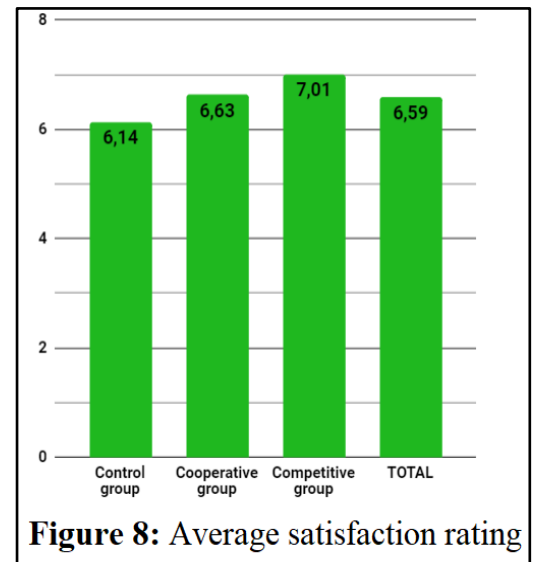


is. By doing a post-hoc test of Bonferroni, we can see that there is indeed a difference between the control and competitive group, however, the same cannot be said about the cooperative group. Therefore, we can conclude that there is a significant difference in the satisfaction APGR for a competitive group, but not for the cooperative one ([See Appendix VII for more information](#)).

- ❑ **Linear regression:** A linear regression summarize what we've seen in the previous analysis of variance, by showing that there is indeed a significant effect of the competitive group over the satisfaction APGR (P-value = 1.52% < 5%), but not for the cooperative group (P-value = 41.41% > 5%). The choice of group by itself can explain 6.60% of the variation of the satisfaction APGR, which is quite small, but not negligible ([See Appendix VIII for more information](#)).

- **Average satisfaction score over the whole experience:** These data would give us an idea about the global perception of their satisfaction for each step of the experiment.

- ❑ **Descriptive statistics:** When we look at the descriptive stats, we can see that the average satisfaction score observed for the control group is 6.14/10 for the whole experiment, while it is 7.01/10 for the competitive group (+0.87), and 6.53/10 for the cooperative group (+0.39). It seems at the first glance that the competitive gamified experience generate a better satisfaction than the two other groups ([See Appendix IX for more information](#)).



- ❑ **ANOVA Analysis:** The analysis of variance show us that there is indeed a difference between the averages scores of the groups (P-value = 1.21% < 5%, F-value = 4,63 > F(2,90) = 3,098). The post-hoc test of Bonferroni show us a distinction between the control and competitive group, but doesn't gives us much information about the cooperative group ([See Appendix X for more information](#)).
- ❑ **Linear regression:** A linear regression summarize what we've seen in the previous analysis of variance, by showing that there is indeed a significant effect of the competitive group over the satisfaction average score (P-value = 0.32% < 5%), but not for the cooperative

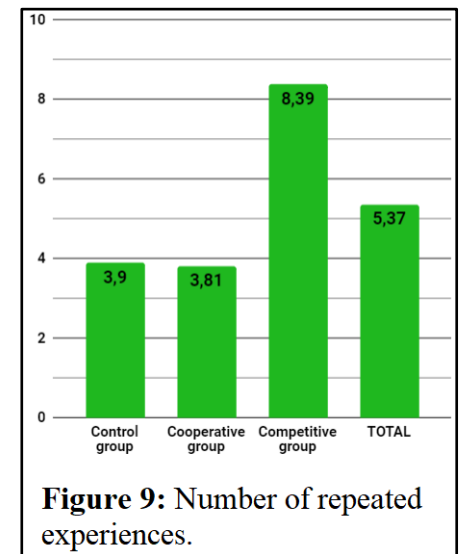
group ($P\text{-value} = 8.53\% > 5\%$). The choice of group by itself can explain 9.34% of the variation of the satisfaction average score ([See Appendix XI for more information](#)).

By looking at the data, we can see that the competitive group is not only more satisfied at the beginning of the experiment, but also, their satisfaction rate decrease slower than with the control group and remain bigger over time on average. Since satisfaction is an important factor in the satiation process, we can interpret that this better satisfaction score means that their satiation pace is reduced in comparison with a cooperative gamified application. No conclusion can be said about the cooperative group, meaning that a cooperative gamified experience does not show any real difference in terms of satisfaction over the control group.

IV.1.3) Number of repeated experiences

The number of repeated experiences works as the behavioral aspect that demonstrate directly if a person satiate during the experiment or not. The same analysis done with satisfaction was done for this variable.

- **Descriptive statistics:** As expected, we can clearly see that the experiment is more repeated by the cooperative group than the two others : On average, for the control group, the experiment was repeated up to 3.90 times, while on the other hand it was repeated 8.39 times in the competitive group (+4.49) and 3.81 times in the cooperative group (-0.09). This difference with the competitive group is quite impressive, as the competitive group boast an impressive difference of 115.13% with the control group ([See Appendix XII for more information](#)).



- **ANOVA analysis:** An Analysis of variance analysis also show some promising results. The single-factor ANOVA show that there is indeed a difference in mean between groups ($P\text{-value} = 0\% < 5\%$, $F\text{-value} = 29,36 > F(2,90) = 3,098$). The Bonferroni post-hoc test make a clear distinction between the competitive group and the two other, but the same cannot be said about the cooperative and control groups ([See Appendix XIII for more information](#)).
- **Linear regression:** This summarizes the information given by the previous analyses : here again, the competitive group not only seems to show a higher number of repeated experiences

in comparison with the control group, but is also the only significant variable ($P\text{-value} = 0\% < 5\%$ for the competitive group, $88,77\% > 5\%$ for the cooperative group). The subdivision of the sample in groups itself can explain 39,48% of the effect of the type of group over the number of repeated experiences, which is quite impressive ([See Appendix XIV for more information](#)).

This show us that, for this sample, it requires much more repeated experiences to reach satiation for the competitive group than for the others, which also confirm our initial hypothesis about a lower pace of satiation for the competitive group. No conclusion can be given for the cooperative group over the number of time that this experiment was repeated.

IV.1.4) Timing & pace

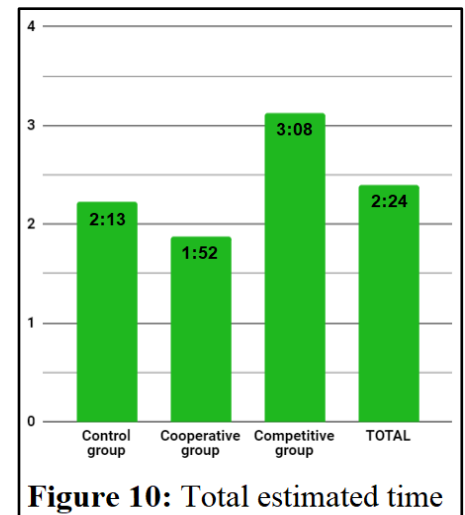
This variable was quite problematic and had to be modified for several reasons. The way those data were collected generated some problems, since the Google Form website only gives data for each time the survey was sent to the interviewer, but didn't give any information about the time when the experiment was actually started, therefore, generating a bias in the time needed to do the whole experiment (The estimated time was always shorter than in reality). This was somewhat troublesome, especially for respondents who only participated once or twice in the experiment, or for the ones who interrupted the experiment for some time and did it again later.

As such, the total time was re-estimated by adding once the average time per step for each individual, except for those who only participated once (Since the time given by Google form was 0). For those people, the estimation was the average time of their group.

- **Descriptive statistics:** When we take a look at the timing, we can see again that overall, in this sample, people from the competitive group remain longer in the experiment than the others (03:08 for the competitive group, 02:13 for the control group and 01:52 for the cooperative group). As such, it shows that they need more time before reaching satiation than others ([See Appendix XV for more information](#)).
- **ANOVA analysis:** The analysis of variance reveal us that there is indeed a difference between mean over the groups ($P\text{-value} = 4,46\% < 5\%$, $F\text{-value} = 3,22 > F(2,90) = 3,098$). The Bonferroni post-hoc test make a clear distinction between the competitive and cooperative test,

but unfortunately, it doesn't give any real information for both groups when we compare it to the control group, since its average time is between the two others ([See Appendix XVI for more information](#)).

- **Linear regression:** The linear regression summarize what we've seen in the previous analysis. The competitive group is the only one that shows a significant difference with the control group ($P\text{-Value} = 2,64\% < 5\%$), while the other group shows, again, no significant effect ([See Appendix XVII for more information](#)).



Overall, it is not surprising to see that the estimation of the time shows a higher result than the two other groups, since this variable is obviously highly correlated with the number of repeated playthrough (63,99%). But overall, it reinforces the confirmation of our initial hypothesis.

IV.1.5) Justifications for stopping the experiment

With such a repetitive experiment, satiation was something that has to be expected. But the reason why people stop doing the experiment can be explained by not only boredom (Mostly an emotional aspect), but also the fact of having no more idea to suggest (Which is a more cognitive) or other potential motives.

By doing logistic regressions to analyze and interpret the results, we can see that none of those dependent variables could be analyzed with the type of group as independent variables, since all P-values were way above 5%. As such, we can conclude that none of those justifications can explain difference between groups and therefore, since none of those variable has a significant impact. Therefore, those variables can't explain potential effects on satiation ([See Appendix XVIII for more information](#)).

IV.2) H2 Experiment

IV.2.1) The sample

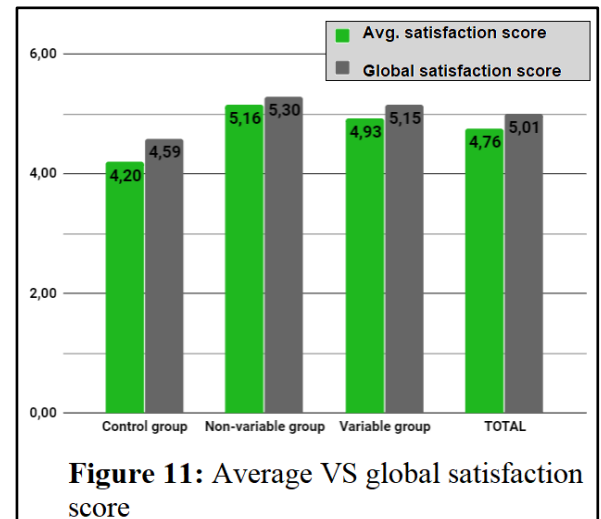
Overall, 110 individuals have participated in this experiment. A total of 352 ideas of new tastes for potato chips were suggested.

This sample was a bit more complex to analyze, since some respondent have not finished the whole experiment. For those, some measure such as the global engagement rating, the global satisfaction

rating and some sociodemographic data were missing (around 12% of the sample). Nevertheless, at least 30 of them in each group have filled the experiment completely, meaning that there are enough significant data to run ANOVAs and linear regressions.

Another problem was the lack of repetition, especially in the control group and the group with non-variable rewards. It means that in most cases, for those groups, we had a satisfaction and engagement APGR of 0%, which can be quite problematic for some measures.

In order to solve those two problem, 14 observations were deleted of the sample, which are the ones who have not finished the whole survey. It also reduces the number of participant who didn't repeat the experiment, since 13 of those participant only played the game once.



Overall, the sample is mostly composed of individuals between 18 and 37 years old (76,47% of the sample), with a small majority of women (55,88%)

IV.2.2) Satisfaction rating

Like the first study, this one required a focus on the satisfaction rating for each step of the experiment. However, this time the result were a bit more inconsistent : even with an overall decrease of the satisfaction score over the repeated experiences (up to 36 times), we can still notice some little increase during some phases of the study ([See Appendix XIX for more information](#)).

Here again, several variables linked with satisfaction, were analyzed here.

- **Influence of short-term satisfaction over the global satisfaction:** Since we've measured the satisfaction rating for each participation and the global perceived satisfaction over the whole experience, we've to make sure of the relationship between those variables.

By doing the linear regression of the short-term satisfaction rating over the global satisfaction, we can clearly see the link between those two variables : one unit of short term satisfaction can increase the global satisfaction rating by 0.53 points. This result is significant ($P\text{-value} = 0\% < 5\%$) and the model can explain 30% of the variance in the global satisfaction rating, which is

quite impressive (See [Appendix XXIX for more information](#)). Therefore, this confirms the effect of short term relationship on long-term relationship.

- **Satisfaction rating at the first try.** As for the first study, this statistic gives us information about the individuals first perception about their gamified experience in the different groups.

