

AALBORG UNIVERSITY COPENHAGEN

DEPARTMENT OF MEDIA TECHNOLOGY

HOW CHEATING AND CONATION AFFECT GAME-BASED LEARNING

A study about player behavior in a learning context



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Resume

Dette speciale undersøger hvorvidt der kan ses en sammenhæng mellem indlæring og konation når spillere snyder i computerspil. At blive kaldt en snyder, er ikke noget spillere har lyst til og er ikke noget, man ønsker at forbinde med sin egen selvpfattelse, da der er en generel udtalt aftale om, at det at snyde ikke er en acceptabel opførsel - heller ikke i spil.

Anonymitet er et af de elementer, der kan friste en spiller til at snyde og det var dette emne, der blev testet i dette speciale. Der blev lavet et simpelt quiz-lignende spil, der handlede om at parre Europæiske flag med det tilsvarende land. Her blev der implementeret en knap med teksten "Cheat" ["Snyd"], der markerede det rigtige svar hvis der blev trykket på den.

Det blev undersøgt hvorvidt deltagerene rent faktisk trykkede på knappen, og om der var en sammenhæng mellem dette og deres konation. Hvor meget de lærte af spillet blev målt ved, at de før og efter spillet skulle nævne så mange af de 50 flag som muligt i et spørgeskema. For objektivt at beslutte om svarene skulle betragtes som rigtige eller forkerte blev deltagerens svar sammenlignet med facit ved at benytte Levensthein minimum string distance til at udregne deres fejlmargen. Var fejlmarginen under den accepterede tærskelværdi, blev svaret godtaget.

Da dataen ikke var normalt distribueret i nogle tilfælde, blev den behandlet med Wilcoxons rank-sum test ($n=51$), der dog ikke vidste nogen statistisk signifikans. I dette forsøg, kan der dog ses en tendens imod en øget læring uanset om der snydes i spillet eller ej. Dette kan dog kun tilskrives dette forsøg og ikke spil generelt.

I fremtidige studier bør man overveje hvor vidt alle tre aspekter skal undersøges

samtidig, fremfor først at undersøge sammenhængen mellem dem individuelt. Da de fleste af studiets deltagere havde dansk som modersmål, bør det også overvejes at lave spillet på dansk. Dette kunne muligvis give andre resultater, fremfor at undersøge hvordan danske studerende lærer i et engelsksproget spil.

Abstract

This thesis seeks to investigate how learning outcome and conation is affected when players cheat in video games. Being a cheater in video games is a strong label, one does not want this as part of their self-image, and players go to great lengths to debate their innocence or by abstracting the action. Anonymity can tempt players into cheating, which was tested during this thesis. By implementing a cheat button into a simple quiz style game of the European flags, it was investigated how many times the participants would press the button. At the same time, the participants were asked to name as many of the countries based on their flags as possible before and after playing the game. Using the Levenshtein minimum string distance, the error rate of the inputs was calculated and if they did not exceed the threshold, accepted as a correct answer. Though none of these results showed any statistical significance using the Wilcoxon rank-sum test ($n=51$), there was a tendency towards an increase in learning outcome, but there was no noticeable difference between the conditions.

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1 | Introduction

The topic of cheating became an interesting field of study after attending a talk at a game jam about how players could be utilized as a design resource for games, in the context of cheating by branding it exploratory play.

The talk brought up points such as, when is cheating, cheating? Are using bugs or game glitches cheating, or cleaver use of game game mechanics? Are bugs even bugs, or are they features? The speaker had the crowd arguing with each other over different definitions, which was the point of his talk. That cheating is defined individually.

After being fascinated by the talk, research into the topic began but from a very different angle than utilizing players as a design resource. Rather by hoping that connecting cheating to learning would reveal results as to why do players cheat.

As the academic research field of cheating in games is rather limited, the hope is that this study will contribute with additional findings and reveal new information about player behaviour in a difficult to define context. Furthermore, this could contribute to future game design, by limiting cheating a better game experience could increase players engagement with the game.

Cheating in video games is an interesting field of study that still require further research as current theories are still rather vaguely defined. Previous theories have had difficulties defining exactly what cheating is and pinpointing it to anything specific. Perhaps because it is so difficult define, label and confine it to a single action, is what makes the topic interesting in itself.

The research field of cheating is rather limited in terms of contributors, where those who have dared to define it have done so in their own specific cases. A general description of cheating exists, however it relies heavily on the context in which it is presented and as a result of this it is vaguely defined.

Another field of study which have been vaguely defined is conation. This topic was partially forgotten in the research of cognition, though it traces back as far as Aristotle. Many psychologist have attempted to understand and explain this phenomenon, but definitions have changed over the years. Though a general understanding of the term exists, despite being forgotten, the concrete definition have always been up for interpretation. The subject have since reappeared in the form of continuation desire, which shows resemblance to the studies of conation.

This study attempts to link cheating to conation, as well as game-based learning which was added later on, and investigate how these might affect one other. A game prototype was developed used to facilitate the investigation, which sought to understand why players cheat in a learning context and how that might affected their conation and experience.

In this thesis the theories of game-based learning, cheating and conation will be presented. Preliminary research on how players defined cheating was conducted and analyzed. Based on inspiration, a prototype game was developed. In combination with the research methods, the prototype game was used to facilitate an investigation, which sought to understand why players cheat in a learning context and how that might affected their conation and experience. The results of the experiments will be analyzed, discussed and bias will be pointed out. Conclusions will be made using the presently available theory.

1.1 | Initial problem statement

As a result of the talk, the research into cheating and conation, the following initial problem statement was formed.

- How does a player's interpretation of cheating/unintended play affect their behavior and/or conation?

This problem statement neglected learning as a component, as at the time an understanding for how cheating was defined was yet to be understood, which later lead the project in a different direction.

2 | Investigation

In the following chapter a preliminary investigation based on the initial ideas for the project, will be explored. Additionally, it was agreed that incorporating game-based learning into the study could be interesting as people cheat in academic for the same reasons as in games (Madigan, 2015, p. 35). The findings of such will be presented before investigating the state of the art related to the topic. Lastly, based upon this investigation a final problem statement will be presented, guiding the course of the thesis.

2.1 | Preliminary investigation

Preliminary research into the scientific field of cheating in games, revealed that the definition is loosely termed. Moreover, players have an individual definition that varies on a game-by-game basis (Consalvo, 2007, p. 94).

Even the researchers had trouble agreeing upon the definition, so a questionnaire was developed to gather data on the subject, which can be seen in Appendix A. The goal of this was to determine how players defined cheating.

The questionnaire starts by determining the participants demographic information including age, gender and native language. Then participants are questioned about about their gaming habits in relation to time spend playing on their tablets and/or smartphones, along with computer and/or game console. Afterwards the participants were asked whether they felt there was a difference between cheating in a single-player versus a multiplayer game (see Appendix A).

Depending on what the participants answered to this question, they were directed to the according section in the questionnaire (see Appendix A). Here, they were tasked with ranking five statements on a Likert scale from 1 (least accurate) to 5 (most accurate). The statements in the questionnaire were as follows, though they were randomly shuffled for each participant:

- Gaining an unfair advantage
- Anything other than getting through the game all on your own
- Applying external software to alter the game
- Using existing game elements for purposes, you know are not intended
- Modifying the game files to access unintended content

After ranking each of the statements, the participants were thanked for participating in the investigation and the data was anonymously submitted to the researchers for further analysis.

2.2 | Investigation data and findings

The data gathered from the questionnaire was sorted and analysed, showing the results presented in this section.

The questionnaire was shared on two social media sites, Facebook and Twitter, where 71 unique responses were gathered before being closed.

Two participants were discarded from the investigation as their responses revealed, that they never played games on either phones, tablets, consoles or computers, thus their data was invalid to the researchers.

What remained were 69 responses, including 52 males and 17 females ranging in the age of 17 to 51.

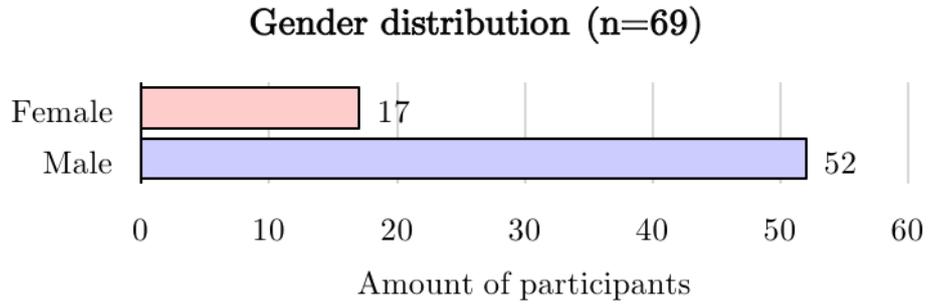


Figure 2.1: Gender distribution

Amongst these 69 participants, 51 reported their native language as Danish, 4 as English and 14 as "other". These languages included Arabic, Bulgarian, Chinese, French, German, Greek, Lithuanian, Norwegian, Polish, Portuguese, Romanian and Thai.

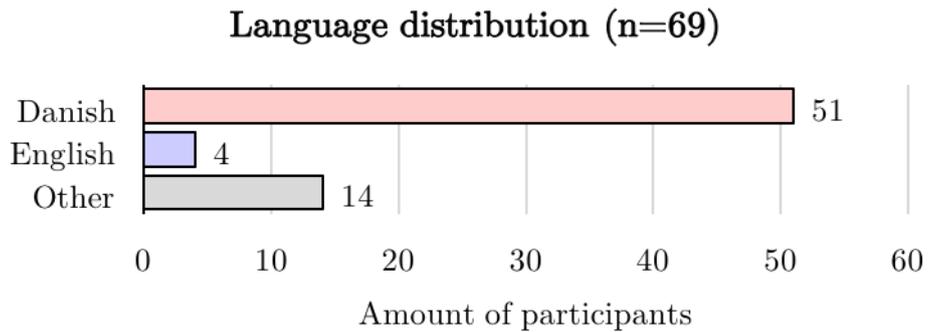


Figure 2.2: Language distribution

The participants self-reported their gaming habits in terms of how often they played on tablets and/or smartphones (see Figure 2.3) and on console/computer (see Figure 2.4).

Gaming habits for tablet and/or smartphone (n=69)

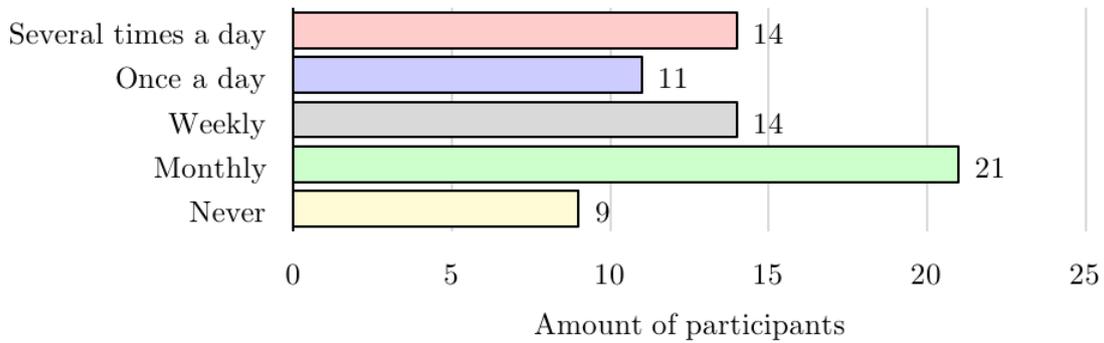


Figure 2.3: Gaming habits for tablet and/or smartphones

Gaming habits for console and/or computer (n=69)

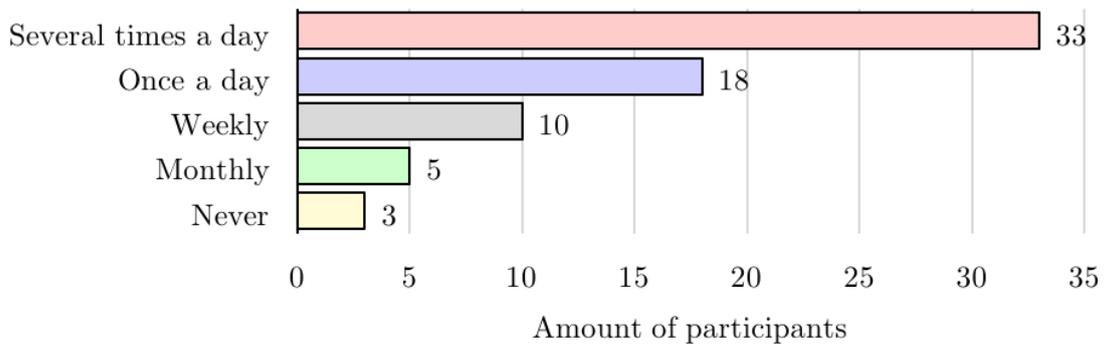


Figure 2.4: Gaming habits for console and/or computer

Amongst the 69 participants, three of them felt that there was no difference between cheating in a single-player game versus a multiplayer game, thus they were not included in the following findings as they were considered outliers. Based on the remaining 66 responses, researchers were only interested in which statements participants had rated most accurate (5), resulting in the following data.

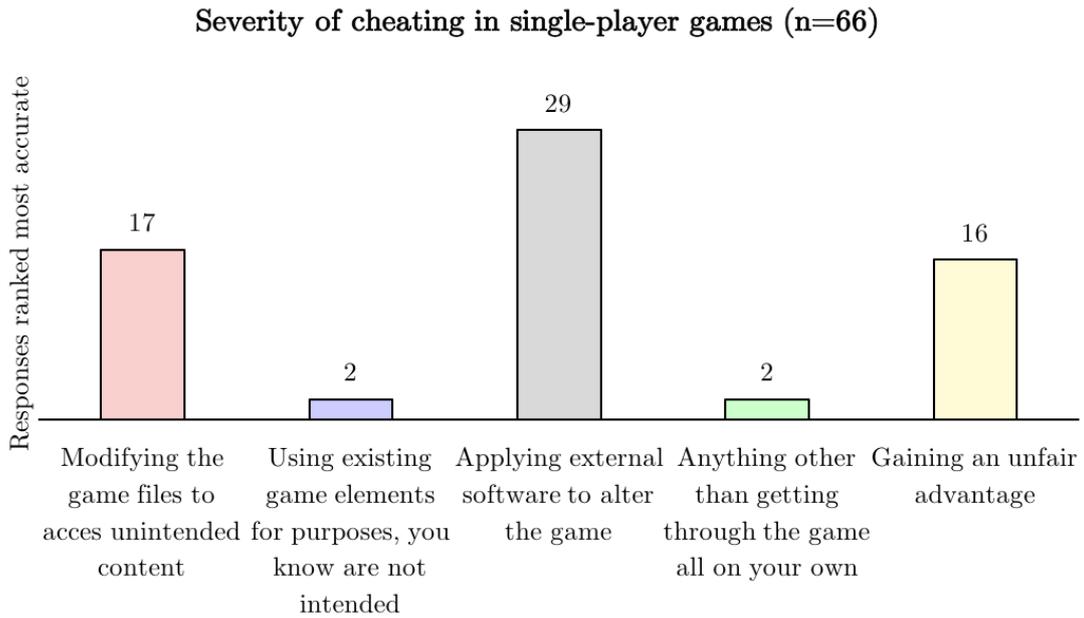


Figure 2.5: Severity of cheating in single-player

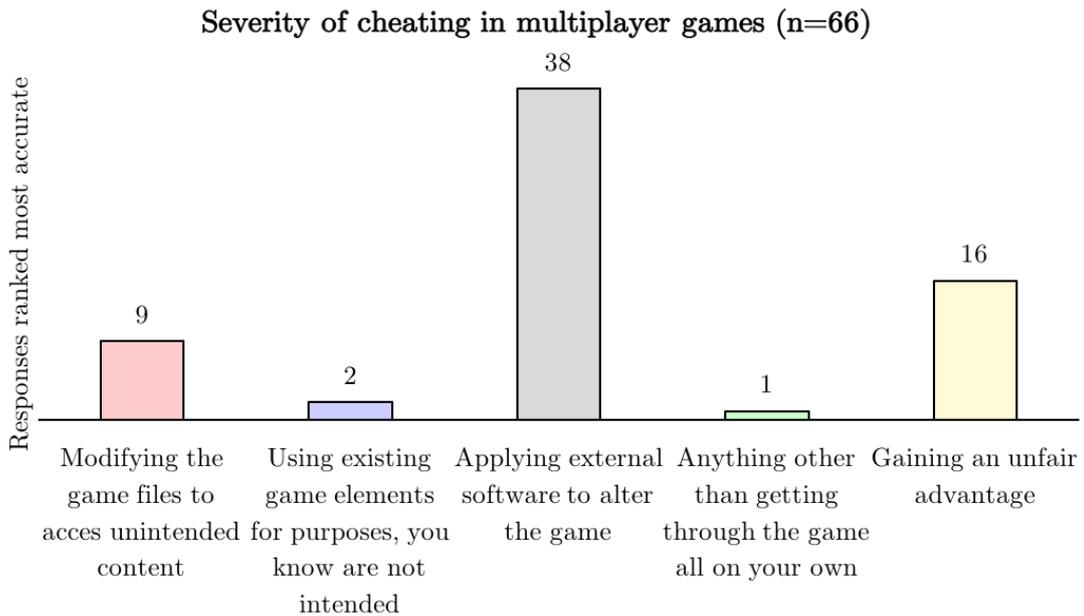


Figure 2.6: Severity of cheating in multiplayer

As seen by the Figures 2.5 and 2.6, participants clearly rated "applying external

software to alter the game" as the most accurate description and therefore the most severe form of cheating in both a single-player and multiplayer case.

2.3 | State of the art

A search through the Google Play Store and the Apple App Store revealed that there are an ocean of games containing learning elements as a part of their game design. The following section is a summary of three cherry picked examples of games, which stood out from the crowd. These games all have a very different approach to learning and served as inspirational sources for prototype development in relation to this project.

2.3.1 | Peak

Among these is an application called Peak (2014). It differentiates itself from other learning games by categorising itself as "the fitness center for your brain" (Peak, 2014). Peak (2014) immediately seeks to be more serious than other games, as they have taken an academic approach to their design.

The games within Peak have been developed with the help of their scientific advisory board, which consists of experts in the field of neuroscience, cognitive science, and education. The application seeks to challenge players attention, creativity, emotion control, language, memory, mental agility and problem solving (Peak, 2014).

