IMPROVING THE DESIGN OF PERSUASIVE GAMES FOR COMPLEX SYSTEMS

Effectiveness of the Design Principles Praise, Suggestion, and Comparison as perceived by Individualists and Collectivists

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Improving the Design of Persuasive Games for Complex Systems

Effectiveness of the Design Principles Praise, Suggestion, and Comparison as perceived by Individualists and Collectivists

by

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TU Delft

Preface

The report you are about he read is the culmination of my time as a student and specifically the final step towards receiving the Master Thesis diploma of the Master program Complex Systems Engineering and Management at the Technical University of Delft. As you will read in the next pages, I did a research around the persuasiveness of persuasive game design principles used in serious games for complex systems as perceived by Individualists and Collectivists. An interesting topic that combines my interest in serious games, the interest of my supervisors for persuasive game design principles, the focus of my master program namely complex systems and my interest in cultural differences. I went on to use the successful game 'Maritime Spatial Planning Challenge' which has links with my bachelors degree, Maritime Engineering. Happy coincidence or good management? I will leave that up to you.

Despite the good basis, the past months remained challenging and I could not have gotten through them on my own. I heartily want to thank the members of my Graduation Committee. Alexander Verbraeck for the clarity of his feedback and the liking of my storyboards. Jan Anne Annema for asking critical questions during my previous attempt at a Master Thesis and for accepting to be in a committee judging a topic that is not his expertise. Rens Kortmann for his help pinpointing a subject for my research, being a facilitator and help during the game sessions and improving my musical knowledge. Last but not least, Annebeth Erdbrink for being very approachable, reading my report many times over, and most of all for being so supporting and giving me the feeling I was not being as terrible as I thought.

Now for the paragraph I have been looking forward to write since I started this project: thanking family and friends. It would be unjust not to point out that they have supported me for longer than the last few months, but have gotten me through very dark times in the past as well. In no particular order and forgetting many: Thank you Chris and Shanita, for ruimte 4, the games and now the books. Thank you Bram, for team November (or should I say December). Thank you Marlou for the wine. Thank you Mieke for all those diners. Thank you Sokjes, for the mothering. Thank you Marieke en Claudia for the complaining. Thank you Hanna for the tea. Thank you Rick for your friendship. Thank you Corrie en Aad, for Laurane and Laurette. Thank you Aubin, for your honesty. Thank you Timothée for your interest. Thank you Papa et Maman for all the opportunities.

And most of all: thank you Arian. For being my schatje, for getting me out of bed, for the rabbit gifs, for listening (which I believe you must have done at times at least), for talking (although I am not sure that was you), for running with me, for feeding me when I couldn't, for the hugs, for reading my report long past you bedtime, for being my guinea pig throughout the research, for keeping up with me and for saying you like me.

Bonne lecture.

Laurane J.N. Macquart
Delft, December 2019

Summary

One of the challenges of complex systems is getting the many stakeholders around the table to discuss the issues at hand. The stakeholders all have a different understanding of the the challenges which complicates communication. By playing a serious game simulating the complex system in question, the stakeholders experience the system through the same lens; this enables them to have a constructive discussion and come up with solutions. These games regularly have a subtle persuasive message they want to convince the players of, this can for example be the necessity of communication, or the need of sharing specific information. The persuasive messages of persuasive games are communicated through the use of persuasive game design principles (PGDPs) such as competition or praise. However, the knowledge about these PGDPs is still lacking. This research aims to increase the knowledge about PGDP which can in turn be used to make persuasive games for complex system more persuasive.

PGDPs persuade different people to various degrees. The research of Orji (2016), Orji, Nacke, and Di Marco (2017), Orji, Vassileva, and Mandryk (2014) showed personality type, player type and culture influence the degree to which an individual is persuaded by a specific PGDP. However, their research concerned primarily persuasive games for healthcare. Those conclusions cannot automatically be translated to persuasive game for complex systems, which have very different dynamics. This research continues with the angle of cultural differences and differentiates between individualistic cultures and collectivistic cultures but concentrated on persuasive games for complex systems. *Individualists* focus on the 'I' and have loose ties with the social groups they are a part of, whereas *Collectivists* focus on the 'we' and have strong ties with their social groups.

The research question that is answered through this research is '*To what extent does the effectiveness of widely used persuasive game design principles used in games for complex systems differ between Individualists and Collectivists?*'

In order to answer the research question, a literature research is done to explore what are the widely used PGDPs in persuasive games for complex systems. This resulted in a list of ten widely used PGDPs by Orji et al. (2014). However, according to Khaled et al. (2007) these principles (and others on lists of widely used PGDPs) are designed by and used for *Individualists*. Principles aimed at groups rather than individuals would be more persuasive for *Collectivists*. For this reason, a variant aimed specifically at individuals and one aimed specifically at groups was defined for each of the ten PGDP listed by Orji. For example, the PGDP Praise consists of 'Praise of individual' and 'Praise of group'.

The experiment could then be designed with the list of widely used PGDPs in mind. In order to measure the effect of the PGDP separately from one-another, a combination of persuasive game for complex systems and storyboards is used. To the best knowledge of the author of this report, this has not been tried before. Previous research only used storyboards, thereby relying in what the participants imagine their experience would have been. Using storyboards in combination with a game enable the participants to experience the scenarios of the storyboards, thereby measuring perceived persuasiveness in stead of imagined persuasiveness. Storyboards are visual representations of, in the case, PGDP present in the game.

The game that was played is Maritime Spatial Planning Challenge (MSPC) which has the persuasive message of the necessity of long-term planning in maritime spatial planning. The game first had to be adapted to the participants of the experiment. Indeed, the game is originally aimed at users of the sea and builds on their knowledge of the system. The students that were part of the experiment had no such knowledge and needed guidance.

The choice of the game influenced the PGDP that could be tested. Only PGDPs that were present in the game and that helped get the persuasive message across could be depicted in storyboards. This led to the selection of the PGDPs 'Praise', 'Suggestion', and 'Comparison', each sub divided in a variant aimed at individuals and aimed at groups. A story-line representing the PGDPs in the game was fleshed out for each variant so that the storyboard could be created. Furthermore, a pre-game and post-game survey was created. The survey consists of (1) a section to determine to what extend the game was persuasive, (2) a section with the storyboards and accompanying questions to measure the persuasiveness of the PGDPs, and (3) a section with questions to compute the degree to which the participants is *individualistic* or *collectivistic*.

Two game sessions with between 30 and 35 players each were held. The analysis showed a majority of the players indicated they either learned something by playing MSPC or were conveyed a message, namely the necessity of long-term planning in maritime spatial planning. The measurements of the attitude towards the persuasive message of MSPC showed an improvement after the game was played. Therefore, it can be concluded that MSPC is a persuasive game, meaning the responses to the storyboards could be analysed.

The participants were asked to describe the storyboard to verify whether they understood what was meant. The storyboards for 'Praise' and 'Suggestion' were mostly not understood as representing 'Praise' and 'Suggestion'. The participant described what was being praised, of what was being suggested, making it unclear whether they understood the storyboard correctly. As a result, not all responses could be used to evaluate the persuasiveness of the PGDP. The storyboards for 'Comparison' were understood more often as they were picturing comparison in general. This shows the importance that must be given to the design of the storyboards to make them an effective tool for research.

The results of the persuasiveness of each PGDP as perceived by either *Individualists* or *Collectivists* were -in all cases but one- inconclusive. The only significant result was that *Individualists* are persuaded more by 'Comparison between groups' than by 'Comparison between individuals'. This result was not expected and shows that the findings of Khaled, Biddle, Noble, Barr, and Fischer (2006), stating *Individualists* are persuaded more by PGDPs aimed at individuals and *Collectivists* more by PGDP aimed at groups, cannot be translated to persuasive games for complex systems. The other results are both inconclusive and, at times, contradicting one another.

Despite the insignificance of the results, the trends seen in data do suggest their is a difference between the way *Individualists* perceive the persuasiveness of PGDPs and the way *Collectivists* perceive the persuasiveness of PGDPs in persuasive games for complex systems. However, more research is needed to clearly define wherein the differences lie. Furthermore, the method of using a combination of a persuasive game for complex systems and storyboards was not invalidated. It could,unfortunately, not be validated due to small samples sizes, but the importance of a good design of storyboards using experienced designers became apparent.

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1

Introduction

In an ever expanding world with more and more ways of communicating with more and more people due to innovative technology, everything becomes increasingly complex. Whenever something has to be built, set up, renovated or redesigned, the information needed to deal with the challenges is dispersed over many (groups of) people. All groups have different priorities, viewpoints and ways of communicating, complicating the situation even further.

Luckily, there are tools to deal with complexities; one of which is the use of serious games. By playing a game, the stakeholders create a common understanding of the system which, in turn, helps them discuss the challenges faced. Regularly, those games have a message of which they want to persuade players. However, there is little known about the ways in which different people are persuaded. This research aims to create more knowledge about ways in which to persuade different types of people playing persuasive games for complex systems. The information can then be used by designers of these games improve the persuasiveness of their products.