❑ **Descriptive statistics:** At a first glance, when we compare the initial satisfaction level (after their first participation) for each group, we can see that overall, people from both the non-variable reward and variable reward group seems more satisfied after their first playthrough. We can observe an average rating of 4.44/7 for the control group, with a difference of +1.03 points for the non-variable and +0,88 points for the variable group. It means that, the simple fact of being immersed in the gamified context shows already a difference between the groups in terms of satisfaction toward the experience. However, it is not enough to conclude anything about the impact of variety in reward on this variable. (See [Appendix XX for more information](#)).

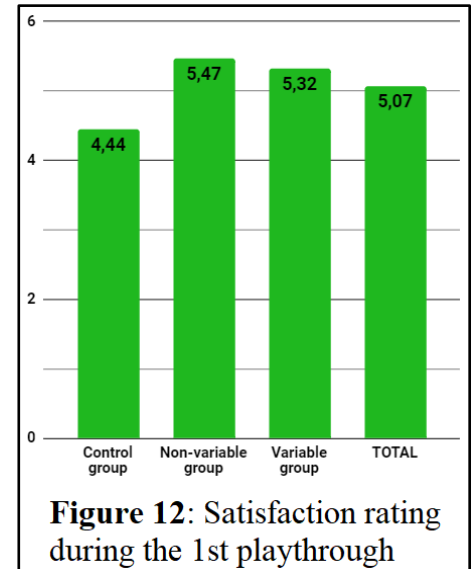
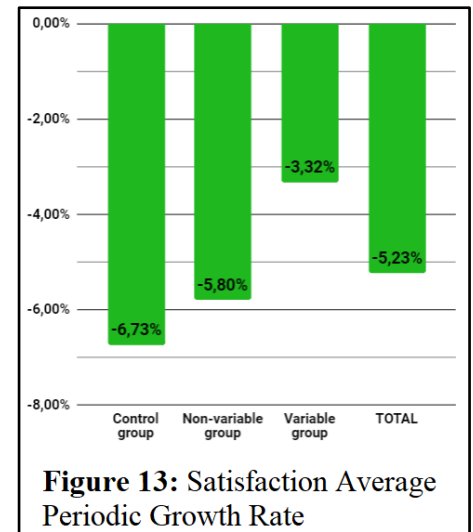


Figure 12: Satisfaction rating during the 1st playthrough

- ❑ **ANOVA Analysis:** An analysis of variance shows us that there is indeed a difference of mean between groups ($P\text{-value} = 1.63\% < 5\%$). However, the Bonferroni post-hoc test shows us quite surprising results, because the difference in mean is between the control group and non-variable reward group. Which means that in this case, there is indeed a group with a better satisfaction at the beginning, but it's the non-variable group, which seems quite contradictory with our hypothesis (See [Appendix XXI for more information](#)).
- ❑ **Linear regression:** A linear regression summarize what we've seen in the previous analysis of variance, by showing that there is indeed a significant effect of the reward over the first-step satisfaction rating. Both P-values are below 5%, so we can assure that the presence of a reward mechanics have indeed a significant effect on the first-step satisfaction rating. (See [Appendix XXII for more information](#)).

- **Satisfaction APGR (“Average Periodic Growth Rate”)** : As we have done during the first experiment, we can also analyze the satisfaction APGR for this study too.

❑ **Descriptive statistics:** As with the previous variable, this one shows us also quite obvious results. The average rate for the control group was a decrease of -6,72% of the satisfaction rate, with a difference of +0,92 for the non-variable reward group and +3,40 for the variable reward group. At a first glance, we can be pretty sure that variety in reward play indeed a role in the decrease of satisfaction, however, we’ll do further analysis to confirm or infirm this. (See [Appendix XXIII for more information](#)).



❑ **ANOVA Analysis:** An analysis of variance shows us that there is no real difference in the means between groups (P-value = 57.85% > 5%, F-value = 0.55 < F(2;93) = 3.091). As such, we cannot see any significant difference in terms of satisfaction growth rate between groups. This is quite odd, considering the result we’ve observed in the descriptive statistic part (See [Appendix XXIV for more information](#)).

❑ **Linear regression:** A linear regression summarize what we’ve seen in the previous analysis of variance, by showing that those variables cannot explain the differences in means for the satisfaction APGR (Both P-values are above the limit of 5%). Plus, the R-square is almost non-existent (1%). As such, we can’t conclude any effect of the presence nor variety in reward over the satisfaction APGR (See [Appendix XXV for more information](#)).

- ❑ **Average satisfaction score over the whole experiment:** Here again, this variable will give us an idea about the global perception of their satisfaction for each step of the experiment.

❑ **Descriptive statistics:** The control group shows an average short-term satisfaction score of 4.20/7, with a variation of +0.96 points for the non-variable reward group and +0.73 points for the variable-reward group. This seems to indict an effect of the reward mechanics over this variable, but doesn’t seem to show any real effect of variety over this satisfaction score, but this element will be covered by further analyses (See [Appendix XXVI and Figure 11 for more information](#)).

❑ **ANOVA Analysis:** The ANOVA analysis shows that there is indeed a difference between groups in terms of means (P-value = 3.88% < 5%, F-value = 3.37 > F(2;93) = 3.091).

Unfortunately, as with the first variable, we also find that the difference is situated between the control group and the group with no variation in rewards, an observation that goes against our hypothesis (See [Appendix XXVII for more information](#)).

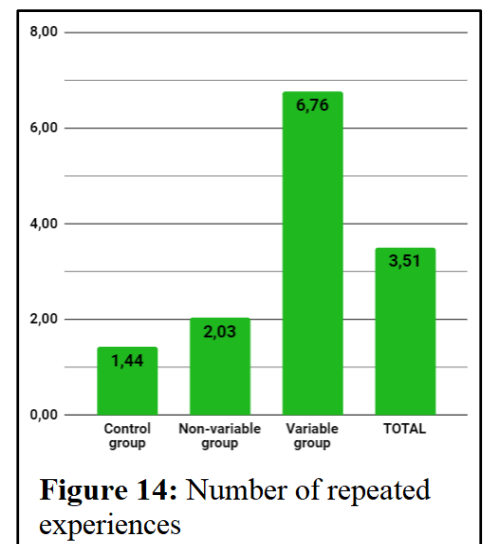
- ❑ **Linear regression:** A linear regression summarize what we've seen in the previous analysis of variance, by showing that reward mechanics have indeed a significant effect over the average short-term satisfaction score in the case of an absence of variety in rewards ($P\text{-value} = 1.55 < 5\%$). However, this effect is very debatable for the presence of variety in reward, as the P-value is slightly over the limit ($5.67\% > 5\%$) (See [Appendix XXVIII for more information](#)).

Overall, all the variables linked with the satisfaction aspect seems to be either insignificant or contradictory with our initial hypothesis. But since satisfaction only covers one part of the satiation mechanics, we will continue our analyze on other factors. These irregularities will be further explained and covered in further parts of this thesis.

IV.2.3) Number of repeated experiments

For this second experiment, we will also have a look at the number of repeated experiments for these three groups. Since it was maybe the most obvious and significant variable for the first study, we can expect that the results will be pretty similar to the ones in the first study.

- **Descriptive statistics:** As expected, we can clearly see that the experiment is more repeated by the group with variable rewards than the two others. On average, the experiment was repeated up to 1.44 times, with a difference of +0.59 for the non-variable reward group and +5.33 for the variable reward group. The gap between the groups is even more astonishing for this study, since we can observe a difference in means of almost 370% between the non-variable group and the control group (See [Appendix XXX for more information](#)).



- **ANOVA analysis:** The ANOVA analysis is also able to make a clear distinction between groups ($P\text{-value} = 0\% < 5\%$, $F\text{-value} = 9.80 > F(2;93) = 3.091$). This time, two distinction can be made thanks to the Bonferroni post-hoc test : One between the variable reward group and the control group, and one between the variable reward and non-

variable reward group. No such distinction can be made with the non-variable-group and the control group. Therefore, we can be assured that the fact of adding a reward mechanics with variety in the type of reward can make a difference in the number of repetition of this experiment ([See Appendix XXXI for more information](#)).

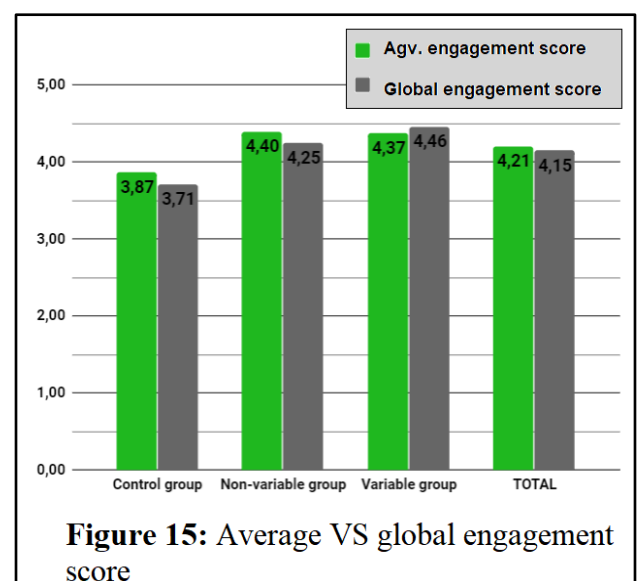
- **Linear regression:** This summarizes the information given by the previous analyses : here again, we can clearly see that only one of the result is significant : the average score for the variable reward group (P-value = 0,01% < 5%). It should also be noted that for this variable, the intercept is not significantly different from zero (P-value = 13,26% > 5%). The type of group itself account for 17.41% of the total variance of the number of repeated experiences ([See Appendix XXXII for more information](#)).

These results were quite promising, since they show that the mere presence of difference in terms of game and reward mechanics have a significant impact on the number of time this experiment was repeated. It can therefore confirm the initial hypothesis.

IV.2.4) Engagement rating

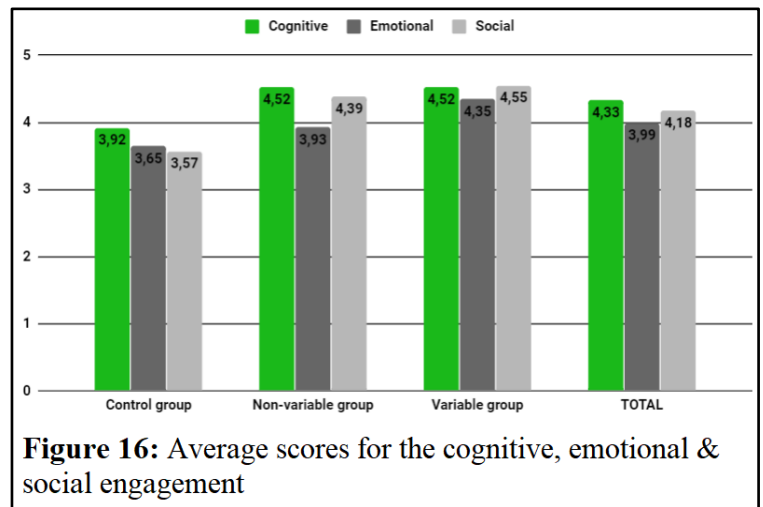
Engagement from the user is maybe one of the key elements when a manager design a gamified project. But surprisingly, the results about engagement variables were quite disappointing, since none of them showed any difference between groups, and no group showed a significant impact in either the satisfaction 1st step rating, APGR or average score. Only one of the ran test seems to be able to bring at least some conclusive results:

- **Influence of short-term engagement over the global engagement:** we can still confirm that there is indeed a link between short-term and global engagement. By doing a linear regression, we can see that both variable can be linked : increasing the average short-term engagement score by one can, on average, increase the global engagement score by 0.55 points. This effect is proven to be significant (P-value = 0% < 5%). This single variable can explain 53.93% of the variance of the global engagement score, which is quite impressive ([See Appendixes XXXIII to XLII for more information](#)).



As such, the only real conclusion that can be done here is the fact that the average short-term engagement shares a relationship with the global one. However, it doesn't prove anything about the effect of the type of gamified context over the engagement rating, which is quite surprising, considering that reward mechanics are considered as a potent way to increase engagement.