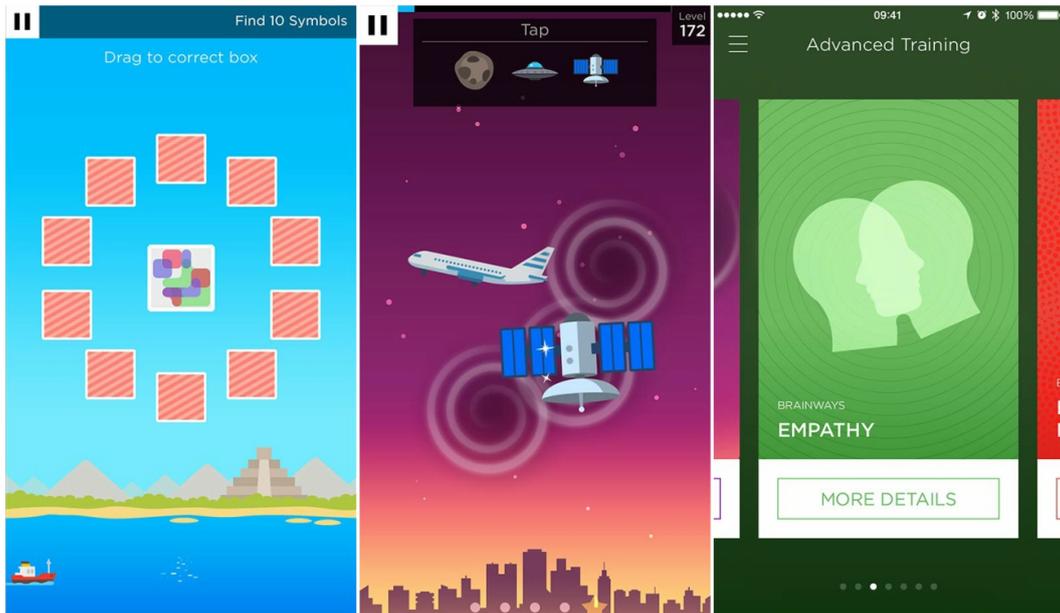


Figure 2.7: Examples of minigames within Peak - Brain Training (Peak 2014, cropped).

Some examples of minigames within Peak are:

- Clicking on numbers from lowest to highest
- On a grid of 4x4 you must connect two dots while avoiding the "mines".
- A row of figures must be sorted either left or right depending on color

Which games are available to players changes on a daily basis, as learning plans are tailored specifically to each players needs and are calibrated to give the best possible results (Peak, 2014).

After each game, the player gets a summery of how many correct answers they got, how high their score was and if it was better than their current highest score. Players are given a daily goal of points to achieve and completing these minigames rewards players with points used to obtain that goal.

The performance results of these minigames are used to evaluate a players overall

"Brain Score" measured out of 1000. Afterwards, players can use this score to compare themselves amongst different age groups, professions or Facebook friends.

Peak offers players the possibility to monitor their overall "Brain Score" and individual scores for memory, problem solving, language, mental agility, focus and emotion over a four week time period. This gives them a visual overview of their progress, incentivizing them to keep playing to become better.

2.3.2 | Duolingo

This next example is something a little different from Peak. Rather than having minigames to train the brain in very different capacities, Duolingo focuses solely on the learning of languages.

Duolingo is an application for learning new languages with gamified elements to encourage players to keep learning. Players can either choose to start completely from scratch or take a placement test which determines where they should start according to Duolingo. When learning a language players will be tasked with different translation assignments, which examples of can be seen in Figure 2.8.

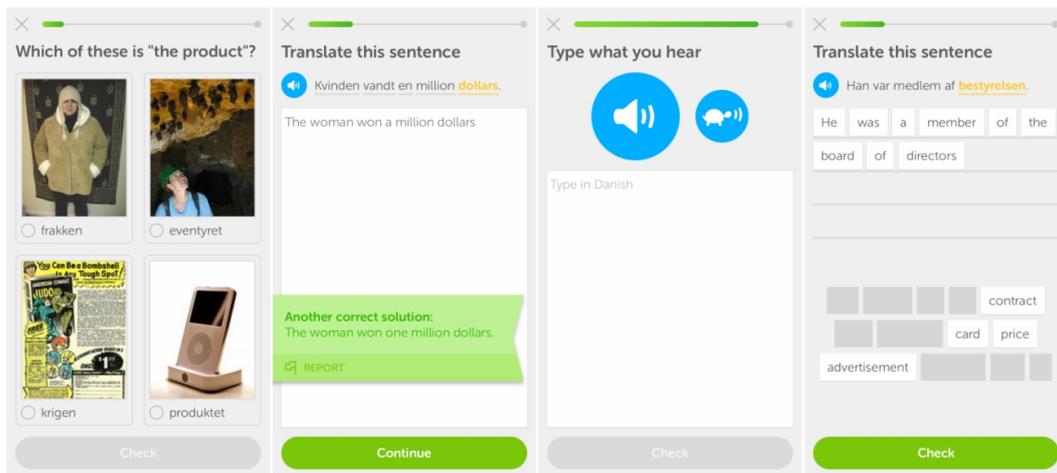


Figure 2.8: Examples of translation tasks within Duolingo for iPhone (Duolingo, 2012)

They can either be asked to select the correct word among four pictures with an associated text. Asked to type the translate of a sentence from either the language they are learning into their native language or vice versa. Occasionally the sentences are invisible where the players have to listen to an audio file and type in the translation. Another task can be to construct the translation by selecting the correct words in the correct order amongst a selection of words.

Players earn experience points by completing language sessions which awards them Lingots, Duolingos virtual currency used to unlock additional features. These can also be earned by keeping a usage streak of seven days, incentivizing players to log in and learn on a daily basis. The learning progress is tracked through a progression tree which players climb as they complete more and more assignments.

2.3.3 | Geo Challenge

Geo Challenge created by Playfish is the last to be presented.

Compared to Duolingo and Peak, it has a heavier focus on graphics and game-play. However, it still encourages learning if players wish to obtain a better score. Geo Challenge secretly teaches players about the geography of the world through a fun series of geographic related minigames which have players:

- Match the flag to a given country, choosing between a range of flags
- Given a list of countries players have pick the correct country based on its geographic shape
- Locating cities on a world map
- Determining a location based on a photography of a known attraction

The goal of the game is to achieve the highest combined score, which is then compared to the players' Facebook friends.



Figure 2.9: Geo Challenge by Playfish.

As friends are able to see scores and how they rank compared to each other, the game motivates players to do better each game session to become better.

However, the game is no longer playable as Playfish was shut down, resulting in Geo Challenge no longer existing.

2.4 | Conclusion to investigation

Based on the results from the investigation of cheating, participants deemed that applying external software to alter the game was the most severe form of cheating in both single-player and multiplayer. However, creating a prototype game in which applying external software made any immediate impact on the imbalance of cheating, such as an first-person shooter with a cheat to see other players through walls, was considered too big a scope.

As a results of the findings and due to Geo Challenges (Playfish, 2016) simplicity in design and easy to understandable game objective. It was selected as the most feasible candidate for prototype development. More specifically the minigame in which players match a flag to a country name (see Figure 2.10) was the inspiration for this prototype.



Figure 2.10: Geo Challenge (cropped) by Playfish via Mack (2008).

A cheat feature that would allow players to instantly know the correct answer was planned and will be discussed further in detail in the prototype section 4.3 Prototype.

Due to the wide range of games within Peak and the lack of a concrete learning subject, it was discarded as an inspirational source for prototype development. Similarly Duolingo was disregarded, as it was deemed to ambitious to create a language learning system within the project period, as the scope of the product would have been to big.

2.4.1 | Final problem statement

Based on the investigation and the preliminary research into cheating, an understanding of why cheating is not clearly defined started developing. Perhaps the

reason is that cheating is so individually defined and open to interpretation (Consalvo, 2007, p. 5).

This led the study to investigate cheating, conation and learning from a different perspective, resulting in the following final problem statement:

- How is a player's conation and learning outcome affected if given the possibility to cheat in an educational game?

With the final problem statement in place, a literature review of game-based learning, cheating and conation, will be introduced in the following chapter.

3 | Literature review

This chapter consists of the various theories related to the study. Game-based learning will be described, then followed by cheating and conation. In the conclusion to the literature review, the hypotheses of this study will be made.

3.1 | Educational games

When games are used in a classroom, they can be used as a new method of teaching. Games can however also be used to affect us in many other ways, that does not only apply to classrooms. The use of game elements in other contexts, gamification, can even be found in workplaces and when filling out profiles on web pages (Madigan, 2015, p. 8). Using the theory of games, the term “stealth learning” should be considered. This term is based on theory of educational games and can be used to inspire players to learn without the players being aware that they are taught something specific (Adams, 2014, p. 27).

3.1.1 | Game-based learning in serious games

Ernest Adams categorizes educational games under the the broader term “serious games” and states that it is the “oldest form of serious game” (Adams, 2014, p. 27). Serious games are not designed purely for entertainment, but rather to achieve goals through enjoyable play (Adams, 2014, p. 27; Mitgutsch, 2011, p. 46). It has been stated that the learning gain is higher for serious games than using conven-

tional instruction methods. This applies in all domains but engineering and biology, and excels especially in language. However, it varied across the different domains (Wouters et al., 2013, p. 258). It had been hypothesized by Wouters et al. (2013) that serious games should be more motivational than conventional instruction methods¹ and though the collected data was in favor of this, it could not be statistically proven that there was a significant motivational effect (Wouters et al., 2013, p. 256).

Games are wonderful learning tools because they can motivate players to voluntarily confront themselves with unnecessary challenges in a satisfying way (Mitgutsch, 2011, p. 45). However, learning can be problematic because it takes hard work to absorb, process and store knowledge in our brains. Humans find it a waste of time to solve the annoying middle part of a mathematical equation, if by looking at it, they are sure they can determine the answer (Koster, 2013, p. 112). Furthermore, it is a bad idea to assume the answer without going through the process of solving it. It might just turn out that the answer was incorrect, but that does not stop the human mind from wanting to take shortcuts (Koster, 2013, p. 112).

3.2 | Cheating

As the brain takes shortcuts to problem solving, the same might be said about players when solving ingame objectives. They will explore the best strategies and determine the optimal path in order to achieve the ultimate goal (Koster, 2013, p. 114). The same goes for academia amongst other aspects in life, where people cheat for the same reasons as in games (Madigan, 2015, p. 35).

Usually people cheat as much as they can without admitting it to themselves or

¹Conventional instruction methods covers: "(...) such as lectures, reading, drill and practice, or hypertext learning environments." (Wouters et al., 2013, p. 249)

others (Madigan, 2015, p. 35) and they go to great lengths to debate their innocence (Consalvo, 2007, p. 166). Being a cheater is a strong label, which people do not want as a part of their self-image (Blackburn et al., 2012, p. 81; Madigan, 2015, p. 43).

With such strong subjective opinions, players often debate which activities are labeled cheating and which are not (Consalvo, 2007, p. 5). Their individual definition often depends on the situation, the time of day and the game (Consalvo, 2007, p. 94), which makes it difficult to define cheating as a single concept.

Some players need the cover of anonymity in order to cheat and cannot do this, if physically located next to someone else (Consalvo, 2007, p. 113). Though a player might never cheat face-to-face, the fluidity of online identity might tempt players to push the boundaries of acceptable behavior, as anonymity makes cheating easier to get away with (Consalvo, 2007, p. 112).

When players become anonymous, they have to rely on environmental- and social cues in terms of what is acceptable behavior (Madigan, 2015, p. 17). As cheating in games is a social mechanism, it is more likely that players are led to cheat when observing someone else cheating (Blackburn et al., 2012, p. 88; Madigan, 2015, p. 35). This is believed to be especially true when the perceived chances of getting caught are low and the action can be classified as a "grey zone" (Madigan, 2015, p. 35). This especially takes place in ambiguous situations such as playing a new game or playing with a group of strangers (Madigan, 2015, p. 37). As humans are dependent on their groups, such as online friends, a player tends to take guidance from those around him (Madigan, 2015, p. 37). In this case it means whether cheating is an acceptable behavior or not.

This way of reading social- and environmental cues whilst being anonymous can be attributed to the theory of deindividuation, and can take place when playing

games (Madigan, 2015, p. 24). Deindividuation derives from social psychology and is a mental state in which players individual identity fade and they become anonymous.

Generally people tend to play the roles they are expected to have based on these environmental and social cues, but being deindividuated affects the behavior of the player (Madigan, 2015, p. 25). Players are affected by this as they take in cues of the environment and if this particular environment has a certain expectation or definition of what is normal, players should be more affected by it in the case of deindividuation (Madigan, 2015, p. 24).

An example of this would be of a war- or military themed game. By putting emphasis on the domination-part of the game, the players should behave in that general direction. In other cases, such as co-op games, the emphasis might be on team work. By simply creating the frame of reference, it can be possible to use deindividuation to enforce a certain behavior (Madigan, 2015, p. 25).

Another way players justify cheating, or other questionable behaviors, are by inserting a level of abstraction between themselves and the action (Madigan, 2015, p. 47). An example of this could be stealing ingame currency versus real money, as some games make it possible to exchange ingame currency to real money

Though an individual might never steal from a cash register, labeling the behavior as "obtaining ingame currency" rather than "stealing money", makes it easier to justify the behavior, as the ingame currency is abstracted and not thought of as "real" money (Madigan, 2015, p. 45).

Much of the literature presented in this section can be traced back to Consalvo, as her book describes cheating in a broader sense. She appear to be the main contributor to this specific field of research as she investigated cheating in different

aspects and contexts. Since cheating in games is still a rather unexplored area of research (Blackburn et al., 2012, p. 82), authors who came after her, only dealt with the concept in their respectable research cases.

Where Consalvo mainly focuses on how cheating is defined and how it takes place in games, Madigan investigates how cheating affects players and what motivates them to do so. Since this study seeks to understand the behavior of cheaters as well as how cheating takes place in games, the study relies heavily on Madigans book as well. By understanding what drives a player to cheat and how this can be done in games should help to understand how this is affected in a learning context.

3.2.1 | Loss aversion

Loss aversion is what motivates players not to lose, as the name suggests. Players simply do not want to lose (Madigan, 2015, p. 40). This phenomenon takes place in various other real-life activities like cheating to pass exams or buying information to avoid losing shares in the stock market (Madigan, 2015, p. 40). The aversion of loss is deemed far more motivating than an actual gain even though it ends with the same result. An example of this is that people would rather avoid spending 5 USD (loss aversion) rather than getting a 5 USD refund (gaining) even though the result would always be saving 5 USD (Madigan, 2015, p. 40).

Cheating should be more likely to happen when the goal of the games is perceived as "performance-related" rather than a "mastery goal" (Van Yperen et al., 2011, p. 5). Performance-related goals are focused on how a player performs in relation to other players, whereas mastery goals are limited to the individual (Van Yperen et al., 2011, p. 6). Where performance-related individuals' main goal is to win (or not to lose) at any possible cost, there is a higher chance they find cheating

a viable means to an end (Van Yperen et al., 2011, p. 6). For those seeking mastery goals, there is simply no point in lying to oneself when you are your own competition (Madigan, 2015, p. 41).

Game design is a way to nudge players into a performance-related state of mind by utilizing high scores, achievements and ranking systems that compare players against each other (Madigan, 2015, p. 41). However, it is worth noting that a game does not have to contain these elements when creating an educational game, as the primary goal is to have an educational impact (Mitgutsch, 2011, p. 46).

3.3 | Conation

The following chapter consist of the relevant theory related to continuation desire and conation. These theories are relevant as this study seeks to test the relationship between cheating and engagement, which is possible to test using the theory of conation and continuation desire.

There have been many theories trying to describe exactly what defines engagement. One of these aspects is that an engaged player simply want to keep playing (Brown and Cairns, 2004, p. 3; Schoenau-Fog, 2011, p. 220). To gain players engagement, the first minutes of their experience are important – if a game is not engaging, the players do not want to keep playing (Schoenau-Fog and Bjorner, 2012, p. 406). This is termed “continuation desire”.

During the research of continuation desire, the concept of “conation” have also been researched. Conation is not easily defined and Militello et al. called it “(...) a somewhat nebulous concept, difficult to define in a concrete, easily understood form.” (Militello et al., 2006, p. 240). It may however contribute with a deeper understanding of how it is possible to get people to interact with technology (and

hereby games) as well as they interact with other people (Militello et al., 2006, p. 246).

Conation derives from the Latin *conatus* or *conari* which means “to try” (Oxford University Press, 2016) and depending on the dictionary, it is termed: “the mental faculty of purpose, desire, or will to perform an action; volition.” (Oxford University Press, 2016).

The term conation dates back to Aristotle (384–322 BC) and it is possible to think of conation as a part of the trilogy of the mind; conation, cognition and affect (Militello et al., 2006, p. 240). Cognition can be viewed as pure reason or intellect, affection as the judgement to feel pleasure or pain, and conation relates to will or action (Hilgard, 1980, p. 109). Conation is also described as volition that embraces an activity as a whole experience directed by the feelings, where feelings includes but are not limited by emotions, passions and sentiment (Hilgard, 1980, p. 111).

The cognitive consciousness serves to give experiences of the outer world, where the affective consciousness allows for staying in touch with ones own being. Conative consciousness can be said to supply the basis of voluntary activities and experiences of life (Hilgard, 1980, p. 112).

Of the elements inside the trilogy, cognition have been the favored component though it has been generally accepted that conation plays an important role in most human behavior (Militello et al., 2006, p. 240; Scherer, 1994, p. 3). The process of favoring cognition more or less put the more dynamic features as incentive motivation, curiosity and drive in the background (Hilgard, 1980, p. 115). However, the trilogy should be recognized as something that coexists in the mind as opposed to being separate forces and where each element changes between dominating (Hilgard, 1980, p. 109-110). Each activity phases through all three elements of the trilogy

during the mental processing, but one is usually prominent (Hilgard, 1980, p. 114).

In terms of research, evaluating player experience as their desire to keep playing should determine whether or not the game is engaging simply by investigating whether or not it keeps the players playing (Schoenau-Fog and Bjorner, 2012, p. 405). It can be argued that a player can not experience the state of flow or being immersed into the game without actually want to continue playing (Schoenau-Fog and Bjorner, 2012, p. 405-406). In relations to learning, it can be beneficial to investigate what drives and motivates a player as this might be related to their conation (Schoenau-Fog, 2014, p. 513).

3.3.1 | Self determination theory

As stated in the previous section 3.3 Conation, conative consciousness supply the basis of voluntary activities, it is relevant to investigate what motivates players or people in general. However, since motivation is a broad concept, this is limited to self determination theory. This links to conation in terms of the conative consciousness' resemblance to the concept of autonomy, which is described below.