1.1. Games for Complex Systems

Complex systems are socio-technical systems beholding many different elements with interactions between them Ridolfi, Mooij, and Corpino, 2012. The different stakeholders in such systems have varying interests as shown in the example below; they often do not have a good overview of what can be done to improve the situation as a whole. Furthermore, complex systems are characterised by the presence of technical challenges Enserink et al., 2010. Another name for complex systems is multi-actor systems, but that terminology will not be used in this report.

Figure 1.1: Planned extension of (part of) the existing European rail network (dark blue) with Rail Baltica (light blue) (RailBaltica, n.d.)

Example of a Complex System: Rail Baltica

In 2019, the European Union and Trans-European Transport Networks will start the construction of Rail Baltica (RailBaltica, n.d.). The rail network will go through Poland, Lithuania, Latvia and Estonia and will connect those countries to the European network (Figure 1.1). The following issues show he complexities of the project. Governments of all countries involved will need to discuss infrastructural issues, planning issues, financial issues, and much more. Other parties involved include NGOs defending flora and fauna, construction companies and local municipalities. All opinions will need to be heard and coordinated in order to finish the project within budgetary and time limits. Environmentally minded organisations will use their influence to ensure the railway avoids areas with rich and fragile ecosystems. Some municipalities will want to be connected to the railway in order to become an important hub and stimulate their economy, while others want to remain as peaceful areas.

One way to visualise complex systems and help stakeholders get an overview of the challenges is through serious games: the use of games in a context other than mere entertainment. One use of serious games is as games for complex systems. Mayer (2009) defines games for complex systems as '*experimental, rule-based, interactive environments, where players learn by taking actions and by experiencing their effects through feedback mechanisms that are deliberately built into and around the game*'. In other words, the complex system is simulated in a game, stakeholders become players and can safely discover what the consequences are of their actions (Caluwé, Geurts, Buis, & Stoppelenburg, 1996; Duke & Geurts, 2004; Mayer, 2009). Getting parties around the table to play and share the same experience will bridge differences. The parties will be able to focus on the shared understanding they have of the system and the dynamics in place, instead of what sets the parties apart. This will help them get a better understanding of how to (re)design the system and/or learn about the system.

Example of a Game for Complex Systems: Rotterdam Rail Cargo
With the construction of the Maasvlakte 2 of the Port of Rotterdam, the transport of containers from the port to Rotterdam's hinterland has grown in size and complexity. Containers are transported through inland shipping, by trucks on the road and by train. Using the railway is not a popular option for multiple reasons. The game Rotterdam Rail Cargo ((Gamelab, n.d.), financed by NWO) was created to bring parties to the table to discuss the problems that prevent rail cargo transport from growing. The game simulates the arrival of freight to the different terminals of the port. Shippers are responsible for ensuring their containers arrive at the right destination in time. They do this by booking space on the trains of the rail operators who must then pick up the containers at the different terminals. However, because of delays at the terminals, not all containers can be picked up. The players experience how difficult it is to ensure transport for all containers, and that one solution is to share information with the other shippers. After having done this in the safe space provided by the game, they could discuss what steps would be necessary to do the same in real life. Figure 1.2 shows stakeholders playing the game and discussing plans.

Figure 1.2: Group of industry leaders playing Rotterdam Rail Cargo (Gamelab, n.d.)

1.2. Persuasion in Games for Complex Systems

The terms serious games, persuasive games, and gamification are often used interchangeably while they do not mean the same thing. Gamification is the use of 'game elements in non-gaming context' (Deterding, Dixon, Khaled, & Nacke, 2011). These games are aimed at increasing motivation to do a task, such as learning a language. Serious games and persuasive games, on the other hand, both aspire to create either trust or distrust towards a situation (Wright & Bogost, 2007). These terms overlap with one another, but not with 'gamification'. This thesis is about persuasive games, which aims for attitude and/or behavioural change (Ciocarlan & Masthoff, n.d.; Orji et al., 2014; Ruggiero, 2015).

Games for complex systems often aim to change attitudes and behaviour of parties towards the system; they often have a subtle, indirect persuasive message. Such games are called persuasive games for complex systems in this report.

Example of the persuasive message in a game for complex systems in Rotterdam

Rail Cargo

When the designers of the Rotterdam Rail Cargo game were analysing the system, they were able to pinpoint the main problem areas and made sure those areas surfaced in the game. This is the fact that the terminals are slow and prone to delays. As the players experienced that while playing, they were able to talk about the problem with one another. They collectively realised they should change their attitude towards sharing data with one another. They initially did not do this because they are competitors. Nonetheless, having played the game, the advantages of sharing information became clear. Information sharing makes it possible to bundle freight at the terminals and ensure that containers reach their destinations in a timely fashion. As their attitude has changed, they could discuss the technical implications of the solutions, namely the need for a system that kept the information from being used against one another. (Gamelab, n.d.); Linda van Veen and Bas van Nuland designers of Rotterdam Rail Cargo, Personal Communication, 2019)

1.2.1. Persuasive Game Design Principles

The persuasiveness of a game can be achieved through the use of persuasive game design principles (PGDPs). They are design variables that enable the game to change the attitude and/or behaviour of players towards a certain issue. Examples of PGDPs are competition, cooperation and monitoring which will be explained in section 2.2. PGDPs are also named persuasive strategies (Orji et al., 2014) or game mechanisms (Siriaraya, Visch, Vermeeren, & Bas, 2018).

The principles imply choices for game dynamics (emergent behaviour during game-play) and game elements such as a scoreboard. The scoreboard in question will influence players to become competitive which in turn is a way of getting them to play more or more actively.

A couple of lists of PGDPs exist which are reviewed in section 2.2. One of these lists is the six PGDP by Cialdini (2001), which he calls fundamental principles of persuasion. The principles are the following: (1) Authority: people listen to experts and follow their advice, (2) Reciprocity: people often pay back favour that were given to them, (3) Scarcity: people value thing of which there is little more than when there is a lot of it , (4) Commitment: people want to finish what they started, (5) Consensus: people observe others and tend to act similarly, and (6) Liking: people follow people they like more easily than people they do not like. Orji et al. (2014) defined ten other PGDP: Comparison, Competition, Cooperation, Customisation, Suggestion, Personalisation, Reward, Self-monitoring, Simulation, and Praise.

Despite the existence of these lists of PGDP, there is as of yet little knowledge on how the PGDP work, how they interact with one another, or why some principles are more persuasive to certain types of people. Serious game designers currently choose what principles to use based on their experience and intuition (Orji et al., 2014). Increasing knowledge on what PGDPs are persuasive to what groups of people will provide guidelines game designers can use to create more persuasive games.

1.2.2. The influence of Cultural Background on Persuasiveness

While serious games in general, and persuasive games in particular, are promising tools to induce behavioural change, they do not always reach the intended goal (Hamari, Koivisto,

Sarsa, et al., 2014; Seaborn & Fels, 2015).G. J. Hofstede, Jonker, and Verwaart (2008) name seven possible sources of failure that can take place either before, during, or after a game is being played. Games can fail because of one or a combination of these reasons. These seven sources of failure are portrayed in 1.3 and are 'Design', 'Game versus unwritten rules', 'Facilitation', 'Emotions', 'Debriefing', 'Cross-cultural issues', and 'Homo Ludens'.

As can be seen in Figure 1.3, two problems can occur at any point in the process, these are 'cross-cultural issues' and 'Homo Ludens'. The Homo Ludens pitfall refers to the fact that players sometimes forget or underestimate the teachings of the game because of the fun they had. Players do not realise something fun can be valuable (G. J. Hofstede et al., 2008). Cross-cultural issues are clashes in habits and/or understanding between players from different cultures, or between players and designers, leading to different outcomes than planned (G. J. Hofstede et al., 2008). Other authors also refer to cultural differences as being the reason some players are persuaded by a game and other are not.

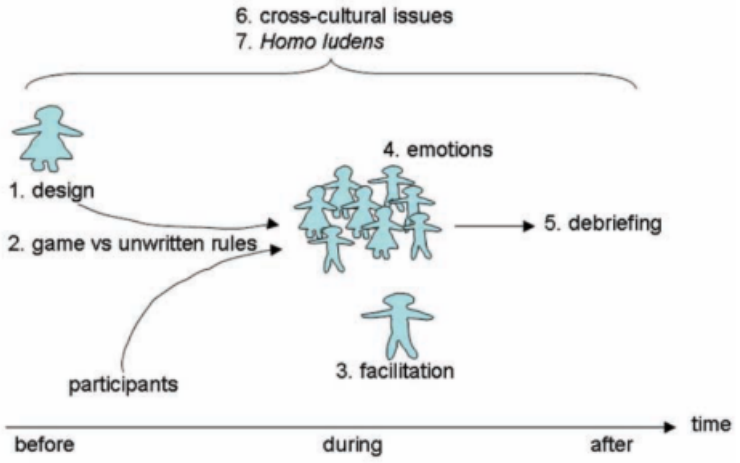

Figure 1.3: Seven sources a failure of serious games (De Caluwé et al., 2008)

Orji et al. (2014) argue that one reason games fail is that they are designed in a one-size-fits-all fashion. Individuals differ and therefore have different game experiences. One player will be completely immersed in the world of the game because of its realism and will therefore be persuaded of the message the game tries to convey, whereas another will be disheartened by the lack of competition and will as a results not be persuaded. In other words, a game that persuades one person, will not necessarily persuade another. Unfortunately for game designers, there are many ways in which people differ from one another. In their research, Orji recorded how participants with varying personality types (Orji et al., 2017), players types (Orji, Tondello, & Nacke, 2018), and cultural backgrounds (Orji, 2016) were persuaded by different PGDPs in games. The results showed that player type, personality type and cultural background impacted how persuaded players were by the PGDPs. For example, the PGDP 'Personalisation' is hardly persuasive for people with the player type 'Disruptor' but is very persuasive for people with the player type 'Socialiser'.