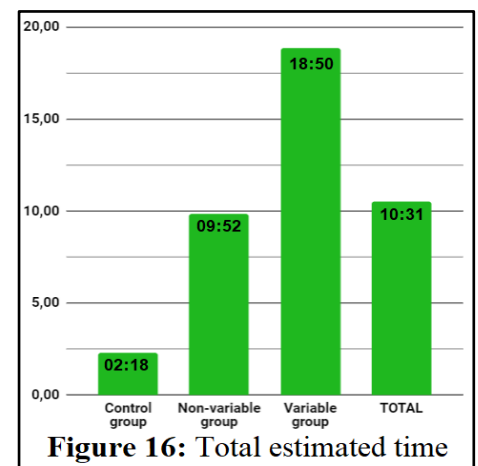
It should also be noticed that global engagement can be defined as the average score of the cognitive, emotional and social engagement variables, as we've seen in the literature.



IV.2.5) Timing & pace

As we did for the first experiment, we also had to adapt the timing variable in order to make it more realistic, since the way the time data has been collected seems to be defective :

- **Descriptive statistics:** This time, the experiment was quite long to fill, as there were more questions than in the previous study. The gap between the average total timing between group is huge : the control group shows an average timing of 02:18, with a difference of +07:34 for the non-variable reward group and +16:32 for the variable reward group. As such we can easily see that people participated for a longer period when several rewards were used(See Appendix XLIII for more information).
- **ANOVA analysis:** Starting with an analysis of variance, we observe a significant difference between means for at least some of the group ($P\text{-value} = 0.39\% < 5\%$, $F\text{-value} = 5,90 > F(2;93) = 3.091$). However, in order to locate where the difference is actually true, we have to run a Bonferroni post-hoc test. This test showed only the presence of a difference between the control group and the variable reward group (See Appendix XLIV for more information).
- **Linear regression:** A linear regression summarize what we've seen in the previous analysis of variance, by showing that reward mechanics have indeed a significant result over the total spent



time on this experiment (P-value = 0.09% < 5%). The intercept itself doesn't seem to be significantly different from zero (P-value = 50.76% > 5%). Therefore, it seems that only variety could explain an increase in the total spent time for this model. Overall, this model can explain 11.26% of the total variance in terms of time ([See Appendix XLV for more information](#)).

This time again, the time spent seems to actually show results that goes in the same direction as our hypothesis. This could be explained by the fact that the gap between the number of repeated experiences is way bigger for this experiment than for the first one, since both variable shares a correlation of 70.50 %.

IV.2.6) Justification for stopping the experiment

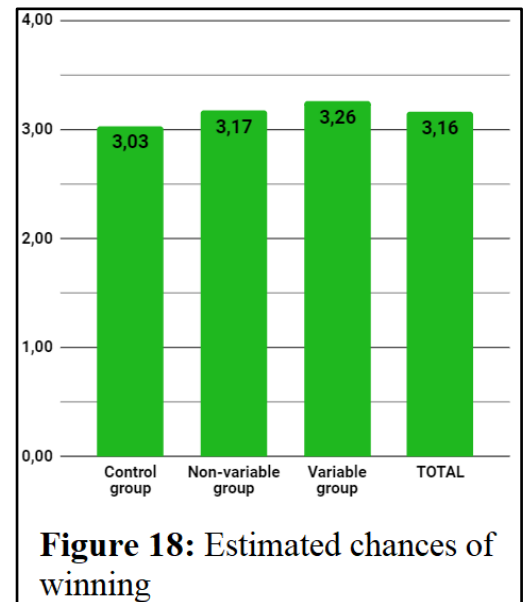
As we did for the first experiment, we also try to have an insight of the motives people mentioned for stopping the experiment.

- **Chi-square test:** The Chi-square test show us that there is indeed a link between type of group and the motive to stop the experiment ($\chi^2 = 9,90 > \chi^2(0,05;4) = 9,49$). However, even this fact, it's not enough to see where the difference is actually located ([See Appendix XLVI for more information](#))
- **Logistic regression:** By doing several logistic regressions, we can see that only one of those coefficients through the 3 regressions is significant : the coefficient of the competitive group for the "Boring/repetitive" independent variable. The interpretation of the Odd-ratio coefficient is $e^{\beta} = 3,57 > 1$, meaning that the fact of finding the experience boring or repetitive is more common in the variable group than in the two other groups. Those two variables are dependents. ([See Appendix XLVII for more information](#))

IV.2.7) Estimated chances of winning

In this particular context, since the gamified experience was designed in a more competitive context, a suggested idea was to ask people about their perceived chances of winning the context. However, it seems that the results for this question were too inconsistent to bring any useful data:

- **Descriptive statistics:** Overall, the average chances of winning for each group are quite close to each other. The estimated score of the control group was 3.03/7, with a difference of +0.14 for the non-variable reward group and +0.23 for the variable reward group. (See [Appendix XLVIII for more information](#))
- **ANOVA analysis:** As expected, the ANOVA procedure shows us that there is no real significant gap between the mean of these groups ($P\text{-value} = 88,91\% > 5\%$, $F\text{-value} = 0,12 < F(2;93) = 3.091$). (See [Appendix XLIX for more information](#))
- **Linear regression:** The linear regression summarize the previous results by showing that none of these coefficients are significant (All p-values are above 5%) (See [Appendix L for more information](#)).



This variable doesn't seem to bring anything valuable to the study. It could have been expected that this variable could be linked or correlated with the number of participation, but even there, the correlation is almost non-existent (6,84%).

CHAPTER V: DISCUSSION

SUMMARY	Behavioural engagement		Perceived engagement			Perceived satisfaction			Motive to stop	Winning expectations
	<i>Repetition</i>	<i>Time</i>	<i>1st round</i>	<i>APGR</i>	<i>Average</i>	<i>1st round</i>	<i>APGR</i>	<i>Average</i>		
Cooperation VS competition	Conclusive results	Conclusive results	---	---	---	Conclusive results	Conclusive results	Conclusive results	Unconclusive results	---
Variety in reward mechanics	Conclusive results	Conclusive results	Debatable results	Unconclusive results	Debatable results	Unconclusive results	Unconclusive results	Unconclusive results	Unconclusive results	Debatable results

Figure 19: Summary of the two studies results over their several variables

V.1) Cooperation & competition VS Satiation effect

The first experiment helped us to identify that overall, people participation to a competitive gamified platform induce less satiation than with a cooperative gamified platform, since they will repeat the experiment more often, spend more time on the platform and feel more satisfied during their first experience with the platform while also showing a smaller decline in satisfaction over time.

V.1.1) Repetition of the experiment in solo consumption and competition context

As mentioned in the literature review, the context of a group consumption can induce more satiation than a context of solo consumption, since consumption in a group generates a shared attention over the task at hand, which itself makes the consumer think about not only his own consumption, but also the other participants (Barghava, Montgomery & Redden - 2018).

In some sense, these results concerning a gamified experience don't actually shows that people satiate more in a group, since most of the results about a cooperative gamified experience are insignificant and doesn't seem to show any difference with the control group. Therefore, we can't make sure that a cooperative gamified experience is actually bringing any improvement or worsening to the initial experience. However, we can clearly see that a competitive context, which isolate people and induce rivalry between them, can actually induce less satiation than in the other groups. It can be observed with the number of repeated experiences for the first group.

This particular aspect seems to confirm our initial hypothesis: A competitive gamified experience induces less satiation than a cooperative one. However, the concept of shared attention doesn't seem to be the cause of it, since we can't really see any increase in satiation for the cooperative group over the control group. As such, it seems that in fact, the competitive group has a particular aspect in its game mechanics that induce less satiation than it does not share with the two other groups. This aspect could be the motivation of winning the game, as it induce people to participate

more and more in order to be amongst the winners of the game ([Leclercq - 2018](#)). In a context of cooperation, any contributor to the experiment is a “de facto” winner; everybody can consider himself as a winner at the end of the experiment, regardless of the number of suggestions he made. But in a context of competition, there are winners and losers, and individuals, in order to be among the winners, would willingly participate more than they would in other groups.

Finally, it was also to be expected, it turns out that participants in a competitive experience participate longer since they gave overall more answers and suggestions than the others. However, we have to consider that this variable could be flawed, since the time was estimated rather than precisely measured. Moreover, even with the suggestion of doing only a few sessions per day on several days, people seemed to prefer consuming the whole experience in a few minutes rather than interrupting it. This aspect can be linked with the theory about perceptions, the effects of an underestimated effect of consumption over satisfaction and melioration. People tend to prefer current consumption, and thus underestimate the effects of satiation, making them consuming the experience faster than they should and thus, reducing the utility they derive from the experience while increasing satiation ([Herrnstein, Lowenstein, Prelec & Vaughan - 1993](#), [Galak, Kruger & Lowenstein - 2012](#)).

V.1.2) Satisfaction in savored victory

In link with the previous aspect, these results also confirm that an overall better experience in terms of satisfaction and enjoyment induces less satiation. This element can be linked with the theory, as a positive outcome in a consumption context can reduce satiation ([Yu & Lang - 2017](#)).

People benefit directly from the fruits of their efforts in a competitive environment, while they only share a part of the merit in a cooperative experience, where everybody earns the same result at the end, which is way less clear in the player’s mind. Therefore, the outcome of the gamified experience is different in both groups, and is the best perceived in a competitive context, while on the other hand, there is no real improvement for the cooperative group over the control group for which no points mechanics was generated.

Overall, this better satisfaction can be already perceived at the beginning of the experiment, where people are directly immersed in the gamified context. Also, people seem to perceive a slower pace of their satisfaction drop over the repeated experiment and overall a better average satisfaction during the experiment, therefore, confirming the initial hypothesis.

V.1.3) Weaknesses of the study

Several of the analyzed variable haven't shown the expected results:

- Time and number of playthroughs were maybe the most obvious evidences of satiation in this experiment. However, even if those variables are significant, several other elements could have altered the results, such as the device used to fill the survey (Phone, tablet or smartphone), the possibility for the user to cheat (Only filling the survey and not the company platform, which would be impossible for the experimenter to verify) or even other potential variable. This fact should be considered and these results have to be considered with caution.
- The satisfaction variable showed us the expected results. However, we have to take into account that there is a potential bias about the satisfaction measures: since most people did the whole experiment in one seance in a short period, there is a possibility that there is an influence of the previous response. For example, if the first step was a good experience for the user, and that we observe a small decrease of satisfaction during the second step, it could be either a really less good perceived satisfaction or a much less good experience, but where people give willingly a false answer in order to remain coherent with their first experience. However, we could consider that it is not the case and that their answers remain honest, since people voluntarily chose to willingly continue the experiment nevertheless. Also, it was measured through a single item scale, which capture fewer dimensions of the variable, even if in this case, variations and satisfaction during the first playthrough were taken into account.
- The justification for stopping the experiment didn't really explain if people satiate or not, but could provide some insights about the source of the satiation itself, the motive for stopping the consumption process, either emotional (Perceived as redundant and boring), or cognitive (no more idea to suggest). However, there was no real difference from one group to another, which is rather odd considering the differences with other variables in the competitive group. One possible suggestion is that since they enjoy the game more, they will only find it repetitive after many more suggestions, and since they put much more effort in it, they can think about and suggest more idea. This possible change in attitude and behavior induced by the context of the game could actually counterbalance the "normal effect" of the gamified experience itself, and therefore, would not show any real perceived difference to them.

To get a better idea of the participants' perception about the experiment, some qualitative feedback was collected after the study. Overall, they enjoyed the fact that the study was pretty short and easy to fill, but regret that they had to give their ID, age and gender during each game, and to switch from the gamified application to the survey each time. Those elements could have induced more satiation about the survey itself, and not the game, which could be quite problematic if only one group had the problem, however, since all groups were submitted to the same rule, it doesn't seem to be a problem. Thanks to this feedback, most of those issues were corrected when designing the second study.

V.2) Variety in rewards & game mechanics VS Satiation effect

With the second experiment, we can make sure that variety has indeed an impact on satiation, since the experiment was much more repeated for the group with multiple reward than for the other group. However, we still have to investigate on some theoretical elements for this study.

V.2.1) Repetition of the experiment with several types of rewards as incentives

As we have seen in the results, the experiment was much more repeated in the variable reward group, which can be linked with the theory about gamification and engagement. Rewards are considered as a very potent way to increase engagement toward a company or a brand, in a B2C as well as in a B2B context. In the current context, it can be measured by the number of times the experiment was repeated (It would therefore be a form of behavioral engagement). Not only that, but rewards are recognized as a good way to increase the repeated usage of the gamified platform and contributions ([Leclercq - 2017](#)) which are in this case the number of participation and idea suggestions from the users.

However, this particular statement could be confirmed if a significant effect had been observed for both the non-variable reward and variable reward group, but only the latter show such an effect. However, it seems enough to conclude that there is indeed a slower satiation pace and better long-term behavioral engagement when several types of reward are accessible. In this case it was points, badges as form of achievement, and an open-access dashboard where they can see their score and achievements.