Games can be found enjoyable in themselves but can also provide players with the basic needs for competence and autonomy (Boyle et al., 2011, p. 71). These two terms derives from self-determination theory, that describes the basic psychological needs that is deemed essential for psychological growth, integrity, and well-being (Deci, 2000, p. 229).

The elements of intrinsic motivation (autonomy, competence and relatedness) will be described, since it has been suggested that people enjoy themselves more if the activities meet intrinsic rather than extrinsic needs (Boyle et al., 2011, p. 71). Relatedness is used to describe the desire to feel connected to others, to care for

them and to be cared for (Deci, 2000, p. 231). The term autonomy refers to an activity people choose to do naturally and freely following their personal interest (Boyle et al., 2011, p. 71; Deci, 2000, p. 234). To satisfy the need for competence there should be provided positive feedback to signify the reflectance of an action whereas negative feedback tends to undermine the effect (Deci, 2000, p. 234).

To put these terms in use inside a video game, the autonomy allows the player to take part in a freely chosen activity, where competence covers the importance of challenges inside the game (Boyle et al., 2011, p. 71). By applying this to the knowledge of serious games, it has to be considered that there is a difference between serious (educational) games and a game made purely for leisure. The latter is chosen by players and can be played for as long as they want, whereas a educational game usually is part of a curriculum (Wouters et al., 2013, p. 261). When a game is part of a pre-chosen curriculum, it should assumingly lower the feeling of autonomy as opposed to a self-chosen leisure game since the educational game is not quite as self-determined as a leisure game.

3.3.2 | Flow theory

As stated in section 3.3 Conation, the state of flow cannot take place if the player does not want to keep playing. Flow research origins from a desire to understand the phenomenon of intrinsic motivated activities regardless of the possible extrinsic rewards (Nakamura and Csikzentmihaly, 2009, p. 195). Put in other words, flow research seeks to understand why it is possible to be engrossed into an activity. What is described in section 3.3.1 Self determination theory by Deci & Ryan (2000) as competence is quite consistent with the often used flow theory (Boyle et al., 2011, p. 71).

The phenomenon of flow occurs when someone (e.g. a player) manage to establish a balance between their perceived capacities and opportunities, and when the state of flow is reached, the user operates at full capacity (Nakamura and Csikzentmihaly, 2009, p. 196). The state of flow therefore depends on a match between skills and challenges. In case the user is struck with boredom or anxiety, the user should seek to adjust the level of either skills and/or challenges in order to re-enter the state of flow (Nakamura and Csikzentmihaly, 2009, p. 196).

It is possible to find flow in most activities, since this state of mind is subjective to challenges and skills, which in the end influences how the individual experiences the activity.

As greater challenges are mastered by users, they develop greater skills, which causes the activity to not be as involving as before. By engaging in more complex challenges, the user should reenter flow since the optimal challenge level are related to the acquired skills (Nakamura and Csikzentmihaly, 2009, p. 196). In the end, experiencing the state of flow encourages the user to take part in and return to an activity as the link to commitment as well as the promise of experiential rewards fosters a growth of skills over time (Nakamura and Csikzentmihaly, 2009, p. 199).

When applying flow to a video game, the challenges inside the game should be doable but reasonably challenging as an attempt not to cause boredom. The challenges should gradually become more complex to counterweight the expanding skill set. If the state of flow is reached inside a video game, the player should ideally reach full capacity.

3.4 | Conclusion to literature review

Based on the literature reviewed in this chapter, the following hypotheses were made to gain knowledge in attempt to answer the final problem statement.

The null-hypothesis and alternative hypothesis are as follows:

- **H0:** *There is no difference in conation or learning outcome if players have the possibility to cheat*
- **H1:** *There is a difference in conation or learning outcome if players have the possibility to cheat.*

With these hypotheses in place, the study will attempt to reject the null-hypothesis (H0) and accept the alternative hypothesis (H1) in order to ideally prove a significant difference in conation or learning when players have the possibility to cheat. The following chapter will describe the necessary method theory in order to conduct a scientific study of these parameters.

4 | Methods

The following section contains details about the methods used to facilitate a study in order to reject the null-hypothesis (H0) and accept the alternative hypothesis (H1).

In order to investigate cheating and conation in a learning situation, a prototype system was designed and developed. Additionally, game based learning was studied to ensure the prototype was developed as a learning tool. In this case, the prototype is a learning tool for naming countries based on their flags.

The prototype will be used in a study to determine how well a person can recognize flags before and after interacting with the prototype, alongside the amount of times the “cheat” button was pressed and participants’ conation rating on a scale from 0-10. The data obtained from the study will later be analyzed in order to draw conclusions based on the test results.

4.1 | Target group

As the prototype is being based on Geo Challenge as presented in the investigation, the target group should be players of age 10 and up. The game design is rather simple and by being a point-and-click style game, it requires very little technical knowledge. However, as geography is a key component in the game and the subject is not taught until grade 7 in Danish primary schools (Danish Ministry for Children, Education and Gender Equality, n.d.), the target group is players of the age 13 and up.

However, as children have a shorter attention span than adults (Lazar, 2010, p. 26) and geography is not taught as a subject by itself after primary school, the target group for this study will be participants of age 16 and up.

4.2 | Participant sampling

Before the testing is begun, it is important to discuss how the test participants should be recruited. Usually there is no problem with using convenience sampling in human-computer interaction (HCI) research by e.g. collecting students walking down the hall or motivate them by the promise of food (Lazar, 2010, p. 368-369). However, it only shows how a product (in this project, a flag game) works and is interpreted by this certain demographic group (Lazar, 2010, p. 369). The game does not necessarily work for other target groups.

It should however be noticed that the test participants should be appropriate for the study in terms of e.g. demographic or educational details (Lazar, 2010, p. 369). This is relevant since each individual test participant's background and motivations are relevant in terms of their respective appropriateness for contributing to the study (Lazar, 2010, p. 369).

For this project, the between-group design is adopted. This means that each participant only is subjected to a single condition (Lazar, 2010, p. 46). This is chosen since this experiment is simple tasked and the results would be greatly affected by learning effect (Lazar, 2010, p. 49). This test design gives a cleaner statistical design as well as it seeks to avoid the learning effect, fatigue and frustration (Lazar, 2010, p. 47). The disadvantages to between-group design are that each individual test participant is different and this can create a high level of "noise" in the statistical analysis, which makes Type II errors (false negatives) more likely (Lazar, 2010, p.

47).

This should however not be more likely to occur since the experiment consists of a fairly simple tasks, that limits the impact of the individual differences (Lazar, 2010, p. 50).

Another disadvantage is the large amount of test participants required as each condition needs approximately the same amount of participants to be comparable (Lazar, 2010, p. 47). At best, the test participants should be randomly assigned to each test condition but the groups need to similar in potential confounding factors e.g. gender, age and experience related to the test conditions (Lazar, 2010, p. 50).

Of ethical considerations, a consent form should be made to make sure the test participants are well informed. They should know what they are participating in and that they are free to leave and withdraw their data at any time (Rosenthal and Rosnow, 2007, p. 69). Informing participants might however impact the validity of the data, since it might alter the participant's perception of the experiment and therefore impact the results (Rosenthal and Rosnow, 2007, p. 70). To avoid this, deception can be used to do valid research as long as the study would be compromised if the participants knew every detail (Rosenthal and Rosnow, 2007, p. 71). The risks of the study should be minimal and the participants should be debriefed to make sure there are no misconceptions and the participants are well informed of the actual study (Rosenthal and Rosnow, 2007, p. 73).

It can always be beneficial to have a debriefing session with the participants after the test, since such a session makes it possible to provide additional details of the test as well as an opportunity to correct possible misunderstanding (Rosenthal and Rosnow, 2007, p. 73) (Lazar, 2010, p. 203). By ending the "official" investigation is over, the participants might get incitement to share comments they would not have made during the session (Lazar, 2010, p. 203). Another possibility is that the

consent form causes slight "paranoia" in the participants, as they might question their own performance according to the test condition (Rosenthal and Rosnow, 2007, p. 70-71).

Another consideration for this study is what is known as social desirability bias. When participants do self-reporting, they tend to present the most favourable image of themselves - whether they actually believe their response themselves or they fake their responses to avoid criticism or gain approval (Van de Mortel, 2008, p. 41).

4.3 | Prototype

In order to facilitate the study, a prototype game was designed and developed based on the research from the investigation as well as the literature review.

Based upon the initial problem statement and the preliminary research, the prototype was originally intended as a player versus player (PvP) quiz battle game, similarly to Geo Challenge (Playfish, 2016). This would have had players compete for the highest score of correct answers within a given time period. However, using time as a factor might influence the players' conation as the method could be too intrusive and the data might be affected by the time pressure since the players would not have enough time to interact with the game (O'Brien and Toms, 2008, p. 947).

As conation is an important aspect of the study, there were concerns that a time-based prototype design could generate meaningless conation data. These concerns were based on the assumption that participants might not take the time to adjust their conation rating during gameplay and therefore skip it entirely, or that the method would be too intrusive, thus being disengaging.

The prototype design draws its main inspiration from Geo Challenge, however

there is less emphasis on scoring and more on game based learning. As this prototype is designed to be a learning tool, many elements of gamified variety were discarded due to the concern that they might interfere with the educational focus in the game (Mitgutsch, 2011, p. 46).

4.3.1 | Implementation

The following section contains information regarding the implementation based upon the final design direction. The result of which is a 2D flag game implemented in Unity using C# as the programming language.

In the game players are presented with a European country name, which they then have to select the corresponding flag for. The prototype is created as a learning game and features a graphical user interface (GUI) created using MaterialUI for Unity (InvexGames (2014)).

When starting the prototype, the first thing it does is it loads a text file containing the names of the 50 European countries into an array. Then it loads a graphics file of each country's flag into another array. Now the prototype is ready to start asking the players questions.

Using the array of the 50 country names, the prototype randomly selects a country it wants the players to answer. The current country in question is displayed in the middle of the top panel as seen in Figure 4.1. To the left of this is a counter for how many questions the prototype have gone through and to the right is a total score, based on amount of correctly answered questions.

Using the graphical array, the prototype places three randomly selected flags alongside the chosen country's flag on the four interactable panels below the top bar. The goal of the game is then for the player to locate the correct flag among



Figure 4.1: Prototype game interface

the four and click it.

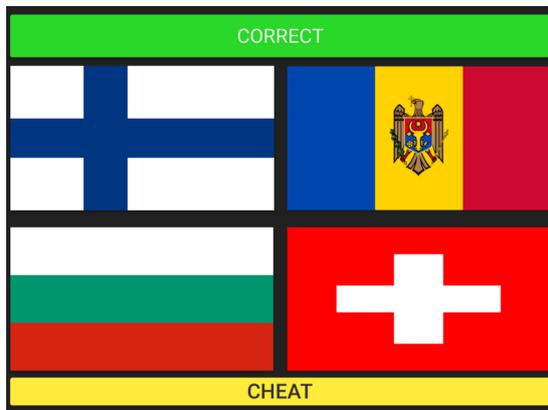


Figure 4.2: Feedback for correct answer

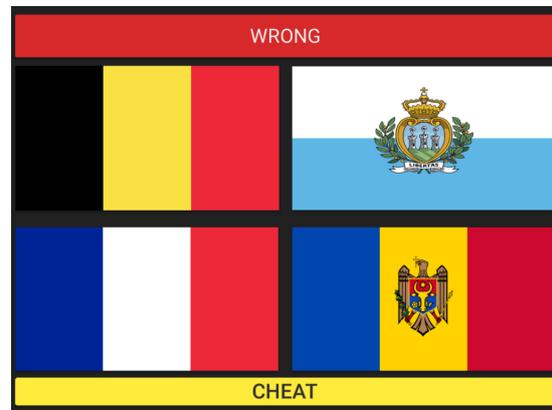


Figure 4.3: Feedback for wrong answer

When the player chooses to click on one of the four panels, the prototype checks to see if the answer was correct or wrong. Appropriate GUI feedback is provided through the top panel (see Figure 4.2 and 4.3). Assuming that the players answer was correct they are awarded one point and their score is increased. However, should the answer be incorrect, they are awarded no points and only the counter for the amount of questions asked is increased.

If the participants were selected to play in the cheat condition, they had an additional button below the four panels labeled "CHEAT" (see Figure 4.4).

This was done to study if players who were presented with the option to cheat, would use the option or stay away from it. Thus, participants who partook in the control group did not have this button, as it was simply removed from their version of the game in order to have a sample group to compare the results to.

Every 10th question players are presented with a pop-up, questioning them about their current conation (Figure 4.5). Players are then asked to select their current conation on a scale from 0 (“I have no desire to keep playing at all”) to 10 (“I have never desired anything more!”), using the slider seen in Figure 4.6.



Figure 4.4: Demonstration of cheat button in use

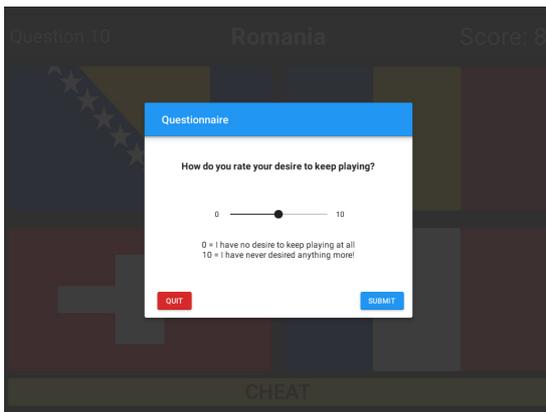


Figure 4.5: In-game conation questionnaire

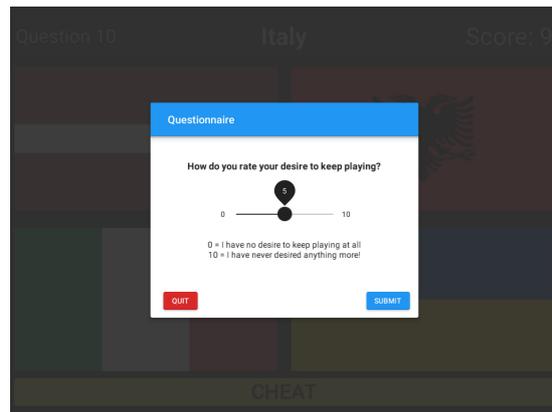


Figure 4.6: In-game conation slider when grapped

For as long as the players keeps submitting their conation rating, the game continues and the prototype will repeat the selecting and placing of the flags. This process is repeated infinitely until players actively press the quit button from within the pop-up to stop playing.

It was debated whether the prototype should quit automatically, if the player selected a conation value of 0 but chose to click the submit (continue) rather than the quit button. However, it was decided that the players had to take an active role in quitting the prototype rather than it doing it for them. This was mainly due to the concern that some player could accidentally select a value of 0 and hit submit and be taken out of the game unwillingly.

4.4 | Questionnaire

In order to obtain quantitative data regarding the learning outcome and conation from the experiment, a questionnaire was developed to facilitate this, see Appendix B. The questionnaire consisted of both Likert scale questions, open-ended questions and a 11-point slider in which the participants could rate their conation. The questionnaire is based on the engagement sample questionnaire (ESQ) adapted by Schoenau-Fog (2011, p. 223), but was modified to account for the game-based learning aspect of the project.

The questionnaire starts by summarizing the consent form (Appendix C) that the participants had signed before participating in the study, asking them if they read and understood the form.

It then follows the same general procedure as the ESQ by first collecting demographic data (gender, age, occupation and native language) about the participants. Additionally this section included two questions designed to help reveal any possible

biases by asking participants to self-report if they studied or worked with anything related to geography or games.

Moreover, the questionnaire served as a method to establish the participants baseline knowledge before playing by having them name as many countries as they could based on each country's flag. Before playing participants were asked to self-report their conation on a 11-point scale. The ESQ uses statements as an evaluation form however to make the questionnaire coherent with the prototype interface a Likert scale was used instead, as it was deemed less intrusive.

When participants chose to quit playing the game, they were taken back to the questionnaire where they were asked to give a brief explanation for why they stopped playing.

If participants were in the cheat condition they were given an additional question before the second round of questions (see Appendix B). They were asked to self-report whether they noticed the cheat button and made use of it and to elaborate on why/why not.

Afterwards, they were asked once again to fill in the names of as many countries as they could, just like before they started playing. This was done to compare their results from before playing, with after playing in order to determine that if by playing the game participants knowledge had increased, resulting in a learning outcome.

Participants were then asked to select the most appropriate response to a series of engagement related statements on a 7-point scale (strongly disagree to strongly agree) to validate their previously reported conation. Lastly they were asked to self-report their conation in relation to replaying the game.

4.4.1 | Levensthein

As a way to determine whether or not a answer correct, an objective method had to be researched as many of the countries are spelled quite similarly in Danish and English (e.g. Denmark (EN) versus Danmark (DK)). To determine whether or not a country is spelled correctly, their Levenshtein minimum string distance should be calculated to determine whether the answer should be accepted or not. To measure the accuracy of the spelling, the text will be compared to the correct spelling and it will be calculated how many steps needed to be taken in order to get the correct spelling. A step is defined as either inserting, deleting or substituting a character to achieve the correct answer (Soukoreff and MacKenzie, 2001, p. 319). This will result in a minimum string distance (MSD), which afterwards can be calculated into an error rate using the following equation by applying the correct answer (A) and the participants answer (B) (Soukoreff and MacKenzie, 2001, p. 320).

$$ErrorRate = \frac{MSD(A, B)}{max(|A|, |B|)} \times 100\% \quad (4.4.1.1)$$

As an example, the error rate for changing "Danmark" to "Denmark" can be calculated as:

A = Denmark; |A| = 8.

B = Danmark; |B| = 8.

Inserting the data into the equation leads to:

$$ErrorRate = \frac{MSD(Denmark, Danmark)}{max(8, 8)} \times 100\% \quad (4.4.1.2)$$

Here, the MSD from Danmark to Denmark is calculated and the maximum length

of the spelling is determined. In this case, the "a" should be substituted with a "e" to achieve the correct answer. This requires one change, which equals a MSD = 1. In this example the incorrect answer has the same amount of characters as the correct answer (8 characters). However, if the incorrect spelling includes more or less characters than the correct spelling, the maximum length is equal to string with the highest amount of characters. Inserting these numbers into the equation leads to:

$$\begin{aligned}
 ErrorRate &= \frac{MSD(Denmark, Danmark)}{\max(8, 8)} \times 100\% \\
 &\Downarrow \\
 ErrorRate &= \frac{1}{8} \times 100\% \\
 &\Downarrow \\
 ErrorRate &= 25\% \tag{4.4.1.3}
 \end{aligned}$$

Based on these calculations an error rate of 25% should be most suitable as the maximum for acceptance of a correct answer. However, this would mean that participants could have 1/4 of the answer incorrect and still get a correct answer. Since the average amount of letters in a country are equal to 8, it was considered that an error rate of 25% was too high and the threshold was lowered to 20% as this was approximately equal to an MSD = 2. Since most of the countries consisted of rather few letters close to the average length, it required very few mistakes to get a high error rate.