It is not uncommon that a successful persuasive game for complex system is developed further to fit a similar complex system where the stakeholders also want to benefit from the game. The second system may very well be in another country. When making adaptations to the game, it is paramount to take into account the different cultural background of the new players. For example, if one culture is more self-reflective than another, a game that allows for self-reflection

will be more effective. Making persuasive games for complex systems more effective means there is a bigger chance of getting the persuasive message across to the players. For this reason, cultural background will be used as demarcation between people in this research.

Culture is an important factor that determines how people think and behave; it influences how messages are perceived (Aaker & Maheswaran, 1997). Players of one culture share a set of unwritten rules coming from their upbringing (G. J. Hofstede et al., 2008). Therefore, when developing a persuasive game for complex systems, whether it be for the first time or when a game is developed further for a similar system, taking into account the culture of the players will most probably increase the effectiveness of the game.

1.3. Research gap: Generalisability of previous findings on PGDPs to persuasive games for complex systems

Researchers Orji et al. (2014) and Khaled, Barr, Fischer, Noble, and Biddle (2006) explored the link between cultural background and persuasiveness of PGDPs. Khaled developed and used a game named *Smoke* (2009) which persuades players to stop smoking. They compared players from the Maori culture to New Zealand Europeans. These cultures are respectively *Collectivistic* and *Individualistic* meaning they are respectively focused on the group ('we') or on individuals ('I'). The results of their research are that a game using PGDPs aimed at groups (for example 'Harmony' or ''Team performance' explained in section 2.2.2) are more persuasive for *Collectivists* than for *Individualists*. Similarly, games using PGDPs aimed at individuals worked better for *Individualists* than for *Collectivists*. Unfortunately, the results do not specify which PGDPs are deemed most persuasive overall by the two groups.

Orji (2016) used storyboards portraying PGDPs in health games and measured the impact on North Americans (individualistic) and Asians (collectivistic). Storyboards are cells that form a visual representation of a situation (Sova & Sova, 2006). She used the aforementioned six persuasive strategies of Cialdini (2001). The results showed that *Collectivists* are persuaded more when Authority, Reciprocity, Consensus and Liking are used than *Individualists*. The only strategy that was more effective for *Individualists* than *Collectivists* is 'Scarcity'. Both researches show the importance of the choice of PGDPs when tailoring to culture. As players with certain cultural background are less persuaded by certain PGDPs, they will in turn be less (or even not) be persuaded by games employing these PGDPs.

However, the findings of Orji (2016)) and Khaled, Barr, et al. (2006) are focused on persuasive games in the healthcare sector and cannot automatically be translated into conclusions for games for complex systems. Persuasive games for complex systems involve more dynamics and are aimed at different problems. Indeed, persuading an individual to change their attitude towards smoking is a different ballgame than persuading rivalling parties to share information in order to both become more profitable. Nonetheless, it is plausible that, in the case of persuasive games for complex systems, *Collectivists* are more persuaded by some PGDPs and *Individualists* more by others, just as is the case with persuasive games for healthcare. PGDPs prescribe how to persuade players, not what players need to be persuaded of or the situation the game portrays.

This research will, therefore, aim to give designers of persuasive games for complex systems knowledge needed to tailor games in order to improve their persuasiveness, depending on the culture of the people that will play the games. The knowledge can either be used during

the first design of a game or when a successful game needs to be refitted a similar system of people of a different cultural background.

1.4. Research Question

When faced with complex systems, a good way to get parties around the table to discuss the situation based on a common understanding is by using a serious game. As such, games often have subtle persuasive messages and want to trigger attitude change after the game is played, knowledge on how to use PGDPs is paramount.

However, as of yet, there is no research that guides game designers for such games in choosing PGDPs that take into account the different cultures of the players, specifically the degree to which cultures are *individualistic* or *collectivistic*. As previously stated, Khaled, Barr, et al. (2006) and Orji (2016) have looked at this problem from the perspective of persuasive games for healthcare. However, persuasive games for complex systems are a different matter, as they involve other dynamics and are aimed at different problems. Persuading an individual to change their attitude towards smoking is a different ballgame than persuading rivalling parties to share information in order to both become more profitable. The research question which must be answered to tackle the challenge described above is therefore:

> To what extent does the effectiveness of widely used persuasive game design principles used in games for complex systems differ between Individualists and Collectivists?

In order to answer the research question, four sub-questions are formulated:

1. What are widely used PGDPs relevant for persuasive games for complex systems?
2. What are good parameters for an experiment measuring the effectiveness of PGDPs?
3. How effective are the PGDPs as perceived by individualists and collectivists?
4. What design recommendations can be made to game designers of persuasive games for complex systems?

1.5. Research approach and method: using a persuasive game for complex system in combination with storyboards

A research method is required to be able to answer the main research question and corresponding sub-questions. Research methods explain the way in which research is conducted; they serve as a blueprint for the process. At this stage, there is little known about PGDPs and their effect in persuasive games for complex systems. The available knowledge primarily comes from persuasive games for healthcare and needs to be broadened to persuasive games for complex systems. Quantitative research is advised when aiming to generalise facts about a topic or testing a hypothesis (Muijs, 2010). As the current research aims to generalise the knowledge about PGDPs to games for complex systems, quantitative research will be used. One way of collecting quantitative data is by using surveys. They enable the efficient collection of data from many people with different cultural backgrounds. Survey research is the ”systematic gathering of information on a defined social group” (O’Byrne, Rapley, & Hansen, 2006). With sufficient randomly selected participants, the results and conclusions can be generalised

to the general population (Muijs, 2010) .

Previous research on the topic of persuasiveness of PGDPs by Orji (2016), Orji et al. (2017), Orji et al. (2018), Orji et al. (2014) made use of storyboards as previously explained in section 1.2.3. However, this method has its limits. The most important one is that it does not measure the actual persuasiveness of a PGDP, but what, based on a picture, participants think the persuasiveness of the PGDP would be. The participants are not able to base their answers of their experience with the situation depicted but have to base it off their imagination. In other words, the method is possibly unreliable when researching the actual persuasiveness of PGDPs.

In order to reduce this problem, in this research, a new method based on that of Orji combining a persuasive game for complex system and storyboards, will be used. The participants of the experiment will first play a persuasive game for complex system which naturally includes certain PGDPs. Afterwards, they will be shown storyboards depicting these PGDPs and will be asked to indicate to what extent they have experienced the situations shown as persuading them of changing their attitude towards what it is the persuasive game for complex systems in question wants them to change their attitude towards. This enables the collection of data on the perceived persuasiveness as experienced by participants in stead of the collection of data on the perceived persuasiveness as imagined by participants.

Qualitative research, especially when combined with quantitative research as mixed methods, would add more depth and understanding to the analysis. Qualitative research often consists of interviews which are time consuming. The group of interviewees would have to hold individuals from a range of cultures in order to capture the effect of being from an individualistic background of collectivistic one. This is not considered feasible for this research due to time limitations, and will therefore not be done.

In order to set up the experiment, a literature research will be done to define widely used PGDPs relevant for persuasive games for complex systems, this means looking into cultural dimensions and PGDPs. Next, an off-the-shelf persuasive game for complex systems will be chosen for the experiment. A final choice on the PGDPs to test will be made out of the PGDPs present in the game. The storyboards containing the PGDPs as they are in the game can be designed. The guidelines on story-boarding provided by Truong, Hayes, and Abowd (2006) will be used for this. Furthermore, the remainder of the survey will be created to measure the persuasiveness of the game, the persuasiveness of the PGDPs and the degree to which the participants are *Individualist* of *Collectivist*.

1.6. Structure of the report

The current chapter introduced the subject of this research: the lack of information of the impact of cultural background on the way people are persuaded by specific PGDPs used in persuasive game for complex systems, and delineated how the research on that topic would be conducted. The second chapter is a literature review on ways to qualify cultural background and PGDPs aimed at these different cultural backgrounds. In the third chapter, the design of the experiment is treated, including the choice and adaptation of a persuasive game for complex system, the selection of PGDPs to test, the designing of the storyboards depicting the PGDPs to be tested and the survey questions used. The results of the experiment are described in the fourth chapter. Finally, the fifth chapter ends with answers to the research questions, a discussion of the findings, the limitations of the research and recommendations for future researchers as well as persuasive games for complex system designers.