An alternative suggestion could be the preferences for specific goals or reinforcers, an element that can apply to games in general, which is the need to “do something”, such as the need to go farther in the game or level, to complete or to finish something. It is one of the few elements that

can be observed in the gaming addiction literature ([King, Herd & Delfabbro - 2017](#)). Since the variable group had points and badge that can be considered as a form of achievement, as they were “titles” for fulfilling a particular task, we could consider that they find the game more interesting and play it until they reach at least some achievements.

It is also quite interesting to see the huge gap of time spent on this experiment between groups. Such observations are quite similar with such experiments with video games, as people seems to lose track of time over the repeated experiences, which is a rather positive sign, as it is mostly observed in cases of addictions ([Mollick & Rothbard - 2014](#))

V.2.2) Weaknesses of the study

Even if most of the weaknesses of the previous study were corrected in this one, several other problems appeared:

- First of all, the engagement measurement was flawed for this study. This could come from the fact that this variable relied on multi-item scales, which are indeed very potent for more “classical” experiment, but is less effective in order to measure engagement during a repeated experimentation. When one is designing a study such as this one, he has to take into account the length of the study and the amount of time such a survey could require to be filled. If the survey is too long, a person’s answers will be less accurate and it would generate even more satiation than the experience that the expert is trying to analyze.
- This problem of satiation induced by the survey itself could also impact the number of people that only did the experiment once, which could cause issues when trying to analyze the drop of satisfaction or engagement. It can also explain the number of unfinished surveys, which limit the number of data for any individual and lead to a drop of several individuals in the sample.
- The same reasoning could also explain the lack of significant impact over the satisfaction measurements. Considering that there is more variety in reward, individuals should find the game more interesting, since they can find more easily a reward that fit their expectation, whatever if it’s a way to compare themselves to others or reach a certain status through badges and past achievements. But it was not the case for the variety group.

All in all, by following a more classical academic approach, this test suffered from an increase in length over the first one, but it’s not the only result that was surprising. Considering the rule of the game, two strategies of playing were expected from the player: either he could suggest more

numerous ideas in order to earn more points, even if those ideas were pretty simple and unoriginal, or he could also suggest less idea, but more creative ones, which would grant him better bonuses. However, most of the winners have actually played both strategies, earning them huge amounts of points. Most of the players in the middle of the ranking seem to have played the strategy of giving more original ideas, but the top 3 have reached all the achievements and are only separated by their number of participation. This kind of study could also be considered with other types of rewards, such as levels or progress bars, in order to determine if one particular type of reward could induce more (or less) satiation than the others.

CHAPTER VI: CONCLUSION

VI.1) Short summary

Since the first implementation of gaming elements in managerial initiatives, its effects over its users satisfaction and motivation are often taken for granted by managers, and the relationship between those variable is still not fully understood by the experts in this field. However, it is often forgotten that using a gamified application is a form of consumption of an experience, which means that it is subject to the constraints of satiation, which could overcome the benefits provided by such applications in the long run. Indeed, this constraint could lead consumers to a drop of their consumption pace, since they don't derive that much satisfaction over the consumption process, or to switch their consumption to alternatives, which are items with different attributes than the previous one.

Satiation is a phenomenon that has been repeatedly analyzed in the literature from all angles, be it the psychological factors, the characteristics of the consumer or those of the consumed item. Some solutions, limiting the pace of satiation have been suggested in studies, such as recalling past variety, relying on categorization levels, bringing a more positive outcome and so on. The literature review on gamification has shown several game mechanics on which managers could rely to reduce the satiation pace, such as the game context (Cooperative, cooperative or competitive), the mechanics of reward (One or more types of rewards), or even many others that weren't explored in this thesis.

All in all, it was proven through experimentation than the most potent way to avoid satiation of a gamified application was to rely on a competitive context, as it motivate people to participate more to the experiment through rivalry. People showed a better behavioral engagement, by participating more often, and were overall more satisfied with the gamified task than with a cooperative context.

This study also showed that variation in game mechanics such as rewards can have an impact on behavioral engagement, as its users will mostly look specific goals or reinforcers such as achievement, a reward type for which users will try to reach higher standards in the competition. Even though the desired type of reward could depend on other parameters, such as the context of the game, users' preferences, their characteristics, and so on.

VI.2) Managerial implications

Overall, thanks to those studies, reviews and experimentation, we now have a better insight about the relationship between gamification and engagement. We can now confirm the presence of a satiety effect that would greatly affect the long-term results of such managerial initiative for a company, and give some insights to make it more successful in order to avoid useless costs and a loss of investments.

With all the elements explored in this thesis, we know that a competitive gamified experience would induce less satiation for its users than a cooperative one. However, it doesn't actually mean that a cooperative one would be useless. All in all, it would depend on of the desired managerial objectives for the company and the context and environment in which it operates. While a cooperative experience would induce strengthened social bond between users and would bring a less negative impact in a losing situation, a competitive one would induce rivalry that would increase motivation, but would generate a higher drop of enjoyment and engagement in a losing situation ([Leclercq – 2017](#)). In such situations, competition would be very positive for the best users, but more unfavorable for the others, which can induce a drop of motivation for these individuals. Therefore, the best choice would be very situational.

We can also confirm that variety in the game mechanics have also an impact on satiation. Bringing variety induce people to repeat much more their participation in the experiment. Therefore, we could say that managers should indeed implement a reward mechanic in their gamified application, but also bring more than one type of them. However, some advice are required considering rewards:

- Even if adding rewards does indeed generate more engagement and fun for the user, rewards should not be the ultimate goal for them, as gamification is, in fact, a tool to generate joy and increase users engagement when doing a redundant or complex task. Nevertheless, even if rewards can help, they remain fragile and does not necessarily take the first place in the user's mind ([King, Herd & Delfabbro - 2017](#)).
- The choice of a mechanic such as badges as form of achievement was proven useful in the second experiment. However, we have to consider that since the experience was rather short, a fact that doesn't poke on the issue of recalling past consumption on satiation. However, for the use of a gamified platform during month, or even years, the fact of relying on achievement

could also be counterproductive, as titles or badges as a reminder of past achievement could also remind past consumption of the experiment.

- Reward should be linked with a particular context, such as a certain achievement, reaching a certain level of efficiency for a particular task and so on. Their distribution should also be fair, which means that when a user deserve it, he has to receive it. It was one of the reasons why the type of reward should not be distributed randomly, as we suspected that it would not bring any desired result.

Finally, it has to be mentioned that even if these solutions are an efficient way to reduce satiation, it doesn't actually overcome it. Over time, satiation will still appear, and updating the gamified platform will become necessary. For example, it is possible that people lose interest over times, as the required tasks will surely become easier, as people will tend to plan their way to interact with the gamified platform more carefully. After all, such observations were made with video games (Mollick & Rothbard - 2014). Over time, changes in the gamified program will be necessary, in order to still surprise its users and pick their interest once again.

Managers should be aware of those conditions when they decide to implement a gamified platform in the daily activity of their users, whether they involve consumers, employees of their company or other individuals.

VI.3) Theoretical implications

The literature on gamification continues to praise its merits when it comes to the positive effects on commitment and motivation of the users it generates. However, even though these initiatives have proven successful in some companies and sectors, some experts and analysts remain skeptical about its long-term effectiveness. The reasons mentioned are often a rather poor design of the application, however, one can also consider that the relationship gamification-commitment is often quite poorly understood. Also, gamification can, and should, be considered as a consumption phase, with all the consequences that it implies.

As gamification is indeed a consumption of an experience, satiation functions as a mediator between the gamified platform and its outcomes on engagement, satisfaction and motivation. As such, the obvious solution would be to find a way to reduce its pace. Since relying on of psychological aspects and consumers characteristics seems difficult, considering the lack of control a manager or expert could have on them, the only viable solution (in terms of monetary

costs as well as efficiency) would be to work on the item characteristics, namely the gamification mechanics that could induce less satiation.

In conclusion, this thesis brings a new approach of the topic of gamification, by providing a new angle of approach and providing some clues on mechanics that could be used to provide a better long term output of such managerial initiatives.

VI.4) Limitations & suggestion for further research

Unfortunately, as many other studies on this field, it has its own flaws. Measuring satiation on a particular experience without actually inducing more satiation can be very tricky. When designing a study for such a topic, an expert has to restrict himself on only a few variables to analyze, and ask as few questions as possible. However, this is a double-edged problem, as too few variable would limit the results and the interest of a particular experiment. The two experiments designed and presented for this thesis are no exception, as we've seen. Designing a survey for such an experiment would often require a specially designed scale, which summarize as many factors as possible without being too long. It also requires very clear objectives and precise design elements, otherwise, it may confuse the user.

Overall, finding a way to measure satiation is a problem in itself. Many literature articles covers the topic, but most of them only focus on physical good, not on experiences. The only formula that was found in all the covered literature for this thesis was in Yu & Lang review, and this particular formula was applied in the context of gaming, even if according to those authors, other applications were possible. However, the formulas were quite difficult to understand and many variables or coefficients were rather poorly detailed, making it rather impractical to use without being able to verify all the necessary elements.

Also, the sample choice could be a real issue, especially when attributing a particular user to a particular game mechanic. The first study relied on a free choice from the user (Choosing between a “neutral”, “cooperative” or “competitive” experience and sticking to it until the end), as consent was mentioned in some literature as a key element for people to willingly engage in a managerial initiative (Mollick & Rothbard - 2014). On the other hand, the second study was a more “classical” approach to sampling, where a question that doesn't matter is used as a way to randomly attribute a user to a particular group (In this case, birth month). Without further researches, it is impossible to say which procedure is the best, but we can suspect, thanks to those results and the literature on the topic that the first method is the best way to proceed.

The sample size, while remaining valid, was quite limited, as each group required 30 people, for a total of 90 people per study. This comes from the fact that, contacting people in order to run such experiences was a tricky process, as it was done in order to avoid that people that participated in the first study could participate in the second one. With such way to proceed, it was possible to avoid that people that satiated of the first experiment and did not fully recover from it over time could participate in the second one and pollute the sample. Therefore, for both studies, it was necessary to find at least 180 different people.

That being said, this first study on the topic of the effects of satiety in a gamified experiment is a real opportunity for future research, as many other game mechanics can be explored in order to find other ways to slow down satiation pace:

- For example, other types of rewards, such as progress bars, virtual goods or levels can be tested.
- Coopetition could also be further explored, as it could be a good way to find a more balanced solution to more complex managerial issues.

Further research should also focus on the effect of consent in gamification over satiation. Such a study was impossible to design in the context of a master thesis, as consent is linked with a certain authority from the expert, something that a master student lacks on his study participants. However, someone with a status of authority (A professor, a manager ,...) could do such experiment, in order to confirm or reject the hypothesis of a link between satiation and consent. However, such studies also require a certain respect of ethics, as people could be, in this case “forced” to participate in an experiment...

Finally, as a more general advice for scholars, in order to find more clues to overcome satiation, they should rely on literature about addiction, as satiation and addiction work as quite opposite effects. For example, since there are so many articles about addictions on video games, one could find some inspiration and potential clues in gaming design to use on satiation applications, with the ultimate goal to reduce drastically the externalities of satiation.