4.5 | Design of the study

The following section will cover how the study was designed, what setup was used, the roles each researcher had, concluding with how the study as a whole was conducted. Three separate locations were used to gather data; University College Sydhavn, IT University of Copenhagen and HTX Sukkertoppen.

4.5.1 | Researchers roles

During testing, one researcher was assigned to interact with the participants, to aid them should any questions arise. The researcher had an observer-as-participant role (Gold, 1958, p. 221).

This role allowed him to assist the participants without disturbing them, if unforeseen problems occurred, such as application crashes or questionnaire issues. This researcher introduced the participants to the experiment and explained the goal of test, while keeping the goal of the study secret (Rosenthal and Rosnow, 2007, p. 71).

Throughout the test, this researcher remained close to the participants in case they needed assistance and did not take any notes in order not to disturb the participants. Another researcher was assigned to take notes of the test and did not have any social interaction with the participants, this gave her the role of a complete observer (Gold, 1958, p. 222).

4.5.2 | Test setup

As the test was conducted at three separate locations, the setup followed the same general setup as seen in Figure 4.7. However, based on what each location offered in terms of tables and chairs, the setup adapted accordingly.



Figure 4.7: This shows the test setup at all three test sites. *Models: Sedus / 3D Warehouse (2014); Fann, R./ 3D Warehouse (2014)*

Two laptops were used to run the prototype. Each placed opposite of each other, with a researcher between them, taking notes.

The choice to seat participants opposite of each other with the researcher between them was to allow the complete-observer to remain close enough to eavesdrop on anything the participants said or mumbled (Gold, 1958, p. 222).

Additionally it also limited the cheating factor to the one inside the game as

appose to both inside and outside, which would have been too difficult to observe without breaking the researchers' roles.

The separation served to alleviate the possibilities to cheat outside of the game and limited the participants' options to cheat using the button inside the game. It allowed for the researchers to preserve their roles as observers without policing participants such as keeping them from peaking at each other's screens or passing friends that attempted to assist them.

Moreover, the theory states that if one participant observes the other participant cheating, they are more likely to cheat as well (Madigan, 2015, p. 35). However, the participants would most likely be influenced by the social context that it is not okay to cheat (Madigan, 2015, p. 43). Because of this, it was deemed more suitable to place the participants opposite of each other so they should assume that there were no consequences of cheating by isolating them to their own screens (Madigan, 2015, p. 44). With no one looking over their shoulders, there would be no one to call them on their behavior and therefore no consequences.

4.5.3 | Test procedure

The procedure of the study is as follows;

Bypassing individuals at each location were asked if they were busy or had some spare time to play a game. If they showed interest and asked "what kind of game?", they were informed that the game was about European flags and would take about 10 minutes to play. If participants asked what the study was for, information about such was shared but the element of cheating was kept secret. However, after testing the goal of the study was disclosed fully to any participants who wished to know.

Before the test, the researchers provided the participants with a consent form (see Appendix C) to be signed in order to obtain permission to use their data.

After signing the consent form, participants were asked to fill out the questionnaire mentioned above (Appendix B), when reaching the midpoint of the questionnaire, a researcher would start the game for the participants.

When the participant encountered the in-game conation slider (see Figures 4.5 and 4.6) they were told that this would pop up ever 10th question. Additionally, they were told that they could play for as long as they wanted and the game had no end if they kept clicking the submit button, but if they wanted to stop playing, they had to hit the quit button from this pop up.

All participants completed at least 10 questions as a minimum set by the implementation. However, some participants chose to spend more time playing so the amount of questions each participant played through varies. After stopping the game, participants would fill out the second half of the questionnaire, once complete they were given the option to take a reward in the form of a cookie or pieces of candy to show appreciation for their participation in the test.

5 | Data analysis

In this section the data gathered from tests conducted at three different locations, will be analysed and bias will be discussed.

For this study, convenience sampling was used to some extent. The data collected was from two Danish universities and a technical high school (HTX); University College Sydhavn, IT University of Copenhagen and HTX Sukkertoppen.

This was done to make sure that the test participants fitted to the target group described in section 4.1 Target group. With the participants being students at respectively universities and a technical high school, should ensure that they had the necessary language skills as well as a basic knowledge of computers to take part in the study.

At the first location, University College Sydhavn, it was noticed that the general level of English was rather low. The majority of the participants from this location had much of the information translated, but apart from the language barrier they seemed to enjoy the game.

5.1 | Data clean up

Before the analysis began, the data had to sorted and be cleared for partial responses.

Participants who had not completed the questionnaire was excluded from the analysis as their data was incomplete and therefore incomparable to other participants. In some cases, the participants fulfilled the test, but their data from the

game was overwritten due to technical issues. This led them to being excluded from the analysis.

Some participants only wrote a single letter when they should name the countries corresponding to each flag and others had just typed in random key strokes - e.g. participant 21 had written the letter "f" as Hungary and Ukraine, "s" as Portugal and "fs" as Sweden.

These keystrokes were considered typos and were changed to a blank answer, since it was assumed that the participants did not actually attempt to name the countries. Responses like these would exceed the threshold required for a correct answer (20%).

Regarding the spelling of the flags, there had to be made some adjustments as well. Some participants had written other words in the text boxes than the name of the actual country. An example of this is participant 27, that put "Also Slovakia" as the answer for Austria, where the text "also" was disregarded.

In case the participants had written a determiner in front of the country (e.g. "the"), this was disregarded as well, e.g. in case "The Netherlands" was written, the data was edited to "Netherlands". The spelling of the country was not edited.

In the case of Bosnia-Herzegovina, though the official spelling contains a hyphen, whatever character(s) the participants used to link the two names was also disregarded, e.g. a space, the word "and" or a hyphen. It was decided that no matter what character(s) the participants used to link Bosnia-Herzegovina together had nothing to do with whether or not the participants knew the flag.

When cleaning up the data, it was also decided to change the abbreviation "UK" to "United Kingdom" as it was assumed that by knowing the abbreviation, the participants must also have known the correct version of the name.

The following sections contains the remaining data after the clean up as will be presented accordingly.

5.2 | Demographic data

The following is a presentation of the demographic data. The age of the participants ranged from 16 - 61 years of age (average age of 22,65 years), though the majority ranged from 16 - 26 years of age, as seen in Figure 5.1. The study included 20 females and 31 males (see Figure 5.2), which gave a ratio of 1 female to 1.6 male.

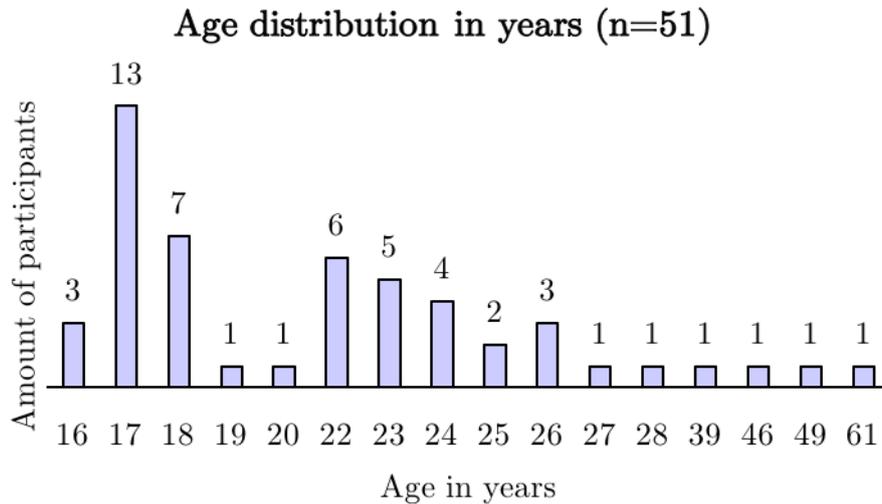


Figure 5.1: The participants ranged from 16 - 61 years of age, though the main population ranged from 16 - 26 years of age.

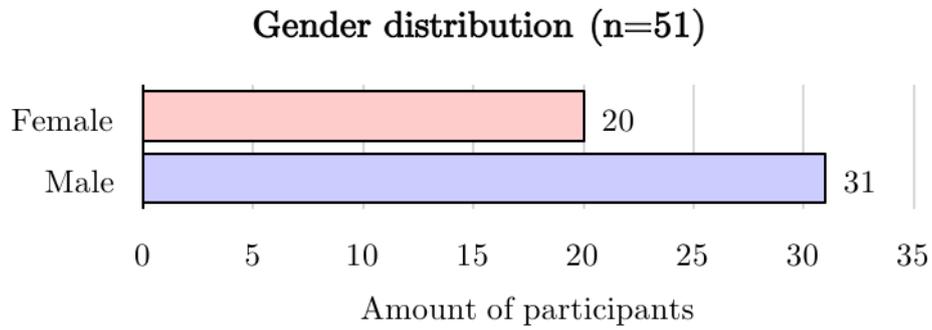


Figure 5.2: This graph shows the gender distribution amongst the participants, which included more men than women.

Amongst the 51 participants, 44 reported their native language as Danish, two as English and six as "other". These languages included Bulgarian, Dutch, Hungarian, Polish and Turkish. Only two participants reported English as a native language, which meant that the remaining 49 participants' responses were not written in their native language.

This could have an impact on the results as some participants expressed that they knew the country in Danish, but could not remember what it was named in English. An example of this is participant 12, who stated (translated): "I am more sure of their names in Danish" (see Appendix D for original conversation).

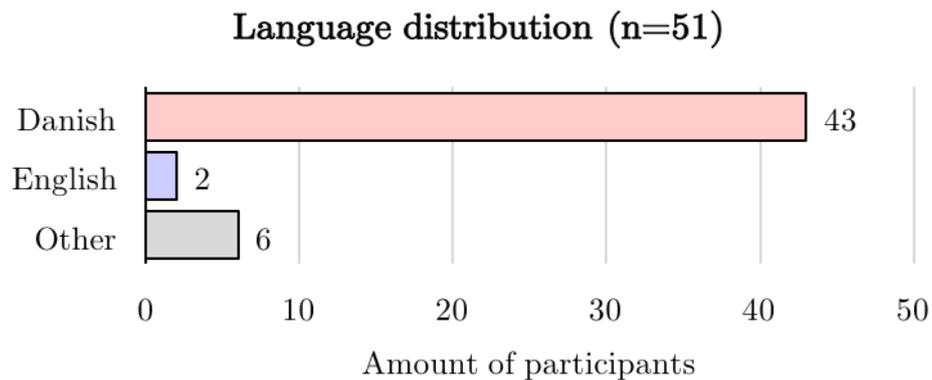


Figure 5.3: The language distribution amongst the participants showed that Danish was the dominating language.

As the study was carried out on three educational locations, a question regarding participants occupation was included. This revealed that 47 of the 51 participants were students, two educators and two reported "other" (self-employed and system administrator) as portrayed in Figure 5.4.

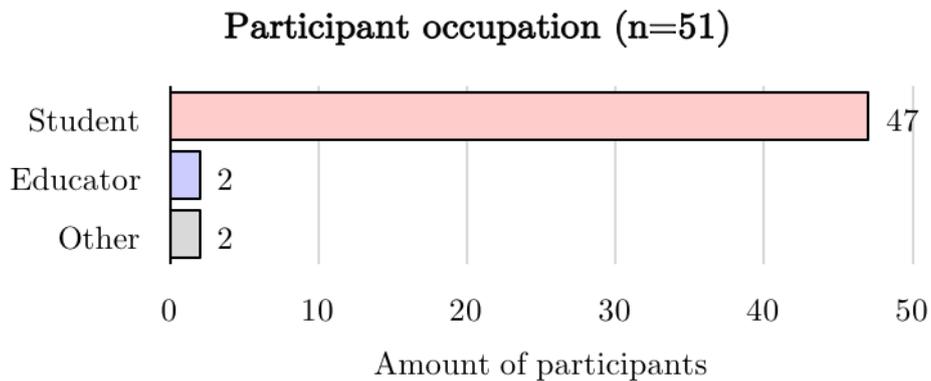


Figure 5.4: As the tests were carried out at educational institutions, the participant occupation were mainly students.

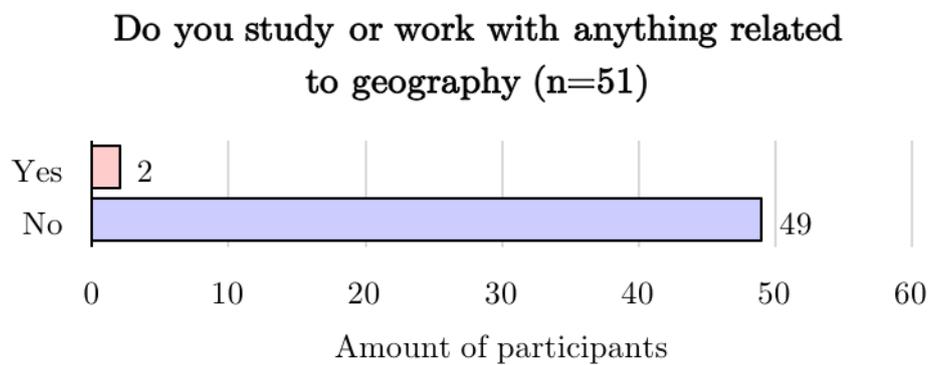


Figure 5.5: Here, participants were asked if they studied or work with anything related to geography.

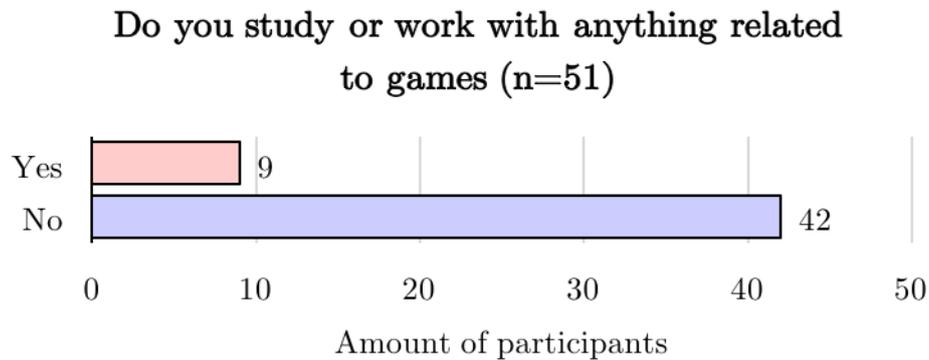


Figure 5.6: The participants were asked if they studied or work with anything related to games, which most of them did not.

As the final questions of the demographic section, participants were asked if they studied anything related to geography (Figure 5.5) or games (Figure 5.6). Two participants answered yes to studying or working with anything related to geography while 50 answered no. In contrast 10 participants reported that they studied or were working with anything related to games, while 42 did not. In only one instance did a participant (participant 25) work or study anything related to both geography and games.

5.3 | Conation data

This section contains the results from the analysis of the conation data extracted from the study. The analysis of the conation data revealed that it was not of normal distribution since the histograms do not fit the bell curves as seen in the graphs below.

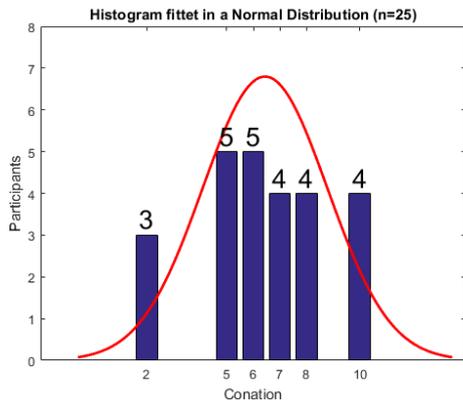


Figure 5.7: Self-reported conation before testing for the cheat condition ($\mu = 6.4400$; $\sigma = 2.3466$).

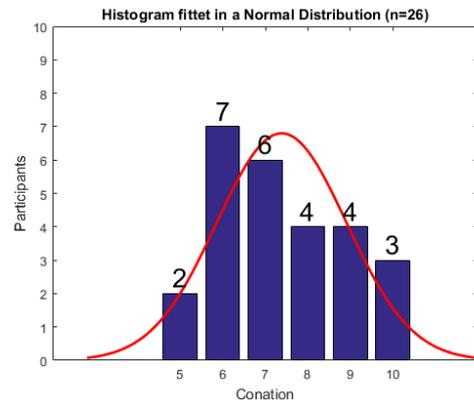


Figure 5.8: Self-reported conation before testing for the control group ($\mu = 7.3846$; $\sigma = 1.5252$).

Figures 5.7 and 5.8 show the self-reported scoring of how the participants rated their desire to start playing in the two conditions. As seen, the mean (μ) was higher for the control group than the cheat group. The same applies to the deviation (σ), which was lower in the control group.

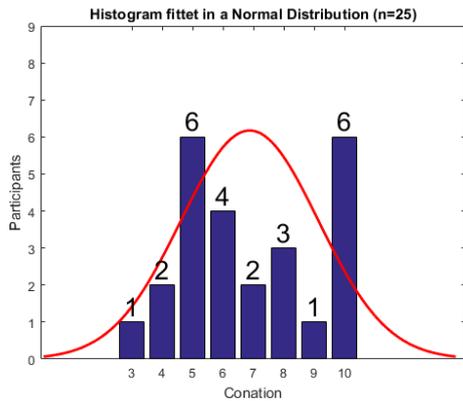


Figure 5.9: Self-reported player conation during testing for cheat condition. ($\mu = 6.8334$; $\sigma = 2.2948$)

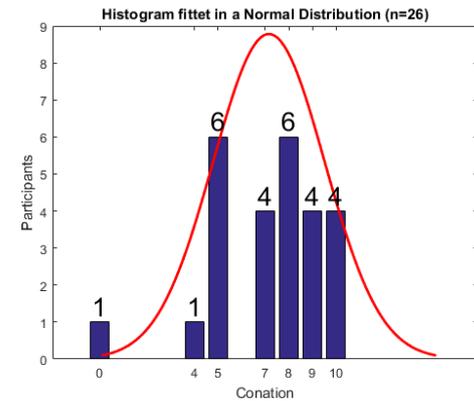


Figure 5.10: Self-reported player conation during testing for control group. ($\mu = 7.1613$; $\sigma = 2.3382$)

In Figures 5.9 and 5.10 the standard deviations are fairly close to each other,

but the mean is higher for the control group. Looking at Figure 5.9, the high score of 10 (maximum score) could indicate bias, which will be explored in further details later in this analysis.