2

Literature Review

The first step to answer the research question is identifying what has already been researched and what findings are in the different fields. In this case, it means doing a literature research on ways to qualify culture, and PGDPs. As a result, at the end of the chapter, the answer to the first sub-question *What are widely used PGDPs relevant for persuasive games for complex systems?* will be given.

2.1. Qualifying Culture

In order to qualify culture, multiple researchers such as Schwartz (1994, 2007) and House, Hanges, Javidan, Dorfman, and Gupta (2004) have defined cultural dimensions. Cultural dimensions are the values of society as a whole that are the result of culture. The cultural dimensions that are most often used are those defined by G. Hofstede (1980), and which he later revised (G. Hofstede, Hofstede, & Minkov, 2010). That contribution is important because Hofstede organised cultural differences into overarching patterns which facilitated comparative research (Oyserman, Coon, & Kemmelmeier, 2002).

2.1.1. Using cultural dimensions by Hofstede (2010)

The work of Geert Hofstede, who was later joined by his son Gert Jan, has been referenced over 40.000 times and has heavily influenced the research topic of cross-cultural research. G. Hofstede (1980, 2001) and G. Hofstede et al. (2010), define culture as: 'The unwritten rules of the social game. It is the collective programming of the mind that distinguishes the members of one group or category of people from other'. Geert Hofstede used data from surveys about work-related values within the IBM company. Respondents came from countries all over the world. Using factor analysis on the data initially yielded four cultural dimensions in 1980. Later research added two other dimensions to the list. The six dimensions are (1) Power distance, (2) Individualism-Collectivism, (3) Masculine-Feminine, (4) Uncertainty Avoidance, (5) Long Term-Short Term Orientation, and (6) Indulgence-Restraint (G. Hofstede et al., 2010).

Countries consist of many regions which differ culturally, meaning results should not be generalised to nations too easily. Furthermore, G. Hofstede et al. (2010) point out that their findings explain the behaviour of cultures, not of individuals. When comparing individuals, other elements such as personality and human nature should be taken into account. Similarly, national culture and organisational culture also differ (G. Hofstede et al., 2010). Nevertheless, cultural dimensions greatly influence organisational culture and are often used in research (Van Oudenhoven, 2001). Concluding, cultural dimensions are to be used to explain the differences between groups of people with different cultural backgrounds.

Over the years, Hofstede's research has been commented on regularly. The primary critics are Minkov (2018), Smith et al. (2002), and McSweeney (2002). They argue the data used by Hofstede cannot be generalised as it comes from IBM employees. Individuals working at the same company will have overarching similarities, which are not present in other individuals from the same country (McSweeney, 2002). G. Hofstede (2001) replies to this that as the respondents had the same organisational culture, national culture jumps out more. However, this implies that there are no differences in organisational culture within IBM across countries or departments.

Also, the contributions have hardly been validated across countries (Kirkman, Lowe, & Gibson, 2017). To this, Hofstede replies that countries are not to be taken as proxies for cultures, as within a country, regions differ culturally (G. Hofstede et al., 2010). Furthermore, the data is said to be outdated. The data used stems from before 1980, 40 years later, cultures may have evolved, especially when taking into account the fast-paced globalisation of the last decades.

However, Hofstede's research is based on data from the highest amount of countries, namely 96 countries. House et al. (2004), who also defined cultural dimensions, only researched Latin American countries and Schwartz (2007) 20 countries. Cultural dimensions by other researchers face similar criticism as those of Hofstede. Hofstede's work is the broadest and most accepted and will, therefore, be used in this research.

Researching all cultural dimensions necessitates the collection and analysis of a lot of data. Therefore, not all six cultural dimensions will be taken into account in the current research. Also, not all dimensions are found to be valid (Minkov, 2018). Individualism-Collectivism is the one cultural dimension that is valid according to Minkov (2018). Khaled, Biddle, et al. (2006) and Orji (2016) (named previously) have also used this dimension in their research towards determining what persuasive design principles in gaming improve the persuasiveness of persuasive games. As the degree to which people are either *Individualists* or *Collectivists* accounts for the biggest differences between cultures (G. Hofstede et al., 2010; H. Triandis, 1995), it is the most relevant dimension for complex systems. Indeed, complex systems are often confronted with many stakeholders with different cultures (be it because of the organisations they work for or the countries they originate from). Moreover, it is not uncommon that a successfull persuasive game for complex system is to be adapted to a new system in another country so stakeholders can benefit from it.

2.1.2. Characteristics of the cultural dimension Individualism and Collectivism

Traditionally, *Collectivism* is seen as the opposite of *Individualism* (Oyserman et al., 2002). G. Hofstede et al. (2010) define *Individualism* and *Collectivism* respectively as follows: 'Individualism pertains to societies in which the ties between individuals are loose: everyone is expected to look after themselves and their immediate family. Collectivism pertains to societies in which people from birth onward are integrated into strong, cohesive in-groups, which

throughout people's lifetime continue to protect them in exchange for unquestioning loyalty'. The data collected by Hofstede in his research with IBM employees allowed him to observe the characteristics that go with the two sides of the dimension. They can be found in Table 2.1. *Individualists* have separate groups of people in their lives that hardly mingle; family and work, for example, are kept separate. Contrary to this, in collectivistic cultures, the groups overlap: business is mostly done with close relationships (Hajikhameneh & Kimbrough, 2019; G. J. Hofstede et al., 2008).

Table 2.1: Characteristics of Individualism - Collectivism by Hofstede (2001)

Individualism	Collectivism
Speak your mind	Maintain harmony, avoid confrontation
Low-context, explicit communication	High-context, implicit communication
Use the word I	Use the word we
Treat all customers equally	Show favour to in-group customers
The task is more important than a good relation	No business without a personal relation
Mutual advantage is the basis of relations	A relation brings right and obligations
Build and maintain relations actively	Relations are given
Keep self-respect	Save face for in-group
Responsible for personal interests	Responsible for group interest

Father and son Hofstede are not the only researchers to have described *Individualism* and *Collectivism*. Another often cited researcher is Harry C Triandis (2001), H. Triandis (1995) who looked at cross-culturalism from the point of view of psychology. He explains that *Individualism* and *Collectivism* are cultural syndromes set around a certain theme. *Individualism*'s theme is autonomy while that of collectivism is connection. As defined by Triandis (2001): people from individualistic cultures are '*autonomous and independent from their in-groups; they give priority to their personal goals over the goals of their in-groups, they behave primarily on the basis of their attitudes rather than the norms of their in-groups'*. On the other hand, in *Collectivistic* societies '*people are interdependent within their in-groups, give priority to the goals of their in-groups, shape their behaviour primarily on the basis of in-group norms, and behave in a communal way'*.

Furthermore, *Collectivists* are especially concerned with relationships and people base their beliefs, behaviour, and even feelings on that of the group. The group is the basic unit of survival, whereas *Individualists* define themselves independently from the group. They believe they can stand and fall on their own (Hui & Triandis, 1986). Lastly, being individualistic or collectivistic has an impact on communication: *Individualists* communicate directly, while *Collectivists* are said to communicate indirectly (Hofstede et al., 2008). These findings were also corroborated by the meta-analysis done by Oyserman et al. (2002) who identified seven domains part of being individualistic and eight-part of being collectivistic. See Table 2.2

Table 2.2: Domains of Individualism and Collectivism by Oyserman, Coon, and Kemmelmeier (2002)

Individualism	Collectivism
Independence	Relatedness
Goals	Belonging
Competition	Duty
Uniqueness	Harmony
Private	Advice seeking
Self-knowing	Context-dependent
Direct communication	Hierarchical
	Group-oriented

After revising their initial research of 1980, G. Hofstede et al. (2010) determined the extent to which 96 countries were *Individualistic* or *Collectivistic*. Moderately *Individualistic* countries are India, Arab countries, and Central Europe, *Individualistic* countries are North America, West- and North Europe. *Collectivist* countries are Central America, Pakistan, Indonesia, and China. Moderately *Collectivistic* are Latin America, Africa, Latin and Balkan Europe. Hofstede also concludes that individualism and collectivism is related to wealth, with richer countries being more individualistic. There are two exceptions to this: Japan, wealthy but collectivistic, and India, less wealthy but individualistic. The ranking determined by Hofstede is not always valid. Saying every Pakistani is more individualistic than a person coming from India is incorrect. It is better to determine the level of individualism or collectivism of individuals by having them fill in a survey than based solely on their origin.

The characteristics of the cultural dimensions will be used to explain the results of the research in section 5.2. Furthermore, it will be used to define variants of the PGDPs relevant for both *Individualists* and *Collectivists* in the next paragraph.