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(<https://www.forbes.com/sites/ninaangelovska/2019/01/20/gamification-trends-for-2019-making-room-for-game-elements-in-politics/#5b1531fb2a77>)

COURSES

- **STEILS & DESSART - Market Research** – 2015-2016
- **VERARDI - Econometrics & Multivariate analysis** – 2015-2016

VIDEOS

- **ZICHERMANN – TEDxKids @ Brussels – Gamification** – 9th of June 2011
(<https://www.youtube.com/watch?v=O2N-5maKZ9Q>)

GAMIFIED PLATFORMS USED FOR EXPERIMENTS

- **What's your Starbucks idea?** (<https://ideas.starbucks.com/>)
- **“Do Us A Flavor” by Lays**
(<https://digital.hbs.edu/platform-digit/submission/crowdsourcing-your-next-chip-flavor-lays-do-us-a-flavor-campaign>)

SURVEY LINKS

- **Experiment 1**
(https://docs.google.com/forms/d/e/1FAIpQLSesdOciqJActD-qr0ZI3-2o6hAtHE6bmlhZ9U7Ji5Byci3F_Q/viewform)
- **Experiment 2**
(https://docs.google.com/forms/d/e/1FAIpQLSdaN8_kv-XoCq2dxqsX7dpDuW6V6S2alf_Wh91NbEU4HMHRVw/viewform?fbzx=80333535080190724)

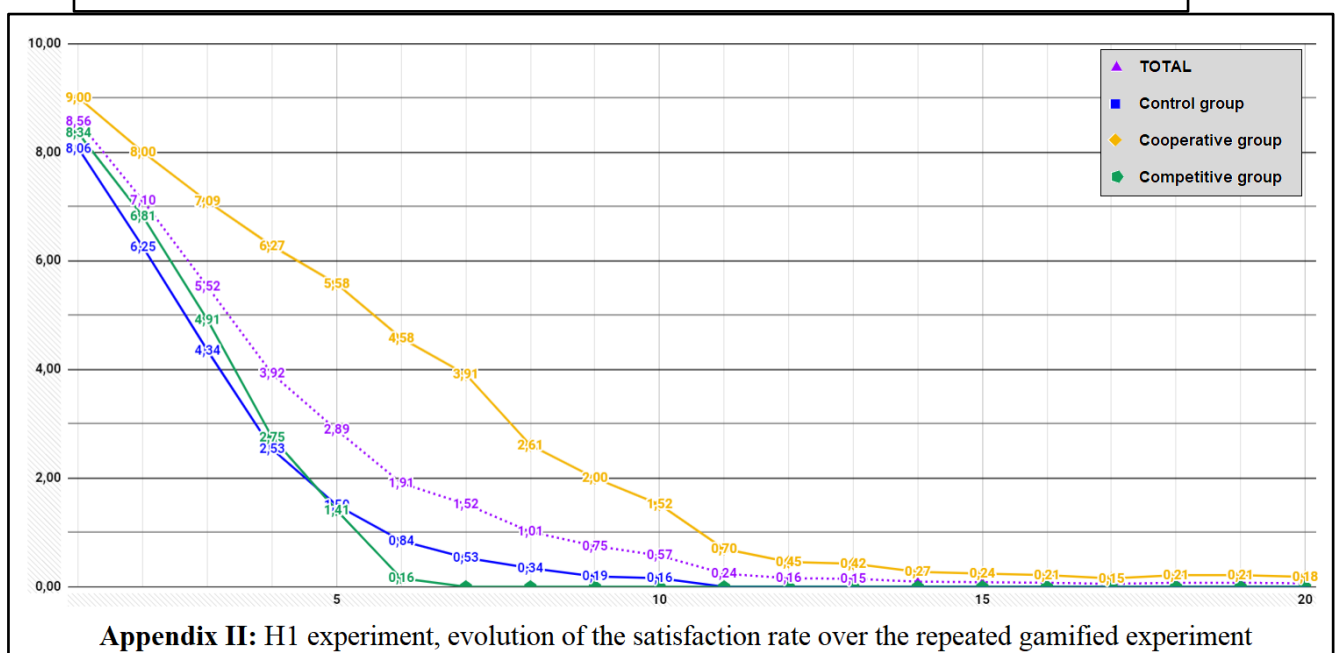
OTHER RESOURCES

- **Gamified.uk - The Hype is Over – Gamification is Here to Stay**
(<https://www.gamified.uk/2015/08/21/the-hype-is-over-gamification-is-here-to-stay/>)
- **Newzoo's 2018 Report: Insights Into the \$137.9 Billion Global Games Market**
(<https://newzoo.com/insights/articles/newzoos-2018-report-insights-into-the-137-9-billion-global-games-market/>)
- **Statista - Distribution of video gamers worldwide in 2017, by age group and gender**
(<https://www.statista.com/statistics/722259/world-gamers-by-age-and-gender/>)
- **WePC.com - 2019 Video Game Industry Statistics, Trends & Data**
(<https://www.wepc.com/news/video-game-statistics/>)
- **YourTrainingEdge.com - Gamification and the Hype Cycle**
(<https://www.yourtrainingedge.com/gamification-and-the-hype-cycle/>)

APPENDIXES

Motivation theory	Incentives/rewards	Role
Self efficacy	Audio/verbal/visual/music/sounds effect	Feedback
	Progress bar	Feedback, achievements
Self-efficacy, goal-setting, PIT, expectancy value, need achievement	Points/bonus/divident	Feedback, reward, status, achievements, competition, progression, ownership
	Mini games/challenges/quests	Reward, status, competition, achievements
Self-efficacy, goal-setting, PIT, expectancy value, social comparison	Badges	Status and reputation, achievements and past accomplishments, collection, competition, ownership
	Virtual goods	Reward, social, status, achievements, ownership, self-expression
	Leaderboard	Status and reputation, achievements, competition
	Rewards-choosing colors, power	Achievements
Self-efficacy, goal-setting, PIT, expectancy value, need achievement, social comparison	Achievements	Collection, status, competition, discovering, progression
	Levels	Feedback, status and reputation, achievements, competition, moderate challenge
Social comparison, personal investment theory, expectancy value	Avatar	Social, self-expression, ownership

Appendix I : Theoretical base of incentives and rewards (Richter, Raban & Rafaeli - 2015)



Means and Descriptive Statistics

Category	Mean of 1	Std. Dev. of 1	Std. Error of 1	Number of non-missing values for 1
	8.7311827957	1.5889549816	0.1647669561	93
Competitive	9.4516129032	0.8098851638	0.1454596694	31
Control	8.1290322581	1.9277263894	0.3462298804	31
Cooperative	8.6129032258	1.5637011512	0.2808490175	31

Generated by the SAS System ('Local', X64_SRV12) on 12 août 2019 at 3:56:10 PM

Appendix III: Descriptive statistics of the 1st playthrough satisfaction rating per group

The ANOVA Procedure

Dependent Variable: 1

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	27.7634409	13.8817204	6.11	0.0033
Error	90	204.5161290	2.2724014		
Corrected Total	92	232.2795699			

r-carré	Coef de Var	Racine MSE	1 Moyenne
0.119526	17.26511	1.507449	8.731183

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Category	2	27.76344086	13.88172043	6.11	0.0033

Generated by the SAS System ('Local', X64_SRV12) on 12 août 2019 at 3:56:10 PM

Page Break

Tests t de Bonferroni (Dunn) pour 1

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than REGWQ.

Alpha	0.05
Degrés de liberté de l'erreur	90
Erreur quadratique moyenne	2.272401
Valeur critique de t	2.43955
Différence significative minimale	0.9341

Les moyennes avec la même lettre ne sont pas très différentes.				
Bon Groupement	Moyenne	N	Category	
A	9.4516	31	Competitive	
A				
B	8.6129	31	Cooperative	
B				
B	8.1290	31	Control	

Generated by the SAS System ('Local', X64_SRV12) on 12 août 2019 at 3:56:10 PM

Appendix IV: H1 experiment : ANOVA procedure & Bonferroni post-hoc test of the type of group on the satisfaction rating at the 1st playthrough

Procédure REG
Modèle : Linear_Regression_Model
Variable dépendante : 1

Nb d'observations lues	93
Nb d'obs. utilisées	93

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	27.76344	13.88172	6.11	0.0033
Erreur	90	204.51613	2.27240		
Total sommes corrigées	92	232.27957			

Root MSE	1.50745	R carré	0.1195
Moyenne dépendante	8.73118	R car. ajust.	0.1000
Coeff Var	17.26511		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	8.12903	0.27075	30.02	<.0001
Competitive	1	1.32258	0.38289	3.45	0.0008
Cooperative	1	0.48387	0.38289	1.26	0.2096

Generated by the SAS System ("Local", X64_SRV12) on 12 août 2019 at 4:05:23 PM

Appendix V: H1 experiment: linear regression of the type of group on the satisfaction rating at the 1st playthrough

Means and Descriptive Statistics

Category Name	Mean of TCPM	Std. Dev. of TCPM	Std. Error of TCPM	Number of non-missing values for TCPM
	(15.17%)	12.46%	1.29%	93
Competitive	(10.91%)	6.23%	1.12%	31
Control	(18.56%)	17.85%	3.21%	31
Cooperative	(16.03%)	9.33%	1.68%	31

Generated by the SAS System ("Local", X64_SRV12) on 31 juillet 2019 at 4:17:58 PM

Appendix VI: Descriptive statistics of the satisfaction APGR per group

The ANOVA Procedure

Dependent Variable: TCPM

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	0.09424170	0.04712085	3.18	0.0463
Error	90	1.33338977	0.01481544		
Corrected Total	92	1.42763147			

r-carré	Coef de Var	Racine MSE	TCPM Moyenne
0.066013	-80.25409	0.121719	-0.151667

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Category Name	2	0.09424170	0.04712085	3.18	0.0463

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 4:17:58 PM

Page Break

Tests t de Bonferroni (Dunn) pour TCPM

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than REGWQ.

Alpha	0.05
Degrés de liberté de l'erreur	90
Erreur quadratique moyenne	0.014815
Valeur critique de t	2.43955
Différence significative minimale	0.0754

Les moyennes avec la même lettre ne sont pas très différentes.			
Bon Groupement	Moyenne	N	Category Name
A	-0.10910	31	Competitive
A			
B	-0.16027	31	Cooperative
B			
B	-0.18564	31	Control

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 4:17:58 PM

Appendix VII: H1 experiment : ANOVA procedure & Bonferroni post-hoc test of the type of group on the satisfaction APGR

Procédure REG Modèle : Linear_Regression_Model Variable dépendante : TCPM

Nb d'observations lues	93
Nb d'obs. utilisées	93

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	0.09424	0.04712	3.18	0.0463
Erreur	90	1.33339	0.01482		
Total sommes corrigées	92	1.42763			

Root MSE	0.12172	R carré	0.0660
Moyenne dépendante	-0.15167	R car. ajust.	0.0453
Coef Var	-80.25409		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	-0.18564	0.02186	-8.49	<.0001
Cooperative	1	0.02537	0.03092	0.82	0.4141
Competitive	1	0.07654	0.03092	2.48	0.0152

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 4:17:58 PM

Appendix VIII: H1 experiment : linear regression of the type of group on the satisfaction APGR

Means and Descriptive Statistics

Category Name	Mean of MEAN	Std. Dev. of MEAN	Std. Error of MEAN	Number of non-missing values for MEAN
	6.5927956989	1.1746214613	0.1218025715	93
Competitive	7.0070967742	0.8379904277	0.1505075239	31
Control	6.1358064516	1.3640986626	0.2449993523	31
Cooperative	6.635483871	1.1283375343	0.2026554036	31

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 5:14:07 PM

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Appendix IX: Descriptive statistics of the average satisfaction score per group

The ANOVA Procedure

Dependent Variable: MEAN

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	11.8515118	5.9257559	4.63	0.0121
Error	90	115.0841613	1.2787129		
Corrected Total	92	126.9356731			

r-carré	Coef de Var	Racine MSE	MEAN Moyenne
0.093366	17.15208	1.130802	6.592796

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Category Name	2	11.85151183	5.92575591	4.63	0.0121

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 5:14:07 PM

Page Break

Tests t de Bonferroni (Dunn) pour MEAN

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than REGWQ.

Alpha	0.05
Degrés de liberté de l'erreur	90
Erreur quadratique moyenne	1.278713
Valeur critique de t	2.43955
Différence significative minimale	0.7007

Les moyennes avec la même lettre ne sont pas très différentes.				
Bon Groupement	Moyenne	N	Category Name	
A	7.0071	31	Competitive	
A				
B	6.6355	31	Cooperative	
B				
B	6.1358	31	Control	

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 5:14:07 PM

Appendix X: H1 experiment: ANOVA procedure & Bonferroni post-hoc test of the type of group on the satisfaction average score

Procédure REG
Modèle : Linear_Regression_Model
Variable dépendante : MEAN

Nb d'observations lues	93
Nb d'obs. utilisées	93

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	11.85151	5.92576	4.63	0.0121
Erreur	90	115.08416	1.27871		
Total sommes corrigées	92	126.93567			

Root MSE	1.13080	R carré	0.0934
Moyenne dépendante	6.59280	R car. ajust.	0.0732
Coeff Var	17.15208		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	6.13581	0.20310	30.21	<.0001
Competitive	1	0.87129	0.28722	3.03	0.0032
Cooperative	1	0.49968	0.28722	1.74	0.0853

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 5:18:50 PM

Appendix XI: H1 experiment: linear regression of the type of group on the average satisfaction score

Means and Descriptive Statistics

Category Name	Mean of 'N° Participations'	Std. Dev. of 'N° Participations'	Std. Error of 'N° Participations'	Number of non-missing values for 'N° Participations'
	5.3655913978	3.4192070853	0.3545552582	93
Competitive	8.3870967742	4.0222499454	0.7224174163	31
Control	3.9032258065	1.9892182503	0.3572741446	31
Cooperative	3.8064516129	1.2495160353	0.2244197049	31

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 4:30:29 PM

Appendix XII: Descriptive statistics of the number of repeated experiment per group

The ANOVA Procedure

Dependent Variable: N° Participations

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	424.666667	212.333333	29.36	<.0001
Error	90	650.903226	7.232258		
Corrected Total	92	1075.569892			

r-carré	Coef de Var	Racine MSE	N° Participations Moyenne
0.394829	50.12096	2.689286	5.365591

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Category Name	2	424.666667	212.333333	29.36	<.0001

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 4:30:29 PM

Page Break

Tests t de Bonferroni (Dunn) pour N° Participations

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than REGWQ.