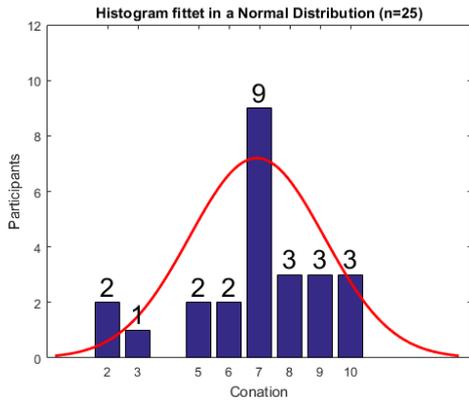


Figure 5.11: Self-reported player conation after testing for the cheat condition ($\mu = 6.9200$; $\sigma = 2.2159$)

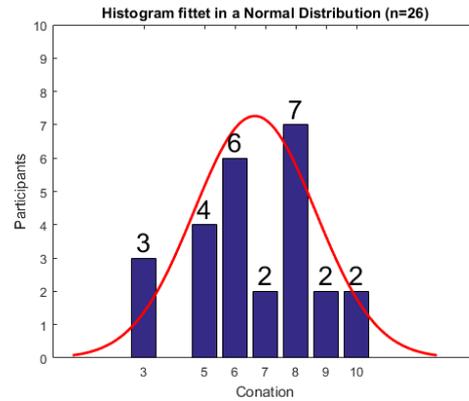


Figure 5.12: Self-reported player conation after testing for the control group ($\mu = 6.6538$; $\sigma = 1.9988$)

After playing, the participants were asked to self-assess their desire to play the game again. These results can be seen in Figures 5.11 and 5.12 that show a higher mean for the cheat condition than the control group. However, the data deviates more from the mean of the cheat condition than compared to the control group. The tendency for the desire to replay the game is in the higher end of the 11-point scale. This might indicate that the players were optimally challenged and therefore they might have reached the state of flow.

5.3.1 | Engagement statements

To get a better understanding of the self-reported conation values contained any bias, the questionnaire included statements about the participants engagement. These were not meant to be analyzed but rather to establish if there was any connection

between the engagement levels and the conation scores. For example, if the engagement statements showed a high level of engagement, but the conation scores did not, it would indicate bias as these two should be somewhat relatable.

When investigating the engagement of the participants, they were asked on a 7-point Likert scale to agree or disagree with the statements written in the title of the graphs. These can be found in the questionnaire in Appendix B. The questions were phrased in both a positive and negative way, to ensure that there was a coherence between the answers.

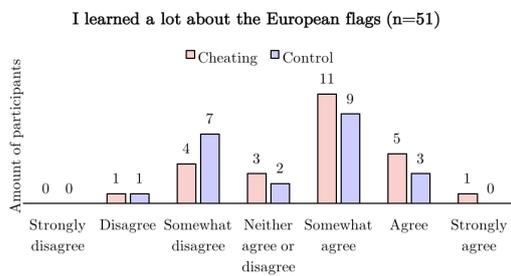


Figure 5.13: This graph shows the participants' responses on how much they felt, they had learned about flags.

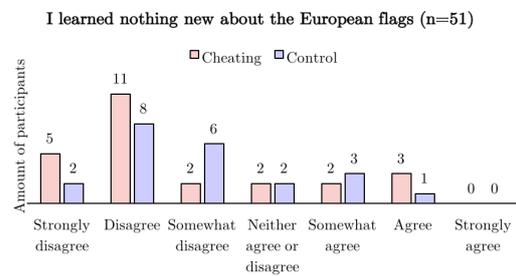


Figure 5.14: Here, the participants were asked whether or not they felt like, they learned nothing.

When investigating whether the participants felt they learned anything about the European flags, they generally agreed to having learned something from playing the game, as seen in the tendency of Figure 5.13. Moreover, the control question supports this, as they disagreed to not having learning anything new as seen in Figure 5.14.

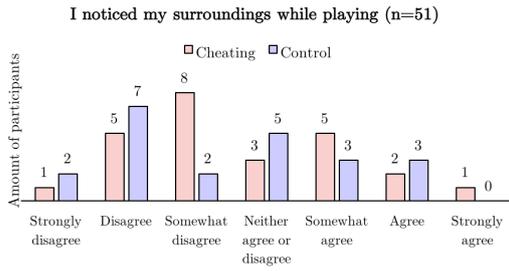


Figure 5.15: This was asked to see if they felt so engaged that they did not notice their surrounding.

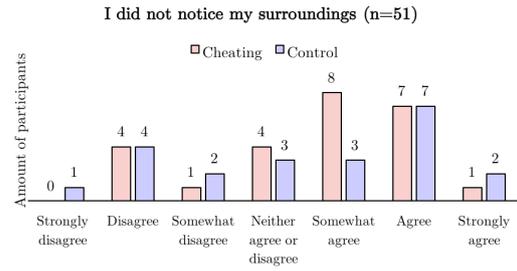


Figure 5.16: To investigate engagement, this was asked to validate the whether they noticed their surroundings or not.

It was assumed that the participants would not notice their surroundings if they were engaged and the data Figures 5.15 and 5.16 shows this to some extent. In both conditions they disagreed to somewhat disagreed that they noticed their surroundings while playing, where they also rated somewhat agreed to agreed that they did not notice their surroundings.

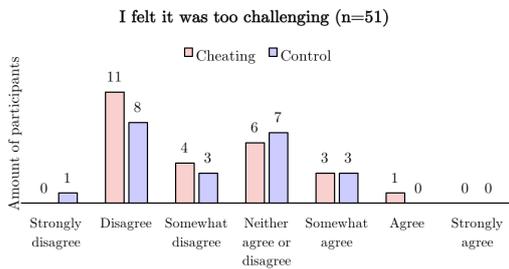


Figure 5.17: This was asked to investigate if it the game was so challenging it was disengaging.

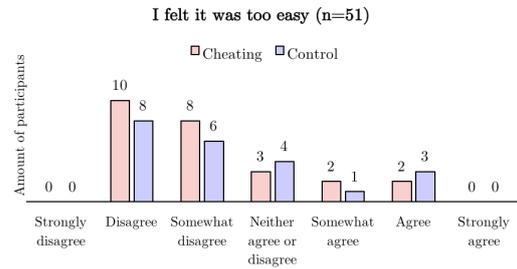


Figure 5.18: The participants were asked if whether or not they found the level challenging.

Since it was assumed that the level of difficulty might influence the level of engagement, the participants were asked whether they felt challenged by the game or not. By looking at Figures 5.17 and 5.18, it is visible that most of the answers are in the disagreement section of the scale. As the participants found the game neither too challenging nor too easy, this suggests that the participants might have

reached the state of flow with the difficulty of the game being reasonable.

5.4 | Wilcoxon rank-sum test

Since the data is not normally distributed and did not meet the assumptions of parametric data, a nonparametric statistical method had to be used for the analysis. A Wilcoxon rank-sum test, also known as a Mann–Whitney U test had to be used to calculate if the observations were of significance.

The Wilcoxon rank-sum test was used on the conation data before (P_{Start}), during ($P_{Gameplay}$) and after playing (P_{Replay}), as well as on the cheating aspect ($P_{Cheating}$) of the study. The calculated P-values of the Wilcoxon rank-sum test are listed below.

$$P_{Start} = 0.1357$$

$$P_{Gameplay} = 0.5727$$

$$P_{Replay} = 0.5478$$

$$P_{Cheating} = 0.00073029$$

As all of the P-values, except $P_{Cheating}$, are above 0.05 (5%) they show no statistical significance. The reason that $P_{Cheating}$ reports a statistical significance happens because the data from the cheat condition is compared to the control group in which they did not have the possibility to cheat at all. All this shows is that participants of the cheat condition cheated when presented with the opportunity, but this is not necessarily linked to anything else.

5.5 | Correlation test

Since the data showed no statistic significance, it was not possible to reject the null-hypothesis (H0).

Therefore, a correlation test was made for each condition in order to investigate whether the data showed any interesting tendencies or not, which could be explored.

The plot visualizes the correlation coefficients ranging from 0 (no correlation) to 1 (high correlation), in which each row is an observation and each column is a variable.

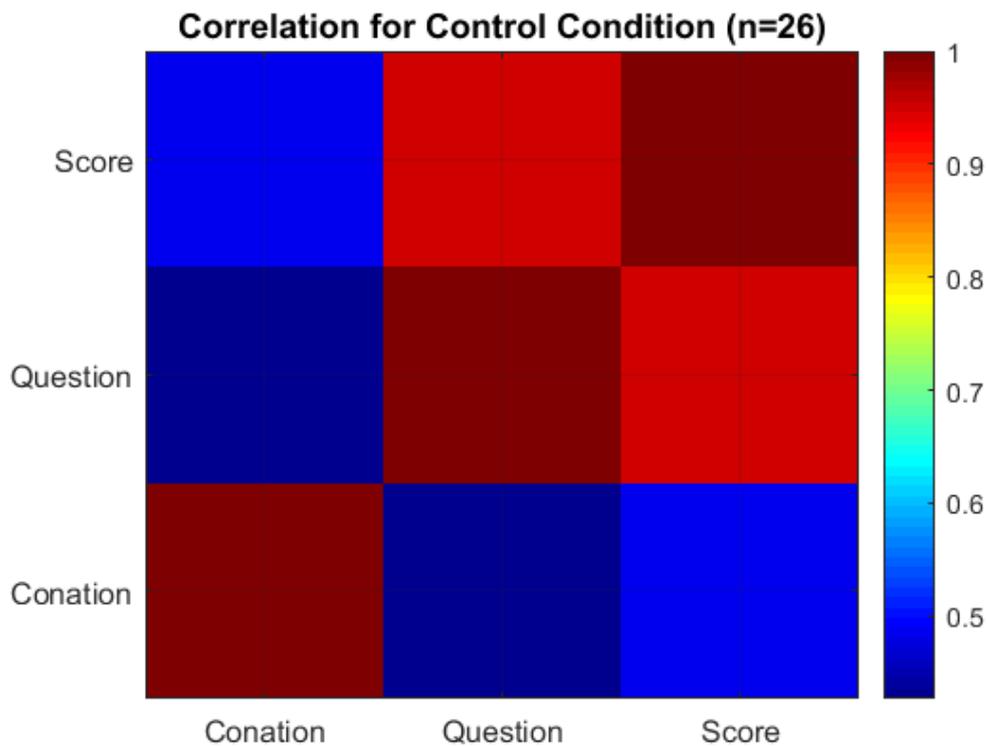


Figure 5.19: Correlation coefficient plot for the control group

As seen in Figure 5.19 it shows a high correlation between the amount of ques-

tions asked and the participants' scoring in the game. This make sense as the score is depended on the amount of questions asked. Aside from this there are no other correlations between the data in the control group.

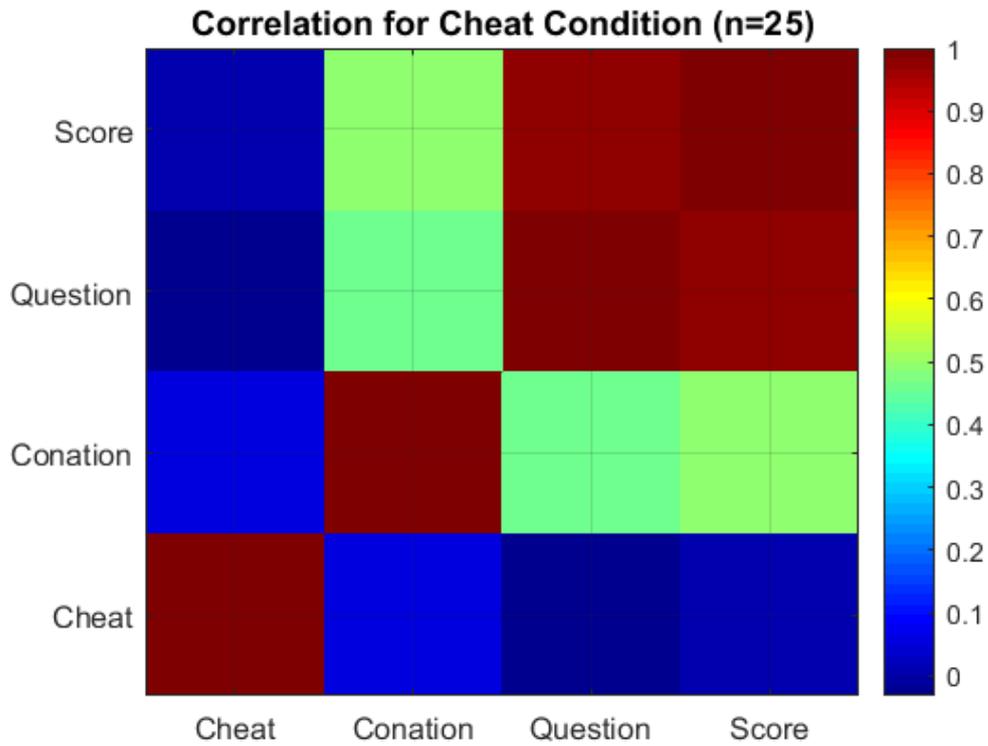


Figure 5.20: Correlation coefficient plot for the cheat condition.

As opposed to the control group (Figure 5.19), the cheat condition (Figure 5.20) appears to also have a slight correlation between conation and questions answered as well as conation and the scoring in the game.

As the data shows a slight correlation between conation and the score obtained in the game, the next section will investigated how the participants scored in the game.

5.6 | Scoring in game

To investigate whether there was a noticeable difference between the two condition, the average score of these were calculated. Since the participants all answered a different number of question in the game, the only way to compare these were to compare the average score with the average questions answered. As the participants were asked to do at least 10 questions, the amount of questions answered ranged from 10 - 110.

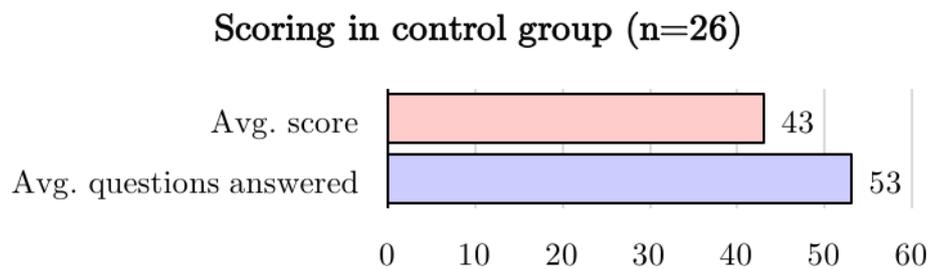


Figure 5.21: The graph shows how the average score was for the participants in the control group. Data rounded off to nearest integer.

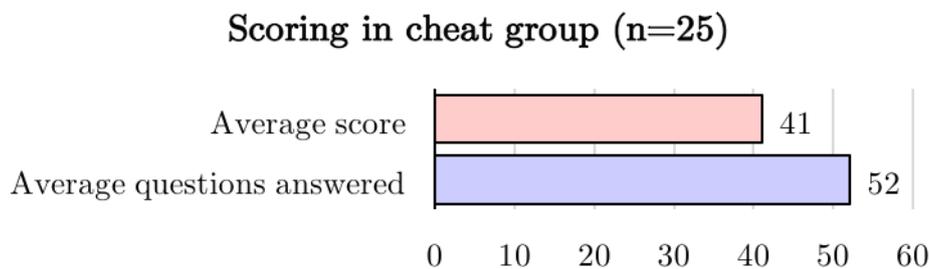


Figure 5.22: The graph shows how the average score was for the participants in the cheat condition. Data rounded off to nearest integer.

As seen in Figures 5.21 and 5.22 there is no noticeable difference in neither average score or average questions answered. The participants in the control group answered on average one more question and had two more correct answers than the

participants in the cheat condition. This difference between the two groups might derive from having an extra participant, as the difference is so small.

Since there is no noticeable difference in the average scoring, the learning outcome was investigated. This was done to see if the participants had a change in learning outcome whether or not they had the possibility to cheat.

5.7 | Learning outcome

In order to objectively calculate the participants learning outcome, the Levenshtein minimum string distance was used. The error rate was calculated for each of the participants' responses using the equation presented in 4.4.1 Levensthein. The products of these calculations are Tables 5.1 and 5.2, which lists the amount of correct answers and the calculated error rate before and after playing as well as the changes in these.

Table 5.1 shows the change in learning outcome and error rate for the control group, where as Table 5.2 lists the changes for the cheating condition. In both cases, most participants showed an increase in the amount of correct flags during the second round when compared to the first, which lead to a decrease in error rate. This positive learning outcome is listed as an increase in amount of correct flags and negative change in error rate.

ID	Amount of correct flags of 50 (before playing)	Amount of correct flags of 50 (after playing)	Change in correct flags (%) (change)	Error rate in % (before playing)	Error rate in % (after playing)	Change in error rate (percentage points)
5	8	9	12,50	84,19	80,34	-3,85
12	42	47	11,90	10,42	4,31	-6,11
15	13	17	30,77	68,84	61,62	-7,22
16	16	14	-12,50	63,53	68,80	5,27
19	12	13	8,33	75,07	73,05	-2,02
23	27	38	40,74	41,67	22,57	-19,09
24	17	21	23,53	64,45	57,69	-6,76
27	22	22	0,00	53,28	55,48	2,20
28	32	39	21,88	26,59	18,37	-8,22
31	10	16	60,00	79,50	66,16	-13,34
32	12	13	8,33	73,93	73,90	-0,03
35	41	46	12,20	15,47	5,37	-10,10
36	26	31	19,23	39,81	33,67	-6,15
39	9	12	33,33	78,78	71,75	-7,02
40	6	9	50,00	87,86	82,00	-5,86
43	7	11	57,14	85,82	75,55	-10,27
44	7	10	42,86	85,86	79,47	-6,39
47	6	6	0,00	88,60	87,60	-1,00
48	22	27	22,73	50,65	42,63	-8,02
50	11	11	0,00	77,86	77,09	-0,77
51	16	21	31,25	67,43	56,03	-11,40
54	38	44	15,79	19,20	8,71	-10,49
55	27	33	22,22	36,95	26,59	-10,36
60	12	15	25,00	76,70	69,14	-7,55
61	7	10	42,86	85,06	77,98	-7,08
62	33	34	3,03	31,82	25,21	-6,61

Table 5.1: Learning outcome for the control group.