2.2. Persuasive Game Design Principles

PGDPs, as used in gaming, find their origin in persuasive technology: a digital product or interactive information technology designed to change what we think and do (Fogg, 2003). Many principles exist to make technology persuasive, as can be seen by the lists of principles defined by various researchers. The three most well-known are Fogg (2003), Cialdini (2001) and Oinas-Kukkonen and Harjumaa (2008). Fogg (2003) has described seven steps or design principles that can be used during the design of persuasive technology. These are 'Reduction', 'Tunneling', 'Customisation and tailoring', 'Suggestion', 'Self-monitoring', 'Surveillance' and 'Conditioning'. His research forms the basis others built upon. Cialdini (2001) defined six principles of persuasion which were explained in the introduction. Oinas-Kukkonen and Harjumaa (2008) listed another 28 persuasive design principles. These principles are often used in combination with one another and implemented in software (Oinas-Kukkonen & Harjumaa, 2008). However, these principles are for persuasive technology in general, not necessarily for games. Orji et al. (2014) did research to determine what the ten most used persuasive design principles are in gaming.

2.2.1. Ten most used PGDPs according to Orji et al. (2014)

Orji et al. (2014) based their work on research from Fogg (2009) and Oinas-Kukkonen and Harjumaa (2008) and their own research. Having done a literature review, they were able to determine which ten persuasive design principles are most used in persuasive games. These PGDPs are listed in Table 2.3. They use these principles in their own research on tailoring persuasive games to improve their effectiveness. The PGDPs were represented on storyboards and shown to respondents. The respondents could indicate how much each principle would persuade them had it been in a real persuasive game. As stated previously, Orji et al. could then determine which PGPDs were preferred by people with different personality types (Orji et al., 2017), player types (Orji et al., 2018; Orji et al., 2014), and cultural backgrounds (Orji, 2016). For unknown reasons, they used the six principles of persuasion defined by Cialdini (2001) in their research using different cultural backgrounds, instead of their own ten most used PGDPs.

Table 2.3: Ten most used PGDPs according to Orji, Vassileva, and Mandryk (2014)

Name PGDP	Description
Competition	Competition strategy allows users to compete with each other to perform the desired behaviour.
Comparison	Comparison provides a means for the user to view and compare their performance with the performance of other users.
Cooperation	Cooperation requires users to cooperate (work together) to achieve a shared objective and rewards them for achieving their goals collectively.
Customisation	Customisation is a strategy that provides the user with an opportunity to adapt the system's contents and functionality to their needs or choices.
Personalisation	Personalisation offers system-tailored content and services to its users, based on a user's characteristics
Praise	Praise applauds the user for performing the target behaviour via words, images, symbols, or sounds as a way to give positive feedback to the user.
Reward	Reward offers virtual rewards to users for performing the target behaviour.
Simulation	Simulation provides the means for a user to observe the cause-and-effect linkage of their behaviour.
Self-monitoring	Self-monitoring (also called Feedback) allows people to track their own behaviours, providing information on both past and current states.
Suggestion	Suggestion strategy suggests certain tasks (for achieving favourable behavioural outcomes) to users during system use.

The principle ‘Cooperation’ stands out because it is two-fold. Players need to work together and are also rewarded for doing so. None of the other principles include a reward for doing what the principle indicates. For example, players do not get rewarded for competing or for monitoring themselves. To bring ‘Cooperation’ at the same aggregation level as the other principles, it will be defined as follows in this thesis:

Cooperation: Cooperation requires users to cooperate (work together) to achieve a shared objective

It should be noted that if research were to be done using solely persuasive games for complex systems, it is possible other PGDPs come out as being widely used. However, due to time restrictions, only a small number of persuasive games for complex systems could have been analysed, which would influence the results. Moreover, the games that would have been access would all have been created by the TU Delft Gamelab, as these are all created by the same group of designers, it is possible that the game share some similarities. This would bias the results as well. The research by Orji et al. (2014), while with games in general, used a broad selection of games, from different origins. Therefore, the PGDPs that come forward as most used are more valid than if they came from a smaller selection.

While not researching persuasive games for complex systems to determine what the widely used PGDPs in them are is the better option for this research, it remains a limitation which will be discussed in section 5.2.1.

2.2.2. PGDPs relevant for collectivistic cultures

Aaker and Maheswaran (1997) argues the importance of cultural background in persuasive processes. Using this as a steppingstone, Khaled, Biddle, et al. (2006) pointed out that the PGDPs named by Fogg (2003) are used by, aimed at, and developed by *Individualists*. This is also the case for the list developed by Orji et al. (2014). In other words, the principles are not aimed at groups, which *Collectivists* relate to more. Khaled’s research, using the game *Smoke*, showed that other principles than Orji’s were better for *Collectivists*. These PGDPs are explained in Table 2.4.

Table 2.4: PGDPs for Collectivists according to Khaled et al. (2006)

Name PGDP	Description
Harmony	Harmony involves presenting social density cues to users. The cues serve to suggest to users that they are in a socially dense environment with members of their in-group, in order to promote harmonious actions that support group goals.
Group Opinion	Group Opinion involves providing users with the opinions of other in-group members or users similar to them at moments when they are required to make important decisions related to their own goals.
Monitoring	Monitoring involves tracking behaviour that users wish to change and making this information available to other trusted group members. In appropriate situations, the group members act as mentors, using the information to support users and keep them motivated to change their behaviour.
Disestablishing	Disestablishing concerns training users out of practising specific actions or behaviours that they do not want to perform. It focuses on the weakening of undesirable behaviours by triggering self-selected reminder cues when undesirable behaviour is detected.
Team Performance	Team performance concerns tracking the behaviour of individuals constituting a group. It rewards or reprimands all members of the group on the basis of the actions of each individual that are related to a group goal.

Similarly, to the principles enumerated by Orji et al. (2014), these principles are most relevant for games for healthcare where players need to be helped take on or abandon a habit. The principle 'Disestablishing' is, in essence, a training by giving feedback when a player shows the behaviour that he/she is not supposed to have. Persuasive games for complex systems do not aim to influence people in such a way. Therefore, the principle 'Disestablishing' is not a widely used PGDP for persuasive games for complex systems.

2.2.3. PGDPs relevant for Individualists and Collectivists

The lists of PGDPs described above are either aimed primarily at individuals or at groups. In games for healthcare, *Individualists* are more persuaded by PGDPs aimed at individuals, and *Collectivists* are more persuaded by PGDPs aimed at groups (Khaled, Biddle, et al., 2006). In order to verify whether this is true for persuasive games for complex systems, PGDPs aimed at individuals and groups must be compared. Therefore, a list must be compiled consisting principles having two versions: one aimed at individuals, one at groups. This will be done by merging the list of Orji et al. (2014) and that of Khaled, Biddle, et al. (2006) and expanding it where needed. Indeed, as will be shown, some principles overlap. In those cases, the de-

scription given by Khaled is the PGDP aimed at a group, and the description given by Orji is the PGDP aimed at an individual. The cases without overlap are PGDPs described by Orji as being aimed at individuals, a variant aimed at groups will then be defined.

The PGDPs that overlap in the list of Orji et al. (2014) and Khaled, Biddle, et al. (2006) are the following:

Praise, Reward and Team performance

These PGDPs are about giving positive or negative feedback to (groups of) players either by giving them something they can use in the game (money) or with words and images (thumbs up pop up saying 'good job). The three terms do not cover all sides of the principle. 'Praise' and 'Reward' are positive while 'Team performance' is positive and negative. 'Praise' and 'Reward' are for individuals, 'Team Performance' on the other hand, is for groups. 'Praise' uses words and images, while 'Team performance' and 'Reward' is giving something valuable in the game. The relationships between the principles are made clear in Table 2.5. In order to answer the research question, it is not necessary to know whether positive or negative feedback is best. Therefore, the principles linked to criticism and punishment will be left out of the remainder if this research.

Table 2.5: Different versions of the PGDPs Praise, Team performance and Reward

		Using words and images	**Using something valuable for gameplay**
Positive	**Individual**	Praise for individual	Reward for individual
	Group	Praise for group	Reward for group
Negative	**Individual**	Criticism for individual	Punishment for individual
	Group	Criticism for group	Punishment for group

Suggestion, Harmony and Group Opinion

These PGDPs are to direct players to do certain actions in the game. 'Harmony' directs the group towards group cohesion, whereas 'Suggestion' and 'Group Opinion' are about directing players in the game itself. Furthermore, in the case of 'Group opinion', the advice is indirect as it corresponds to showing what other player did in a situation, while the game provides direct recommendations in 'Harmony' and 'Suggestion'. To clarify the principles and show that they are linked, they are renamed as shown in Table 2.6. The same table also shows the relationships between various subtleties to this principle. For example, the facilitator giving suggestions to an individual on how to progress in the game was previously called 'Suggestion' and is now called 'Progress suggestion by facilitator to individual'

Table 2.6: Different versions of the PGDPs Suggestion, Harmony, and Group Opinion

		By facilitator	By individual	By group
About progress	To individual	Progress suggestion by facilitator to individual (Previsously: Suggestion by Orji	Progress suggestion by individual to individual	Progress suggestion by group to individual (previously: Group opinion by Khaled)
	To group	Progress suggestion by facilitator to group	Progress suggestion by individual to group	Progress suggestion by group to group
About cohesion	To group	Conformity suggestion by facilitator (Previsouly: Harmony by Khaled)	Conformity suggestion by individual	Conformity suggestion by group

Self-Monitoring and Monitoring
Both are aimed at providing a track-record. 'Monitoring' allows the team to use the information to guide a player, whereas 'Self-monitoring is personal. For clarity, 'Monitoring' will be renamed to 'Group-monitoring'

The remaining principles are 'Customisation', 'Personalisation', 'Comparison', 'Competition', 'Cooperation' and 'Simulation'. Note that these are all originating from Orji's list, meaning all PGDPs listed by Khaled already had a counterpart aimed at individuals in one or more principle from Orji. They are analysed and sub-divided into a variation aimed at individuals and aimed at groups.