Alpha	0.05
Degrés de liberté de l'erreur	90
Erreur quadratique moyenne	7.232258
Valeur critique de t	2.43955
Différence significative minimale	1.6664

Les moyennes avec la même lettre ne sont pas très différentes.			
Bon Groupement	Moyenne	N	Category Name
A	8.3871	31	Competitive
B	3.9032	31	Control
B			
B	3.8065	31	Cooperative

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 4:30:29 PM

Appendix XIII: H1 experiment: ANOVA procedure & Bonferroni post-hoc test of the type of group on the number of repeated experiences

Procédure REG
Modèle : Linear_Regression_Model
Variable dépendante : N° Participations

Nb d'observations lues	93
Nb d'obs. utilisées	93

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	424.66667	212.33333	29.36	<.0001
Erreur	90	650.90323	7.23226		
Total sommes corrigées	92	1075.56989			

Root MSE	2.68929	R carré	0.3948
Moyenne dépendante	5.36559	R car. ajust.	0.3814
Coef Var	50.12096		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	3.90323	0.48301	8.08	<.0001
Cooperative	1	-0.09677	0.68308	-0.14	0.8877
Competitive	1	4.48387	0.68308	6.56	<.0001

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 4:42:31 PM

Appendix XIV: H1 experiment: Linear regression of the type of group on the number of repeated experiences

Means and Descriptive Statistics

Category Name	Mean of 'Total estimated timing'	Std. Dev. of 'Total estimated timing'	Std. Error of 'Total estimated timing'	Number of non-missing values for 'Total estimated timing'
	0:02:24	0:02:04	0:00:13	93
Competitive	0:03:08	0:02:13	0:00:24	31
Control	0:02:13	0:02:20	0:00:25	31
Cooperative	0:01:52	0:01:24	0:00:15	31

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 4:48:43 PM

Appendix XV: Descriptive statistics of the total estimated timing per group

The ANOVA Procedure

Dependent Variable: Total estimated timing

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	95030.473	47515.237	3.22	0.0446
Error	90	1328407.806	14760.087		
Corrected Total	92	1423438.280			

r-carré	Coef de Var	Racine MSE	Total estimated timing Moyenne
0.066761	84.21161	121.4911	144.2688

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Category Name	2	95030.47312	47515.23656	3.22	0.0446

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 4:48:43 PM

Page Break

Tests t de Bonferroni (Dunn) pour Total estimated timing

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than REGWQ.

Alpha	0.05
Degrés de liberté de l'erreur	90
Erreur quadratique moyenne	14760.09
Valeur critique de t	2.43955
Différence significative minimale	75.282

Les moyennes avec la même lettre ne sont pas très différentes.			
Bon Groupement	Moyenne	N	Category Name
A	187.87	31	Competitive
A			
B	132.81	31	Control
B			
B	112.13	31	Cooperative

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 4:48:43 PM

Appendix XVI: H1 experiment: ANOVA procedure & Bonferroni post-hoc test of the type of group on the total estimated time

Procédure REG
Modèle : Linear_Regression_Model
Variable dépendante : Timing

Nb d'observations lues	93
Nb d'obs. utilisées	93

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	109698	54849	4.70	0.0115
Erreur	90	1051019	11678		
Total sommes corrigées	92	1160716			

Root MSE	108.06474	R carré	0.0945
Moyenne dépendante	120.59140	R car. ajust.	0.0744
Coeff Var	89.61231		

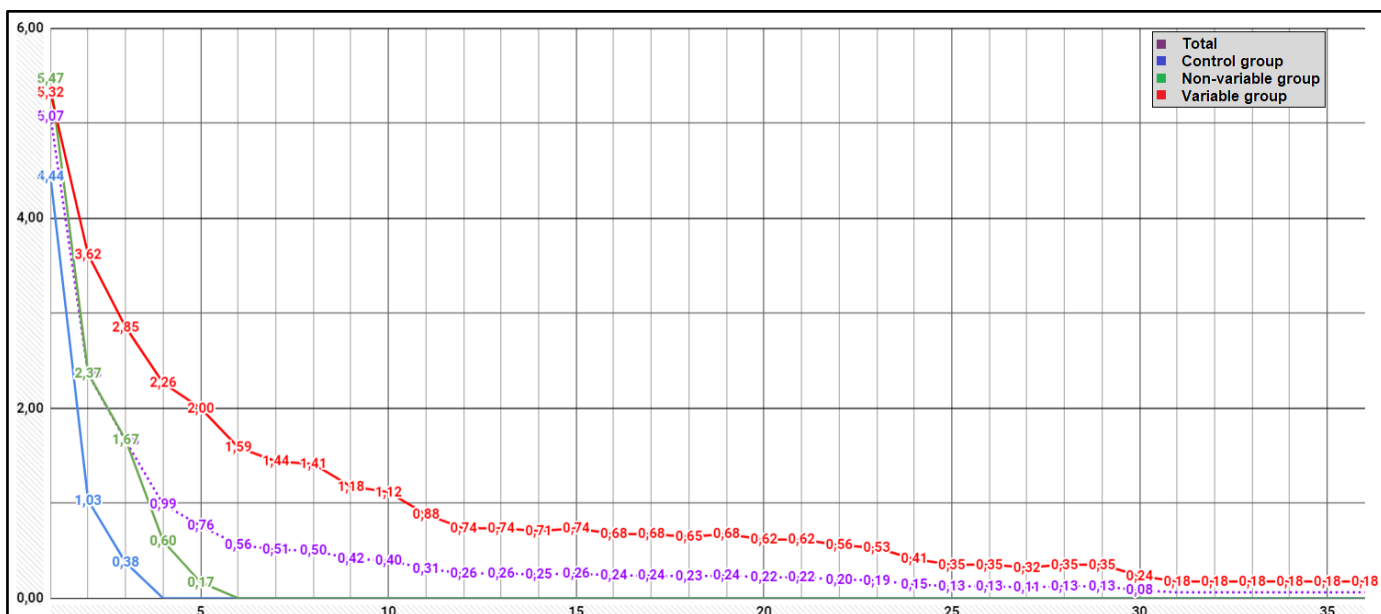
Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	106.03226	19.40900	5.46	<.0001
Cooperative	1	-18.29032	27.44847	-0.67	0.5069
Competitive	1	61.96774	27.44847	2.26	0.0264

Generated by the SAS System ('Local', X64_SRV12) on 31 juillet 2019 at 5:01:53 PM

Appendix XVII: H1 experiment: linear regression of the type of group on the total estimated time

SUMMARY OUTPUT									Boring
Regression Statistics									
Chi Square	0,7755								
Residual Dev.	128,0530								
# of iterations	4,0000								
Observations	93,0000								
	Coefficients	Standard Error	P-value	Odd Ratio	Lower 95%	Upper 95%	Lower 95%	Upper 95%	
Intercept	-0,1942	0,3609	0,5906	0,8235	0,4060	1,6706	0,4060	1,6706	
Competitive	0,3883	0,5104	0,4468	1,4745	0,5422	4,0095	0,5422	4,0095	
Cooperative	0,0000	0,5104	1,0000	1,0000	0,3677	2,7193	0,3677	2,7193	
SUMMARY OUTPUT									No more ideas
Regression Statistics									
Chi Square	1,0632								
Residual Dev.	125,4322								
# of iterations	4,0000								
Observations	93,0000								
	Coefficients	Standard Error	P-value	Odd Ratio	Lower 95%	Upper 95%	Lower 95%	Upper 95%	
Intercept	0,5978	0,3754	0,1112	1,8182	0,8712	3,7945	0,8712	3,7945	
Competitive	-0,2724	0,5229	0,6024	0,7615	0,2733	2,1220	0,2733	2,1220	
Cooperative	-0,5333	0,5197	0,3048	0,5867	0,2119	1,6246	0,2119	1,6246	
SUMMARY OUTPUT									Other reasons
Regression Statistics									
Chi Square	0,4937								
Residual Dev.	32,5022								
# of iterations	5,0000								
Observations	93,0000								
	Coefficients	Standard Error	P-value	Odd Ratio	Lower 95%	Upper 95%	Lower 95%	Upper 95%	
Intercept	-2,6741	0,7311	0,0003	0,0690	0,0165	0,2890	0,0165	0,2890	
Competitive	-0,7270	1,2521	0,5615	0,4833	0,0415	5,6242	0,0415	5,6242	
Cooperative	-0,7270	1,2521	0,5615	0,4833	0,0415	5,6242	0,0415	5,6242	

Appendix XVIII: H1 experiment: logistic regressions of the type of group over the motive to stop the experiment



Appendix XIX: H1 experiment: evolution of the average satisfaction rate over the repeated gamified experience

Means and Descriptive Statistics

Group	Mean of '1st step sbs satisfaction'	Std. Dev. of '1st step sbs satisfaction'	Std. Error of '1st step sbs satisfaction'	Number of non-missing values for '1st step sbs satisfaction'
	5.07	1.56	0.16	96
Control	4.44	1.50	0.27	32
Non-variable	5.47	1.38	0.25	30
Variable	5.32	1.63	0.28	34

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Appendix XX: Descriptive statistics of the 1st playthrough satisfaction rating per group

The ANOVA Procedure

Dependent Variable: 1st step sbs satisfaction

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	19.7067402	9.8533701	4.31	0.0163
Error	93	212.7828431	2.2879876		
Corrected Total	95	232.4895833			

r-carré	Coef de Var	Racine MSE	1st step sbs satisfaction Moyenne
0.084764	29.81735	1.512610	5.072917

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Group	2	19.70674020	9.85337010	4.31	0.0163

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Page Break

Tests t de Bonferroni (Dunn) pour 1st step sbs satisfaction

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Degrés de liberté de l'erreur	93
Erreur quadratique moyenne	2.287988
Valeur critique de t	2.43805

Comparaisons significatives au niveau 0.05 indiquées par ***.			
Group Comparaison	Différence Entre les moyennes	Simultané 95% Intervalle de confiance	
Non-variable - Variable	0.1431	-0.7806 1.0669	
Non-variable - Control	1.0292	0.0920 1.9664	***
Variable - Non-variable	-0.1431	-1.0669 0.7806	
Variable - Control	0.8860	-0.0223 1.7943	
Control - Non-variable	-1.0292	-1.9664 -0.0920	***
Control - Variable	-0.8860	-1.7943 0.0223	

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Appendix XXI: ANOVA procedure & Bonferroni post-hoc test of the type of group on the 1st step satisfaction score

Modèle : Linear_Regression_Model
Variable dépendante : 1st step sbs satisfaction

Nb d'observations lues	96
Nb d'obs. utilisées	96

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	19.70674	9.85337	4.31	0.0163
Erreur	93	212.78284	2.28799		
Total sommes corrigées	95	232.48958			

Root MSE	1.51261	R carré	0.0848
Moyenne dépendante	5.07292	R car. ajust.	0.0651
Coef Var	29.81735		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	4.43750	0.26739	16.60	<.0001
Non-variable	1	1.02917	0.38440	2.68	0.0088
Variable	1	0.88603	0.37255	2.38	0.0194

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Appendix XXII: Linear regression of the type of group on the 1st step satisfaction score

Means and Descriptive Statistics

Group	Mean of 'Satisfaction APGR'	Std. Dev. of 'Satisfaction APGR'	Std. Error of 'Satisfaction APGR'	Number of non-missing values for 'Satisfaction APGR'
	(5.23%)	13.58%	1.39%	96
Control	(6.72%)	19.01%	3.36%	32
Non-variable	(5.80%)	12.07%	2.20%	30
Variable	(3.32%)	7.57%	1.30%	34

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Appendix XXIII: Descriptive statistics of the satisfaction APGR per group