ID	Amount of correct flags of 50 (before playing)	Amount of correct flags of 50 (after playing)	Change in correct flags (%) (change)	Error rate in % (before playing)	Error rate in % (after playing)	Change in error rate (percentage points)
1	16	21	31,25	65,90	53,72	-12,17
2	10	15	50,00	77,48	67,80	-9,68
13	19	19	0,00	61,40	60,67	-0,73
17	6	7	16,67	88,00	86,00	-2,00
21	8	7	-12,50	83,13	86,00	2,87
22	24	30	25,00	47,24	35,25	-11,98
25	1	2	100,00	92,07	96,29	4,22
30	7	16	128,57	84,14	65,00	-19,14
33	17	21	23,53	61,30	54,82	-6,48
34	8	17	112,50	81,96	65,12	-16,85
37	12	14	16,67	70,98	67,02	-3,95
38	24	10	-58,33	49,30	80,14	30,84
41	8	11	37,50	80,88	74,05	-6,83
42	12	22	83,33	72,39	53,21	-19,18
45	11	18	63,64	75,95	64,00	-11,95
46	40	43	7,50	16,71	11,55	-5,16
49	15	18	20,00	59,52	57,14	-2,38
52	18	24	33,33	56,78	42,29	-14,49
53	16	20	25,00	68,23	57,34	-10,89
56	7	10	42,86	85,01	78,18	-6,83
57	11	13	18,18	75,39	72,60	-2,80
58	18	22	22,22	58,73	47,03	-11,71
59	3	3	0,00	93,13	93,06	-0,06
63	24	25	4,17	49,75	47,49	-2,26
64	13	17	30,77	72,26	63,90	-8,36

Table 5.2: Learning outcome for cheat condition

Tables 5.1 and 5.2 reveals that there is a positive tendency among the participants in regards to their learning outcome. In only four instances (two in each condition) did the participants perform worse in the second round of answering questions than during their first round. These were participants 16, 21, 27 and 38.

Participant 16 stated in his test that he felt like he remembered less flags than when playing the game, during his second round of answering country flags, which is why he had a slight increase in his error rate.

Participant 27 answered the same amount of questions before and after playing, how he spelled those countries were slightly misspelled in the second round, which could be due to typos.

Participants 21 had to return to class, so she answered might have been rushed as she was short on time. This could be why her score is worse during the second round, as she might have hurried through naming the countries rather than taking her time. During the test, the participant did not say much but seemed focused on the screen.

In the case of participant 38, it is difficult to pinpoint exactly why he did worse when strictly consulting the data. However, when reviewing the observation notes from his test (Appendix D) it might be related to the fact that the game did not engage him. He evaluated his desire to start playing rather low (conation = 2) though it increased during the game (average $\approx 5,67$) and he ended the test with a replay desire (conation) of 6 (see Appendix E). The increase in his error rate might be attributed to the fact that he was very interested in the point system of the game as he gave his input on how the scoring system could be more gamified, which he thought could be better (see Appendix D for original statement).

All participants, except the four presented here had a positive learning outcome from playing the game, which means they either spelled more correctly or guessed more questions right.

To calculate if the learning outcome was of statistical significance, the Wilcoxon rank-sum test (as described in section 5.4) calculated $P_{Learning}$ to be 0.7702, which

revealed it was not of any significance as the P-value was above 0.05.

Based on the data presented in this chapter, the research show no statistical significance. It is however possible to see some interesting tendencies in the collected data, such as the desire to replay the game and the increase in learning outcome.

However, as the data is not of statistical significance, it makes it impossible to conclude anything specifically. This could be attributed to the experiment design used for this study, a flawed sampling of the participants and/or the biases involved. These possibilities of bias became apparent during the data analysis and will be explored further in the following section.

5.8 | Bias

The following section will describe the biases from this study. The first noticeable bias was the social desirability bias, followed by the technical issues during testing. When further reflecting over the design of the study, it is discussed whether the setup could have been done otherwise.

5.8.1 | Social desirability bias

The most noticeable bias was the social desirability bias, described in section 4.2 Participant sampling. This was especially noticed when the test involved two participants, that already knew each other. They compared their answers, scores and how they rated their conation. An example of this is the conversation between participants 9 and 10 though they tested a condition not included in this project. When they started the game, they together decided how high their desire to start playing were:

- **Participant 9:** "What do we start on?"
- **Participant 10:** "We start with 10."

It was also noticed that when two friends played the game at the same time, they usually compared scores during the game. Since the game could possibly run forever, they sometimes decided to end at a certain number. This could possibly have interfered with the participants conation and general engagement as they were "forced" to keep going until a certain number. An example of this is participants 31 and 32, that decided to stop after 100 questions:

- **Participant 31 to participant 32:** "Should we do 100 questions and then see who has the most correct [answers]? I'm at [question] 70 now."

All quotes were translated from Danish (see Appendix D for the original conversations). Besides social desirability bias the testing were impacted by issues as a result of the experiment design.

5.8.2 | Experiment design

The test might have been too similar to a lab style experiment in order to affect the participants as intended. It is possible that the setting itself discouraged them from cheating, since they were not in a social context where they felt comfortable enough to cheat.

A between-groups design might not have been the best experiment design method for this study, as all it proves is that when given the opportunity to cheat, players will do so. The study should instead have been an exploratory study and should not have limited cheating to only one button inside the game, but rather allowed participants to be imaginative about how they cheated. Examples of this could

be peaking at other participants' screens, getting help from friends or using other resources such as the internet to assist them in their cheating.

Besides this, a few technical issues occurred during testing, which might have affected the participants' experience.

5.8.3 | Technical issues

The technical issues during testing might have affected the participants desire to keep playing. The mice connected to the laptops had forward and back buttons, that were not disabled from the beginning. In some cases, participants hit the buttons which send them a step back in the questionnaire. This happened for participants 14, 35 and 64. In the case of participants 35 and 64 the answers were saved but participants 14 had to redo her answers. Her file was however overwritten due to a human error, so her data was never included in the analysis.

Another issue that might have affected the participants conation was problems with the internet connection. This also lead to a participant having to redo the first round of the flags inside the questionnaire. This was participant 32, who stated: "Damn, now I've forgotten half of them!" and when he noticed the flags were randomized, he said: "Oh no, they moved!". The connection issues continued and he had to redo the second part of the questionnaire as well. This was however done inside the editor of the questionnaire, on a researchers laptop meant for note-taking. This was done so the participant could complete the questionnaire rather than starting over from scratch.

For the first 8 participants of the study, the "autofill" feature within Google Chrome was turned on. The feature lets users choose to automatically fill out information of a form, in this case, the answers to the flags. That meant that any

answer to a flag from a previous participant was saved and could be automatically filled in when new participants started typing in the text box field.

However, even with the randomization option within the questionnaire switched on, Google Chrome knew which text belonged to which flag. This could have yielded interesting results for the cheating aspect of the study, but was deemed too difficult to supervise the use of as this was an aspect of cheating not thought of before the start of the experiment. Moreover, it would have negatively affected the learning outcome of the study and the tough decision to turn off "autofill" was made.

5.8.4 | Levenshtein minimum string distance

The learning outcome data might have been biased by the Levenshtein minimum string distance, as some countries are spelled very similarly in Danish and English, which could lead to false positives.

As the strings compared are fairly small (average length of country name = 8), there is little room for interpretation whether the errors are typos or written in Danish, e.g. Denmark vs. Danmark.

When analyzing the data an objective method was needed to avoid the personal opinions of the researchers. This was done to make sure the data was processed equally and not influenced by the researchers own bias, when assessing an answer which appears to be written in Danish.

Based on this data analysis and the bias considered, the following chapter will present the findings of this study.

6 | Findings

This chapter will sum up the findings found in chapter 5 Data analysis.

The study cannot conclude anything of statistical significance as confirmed by the Wilcoxon rank-sum test. The only concrete result the study can conclude is that when giving players the possibility to cheat, some of them will use it ($P_{Cheating} = 0.00073029$). This is further supported by the correlation plot, which shows no correlation between cheating and the other parameters from the game.

As the majority of the participants in the study self-reported as being Danes thus language might have been a factor which affected the study. Since English is not the native language in Denmark, it might have influenced how well the participants were able to answer the questions. This assumption is based on the fact that many of the Danish participants stated, they knew what the countries were called in Danish but were unsure of what the English name was.

Ideally, no participants should have been studying or working with anything related to geography or games, but the data did not show any indication of being affected by this. Regardless, their data was included in the analysis and did not seem to shift the results in either direction.

Since the conation data is widely spread it might show tendencies towards bias or having been influenced by the time of testing. As the majority of the participants self-reported as being students, testing took place close to the exam period, which might have influenced how they reported their conation. In relation to this, playing video games is assumed to be deprioritized during this period of a semester. However, participants might have felt compelled to assist the data collection and

participated in the study regardless.

Participants from the technical high school were coerced to contribute to the study by an employee of their school. He did this with the best of intentions to help the study, however the participants were informed by the researchers that they were not obligated to participate.

The conation data collected during gameplay is similarly wide spread to the data collected before the game began. This could possibly be attributed to the method chosen for collecting the conation data, as a pop-up might have been too intrusive. When reviewing the data for the participants' desire to replaying the game, the exam period should be taken into account once more as this might have interfered with their desire to play the game once more.

However, when comparing the conation data to the engagement statements, these support each other to an extent. Though the data shows no statistical significance, there seems to be some coherence in the data when comparing conation and engagement. The statements concerning the level of challenge seemed to show that it was not the difficulty of the game that disengaged the players. Most participants did not feel the game was too challenging nor too easy, which might indicate they reached the state of flow.

There seems to be a consistency between the statements concerning learning and the learning outcome. Generally participants felt that they learned a lot and disagreed with the statement of not learning anything new, which is consistent with their decrease in error rate.

When the data was processed using the Levenshtein minimum string distance, it was noticed that when comparing relatively small strings, it required few mistakes to obtain a high error rate.

However, the researchers informed the participants that correct spelling of the countries were not of importance, the analytic method should taken this into consideration. In order to stay as objective as possible when analyzing the data, this method proved to be effective but perhaps not as reliable as hoped.

7 | Discussion

This chapter will be a discussion of the different aspects of the project.

The reason the data analysis did not yield anything of statistical significance, is primarily due to the biases involved in this study. The majority of the bias derive from the test procedure, which is the result of poor experimental design. The setting in which the tests were conducted might have too close to a lab style experiment, in which the participants might not have acted as they would if naturally observed. To obtain as close to natural data as possible, the test should have been conducted on the participants terms, which might have given different results.

As procedure, the participants were given the consent form, which explained the experiment though keeping the cheating elements a secret at that point. However, the length of the document might possibly have discouraged some participants as it was rather extensive and detailed as a consent form sometimes need to be. The length of the document was however needed as ethically the participants need to know what study they are participating in and what data is being collected. Though the consent form was necessary, it was quite overwhelming to some participants.

When conducting the experiment, the participants were seated opposite of each other with an observer between them. This was done to simulate a multiplayer experience and attempt to create a situation where each participant could be anonymous. However, this illusion might have been broken as the tests were conducted in public spaces. As cheating spreads in a social context, it would have been ideal to test participants who already knew each other as this should have created an environment where cheating could be acceptable. However, this might have worked the other

way around as the participants might have an implicit agreement that cheating is not acceptable behavior. Another contributing factor might have been that the observer was placed between the participants. Though the observer was placed in the middle and therefore was not able to view the participants screens, this might have influenced their feeling of anonymity and discouraged their natural behavior.

When discussing the questionnaire, the way of measuring learning by naming the 50 countries based on their flags might not have been ideal as this was rather overwhelming to the participants. Rather than viewing all flags at once, they should have been separated over multiple pages instead. An aspect the questionnaire did address was how the participants of the study defined cheating. Knowing this might have clarified why participants of the cheat condition did not cheat more than they did. Perhaps asking them to select one of the five statements from the preliminary questionnaire, they felt described cheating best. Additionally they should have been given the possibility to comment on their choice.

During testing some technical issues occurred but they were not all visible to the participants. These included internet connectivity issues, the use of forward/backwards buttons on the connected mice and the loss of data files from the prototype. The questionnaire was particularly affected as both connectivity issues and the use of forward- and backwards buttons broke the functionality and lead to some participants loosing their responses. When pressing the button to submit their response or accidentally hitting the mouse buttons, the questionnaire stopped functioning and the replies were not always salvageable. This occurred in a few instances, which most likely affect the participants' conation.

The game itself could have been a contributing factor to the participants' conation, as the game was described as a rather simple quiz style game. As the design was kept rather simple and only required players to select the correct flag amongst

four, the gameplay might have been monotonous. This could be due to the design being partially based on a game, which closed down almost five years ago. It is possible that the concept of Geo Challenge is only fun with all four of its original minigames and not as a single concept quiz game in which you guess a country based on its flag.

Even though the conation data during gameplay is above the midpoint of the 11-point Likert scale, it is most likely influenced by social desirability bias or the possibility that the participants were simply not motivated. Perhaps this is due to the sampling of the participants, as the data collection took place at educational institutions close to exam periods.

The choice to use geography as the educational material in the prototype proved to have both advantages and disadvantages. This topic is only taught from grade 7 to 9 in primary school, after which geography is only learned if choosing to pursue it further. As people have no further mandatory schooling in geography, this creates a rather identical starting point for players of the game. The disadvantage to choosing the subject of geography is that it requires a certain level of motivation in order to facilitate learning. If players have no interest in the subject, and are therefore not motivated, the goal of the game becomes irrelevant.

The Levenshtein minimum string distance served as an objective method to validate which answers were considered correct but was perhaps not suitable for this study. The threshold for which participants answers were accepted could have been set to high but as the average length of characters in country names were rather short, it only required few mistakes to obtain a high error rate.

Conducting the study in Danish could possibly have produced different results, as English is a second language in Denmark.

Perhaps the study as a whole attempts to investigate too many aspects at once. Instead of attempting to connect cheating, conation and game-based learning at once, perhaps a connection between each aspect needs to be established before correlating all three.

Instead of utilizing a between-group design whose only concrete result proves, that giving players the option to cheat, they will use it.

If the goal of the study was to investigate how they cheating instead of why, an exploratory study should have been conducted instead. Perhaps limiting cheating to a button instead the game, instead of allowing it to occur in all aspects, could have limited the findings in the study.

Based on the discussion, the following chapter will attempt to conclude the study based on the final problem statement.

8 | Conclusion

The final problem statement is as follows.

- *How is a player's conation and learning outcome affected if given the possibility to cheat in an educational game?*

This thesis sought to investigate how cheating and conation influenced a learning context in games. The data of this study did not show any statistical significance, and it is therefore not possible to draw any conclusions. This is most likely contributed to bias and a flawed test setup, which should be explored further in another study.

Though the collected data did not show any statistical significance, there were some interesting tendencies. It showed a slight correlation between the self-reported level of conation and the amount of questions answered as well as the score for the cheat condition of this study. It would appear, that there is no noticeable difference in the learning outcome whether or not the players are given the possibility to cheat during the game, though this can only be stated for this particular study and not be applied to games in general.

9 | Future work

The next iteration of the prototype should consider the following points brought up by participants and researchers during testing. Currently the prototype picks a country and four flag randomly from a list of 50 European countries, which presents the chance of not all flags being displayed.

A fix for this could be to have the 50 countries in a list, pick one at random and then move that country to a new list of already used flags. Then the list shrinks until all countries have been used and the game could loop the countries back into the original list.

Future development of the prototype should consider including a web build of the game inside the questionnaire or integrate the questionnaire into the prototype as some participants skipped the part where the questionnaire asks them to have a researcher start the game for them. Also having to switch to the correct application for the participants is disruptive.

A point that was brought up during testing was that the game could be made more accessible with audio. For the part of the questionnaire before and after the game, where participants have to type the names of the countries next to their respected flag, could be considered allowing voice recording or text-to-speech input. A participant noted that she knew that the flag was Azerbaijan's but did not want to misspell it, even after being told that correct spelling did not matter, as long as the researchers understood what they were trying to communicate. Lastly, an audio source that speaks each country, could also make the game more accessible, but research whether this is disruptive in a learning context should be conducted.

Cheating aspects which was not considered before the study was under was could have yielded interesting results and should be explored further. Letting participants cheat in the questionnaire using Google Chrome's "autofill" would have allowed them to fill in any answer given by a previous participant, but they would not know if the answer was correct or not. However, this could have been exploited even further if combined with the "inspect element" feature of Google Chrome. Participants would be able to view the URLs associated with each flag, revealing their file name and thereby the name of the country.

The study attempted to link cheating to conation and game-based learning, which might have been too broad. Before attempting to establish a shared link, the elements should instead have been individual. This should be prioritized if attempting to reproduce this study.

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Appendices

A | Preliminary questionnaire

Definitions of cheating

Welcome and thank you for participating in our survey.

We are two Master's students from Medialogy (Games) at Aalborg University Copenhagen seeking to investigate how you define cheating in video games.

Firstly, you will be filling out some demographic information.
Afterwards you will be asked some questions about your gaming habits and how you define cheating in games

The survey is anonymous and you can withdraw anytime by simply closing the window.
The data will be used in our Master's thesis.

Thank you for your time and participation.

Kind regards,
Nicholas and Josephine

NEXT

 12% complete

Never submit passwords through Google Forms.

Figure 9.1: *The first page introduced the investigation.*

Definitions of cheating

*Required

About you

Please fill out these demographics.

What is your age? *

Please answer in years.

Your answer

Gender *

- Male
- Female
- Prefer not to disclose

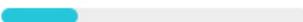
Native language? *

Please write your native language in the other box, if it is not Danish or English.

- Danish
- English
- Other:

BACK

NEXT

 25% complete

Never submit passwords through Google Forms.

Figure 9.2: *The demographic part of the questionnaire*

Definitions of cheating

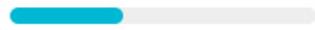
*Required

How often do you play on a tablet and/or smartphone? *

- Several times a day
- Once a day
- Weekly
- Monthly
- Never

BACK

NEXT

 37% complete

Never submit passwords through Google Forms.

Figure 9.3: *This was asked to determine how often they played on either smartphone or tablet.*

Definitions of cheating

*Required

How often do you play on a computer and/or game console? *

- Several times a day
- Once a day
- Weekly
- Monthly
- Never

BACK

NEXT

 50% complete

Never submit passwords through Google Forms.

Figure 9.4: *This was asked to determine how often they played on either PC or console.*

Definitions of cheating

*Required

Do you feel like there is a difference between cheating in a single player game versus a multiplayer game? *

A single player game is a game where you play alone or against the computer, e.g. The Sims, Skyrim, Angry Birds, Limbo, Half-Life, etc. A multiplayer game is a game that takes place against or with other people, e.g. World of Warcraft, League of Legends, StarCraft, Counter-Strike, Star Wars - The Old Republic, etc.

Yes

No

Please elaborate your answer (optional)

Your answer

BACK

NEXT

 62% complete

Never submit passwords through Google Forms.