Cooperation
Cooperation encourages participants to work together and is therefore already a PGDP aimed at groups. Individuals can be made to cooperate with one another, and groups can be made to cooperate with one another. A variant solely aimed at individuals of this PGDP would be to encourage players not to work together, which is very rarely done in games for complex systems. The variant aimed at individuals is not a widely used PGDP relevant for persuasive games for complex systems, whereas the variant aimed at groups is.

Simulation
Simulation entails showing cause and effect and the link to reality. There is no reason to believe that individualistic cultures are more susceptible to cause and effect than collectivistic cultures, or the other way around. However, the PGDP can focus on showing some causes and effects and some links with reality differently than others. In other words, it can be that group processes or elements pertaining to the group are made to stand out through the use of simulation, making it aimed at groups. This variant will be called 'Group-based simulation'. Similarly, the simulation can put more focus on the process's individuals go through, than on what happens to the group. This variant aimed at individuals of the PGDP will be called 'Individual-based simulation'. Both variants are widely used PGDPs

Competition
Competition can either be between individuals or between groups. Both variants are relevant for persuasive games for complex systems and are widely used.

Comparison
As defined by Orji et al. (2014), comparison is aimed at individuals. One player compares itself to one or more other player(s). A version aimed at groups means groups compare themselves with other groups. It is a relevant principle for any game where players are put in groups. It is also possible for a group to compare itself with an individual and vice versa, but this is less common.

Customisation
Customisation allows players to adapt the content of the game to their choices. As such, it is not aimed at either individualistic or collectivistic cultures. A variation aimed at individuals of this PGDP is one where each individual can customise their game-play. In the same way, a variation aimed at groups is that groups can customise their game-play. The variations will be named ‘customisation for individuals’ and ‘customisation for groups’

Personalisation
The content of the game is tailored to the characteristics of the player. Similarly to customisation, ‘personalisation for individuals’ and ‘personalisation for groups’ are the versions aimed at individuals and groups of the PGDP.

2.3. Conclusions

In summary, there are many ways to qualify culture. Hofstede et al. (2010) defined multiple cultural dimensions to do so. Of these dimensions, the most valid and most used is the individualism-collectivism scale (Minkov, 2018). *Individualists* are characterised by having loose ties between people, by being independent, and valuing uniqueness. *Collectivists*, on the contrary, value strong ties between members of groups, they, therefore, have a stronger sense of duty (Oyserman et al., 2002).

This shows in the differences between PGDPs as listed by Orji et al. (2014), which come from individualistic cultures, and the PGDPs listed by Khaled, Biddle, et al. (2006) aimed at *Collectivists*. Both types are relevant for persuasive games for complex systems. By merging the principles from both lists, and specifying variants aimed at individuals and aimed at groups, the first sub-question of this research can be answered. In order to stay close to existing research on persuasiveness and to be able to compare results, no research was done to find principles that are not widely used in healthcare but would be in games for complex systems. In other words, principles whose persuasiveness have not been researched previously will not be investigated during this research.

The answer to the first sub-question ‘What are widely used PGDPs relevant for persuasive games for complex systems?’ are the principles found in Table 2.7. An overall name was given to two variants for clarity. For example, ‘Praise’ encompasses ‘Praise for Individuals’ and ‘Praise for Groups’. Not all principles can be tested in this research because they are too numerous. In the following chapter, a selection will be made taking into account the game that will be used for the research.

Table 2.7: Widely used PGDPs relevant for persuasive games for complex systems and their variants aimed at individuals and groups

PGDP	**Variant aimed at individuals**	**Variant aimed at groups**
Comparison	Comparison between individuals	Comparison between groups
Competition	Competition between individuals	Competition between groups
Cooperation	none	Cooperation between individuals
		Cooperation between groups
Customisation	Customisation for individual	Customisation for group
Monitoring	Self-Monitoring	Group-Monitoring
Personalitation	Personalisation for individual	Personalisation for group
Praise	Praise of individual	Praise of group
Reward	Reward for individual	Reward for group
Simulation	Individual-based Simulation	Group-based Simulation
Suggestion	Progress suggestion by facilitator to individual	Progress suggestion by group to individual
	Progress suggestion by individual to individual	Progress suggestion by facilitator to group
		Progress suggestion to individual to group
		Progress suggestion by group to group
		Conformity suggestion by facilitator
		Conformity suggestion by individual
		Conformity suggestion by group

3

Experimental Design

In the following chapter, the experimental design will be described in order to answer the second sub-question of this research. The question is: *What are good parameters for an experiment measuring the effectiveness of PGDPs?*. As explained in the first chapter, the experiment consists of a persuasive game for complex systems, and a survey containing storyboards to determine to what extent the participants were persuaded by the PGDPs of the game. The survey also includes questions to determine the degree to which each participant is *Individualistic* or *Collectivistic*.

The design of the experiment starts with choosing a persuasive game for complex systems and adapting it for the participants of the experiment. In the second section, the choice of PGDPs to test will be explained. Section 3.3 describes how the storyboards were designed, and section 3.4 the surveys that were used. Finally, the complete procedure of the experiment is explained.

3.1. Choosing and adapting a game to use in the experiment

Designing a game for complex systems takes a considerable amount of time. The system needs to be understood, macro cycles and micro cycles need to be designed, game mechanics found, play testing organised, balancing done, and more. Because of this, it fell outside of the scope of this research to develop a game from scratch. A working game was needed and was selected from the list of existing serious games created by the TU Delft Gamelab. The chosen game influences the results, as it will use PGDPs in a different way than another game might. This is a necessary limitation of the research and will be discussed further in section 5.2.3.

The existing game that is used is the game Maritime Spatial Planning Challenge (MSPC), a table-top strategy game aimed at policymakers in the field of maritime spatial planning, development of sustainability and short sea shipping. The table-top game is based on a computerised game with the same name. It was developed by the same team for a convention about short sea shipping during the EU Presidency of the Netherlands in 2016. The goal of the

game is for players to experience the dynamics between maritime spatial planning and short sea shipping. The game aims to persuade the players of the necessity of long-term planning in maritime spatial planning. MSPC can be played by up to 30 players and can be played in one to four hours. The game is explained into more detail in the following paragraph.

3.1.1. Game-play of MSPC

MSPC is led by two facilitators who start by introducing the reasons for which the game was designed and how it evolved before explaining the rules. The participants are then organised into three groups. Each group corresponds to one of the three countries represented on the board: Bayland, Peninsuland or Island. The board is visible in Figure 3.1 and in Appendix C.7.

Each player is then assigned a specific role, either that of a planner, or of a sea-bound industry such as a fisher, an energy producer, an NGO etc. There are a dozen possible roles per country to choose from in the game provided by the designers. The players are given a large selection of square flat tokens representing different activities, functions or inhabitants of the sea. These tokens are to be put on the board, depicting the map of the fictive RICA sea, thereby signifying the activity takes place in that specific area. Economic activities must then be linked to a nearby port using string, symbolising the shipping lanes needed to transport people or resources to and from the area. The shipping lanes cannot go through marine protected areas, wind farms, or energy zones. Other pins can be used to make corners in the string.

Figure 3.1: Board of MSPC, 2019

Example

A ‘Local’ wants to have a scuba diving possibility near a coral reef for tourists. They select the token representing ‘Scuba diving’ and put in on the desired location on the board. Because the tourists need to be able to get to the coral reef in question to scuba dive, a shipping lane must be put on the board using string. The player takes the appropriately coloured string, in this case the ‘Nautical tourism and recreation’ one and ties it to the pin in the ‘Scuba diving’ token on one side, and to the nearby ‘Marina’ token on the other.

Comparable to the situation in the real world, stakeholders/players are not given turns in which

they can act. Rather, everyone can interact with the board and with each other at all times. Using real world logic, players can build anything on the board. They need to share what they are doing aloud with the rest of the players for transparency. Players are encouraged to discuss their plans with others before actually implementing them. The board (just as the sea in real life) is limited in size, meaning players will be in each other's way when placing activities. Conflicts arise that must be solved using real world arguments.