The ANOVA Procedure

Dependent Variable: Satisfaction APGR

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	0.02050815	0.01025408	0.55	0.5785
Error	93	1.73232759	0.01862718		
Corrected Total	95	1.75283574			

r-carré	Coef de Var	Racine MSE	Satisfaction APGR Moyenne
0.011700	-261.0364	0.136481	-0.052284

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Group	2	0.02050815	0.01025408	0.55	0.5785

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Page Break

Tests t de Bonferroni (Dunn) pour Satisfaction APGR

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Degrés de liberté de l'erreur	93
Erreur quadratique moyenne	0.018627
Valeur critique de t	2.43805

Comparaisons significatives au niveau 0.05 indiquées par ^{***} .			
Group Comparaison	Différence Entre les moyennes	Simultané 95% Intervalle de confiance	
Variable - Non-variable	0.02484	-0.05851	0.10819
Variable - Control	0.03401	-0.04794	0.11597
Non-variable - Variable	-0.02484	-0.10819	0.05851
Non-variable - Control	0.00917	-0.07539	0.09374
Control - Variable	-0.03401	-0.11597	0.04794
Control - Non-variable	-0.00917	-0.09374	0.07539

Generated by the SAS System ('Local', X64_SRV12) on 12 août 2019 at 12:15:44 PM

Appendix XXIV: H2 experiment: ANOVA procedure & Bonferroni post-hoc test of the type of group on the satisfaction APGR

Linear Regression Results

Procédure REG
Modèle : Linear_Regression_Model
Variable dépendante : Satisfaction APGR

Nb d'observations lues	96
Nb d'obs. utilisées	96

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	0.02051	0.01025	0.55	0.5785
Erreur	93	1.73233	0.01863		
Total sommes corrigées	95	1.75284			

Root MSE	0.13648	R carré	0.0117
Moyenne dépendante	-0.05228	R car. ajust.	-0.0096
Coeff Var	-261.03635		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	-0.06720	0.02413	-2.79	0.0065
Variable	1	0.03401	0.03361	1.01	0.3142
Non-variable	1	0.00917	0.03468	0.26	0.7920

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Appendix XXV: H2 experiment: Linear regression of the type of group on the satisfaction APGR

Means and Descriptive Statistics

Group	Mean of 'AVG sbs satisfaction'	Std. Dev. of 'AVG sbs satisfaction'	Std. Error of 'AVG sbs satisfaction'	Number of non-missing values for 'AVG sbs satisfaction'
	4.76	1.57	0.16	96
Control	4.20	1.65	0.29	32
Non-variable	5.16	1.58	0.29	30
Variable	4.93	1.37	0.24	34

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Appendix XXVI: Descriptive statistics of the satisfaction average score per group

The ANOVA Procedure

Dependent Variable: AVG sbs satisfaction

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	15.7997803	7.8998901	3.37	0.0388
Error	93	218.3155430	2.3474790		
Corrected Total	95	234.1153233			

r-carré	Coef de Var	Racine MSE	AVG sbs satisfaction Moyenne
0.067487	32.18099	1.532148	4.761035

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Group	2	15.79978027	7.89989013	3.37	0.0388

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Tests t de Bonferroni (Dunn) pour AVG sbs satisfaction

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's fc all pairwise comparisons.

Alpha	0.05
Degrés de liberté de l'erreur	93
Erreur quadratique moyenne	2.347479
Valeur critique de t	2.43805

Comparaisons significatives au niveau 0.05 indiquées par ***.				
Group Comparaison	Différence Entre les moyennes	Simultané 95% Intervalle de confiance		
Non-variable - Variable	0.2322	-0.7035 1.1679		
Non-variable - Control	0.9602	0.0109 1.9095	***	
Variable - Non-variable	-0.2322	-1.1679 0.7035		
Variable - Control	0.7280	-0.1920 1.6481		
Control - Non-variable	-0.9602	-1.9095 -0.0109	***	
Control - Variable	-0.7280	-1.6481 0.1920		

Generated by the SAS System ('Local', X64_SRV12) on 12 août 2019 at 12:49:12 PM

Appendix XXVII: H2 experiment: ANOVA procedure & Bonferroni post-hoc test of the type of group on the satisfaction average score

Modèle : Linear_Regression_Model
Variable dépendante : AVG sbs satisfaction

Nb d'observations lues	96
Nb d'obs. utilisées	96

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	15.79978	7.89989	3.37	0.0388
Erreur	93	218.31554	2.34748		
Total sommes corrigées	95	234.11532			

Root MSE	1.53215	R carré	0.0675
Moyenne dépendante	4.76104	R car. ajust.	0.0474
Coef Var	32.18099		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	4.20313	0.27085	15.52	<.0001
Variable	1	0.72803	0.37736	1.93	0.0567
Non-variable	1	0.96021	0.38937	2.47	0.0155

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Appendix XXVIII: H2 experiment : linear regression of the type of group on the average satisfaction score

Linear Regression Results

Procédure REG
Modèle : Linear_Regression_Model
Variable dépendante : Global satisfaction

Nb d'observations lues	96
Nb d'obs. utilisées	96

Analyse de variance				
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F
Modèle	1	66.85265	66.85265	41.86
Erreur	94	150.13693	1.59720	
Total sommes corrigées	95	216.98958		

Root MSE	1.26380	R carré	0.3081
Moyenne dépendante	5.01042	R car. ajust.	0.3007
Coeff Var	25.22354		

Résultats estimés des paramètres				
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t
Intercept	1	2.46625	0.41386	5.96
AVG sbs satisfacton	1	0.53437	0.08260	6.47

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Appendix XXIX: H2 experiment: linear regression of the average satisfaction over the global satisfaction

Means and Descriptive Statistics

Group	Mean of 'Nb Participations'	Std. Dev. of 'Nb Participations'	Std. Error of 'Nb Participations'	Number of non-missing values for 'Nb Participations'
	3.5104166667	5.8345518777	0.5954864574	96
Control	1.4375	0.7156093726	0.12650306	32
Non-variable	2.0333333333	1.3256965205	0.2420379629	30
Variable	6.7647058824	8.883279573	1.5234698782	34

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Appendix XXX: Descriptive statistics of the number of repeated experiences

The ANOVA Procedure

Dependent Variable: Nb Participations

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	563.030270	281.515135	9.80	0.0001
Error	93	2670.959314	28.719993		
Corrected Total	95	3233.989583			

r-carré	Coef de Var	Racine MSE	Nb Participations Moyenne
0.174098	152.6629	5.359104	3.510417

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Group	2	563.0302696	281.5151348	9.80	0.0001

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Tests t de Bonferroni (Dunn) pour Nb Participations

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Degrés de liberté de l'erreur	93
Erreur quadratique moyenne	28.71999
Valeur critique de t	2.43805

Comparaisons significatives au niveau 0.05 indiquées par ***.

Group Comparaison	Différence Entre les moyennes	Simultané 95% Intervalle de confiance	
Variable - Non-variable	4.731	1.459 8.004	***
Variable - Control	5.327	2.109 8.545	***
Non-variable - Variable	-4.731	-8.004 -1.459	***
Non-variable - Control	0.596	-2.725 3.916	
Control - Variable	-5.327	-8.545 -2.109	***
Control - Non-variable	-0.596	-3.916 2.725	

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Appendix XXXI: H2 experiment: ANOVA procedure & Bonferroni post-hoc test of the type of group on the number of repeated experiences

Procédure REG

Modèle : Linear Regression Model
Variable dépendante : Nb Participations

Nb d'observations lues	96
Nb d'obs. utilisées	96

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	563.03027	281.51513	9.80	0.0001
Erreur	93	2670.95931	28.71999		
Total sommes corrigées	95	3233.98958			

Root MSE	5.35910	R carré	0.1741
Moyenne dépendante	3.51042	R car. ajust.	0.1563
Coeff Var	152.66290		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	1.43750	0.94736	1.52	0.1326
Non-variable	1	0.59583	1.36192	0.44	0.6628
Variable	1	5.32721	1.31993	4.04	0.0001

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Appendix XXXII: H2 experiment : linear regression of the type of group over the number of repeated experiences

Means and Descriptive Statistics

Group	Mean of '1st step sbs engagement'	Std. Dev. of '1st step sbs engagement'	Std. Error of '1st step sbs engagement'	Number of non-missing values for '1st step sbs engagement'
	4.32	1.72	0.18	96
Control	3.88	1.86	0.33	32
Non-variable	4.45	1.55	0.28	30
Variable	4.60	1.69	0.29	34

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Appendix XXXIII: Descriptive statistics of the average engagement rate at the first playthrough per group.

The ANOVA Procedure

Dependent Variable: 1st step sbs engagement

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	9.3428462	4.6714231	1.60	0.2064
Error	93	270.6877528	2.9106210		
Corrected Total	95	280.0305990			

r-carré	Coef de Var	Racine MSE	1st step sbs engagement Moyenne
0.033364	39.53680	1.706054	4.315104

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Group	2	9.34284620	4.67142310	1.60	0.2064

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Tests t de Bonferroni (Dunn) pour 1st step sbs engagement

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Degrés de liberté de l'erreur	93
Erreur quadratique moyenne	2.910621
Valeur critique de t	2.43805

Comparaisons significatives au niveau 0.05 indiquées par ^{***} .			
Group Comparaison	Différence Entre les moyennes	Simultané 95% Intervalle de confiance	
Variable - Non-variable	0.1529	-0.8890	1.1948
Variable - Control	0.7201	-0.3043	1.7446
Non-variable - Variable	-0.1529	-1.1948	0.8890
Non-variable - Control	0.5672	-0.4899	1.6242
Control - Variable	-0.7201	-1.7446	0.3043
Control - Non-variable	-0.5672	-1.6242	0.4899

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Appendix XXXIV: ANOVA procédure & Bonferroni post-hoc test of the type of group on the average engagement rate during the first playthrough

Procédure REG
Modèle : Linear_Regression_Model
Variable dépendante : 1st step sbs engagement

Nb d'observations lues	96
Nb d'obs. utilisées	96

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	9.34285	4.67142	1.60	0.2064
Erreur	93	270.68775	2.91062		
Total sommes corrigées	95	280.03060			

Root MSE	1.70605	R carré	0.0334
Moyenne dépendante	4.31510	R car. ajust.	0.0126
Coeff Var	39.53680		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	3.88281	0.30159	12.87	<.0001
Non-variable	1	0.56719	0.43356	1.31	0.1940
Variable	1	0.72013	0.42019	1.71	0.0899

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Appendix XXXV: H2 experiment: linear regression of the type of group over the average engagement rate during the 1st playthrough

Means and Descriptive Statistics

Group	Mean of 'Engagement APGR'	Std. Dev. of 'Engagement APGR'	Std. Error of 'Engagement APGR'	Number of non-missing values for 'Engagement APGR'
	(1.02%)	4.39%	0.45%	96
Control	(0.32%)	3.34%	0.59%	32
Non-variable	(0.92%)	4.47%	0.82%	30
Variable	(1.76%)	5.14%	0.88%	34

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Appendix XXXVI: Descriptive statistics of the average engagement APGR per group

The ANOVA Procedure

Dependent Variable: Engagement APGR

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	0.00343467	0.00171734	0.89	0.4145
Error	93	0.17962953	0.00193150		
Corrected Total	95	0.18306420			

r-carré	Coef de Var	Racine MSE	Engagement APGR Moyenne
0.018762	-432.0235	0.043949	-0.010173

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Group	2	0.00343467	0.00171734	0.89	0.4145

Generated by the SAS System ('Local', X64_SRV12) on 12 août 2019 at 2:36:53 PM

Page Break

Tests t de Bonferroni (Dunn) pour Engagement APGR

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Degrés de liberté de l'erreur	93
Erreur quadratique moyenne	0.001932
Valeur critique de t	2.43805

Comparaisons significatives au niveau 0.05 indiquées par ***.			
Group Comparaison	Différence Entre les moyennes	Simultané 95% Intervalle de confiance	
Control - Non-variable	0.00604	-0.02119 0.03327	
Control - Variable	0.01435	-0.01204 0.04075	
Non-variable - Control	-0.00604	-0.03327 0.02119	
Non-variable - Variable	0.00832	-0.01852 0.03516	
Variable - Control	-0.01435	-0.04075 0.01204	
Variable - Non-variable	-0.00832	-0.03516 0.01852	

Generated by the SAS System ('Local', X64_SRV12) on 12 août 2019 at 2:36:53 PM

Appendix XXXVII: H2 experiment: ANOVA procedure & Bonferroni post-hoc test on the average engagement APGR