Figure 9.5: *They were asked if they felt, there was a difference when cheating in single player games versus multiplayer games.*

Definitions of cheating

*Required

Cheating in video games

What is cheating? Please rank these definitions based on how accurate you feel they are. *

Please rank these statement from 1-5, with 5 being the most accurate and 1 being the least. You cannot chose the same number twice. Mobile users: this is easier in horizontal view.

	1	2	3	4	5
Applying external software to alter the game	<input type="radio"/>				
Using existing game elements for purposes, you know are not intended	<input type="radio"/>				
Gaining an unfair advantage	<input type="radio"/>				
Anything other than getting through the game all on your own	<input type="radio"/>				
Modifying the game files to access unintended content	<input type="radio"/>				

BACK

SUBMIT

100%: You made it.

Never submit passwords through Google Forms.

Figure 9.6: *These definition of cheating should be ranked from 1-5, with 5 being the most accurate. This was only answered, if they felt no different between single- and multiplayer games.*

Definitions of cheating

*Required

Cheating in single player games

This part of the survey concerns cheating in single player games. A single player game is a game where you play alone or against the computer, e.g. The Sims, Skyrim, Angry Birds, Limbo, Half-Life, etc. Mobile users: this is easier in horizontal view.

What is cheating? Please rank these definitions based on how accurate you feel they are. *

Please rank these statement from 1-5, with 5 being the most accurate and 1 being the least. You cannot chose the same number twice.

	1	2	3	4	5
Applying external software to alter the game	<input type="radio"/>				
Using existing game elements for purposes, you know are not intended	<input type="radio"/>				
Modifying the game files to access unintended content	<input type="radio"/>				
Gaining an unfair advantage	<input type="radio"/>				
Anything other than getting through the game all on your own	<input type="radio"/>				

BACK

NEXT

75% complete

Never submit passwords through Google Forms.

Figure 9.7: These definition of cheating should be ranked from 1-5, with 5 being the most accurate. This was only answered, if they felt there was different between single- and multiplayer games. This is concerning the single player experience.

Definitions of cheating

*Required

Cheating in multiplayer games

This part of the survey concerns cheating in multiplayer player games. A multiplayer game is a game that takes place against or with other people, e.g. World of Warcraft, League of Legends, StarCraft, Counter-Strike, Star Wars - The Old Republic, etc.

What is cheating? Please rank these definitions based on how accurate you feel they are. *

Please rank these statement from 1-5, with 5 being the most accurate and 1 being the least. You cannot chose the same number twice. Mobile users: this is easier in horizontal view.

	1	2	3	4	5
Anything other than getting through the game all on your own	<input type="radio"/>				
Modifying the game files to access unintended content	<input type="radio"/>				
Applying external software to alter the game	<input type="radio"/>				
Gaining an unfair advantage	<input type="radio"/>				
Using existing game elements for purposes, you know are not intended	<input type="radio"/>				

BACK

SUBMIT

100%: You made it.

Never submit passwords through Google Forms.

Figure 9.8: These definition of cheating should be ranked from 1-5, with 5 being the most accurate. This was only answered, if they felt there was different between single- and multiplayer games. This is concerning the multiplayer experience.

B | Test questionnaire

Flag test1

Welcome

Thank you for participating in our test, we greatly appreciate it!

You will be playing a simple game of naming European flags.

Before we begin, we would love to know who you are, so we need some demographic data. After answering this, we would like to know how many European flags you can identify before playing.

Once you have named the flags, we will let you play our game.

When you are done playing, there will be follow-up questions about your experience, before you have to name the European flags once again.

Your data is anonymous and you can withdraw at any time if you chose so.

Have you read, understood and signed the consent form? *

Yes

No

Next

0%

Figure 9.9: *Welcome screen for questionnaire*

Flag test1

Demographics

In this section you will be asked to answer some questions about yourself. The data is completely anonymous.

What is your gender? *

- Male
- Female

How old are you? *

What is your primary occupation? *

- Student
- Educator
- Other *

What is your native language? *

- Danish
- English
- Other *

Are you currently working with or studying anything related to geography?

- Yes
- No

Are you currently working with or studying anything related to video games?

- Yes
- No

Back

Next

9%

Figure 9.10: *The demographic section of questionnaire*

Flag test1

Before playing

Before you start playing, we would love to know how many flags you can recognize. If you are not completely sure, it is okay to guess. Correct spelling is not important.

	<input type="text"/>		<input type="text"/>
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	<input type="text"/>		<input type="text"/>
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Back Next

18%

Figure 9.11: To establish which flags the participants already knew, they were asked to fill in as many as possible before playing the game.

Flag test1

Play desire

How would you rate your desire to start playing? *

0 = I have no desire to start playing at all.
10 = I have never desired anything more!



0 5 10

Back Next

27%

Figure 9.12: *Here the participants would rate how much they desired to start playing.*

Flag test1

Playtime

Please ask a researcher to start the game for you.

Back Next

36%

Figure 9.13: *This page was made to ensure participants did not skip ahead and started playing the game*

Flag test1

Game stopped

Why did you choose to stop the game at this particular point? *

*Was the game fun / stimulating / challenging? Did you have to return to class?
Please elaborate on why you chose to stop the game at this specific time.*

Back

Next

45%

Figure 9.14: *This open-ended question asked participants to explain why they chose to stop playing*

Flag test1

Cheating

Did you press the cheat button? *

- Yes
- No
- I did not notice the button

Please elaborate why / why not

Back

Next

55%

Figure 9.15: Self reporting question regarding cheating. This was however only visible in the condition that involved the cheat button. Those playing the control version skipped right to naming the flags again.

Flag test1

After playing

We would love to know how many flags you can recognize after playing this game.
If you are not completely sure, it is okay to guess. Correct spelling is not important.

	<input type="text"/>		<input type="text"/>
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Back
Next

64%

Figure 9.16: To investigate whether or not participants had learned anything from the game, they were asked to name the European flags once again.

Flag test1

Engagement

Please select the the appropriate response to each statement below *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I did not notice my surroundings *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I learned a lot about the European flags *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I learned nothing new about the European flags *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt it was too easy *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I noticed my surroundings while playing *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt it was too challenging *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Back

Next

73%

Figure 9.17: To measure their engagement, the participants were asked to rate these statements related to both the game and the overall experience.

Flag test1

Comments

Do you have any comments on the test and / or the game played?

Back

Next

82%

Figure 9.18: *This text box provided the participants with the option of giving general feedback on the whole test experience.*

Flag test1

Replay desire

How would you rate your desire to play the game another time? *

0 = I have no desire to start playing at all.
10 = I have never desired anything more!



Back

Submit

91%

Figure 9.19: A final attempt to measure conation was made by asking the participants if they would play the game again. This was done by asking them to rate their replay desire using the slider.

Flag test1

Thank You!

Thank you for participating. Your response is very important to us.

100%

Figure 9.20: This page thanked the participants once again for their contribution to the investigation.

C | Consent form

Consent form for participant no. _____

Researchers: Nicholas Egede Bukdahl and Josephine Sjøgaard Andersen.
MSc Medialogy (Games), Aalborg University Copenhagen.

Thank you for participating in our test. It is greatly appreciated.

This study investigates players' desire to continue playing a learning game as well as the learning outcome.

The collected data will be used for our master's thesis that can be publicly accessed when submitted and graded. The data might also be used for other types of publications (e.g. scientific or journal) if the researchers see fit. All data are anonymous and you can withdraw your data from the test if you chose not to participate. You are of course free to ask any questions at any time.

In this test, you will be playing a game that simply requires you to click with a mouse and requires no prior experience with video games.

Before playing the game, you will be asked to fill out a questionnaire containing demographic questions. Then you will be presented with the images of European flags and asked to name them. If you are not completely sure, it is okay to guess. The correct spelling of these is not relevant.

When you start the game, you are presented with a name of a European country where you have to match it with its correct flag. You will get a point for each correct answer. You decide for yourself when you want to stop playing, but please consider completing at least 10 flags. You can however exit the game at any given time without explanation, if you choose so.

After playing the game, the questionnaire is revisited and there is some follow up questions about your experience. You will again be asked to name as many flags as you can, to see if the game taught you anything. During testing, you might be photographed or recorded for documentation purposes only. The recording has nothing to do with your performance and is solely for professional use.

By signing this, I confirm that I have read and understood the consent form and I have had the possibility to ask the researchers any questions. I understand that my participation is voluntary and I am free to withdraw at any time. I understand that the collected data is to be used primarily in a master's thesis and might be used in summary form for other publications as well, and I consent for it to be used in that manner.

I also give my permission to be recorded or photographed (tick).

Name: _____

Date: ____/____/2016

Signature: _____

D | Observations from test

This appendix contains the notes made during testing at the three test sites (UCC Sydhavn, IT University of Copenhagen and the technical high school HTX Sukkertoppen). The quotes are written in the language of the participants. The three conditions tested were:

1 = Cheat - included the cheat button at the bottom of the screen.

2 = Show - included the same button as the cheat-condition, but with the text "Show me the right answer"

3 = Control - the control condition, that did not include any cheat button. Condition 2 was however not used in the final report.

Location: UCC Sydhavn | Monday 2nd of May 2016

Got permission to answer in Danish since a lot of them had a hard time with English.

Participant 1:

Condition: 1

Male

Studied geography at high level (High school, perhaps?)

“Nu går jeg altså videre! Nu kan jeg ikke flere”

“Nåh, er vi ikke færdige endnu” – “Vi er ikke startet endnu”

“Hvad er din score?”

To participant 2: “Spiller vi op til 100 spørgsmål og så stopper vi?”

“Ejj, det var ikke godt, det der!”

“Så! 100 spørgsmål! Færdig!”

Participant 2:

Condition: 1

Female

She wrote a lot in Danish. (“Jeg må godt skrive på dansk ikke?”)

“De er jo voldsvære!”

“Jeg kan flere! Jeg skal kunne flere!”

“Jo, det er en konkurrence!”

“Jeg skal da også være god her! Skal jeg ikke være god her?”

When she reached the conation-slider: “Hvad skal jeg her?” (told us, she didn’t understand English)

Friend asked: “Skal du ha hjælp?” – “NEEEJ!” (flere gange!)

“Belarus... Det er Rusland... Yes!”

“Nu er det altså ved at være tarveligt, det her!”

In despair: “Ej, nu må det stoppe!”

“Aiiiiii!! Yess!”

“Det er godt, når man kan lave udlukkelsesmetoden”

Her response to the second part of the questionnaire: “Årh, så skulle man jo have husket hvad man svarede!”

After participant 1 were done herself, she sat next to her participant 2 and helped fill out the questionnaire.

1 and 2 helped each other a bit. E.g. they talked about China not being in Europe and therefore not in the game.

A good bit into the the test: 1: “Du kan også snyde”

2: “Ka’ man snyde?! Nåh ja, det står dernede!”

Participant 1 to participant 2: "Hvor mange point fik du?" Participant 2 responds: "SHY!"

Participant 3:

This participant tested a condition not included in the final report, however their test notes persist.

Condition: 2

Female

“Jeg er ikke så god til engelsk”

“Jeg interesserer mig altså ikke for det...”

“Ej, det fandme pinligt!”

“Det er der, hvor man skulle have set fodbold, ikke? Det europæiske mesterskaber”

Starter spillet: “Ej, det ved jeg ikke!”

“Ej hvor er det tarveligt!”

“Ej, jeg kan faktisk flere.” Shortly after: “Ej, jeg tror bare jeg stopper.” (Conation slider)

Wrote some in Danish, some in English.

Participant 4:

This participant tested a condition not included in the final report, however their test notes persist.

Condition: 2

Female

“Er der tid på?”

“Nej, hvad sker der her? ” “Årh nej, skal jeg skrive på engelsk?”

Is able to recognize a lot of flags but not name them.

“Er nogle af flagene snydeflag?”

“Lige pludselig følte jeg mig meget dum”

“Jeg VIL kunne flere”

“Jeg trykker videre! Det må være nok det her!”

“Lichtenstein...? Hva fanden?!”

“Ørrrjjj!!”

“Hov! Nu kom jeg til at trykke quit” – Researcher: “Du ville ikke stoppe?” - Participant: “Nej, det var hyggeligt. Jeg var blevet fan”.

When the cheat-question was reached: 4: “Var der en snydeknop?!”

3: “Ja, jeg så den heller ikke!”

“Så jeg skal skrive flagene igen? Nu har jeg jo glemt at kigge,”

Participant 5:

Condition: 3

Female

“Skal jeg så svare på engelsk?”

“Skal jeg så bruge musen?”

She thought it was annoying that she did not get the right answer when she answered wrong.

Second round of flags: humming.

Participant 6:

Condition: 3

Male

“På engelsk?! Det er jeg slet ikke med på!” – Nicholas had to translate from here on. He could answer basic demographics himself. Did not know what geography is, so that had to be explained.

In game: “Jeg skal jo gætte, ikke?”

Sighs a lot. “Det her må du altså også hjælpe mig med” at statements-questions. Seemed super disengaged.

Participant 7:

Condition: 1

Female

“Jamen, den er jo på engelsk”

“Jeg er spejlblank på flag”

“Ej, hvor er det pinligt!”

“Nu ved jeg det jo godt, når jeg ser dem og der kommer navn på. . .”

“Ej, pis. . .” (multiple times)

“Ej, så kommer der et flag, man aldrig har set i sit liv!”

“Det fucker helt op nu”

“Nu har jeg mistet mit drive”

[about the final score] “Det er jeg okay med at slutte på.”

“Skal jeg skrive ind om jeg har lært nogle af de flag?”

Suggests that we show which one is correct, when you hit the wrong flag. It’s nice to be confirmed that you’re correct.

Auto Fill in browser was on! Did not seem to use it. Got statements in questionnaire translated, so Nicholas sat next to her while answering. Didn’t seem to mind.

Participant 8:

This participant tested a condition not included in the final report, however their test notes persist.

Condition: 1

Female

“Ej, jeg kan jo ikke engelsk” “Hvorfor er der ikke det japanske [flag]?”

Asks her friend for help about a blue flag, but we stop them.

“Er det på tid?”

“Jeg tager det der. . . Ej, for satan!”

“Ej, det vidste jeg godt.”

About why she used the cheat button: “Fordi den var der.”

Reads email during testing. Asks friend (Participant 7) about an assignment. Reads aloud about the assignment. Then says to us: “Ja, den skulle jeg lige læse”. Participant 7: “Det er godt, det ikke er på tid, hva’?”

Asks about what we study. Then reads another message on the phone, mentions the assignment again, and then continues playing.

7 and 8 talks about strategy: Name the ones you know first, then guess. Compares how many flags they answered in flag round one.

8: “Må man snyde?”

7: “Nej man må da ej!”

8: “Ej, jeg prøver sgu!”

Compares scores and agree that it’s “sgu meget godt!”

About playing again: “Det gider jeg godt. Det er ikke så meget spil, mere sådan vidensspil og det gider jeg godt”

Location: UCC Sydhavn | Tuesday 2nd of May 2016

More noise in the canteen than yesterday

Participant 9:

This participant tested a condition not included in the final report, however their test notes persist.

Condition: 2

Male

Okay with English

Two friends came and talked during. Did not really take eyes off the screen. Friend: “Er det på tid?”

“Er du gal, der er mange, der minder om hinanden”

“Fortsætter man i det uendelige, eller hvad?”

“Jeg tror, jeg holder her”

Participant 10:

Condition: 2

Male

Okay with English

After telling it's okay to write in Danish: “Jeg skriver det bare på dansk, når det er okay”

A friend(?) comes over and distracts since the participant left his computer unattended. When first talked to, his reaction was a confused “Huh..?”

About desire to start the game:

9: “Hva starter vi på?”

10: “Vi starter på 10”

Though canteen was really noisy, the participants seemed to stay focused on the screen unless directly talked to by other people. They did not talk much with each other.

Participant 11:

Condition: 3

Female

“Altså, jeg er totalt dårlig til det. Tror jeg..”

“Jeg er seriøst elendig til det her”

“Kan jeg skrive på dansk, er det okay?”

Had to restart the game since it had trouble starting.

Had to explain the conation slider – possibly distracted by restarting the game and getting instructions at the same time.

“Så hvis jeg ikke gider mere, så skal jeg trykke quit?” (When second round of flags)

“Skal jeg skrive på engelsk?”

When done: “Så! Det var det!”

Participant 12:

Condition: 3

Male

A bit trouble with English, so got it translated.

About whether he should write in Danish or English: “Jeg er mere sikker på hvad de hedder på dansk”

Got a friend giving him a message during the first round of the questionnaire.

Got a friend coming over, looking over his shoulders going: “Det’ forkert”. Said he was a “geografisk spasser”, so it seemed like a joke.

12 to friend: “Du må ikke hjælpe!”

During game: “Ehm... Hvor længe fortsætter det her egentlig?” (Did we forget to tell?)

Keeps focus on the screen even though there is chatter around.

Location: IT University of Copenhagen | Wednesday 4th of May 2016

Skipped condition 2 to begin with.

Participant 13:

Condition: 1

Male

Asks about Danish or English.

“Der er altså bare nogle flag, jeg aldrig har set før”

“Nu har jeg taget alle de nemme [flag]”

“Skal jeg så rate den 0 for at slutte?”

“Er der nogen penalty for at cheate?”

Participant 14:

Data was unfortunately overwritten and not included in results, however their test notes persist.

Condition: 1

Female

“Ej, jeg er så dårlig til sådan noget”

“Ej, nej nej nej nej”

“Ej, okay, jeg kan lidt”

“Det er jo pinligt, det her”

About seeing a lot of flags, that look alike. “Nej, nej, nej, hvor er det vildt”

She hit a button on the mouse, so she had to redo the first round of flags.

About “desire to start playing”-button: “Jeg vil jo gerne spille... Jeg vil jo hellere det her [end at arbejde]”

“Det er godt for min selvtillid, når man kan vælge. Så kan man bruge udelukkelsesmetoden”.

When quitting: “Nåh, jeg må nok hellere komme op og arbejde.”

Participant 15:

Condition: 3

Female

Tested as the only one, so she didn't say much. Only asking us to start the game. Seemed focused on the screen.

Participant 16:

Condition: 3

Male

“Skal man skrive på engelsk?”

Noticed size difference in the flags.

After first round of flags: “Så tror jeg simpelthen ikke, jeg kan komme på flere.”

“Så I har simpelthen lavet et Unity spil...”

“Kan jeg se min score et eller andet sted?”

About second round of flags: “Jeg syntes, jeg kan huske færre flag nu end da jeg spillede spillet”

Participant 17:

Condition: 1

Female

Had a friend looking over her shoulder, she talked a bit with. The friend said the answer out loud some times.

Skipped the game in the questionnaire the first time and kept answering the questions.