The planners have a slightly different role than the other players. They look at the country as a whole and try to streamline the process of organising the sea. They can do this in different ways: by monitoring what other players are doing, persuading them to work towards a certain goal, implementing legislation to restrict sea usage, encouraging players using subsidies, mediating conflicts, coordinating with other countries, and any other strategy they want. There are two planners per country as this is a demanding and important role.

The game lasts for a previously determined amount of time, which can be between one and four hours. Intermediate debriefs can serve to help players regroup, evaluate the situation and make changes in their strategy. In the end, a longer debrief is held where participants reflect on the complexity of maritime spatial planning.

3.1.2. Recruiting Participants

Preferably, the participants are the people that would play and benefit from the game in reality as well. Those people have the background information needed to understand the game fully and know how it relates to real-world challenges. However, it was not possible to set up such a game session because the time it would require to find people from all the different industries willing to make time to play the game was not available. The developers of the game also had no game session planned in the time window in which this session needed to take place, that could be profited from. The next best thing for a researcher is using university students, mainly because they are more easily accessed. Preferably, the students would have an affinity with the system presented in the game, so they understand the subtleties involved and see how the game relates to the real-world. Another requirement is that the participants have different cultural backgrounds in order to measure various levels of individualism and collectivism.

The director of the master program Engineering and Policy Analysis (EPA) was contacted to recruit participants. This resulted in the game being played during the orientation week of the EPA master program. Approximately 65 students from different backgrounds participated in the orientation week. As there is one version of MSPC to our disposal and two facilitators are needed per session, only one game session could be held at the same time. In coordination with the organisers of the orientation week, it was decided to hold two sessions lasting two hours each, meaning one hours of actual game-play, with 30-35 players at a time.

The use of students, the game time and the number of players per session is not ideal. It would have been preferable to use people from the maritime industry that have the appropriate background knowledge, have the players play for a minimum of two hours to ensure that conflicts arise and the necessity of planning becomes more apparent, and play with a maximum of 20 players so all players experience MSPC enough. These are considered as limitations of the experiment.

3.1.3. Adapting MSPC to students

Over the years, the game has been expanded to allow for the many industries of the sea to play a part. The version provided by the developers for the research includes 16 roles per country.

People confronted with maritime spatial planning on a regular basis have enough knowledge for all the roles to make sense. Students, however, will be overwhelmed if all possibilities and corresponding information are given to them. Therefore, MSPC must be simplified and adapted. Luckily, the game is very flexible. The advice of one of the designers of MSPC, Xander Keijser (Rijkswaterstaat), was used to decide what should be changed. Furthermore, in order to test the changes, two test sessions were held. The sessions are described in Appendix A.1.

The main difficulty was finding the balance between simplifying MSPC enough so students with no background know what is expected of them, and keeping enough complexities and conflicts so planning is necessary to do well.

After the test sessions the following adaptations were made:

- Reducing the initial amount of 16 roles to 6 roles: planner, fisher, environmentalist, energy producer, shipper and local/tourism. These are the most important roles and summarise some of the initial roles. The descriptions of the roles given to the players can be found in Appendix C.2;
- Giving each role of each country a specific goal to reach. As a results, the players had an indication if they were placing enough tokens compared to other players. The goal were written on the aforementioned Role Descriptions ;
- Leaving out the different policy viewpoints of the three countries;
- Adding rounds, lasting five minutes each, representing one year, in which the number of tokens players can place is limited. This gives rhythm to the game-play and simulates the time necessary set up and build the activities. The building limits are role and country specific and can be found on the aforementioned Role Descriptions;
- Using the time in between rounds to let the facilitator give suggestions to players;
- Adding opportunity maps to guide players in where certain activities make more sense (eg, location of birds to be protected), these can be found in Appendix C.4;
- Including an intermediate debrief to direct the players in the right direction by making them evaluate themselves.

These decisions are described in more detail in Appendix A.2. All the game necessities can be found in Appendix C.

Unfortunately, it was not possible to organise a test session to verify all of the adaptations, meaning the game could still go differently than wanted. More importantly, the adapted game was never tested at full capacity with all roles of all countries filled. Therefore, it could not be ensured the balancing was right. It is not easy to find enough participants for such a session in the available time frame. Ideally, the real experiment would only be organised once it has been sufficiently tested, but this is not a possibility as most research projects are restricted by financial and time limits.
After having adapted the game to students, the rest of the experiment could be designed. This meant choosing PGDPs to portray in the storyboards that would be shown to the participants.

3.2. Selecting PGDPs to test based on MSPC

As stated previously, it is not possible to test all widely used PGDPs for persuasive games for complex systems listed Table 2.7 because they are too numerous. Further selection was done

based on MSPC. The game was analysed to determine which PGDPs are currently helping to persuade players of the necessity of long-term planning. It is necessary to understand the game thoroughly in order to determine which PGDPs are included. This was complicated as it was not possible to organise a game session in which the game was played with the right number of players. The two test sessions were with six or seven players in stead of the 30 that would play during the experiment. This made analysing the game harder that ideal.

As stated before, the PGDPs are embedded in MSPC differently than in other games, the results can therefore not be translated to any other persuasive game for complex systems.

MSPC is a game with a lot of interaction between players. Some PGDPs, such as cooperation and competition, rely heavily on interaction between players. However, these are difficult to control in MSPC, meaning it is difficult to ensure players have similar experiences with that specific principle. For example, during the game, there is no way of knowing players will compare themselves with over player, or with other groups; and when they do, what they compare: progress on the board or the process of getting things done (PGDP: Comparison). One way to exercise control over the PGDP is to make sure they go through the facilitator. The facilitator can ensure a PGDP is implemented. For example, the facilitator can take a moment during the intermediate debrief to encourage players to look at how the others are doing and to share how they are solving problems, thus ensuring comparison takes place.

Using primarily facilitator driven PGDPs in the experiment means it is possible to control when players are confronted with them. The timing of the principles can be adjusted to when they are needed by the players. PGDPs that are purely between players will not be tested because it is harder to control whether they happen in the game.

All PGDPs listed in Table 2.7 were evaluated. Three PGDPs that are present in the game, can be directed by the facilitator, and help get the persuasive message across are Praise, Suggestion and Comparison. The detailed analysis of the other PGDPs can be found in Appendix B.

Praise

There are different ways of giving praise: using words, using symbols, using sounds etc. In MSPC, praise is primarily given by the facilitators to individuals or groups using words. Praise can be given to players or groups that plan ahead, or players or groups that communicate their plans with one another. The facilitator can choose to praise an individual or the group while all players are listening, for example during the intermediate debrief, or on a more private level.

Furthermore, it should be noted that not all praise helps to get the persuasive message across. Players can also be praised for using all tokens at hand, thereby taking into account the complexity of the system, or for respecting certain rules.

Suggestion

Various actors can give suggestions: individuals, groups and facilitators. As previously stated, due to the nature of MSPC, PGDPs implemented by the facilitator will be researched. Furthermore, the PGDP 'Conformity Suggestion to groups' has no counterpart aimed at individuals, making it unfit for this research. Accordingly, the remaining options for 'Suggestion' are 'Progress suggestion to individuals' and 'Progress suggestion to group' which will be treated together.

Progress suggestion to individuals/groups

In order to bring the message across that long-term planning is necessary, the facilitator can give suggestions to the players to plan ahead. The suggestions depend on the challenges faced by the players. By observing how they are doing and/or asking how they think they are doing, the facilitator can give advice relevant for the problem at hand. For example, players that cannot place tokens because other players have already placed tokens in that location are advised to make plans with that other player for the rest of the game, thereby preventing conflicts from arising. Furthermore, the group can be advised to define plans as a groups: determining beforehand in what areas what players can operate.

Suggestions to individuals can be done throughout the game. Suggestions to the group are better done in the time between rounds, as the whole group can then be addressed. This is not possible while players are playing due to the hectic game-play.

Comparison

As the players play on the same board, they are able to see how they progress compared to others. Individual players can compare their progress with that of other players that have similar roles, and groups that represent countries can compare their progress with other countries. This PGDP is one that happens between players and is therefore hard to use in an experiment. However, the facilitator can ask players to compare themselves with others, or listen to other player's experience during the intermediate debrief or during the game. This way, this principle can be used in the experiment.

Conclusion

In conclusion, three PGDPs will be used in the research, each with a variant aimed at individuals, and with a variant aimed at groups. They are presented in Table 3.1.

Table 3.1: Selected PGDPs to implement in the storyboards

PGDP	**Variant aimed at individual**	**Variant aimed at group**
Praise	Praise of individual	Praise of group
Suggestion	Progress suggestion to individual (Further: Suggestion to individual)	Progress suggestion to individual (Further: Suggestion to group)
Comparison	Comparison between individuals	Comparison between groups

The PGDPs 'Praise of group' and 'Suggestion to group' will be implemented by the facilitator in between rounds. All players will therefore experience these PGDPs. Furthermore, the facilitator will give groups praise and suggestions during the rounds, which will correspond to their needs or actions at that moment. 'Comparison between groups' will be enabled by asking the different countries to talk about their experiences during the intermediate debrief. By having to listen to how the other countries are organising themselves, each group can compare themselves to the others.