Procédure REG
Modèle : Linear_Regression_Model
Variable dépendante : Engagement APGR

Nb d'observations lues	96
Nb d'obs. utilisées	96

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	0.00343	0.00172	0.89	0.4145
Erreur	93	0.17963	0.00193		
Total sommes corrigées	95	0.18306			

Root MSE	0.04395	R carré	0.0188
Moyenne dépendante	-0.01017	R car. ajust.	-0.0023
Coef Var	-432.02353		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	-0.00320	0.00777	-0.41	0.6812
Non-variable	1	-0.00604	0.01117	-0.54	0.5900
Variable	1	-0.01435	0.01082	-1.33	0.1880

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Appendix XXXVIII: H2 experiment: linear regression of the type of group over the average engagement APGR

Means and Descriptive Statistics

Group	Mean of 'AVG sbs engagement'	Std. Dev. of 'AVG sbs engagement'	Std. Error of 'AVG sbs engagement'	Number of non-missing values for 'AVG sbs engagement'
	4.21	1.67	0.17	96
Control	3.87	1.85	0.33	32
Non-variable	4.40	1.57	0.29	30
Variable	4.37	1.58	0.27	34

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Appendix XXXIX: Descriptive statistics of the average step-by-step engagement score per group

The ANOVA Procedure

Dependent Variable: AVG sbs engagement

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	5.6066293	2.8033147	1.00	0.3703
Error	93	259.6338506	2.7917618		
Corrected Total	95	265.2404799			

r-carré	Coef de Var	Racine MSE	AVG sbs engagement Moyenne
0.021138	39.64158	1.670857	4.214910

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Group	2	5.60662931	2.80331465	1.00	0.3703

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Tests t de Bonferroni (Dunn) pour AVG sbs engagement

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Degrés de liberté de l'erreur	93
Erreur quadratique moyenne	2.791762
Valeur critique de t	2.43805

Comparaisons significatives au niveau 0.05 indiquées par ***.			
Group Comparaison	Différence Entre les moyennes	Simultané 95% Intervalle de confiance	
Non-variable - Variable	0.0338	-0.9866	1.0542
Non-variable - Control	0.5298	-0.5055	1.5650
Variable - Non-variable	-0.0338	-1.0542	0.9866
Variable - Control	0.4960	-0.5073	1.4993
Control - Non-variable	-0.5298	-1.5650	0.5055
Control - Variable	-0.4960	-1.4993	0.5073

Generated by the SAS System ('Local', X64_SRV12) on 12 août 2019 at 1:55:03 PM

Appendix XL: H2 experiment: ANOVA procedure & Bonferroni post-hoc test of the type of group on the average step-by-step engagement score per group

Procédure REG
Modèle : Linear_Regression_Model
Variable dépendante : AVG sbs engagement

Nb d'observations lues	96
Nb d'obs. utilisées	96

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	5.60663	2.80331	1.00	0.3703
Erreur	93	259.63385	2.79176		
Total sommes corrigées	95	265.24048			

Root MSE	1.67086	R carré	0.0211
Moyenne dépendante	4.21491	R car. ajust.	0.0001
Coeff Var	39.64158		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	3.87370	0.29537	13.11	<.0001
Non-variable	1	0.52977	0.42462	1.25	0.2153
Variable	1	0.49597	0.41153	1.21	0.2312

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Appendix XLI: H2 experiment: linear regression of the type of group on the average step-by-step engagement score per group

Procédure REG
Modèle : Linear_Regression_Model
Variable dépendante : Global engagement

Nb d'observations lues	96
Nb d'obs. utilisées	95
Nombre d'observations avec valeurs manquantes	1

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	1	82.41996	82.41996	108.85	<.0001
Erreur	93	70.41688	0.75717		
Total sommes corrigées	94	152.83684			

Root MSE	0.87016	R carré	0.5393
Moyenne dépendante	4.14737	R car. ajust.	0.5343
Coeff Var	20.98091		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	1.79910	0.24214	7.43	<.0001
AVG sbs engagement	1	0.55858	0.05354	10.43	<.0001

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Appendix XLII: H2 experiment: linear regression of the average step-by-step engagement score over the average global engagement score

Means and Descriptive Statistics

Group	Mean of 'Total estimated timing'	Std. Dev. of 'Total estimated timing'	Std. Error of 'Total estimated timing'	Number of non-missing values for 'Total estimated timing'
	0:10:31.45	0:20:34.34	0:02:05.98	96
Control	0:02:18.17	0:05:08.87	0:00:54.60	32
Non-variable	0:09:52.16	0:19:44.89	0:03:36.33	30
Variable	0:18:50.37	0:26:42.76	0:04:34.87	34

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Appendix XLIII: Descriptive statistics of the total estimated time per group

The ANOVA Procedure

Dependent Variable: Total estimated timing

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	16295779.3	8147889.7	5.90	0.0039
Error	93	128444617.6	1381124.9		
Corrected Total	95	144740396.9			

r-carré	Coef de Var	Racine MSE	Total estimated timing Moyenne
0.112586	186.1144	1175.213	631.4465

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Group	2	16295779.33	8147889.66	5.90	0.0039

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Tests t de Bonferroni (Dunn) pour Total estimated timing

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Degrés de liberté de l'erreur	93
Erreur quadratique moyenne	1381125
Valeur critique de t	2.43805

Comparaisons significatives au niveau 0.05 indiquées par ***.				
Group Comparaison	Différence Entre les moyennes	Simultané 95% Intervalle de confiance		
Variable - Non-variable	538.2	-179.5 1255.9		
Variable - Control	992.2	286.5 1697.9	***	
Non-variable - Variable	-538.2	-1255.9 179.5		
Non-variable - Control	454.0	-274.2 1182.1		
Control - Variable	-992.2	-1697.9 -286.5	***	
Control - Non-variable	-454.0	-1182.1 274.2		

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Appendix XLIV: H2 experiment: ANOVA procedure & Bonferroni post-hoc test of the type of group over the total estimated timing

Procédure REG
Modèle : Linear_Regression_Model
Variable dépendante : Total estimated timing

Nb d'observations lues	96
Nb d'obs. utilisées	96

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	16295779	8147890	5.90	0.0039
Erreur	93	128444618	1381125		
Total sommes corrigées	95	144740397			

Root MSE	1175.21271	R carré	0.1126
Moyenne dépendante	631.44650	R car. ajust.	0.0935
Coeff Var	186.11438		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	138.17338	207.75022	0.67	0.5076
Variable	1	992.19239	289.45030	3.43	0.0009
Non-variable	1	453.98929	298.65976	1.52	0.1319

Appendix XLV: H2 experiment: linear regression of the type of group over the total estimated timing

OBSERVATIONS	Boring/repetitive	No more ideas	Other	TOTAL
Control	7	22	3	32
Cooperative	8	20	2	30
Competitive	18	16	0	34
TOTAL	33	58	5	96
	34,38%	60,42%	5,21%	
TH. FREQUENCIES	Boring/repetitive	No more ideas	Other	TOTAL
Control	11,0000	19,3333	1,6667	32,0000
Cooperative	10,3125	18,1250	1,5625	30,0000
Competitive	11,6875	20,5417	1,7708	34,0000
TOTAL	33,0000	58,0000	5,0000	96,0000
CHI² TABLE	Boring/repetitive	No more ideas	Other	TOTAL
Control	1,4545	0,3678	1,0667	2,8890
Cooperative	0,5186	0,1940	0,1225	0,8350
Competitive	3,4094	1,0041	1,7708	6,1844
TOTAL	5,3825	1,5659	2,9600	9,9085
Chi²	9,9085		DDL	4
Inverted chi ² (5%)	9,4877			

Appendix XLVI: H2 experiment: Chi² test of the type of group over the motive to stop

SUMMARY OUTPUT								Boring
Regression Statistics								
Chi Square	6,66							
Residual Dev.	115,55							
# of iterations	5,00							
Observations	96,00							
	Coefficients	Standard Error	P-value	Odd Ratio	Lower 95%	Upper 95%	Lower 95%	Upper 95%
Intercept	-1,27	0,43	0,00	0,28	0,12	0,65	0,12	0,65
Non-variable	0,26	0,59	0,66	1,30	0,41	4,16	0,41	4,16
Variable	1,27	0,55	0,02	3,57	1,22	10,46	1,22	10,46

SUMMARY OUTPUT								No more idea
Regression Statistics								
Chi Square	3,49							
Residual Dev.	126,20							
# of iterations	4,00							
Observations	96,00							
	Coefficients	Standard Error	P-value	Odd Ratio	Lower 95%	Upper 95%	Lower 95%	Upper 95%
Intercept	0,79	0,38	0,04	2,20	1,04	4,65	1,04	4,65
Non-variable	-0,24	0,54	0,65	0,79	0,27	2,25	0,27	2,25
Variable	-0,91	0,51	0,08	0,40	0,15	1,11	0,15	1,11

SUMMARY OUTPUT								
Regression Statistics								
Chi Square	4,68							
Residual Dev.	34,61							
# of iterations	19,00							
Observations	96,00							
	Coefficients	Standard Error	P-value	Odd Ratio	Lower 95%	Upper 95%	Lower 95%	Upper 95%
Intercept	-2,27	0,61	0,00	0,10	0,03	0,34	0,03	0,34
Non-variable	-0,37	0,95	0,70	0,69	0,11	4,45	0,11	4,45
Variable	-19,72	6 185,82	1,00	0,00	0,00	infinity	0,00	infinity

Appendix XLVII: H2 experiment: logistic regression of the type of group over the motives to stop the experiment

Means and Descriptive Statistics

Group	Mean of 'Est# chances of winning'	Std. Dev. of 'Est# chances of winning'	Std. Error of 'Est# chances of winning'	Number of non-missing values for 'Est# chances of winning'
	3.1578947368	1.9147567451	0.196449897	95
Control	3.0322580645	1.7978481762	0.3229030647	31
Non-variable	3.1666666667	1.9666764075	0.3590643439	30
Variable	3.2647058824	2.0197333087	0.3463814048	34

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Appendix XLVIII: Descriptive statistic of the estimated chances of winning per group

The ANOVA Procedure

Dependent Variable: Est# chances of winning

Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Model	2	0.8795233	0.4397616	0.12	0.8891
Error	92	343.7520557	3.7364354		
Corrected Total	94	344.6315789			

r-carré	Coef de Var	Racine MSE	Est# chances of winning	Moyenne
0.002552	61.21123	1.932986		3.157895

Source	DDL	Anova SS	Moyenne quadratique	Valeur F	Pr > F
Group	2	0.87952329	0.43976164	0.12	0.8891

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Tests t de Bonferroni (Dunn) pour Est# chances of winning

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Degrés de liberté de l'erreur	92
Erreur quadratique moyenne	3.736435
Valeur critique de t	2.43854

Comparaisons significatives au niveau 0.05 indiquées par **.			
Group Comparaison	Différence Entre les moyennes	Simultané 95% Intervalle de confiance	
Variable - Non-variable	0.0980	-1.0827 1.2788	
Variable - Control	0.2324	-0.9381 1.4030	
Non-variable - Variable	-0.0980	-1.2788 1.0827	
Non-variable - Control	0.1344	-1.0728 1.3416	
Control - Variable	-0.2324	-1.4030 0.9381	
Control - Non-variable	-0.1344	-1.3416 1.0728	

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Appendix XLIX: H2 experiment: ANOVA procedure & Bonferroni post-hoc test of the type of group over the estimated chances of winning

Procédure REG

Modèle : Linear Regression Model

Variable dépendante : Est# chances of winning

Nb d'observations lues	96
Nb d'obs. utilisées	95
Nombre d'observations avec valeurs manquantes	1

Analyse de variance					
Source	DDL	Somme des carrés	Moyenne quadratique	Valeur F	Pr > F
Modèle	2	0.87952	0.43976	0.12	0.8891
Erreur	92	343.75206	3.73644		
Total sommes corrigées	94	344.63158			

Root MSE	1.93299	R carré	0.0026
Moyenne dépendante	3.15789	R car. ajust.	-0.0191
Coeff Var	61.21123		

Résultats estimés des paramètres					
Variable	DDL	Valeur estimée des paramètres	Erreur type	Valeur du test t	Pr > t
Intercept	1	3.03226	0.34717	8.73	<.0001
Variable	1	0.23245	0.48003	0.48	0.6294
Non-variable	1	0.13441	0.49505	0.27	0.7866

Appendix L: H2 experiment: linear regression of the type of group over the estimated chances of winning