To friend after getting told what time it is: “Jeg skal nok stoppe nu”.

Friend: “Kom så!”

17: “Du kan bare gå ud,”

Having a friend looking over her shoulder might force her NOT to cheat.

Participant 18:

Data was unfortunately overwritten and not included in results, however their test notes persist.

Condition: 1

Female

“Jeg er super dårlig til flag”

“Må jeg skrive på dansk?”

Participant 19:

Condition: 3

Female

“Der er sygt mange flag, jeg er sygt dårlig til flag. Det er tarveligt, syntes jeg”

“Man bliver i tvivl, når det står ved siden af andre”

Just before starting the game: “Jeg har ikke så meget tid, sååå...”

“Så bliver man jo ked af det, når man får tre forkerte i træk”

Has played GeoChallenge before, where she was good.

Had a streak of 9 of 10 right answers in a row. Wanted to do another round because of that.

Participant 20:

Condition: 3

Male

Has a friend that studies Medialogy.

“Ej, flag er jo det mest ubrugelige nogensinde!”

“Så er jeg nogenlunde klar”

“Jeg har aldrig været stærk til geografi”

“Ej, fuck”

“Jeg har lige haft Frankrig to gange i træk”

Participant 21:

Condition: 1

Female

Didn't say much. Seemed focused on the screen.

When quitting: “Okay, I’m done.”

Lot of noise since everybody is going to lunch.

Participant 22:

Data was unfortunately overwritten and not included in results, however their test notes persist.

Condition: 1

Male

“Hvad hedder Letland på engelsk?”

About to start the game and rating desire to begin: “Bortset fra, jeg er lidt sulten, så...”

Lot of noise since everybody is going to lunch.

“Ligger Azerbaijan i Europa?!”

“Hvad sker der, hvis man trykker på cheat? Nååh!”

“Nå er jeg done...” Gets told he should have pressed quit “Nåh, så kører jeg lige en runde mere”

To distracting smalltalking friend: “Jah, du ødelægger lidt min koncentration”

“Er han [number 23] bedre end mig?”

Participant 23:

Condition: 3

Male

First round of flags: “Jeg syntes de begynder at blive lidt sværere derned ad”

“Hov! Neej!”

About quitting the game: “Jeg tror, jeg har trykket på de fleste flag nu”

During second round of flags: “Oh shit...”

Participant 24:

Condition: 3

Male

Before starting: “Kan det tage 5 minutter?”

“Det kunne godt blive pinligt, det her,”

Got a friend looking over his shoulder during first round of flags. Friend: “That’s not how you spell it”

Friend: “Du ser slet ikke nok fodbold til at kunne det der”

24: "Nej, haha"

Friend during second round of flags: "Er du færdig?"

Participant 25:

Condition: 1

Male

"I didn't know Israel was a part of the European continent"

Friend comes over and talk a bit. "No problem, it's just a clicking game"

Mumbles a lot or hums during playing. E.g. "mumble Estonia mumble" or "... must be this one..."

"Aha! No... That wasn't the one..."

Had never heard of Lichtenstein: "Is this one a real country? Where is it?"

Didn't really understand the part about how to close the game.

Participant 26:

Condition: 1

Male

When starting questionnaire: "Ej, hvor er der meget tekst"

"Årh nej! EVIL!"

"Chinaaaaaa! No... Is this German?"

Got distracted by friend giving some quick messages while game started up.

Pressed 0 on slider and pressed submit to cancel. Chose to do the next 10 to get to the next popup. Pressed cheat while being watched.

Participant 27:

Condition: 3

Male

"Hold kæft, det er svært, det her"

"Har jeg startet playing eller skal jeg starte playing nu?"

"Er det på tid, det her?"

"Kan man se min score bagefter?"

Conation slider: "Ja, jeg vil gerne.. Mere!"

"Lichtenstein?! Det er fandme ikke fair!"

"Hvor mange..? Okay, jeg kører lige en gang mere,"

Discovers that he can press the mouse, and then drag the mouse away if he doesn't let go of the mouse button.

Whistles.

“Hvor meget må man snyde i det her spil? Ej, jeg skal nok være sød” Would like to get another point.

Missing confirmation when a flag is wrong. Wants to play again, mainly just to see if we accepted his feedback (games student).

He showed that he could just right click and look at the source code.

Participant 28:

Condition: 3

Male

Did not say or do much. He just owned the game.

Participant 29:

Condition: 1

Male

Checks his phone while game is starting up. Mumbles a bit between answering.

Participant 30:

Condition: 1

Female

“Så starter jeg med Danmark...” Hums while doing first round of flags. During second round of flags: Gets distracted by a friend, discussing if and when they are leaving.

Participant 31:

Condition: 3

Male

“Hvordan staver man til Czechoslovakia eller. . . The Czech Republic eller whatever”

To 32: “Skal vi sige 100 spørgsmål og se hvem, der har flest rigtige? Jeg er på 70 nu,”

Participant 32:

Condition: 3

Male

“Årh nej! For satan i helvede, mand!”

“Der er mange jeg ikke kan”

“Hvorfor ligner de flag også så fucking meget, altså?!”

“Jeg giver sådan semi op”

Had to redo first round of flags due to internet issues: “Ej, nu har jeg jo glemt halvdelen af dem”

Noticing they are random: “Ej, nu har de flyttet sig!”

31 and 32 compares “scores” during the first round of flags. They do the same after ending the game.

“Jeg er meget lidt Jeppe K lige nu”

“Er det på tid?”

“Belarus..? What?!”

The second round of flags was not saved the first time due to internet issues. When reloaded, the second part of the questionnaire was made inside SurveyGizmo editing the answer (number 15, condition 3).

Participant 33:

Condition: 1

Male

Laughs.

“May I cheat?”

“Does it continue forever?”

Participant 34:

Condition: 1

Female

“Yay, there is Hungary!”

“It would be easier if you could put it in pairs”

Laughs about the phrasing of “I have never desired anything more”

When the game is started, she looks behind her. [hear something? See if anybody is looking?]

Asks about our thesis during the game.

Laughed when she realized, she had to name the flags again in round two.

Location: HTX Sukkertoppen | Monday 19th of May

Participant 35:

Condition: 3

Male

About first round of flags: “Det er nemt, det her!”

Hit the mouse’s back button, but the answers were saved! Check if saved

About the game: “Det’ sjovt, det her”

About the flags being randomized: “Det skal i lige ha styr på”

“Jeg må sige. . . Spillet... Det’ rigtig godt,”

“Har I lavet sådan en algoritme til det her?”

“Blir ens high score gemt?”

Got friend coming over looking over his shoulder. Helps a bit with a few flags.

About explaining how to stop the game again: “Jeg gider ikke. . . Eller jeg kan ikke. . . Jeg vil gerne have en score på 1000”

About second round of flags: “Jeg havde skrevet Great Britain i starten, men man kan også skrive United Kingdom”

Got a friend coming over and talking.

Participant 36:

Condition: 3

Male

Asks his friend next to him about a flag.

35 and 36 really want to know if they get a score or know which ones are the right answer (during first round of flags)

They did not seem affected by their friend playing ping pong next to them – they were still focused on the screen.

35: “Hvor mange point har du?”

36: “Eehh. . . 27.”

35:” Jeg ska’ da’ high score på det lort”

They mention that they should stop the next time, so they can go play football.

36 to 35: “Du skal ikke skrive en stil, nej,” – about why did you stop the game.

About second round of flags: 36: "Årh, det har jeg glemmt!"

Says hi to a friend during second round of flags.

35 and 36: social desirability bias.

Participant 37:

Condition: 1

Male

Has a friend that came over and talked about something with the printer. He was talking to her during first round of flags. They started comparing sun eczema. She whispered a lot of answers until he said: "Du må ikke hjælpe mig"

"Det må være vaticanet. Det kan jeg ikke stave til på engelsk"

"Må man godt gå videre, hvis man ikke gider flere flag?"

About game: "Det fandme fejlt, der er så mange østeuropæiske lande"

Another friend comes over and talks about the printer. He keeps playing.

"Nu kan jeg slet ikke længere,"

"Kan jeg trykke quit nu? Jeg syntes, jeg har trykket på nok flag nu"

"Det jo sådan noget, hvor man skulle kunne huske dem bagefter... Damn..."

Participant 38:

Condition: 1

Male

"I kunne måske lave sådan en streak system, så jo flere man svarer rigtigt i træk, jo flere point får man. Det ku' gøre det sådan mere spil-agtigt"

He kept answering flags even though his friend left.

During first round of flags:

37: "Er du god til det her?"

38: "Jeg har kaldt tre flag for Bosnien, såå..."

Participant 39:

Condition: 3

Female

"Jeg er ikke så flag"

Can recognize some, but can't remember their name.

"Okay, jeg giver op,"

“Jeg tager lige en [runde] til,”

Participant 40:

Condition: 3

Male

During first round flags: “Okay, fuck det her”

“[tager] dem man kender til at starte med,”

“Jeg kan ikke finde ud af geografi”

“Jeg ved det her land, jeg kan bare ikke huske hvad det hedder”

“Jeg ved ikke engang hvad det her land hedder på dansk”

“Okay, jeg prøver én gang mere, så giver jeg op”

39 and 40 got pressured a bit into it by Bo.

They compare how many flags they have answered.

Had a teacher(?) looking over their shoulder at some point.

When done, he stepped over to 39 and looked at her screen a bit.

Participant 41:

Condition: 1

Male

Has 39 and 40 looking over her shoulder during most of the first round of flags.

Using abnormal amount of time in the first round of flags, scrolling up, down, up down

“Hvad sker der egentlig, hvis jeg trykker cheat”

About cheat button: “Hvad er pointen egentlig med den?”

39: “Det der er Norge!”

41: “Gå nu væk!”

“Jeg kan bare ikke lide at cheate”.

Really uses a lot of time choosing answers – even though 39 and 40 kept looking at the screen and talked to him.

Participant 42:

Condition: 1

Female

Has 39 and 40 looking over her shoulder during part first round of flags.

Participant 43:

Condition: 3

Female

“Ej, det kan jeg jo ikke, det her!”

“Yay, Danmark! Jeg kan et flag!”

About flag game: “Jeg bliver ved til jeg kan dem alle sammen”

“Hvorfor ved jeg ikke sådan noget!”

Has a friend looking over her shoulder during the game.

During second round of flags: “Neej! Ikke mere!”

Participant 44:

Condition: 3

Male

Was partially talking with a teacher during the first round of flags. He looks at the screen while he answers.

Talks a bit with a friend.

“Geografi har aldrig liiiiige været mit foretrukne flag”

Participant 45:

Condition: 1

Female

Has friends looking during the game.

Doesn't say much.

Participant 46:

Condition: 1

Male

Have been looking on other people playing the game. Has 39-42 looking during the first round.

Might find the game super boring, since he was crushing it.

“Det' jo bare flag. Det' bare at se dem og genkende dem”

During game time:

“Armenien?! Er det i Europa?”

“Det' godt, det kun er Europa, det her”

“Årh, det jo ondt, det der!” About 4 mostly identical flags

“Når man får nogle, man har haft før er det sådan forholdsvis nemt,”

After game: “Det var da meget sjov”

Participant 47:

Condition: 3

Male

Generally seems hesitant, since he is waiting for someone. Looks around almost every time someone walks by.

When stopping the game: “Ej, det må være fint nok nu”.

Participant 48:

Condition: 3

Male

Mumbles a bit to himself: “Nej, det er Georgia, er det ikke?”

About a flag: “Årh, den er svær!”

“Jeg tænker!”

During game: For a while he has four students looking, some yelling answers – some just yelling. Later has two coworkers looking, sometimes discussing the answer.

“Belarus... Det var den, jeg ikke fik før, ikke?”

When starting second round of flags: “Fuck... Det kan jeg stadig ikke huske”

Participant 49:

Condition: 1

Female

During the game: Mumbles the names of the presented countries.

When quitting: “Jeg skal jo også lade de andre prøve” There were a bunch of her friends queuing.

Participant 50

Condition: 3

Male

During game: Got Denmark twice in a row. “Jeg trykkede for hurtigt”

Participant 51:

Condition: 3

Female

Didn't say much. Was simply focusing on the screen.

Participant 52:

Condition: 1

Female

Teacher walking by: "Spanien!"

Participant 52: "Shy!"

About game and identical flags: "Det her mærke i midten, eller det her mærke i midten!"

"Det' jo det same flag!"

When a friend asks about what sh's doing: "Vi lærer flag. Det' faktisk meget sjovt,"

"Jeg har fået den samme to gange i træk"

"Det virkelig tarveligt, der er så mange flag, der er ens"

Second round of flags:

Two friends coming over: "I må ikke hjælpe mig! Det er snyd!"

"Den der havde jeg haft mange gange, men jeg kan stadig ikke huske hvad det er"

Participant 53:

Condition: 1

Female

Friend: "Nåh, hva' laver I?"

Participant 53: "SHY! Du må ikke hjælpe!"

"Årh, hvilken en er Malta, hvilken en er Polen?"

Friend was looking over her shoulder, but didn't really help.

Friend about helping out: "Det' irriterende man ikke må sige noget!"

When done doing first round of flags: "Så!"

Wants to reach 100.

"Jeg skal til time nu"

Participant 54:

Condition: 3

Male

During first round of flags: "Jeg kan huske dem fra Eurovision. . . De havde en vildt dårlig sang" – recognised the flag during the game, but not in the first round of flags.

“Nåh nej! Hmm. . .”

Discusses how long they should play, since they should be in class (allowed to be late if it was for testing) – They agree they should keep going till 15.15 (approx. 5 more minutes)

Participant 55:

Condition: 3

Male

Sighs

Doesn't say much.

During game time: “Der mange af dem, der ligner hinanden på en prik!”

Participant 56:

Condition: 1

Male

Didn't say much, just played.

Participant 57:

Condition: 1

Male

Didn't say much, just played.

Participant 58:

Condition: 1

Male

Didn't say much, just played.

Participant 59:

Condition: 1

Male

Didn't say much, just played.

Participant 60:

Condition: 3

Female

“Skal jeg bare begynde?”

“Jeg har set dem alle sammen før, jeg ved bare ikke hvad de hedder”

“Hva' fuck er det her?”

About the game: “Er det på tid?”

“Ej, det var trist!”

“Nej, er det United Kingdom? Jeg har bare kaldt det England!” When told that is wrong: “Fuck it! Dammit!”

“Ej, det næsten pinligt, det her...”

“Jeg har haft den her to gange nu, og jeg kan jo ikke huske den”

“Uh fuck, jeg er god!”

“Cypern! Yas! I’m good at this”

Two people watching over her shoulder, but doesn’t say much. She is really engaged, talks aloud.

When her friends want her to leave: “Ej, så må jeg lige sige at jeg ikke kan [spille] mere,”

When doing second round of flags: “Men jeg lærte noget, så det er okay”

Participant 61:

Condition: 3

Female

Does not study at HTX. “Jeg kan da ikke flagene på engelsk”

“Jeg starter bare med dem, jeg kan”

“Jeg kan jo godt Finlands flag, men jeg kan jo ikke huske hvad det hedder på engelsk!”

After first round of flags:

60: “Fuck it, vi hopper videre!”

61: “Ja, vi gør.”

“Man kan bare bruge udelukkelsesmetoden”

“Jeg prøver lige en gang til. Det er meget sjovt,” About doing another round in game.

Location: IT University | 11th of May 2016

There was the semi final in the Eurovision Song Contest the evening before.

Participant 62:

Condition: 3

Female

Asks if we can compare her score to the other people.

During first round of flags: “Just one more... No it doesn’t matter. I want to be good, not that good.”

Asks if she can see afterwards how many she had correct before vs. after. When told no: “Nooo! I don’t wanna play then...” She keeps playing, though.

During game: “No, fuck,”

During second part of questionnaire – checks her phone and says “sorry about that”.

Helped her a bit by phrasing the last comments.

When hitting second round of flags: “Ohhh! Noo!” *laughs*

She thinks the game was too easy, but writing the flags was not.

She badly wanted to know which ones were right, so she was shown the Wikipedia page after testing, where she said: “Oh nooo! I made so many mistakes!”

She thinks the game didn’t give her a learning experience, because she likes seeing it first and then learning/remembering them. She said, she didn’t concentrate on remembering flags inside the game since she was already thinking on the next flags.

Participant 63:

Condition: 1

Male

First round of flags: “Det’ jo sygt svært, mand!”

During game: “Det er nemmere sådan her”

Participant 64:

Condition: 1

Female

“Årh, jeg skulle have fulgt bedre med i flagene i Eurovision igår”

Hit the back button during first round of flags, but the answers were saved.

Checks her phone during game.

General notes to Monday

People does not really change the conation slider before pressing quit. That data might have to be excluded.

Autofill was enabled on one computer, but was turned off for Tuesday.

Seemed to be a great difference between playing alone or with a friend.

General notes to Tuesday

Rather noisy canteen at UCC.

Only four participants, but there seemed to be more chatter between participants that knew each other versus the ones that played alone.

General notes to HTX

Rather noisy most of the time. Tiled floor, acoustics and a lot of people talking. About half got persuaded into participating by their teacher. There were sessions with a lot of queuing, so people might have been disengaged because of the waiting. A lot of the participants were often distracted by friends talking to them or by their surroundings. It seemed to take place more during the questionnaire flags rather than during the actual game. Friends looking over shoulders had a hard time keeping the right answers to them self, even though we told them not to help.

E | Tables of conation data values

ID	Conation before	Average conation during	Conation after
5	8	8	5
12	8	9	7
15	6	0	6
16	6	6,75	3
19	7	8,14	6
23	7	5,43	5
24	8	8	8
27	9	7	9
28	6	5,25	3
31	7	5	6
32	6	8,45	8
35	10	10	8
36	9	10	10
39	9	9	8
40	6	5	8
43	9	10	10
44	7	8	8
47	7	5	3
48	6	8,8	6
50	7	7,67	5
51	6	6,50	6
54	10	10	9
55	8	7,40	8
60	5	4	5
61	5	5	6
62	10	8,80	7

Table 9.1: Conation score for the control group

ID	Conation before	Average conation during	Conation after
1	6	10	10
2	8	7,70	7
13	6	6,25	7
17	5	5	6
21	6	5	9
22	6	4,29	10
25	10	10	5
30	8	8	7
33	6	3,67	2
34	5	6,6	7
37	5	2,5	2
38	2	5,67	6
41	10	10	9
42	8	7,3	9
45	10	10	10
46	10	10	7
49	7	6	8
52	8	5	7
53	5	10	7
56	7	5,33	7
57	7	8,67	8
58	7	5	8
59	2	4,5	2
63	5	6,33	5
64	2	8	7

Table 9.2: Conation score for the cheat condition