The PGDPs 'Praise of individual', 'Suggestion to individual', and 'Comparison to individual' will be given on a personal level during the rounds by the facilitator to the players. However, not all players will receive either praise or suggestions because many players play the game simultaneously. It is not feasible to keep track of which players receive praise, which suggestions and which are advised to compare themselves to others, as it would necessitate a supplementary facilitator for this purpose. This could not be achieved.

3.3. Designing storyboards to test PGDPs

Next, storyboards needed to be designed. Participants will get to see the storyboards depicting PGDPs after having played MSPC. These storyboards are used to let them indicate to what extent each principle persuaded them of the necessity of long-term planning in maritime spatial planning.

Guidelines for design by Truong et al. (2006)

In order to design the storyboards, the guidelines on story-boarding provided by Truong et al. (2006) are studied. Truong advises starting with understanding the people that will be confronted with the storyboards. What is their background and experience, especially vis-a-vis the system they will be presented with? Then, designing itself can start. Truong advises brainstorming with a group to close in on a story to depict in each storyboard. The story can then be split up into sections, each corresponding to a frame of the board. Each section should be described using one simple sentence. If that is not possible, sections should be merged or split apart further. It is possible that in this stage it becomes apparent the initial story-line needs to be changed.

3.3.1. Determining story-lines to by portrayed in the storyboards

Understanding the background of the participants

The storyboards will represent PDGPs that participants have experienced in the game or are variations of what has happened in the game. The participants are students of the EPA Master of the Technical University of Delft in the Netherlands. These students do not have a background in serious game design or psychology. Consequences being that the PGDPs need to be represented broadly and clearly. No very specific nuances and details should be added.

Establishing story-lines corresponding to PGDPs

The story-line of the storyboards could be based on how each principle is present in the game, and how it helps get the persuasive message - the importance of long-term-planning in maritime spatial heading - across. The stories were kept as general as possible, not referring to a specific role, country, or element. In the time window available, it was not possible to find a person than had an understanding of MSPC and PGDPs to brainstorm with. The process of defining story-lines was therefore less effective. Table 3.2 shows the chosen story-lines.

Table 3.2: Story-lines for storyboards corresponding to each PGDP

Name	Storyboard story-lines
Praise of individual	Facilitator praising a person for having a plan for multiple rounds from now on
Praise of group	Facilitator praising a group for having a plan for multiple rounds from now on
Suggestion to individual	Facilitator suggesting to a player to decide on an end goal
Suggestion to group	Facilitator suggesting to a group to decide on a strategy
Comparison between individuals	Individual comparing themselves to another player and thinking 'that person is doing well, I should try playing in a similar way.'
Comparison between groups	Group comparing themselves to another group and thinking 'that group is doing well, we should try playing in a similar way'

The story-lines of the PGDPs are short, therefore, it is not necessary to spilt the storyboard into multiple frames.

3.3.2. Arranging the storyboards

Truong et al. (2006) advises limiting the use of text when designing storyboards. Text should only be used to increase understanding, as it can bias the participants. Similarly, using elements to indicate the passing of time should be avoided as the reader often find that confusing. Some boards include a rendering of the reader. This should only be done when the storyboard is about the interaction between the reader and the system depicted. If the board only depicts some technical details, adding the reader in the board is not necessary. Furthermore, the level of detail in the pictures should be minimal, only sufficient to show relevant features. The storyboards were tested by a test panel to ensure they could be understood. The test panel was shown the storyboards after having played MSPC.

The main difficulty in arranging the storyboards is choosing a scenario the represents the PGDP, which occurs in the game, and that can be understood by players even if they have not experienced it themselves in that exact way. For example, the facilitator can give different suggestions to the players in order to persuade them of the importance of long term planning in maritime spatial planning. For instance by advising them to think beforehand of other players they will interact with and talk with that person, or by advising groups to divide themselves in two, one group building tokens in that round, the other planning for the next round. It is difficult to design the storyboard in a way that it represents both situations, but is still specific enough for participants to recognise the event.

In the cases of the storyboards representing the variations of Praise and Suggestion, the storyboards need to be about a specific situation, they need to be explicit about what it is the players are praise for, or the suggestion that is given. This may have an effect on how the storyboards are understood by the participants. In section 4.4.3, the interpretation of the storyboards will be described, the results will be discussed in section 5.1.3.

3.3.3. Presenting the storyboards

Players from different countries in the game are indicated with different colours. The facilitator is represented in black. See Figure 3.2

Figure 3.2: Representation of players from different countries (blue, orange and green) and the facilitator (black)

Players with different roles are indicated with a letter as can be seen in Figure 3.3. Each letter corresponds to a specific role. F = fisher, E = Environmentalist, P = Planner, L= Local

Figure 3.3: Representation of players with different roles, F: fisher, E: environmentalist, P: planner, L: local

The storyboards are as follows:

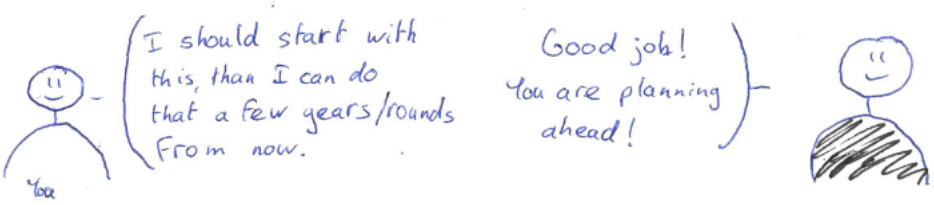

Figure 3.4: Storyboard representing the PGDP 'Praise of individual'

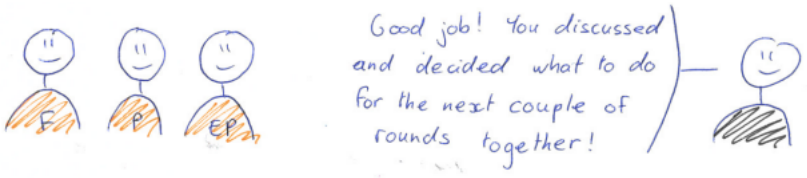

Figure 3.5: Storyboard representing the PGDP 'Praise of group'

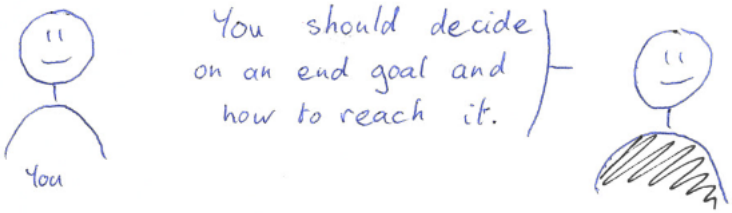

Figure 3.6: Storyboard representing the PGDP 'Suggestion to individual

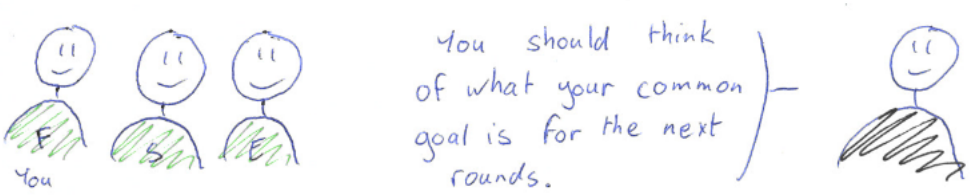

Figure 3.7: Storyboard representing the PGDP 'Suggestion to group'

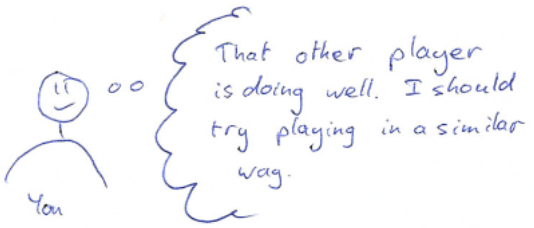

Figure 3.8: Storyboard representing the PGDP 'Comparison between individuals'

Figure 3.9: Storyboard representing the PGDP 'Comparison between groups'

3.4. Surveys for evaluation

The surveys used to collect data to answer the research question consist of several components: measuring *individualism* and *collectivism*, measuring the perceived persuasiveness of the game, and measuring the perceived persuasiveness of the PGDPs presented in the storyboards. The choices made concerning these components are treated in this section. The pre-game survey and post-game survey can be found in D.

3.4.1. Measuring Individualism and Collectivism

To the knowledge of the author if this report, there is currently to no agreed upon way to measure *Individualism* or *Collectivism* in literature. There are multiple strategies possible to determine the cultural background of participants.

- Asking the participants to state their country of origin;
- Describing individualism and collectivism and asking the participants to what extent they recognise themselves in each;
- Using a survey with multiple questions that allow to determine to what extent the person in *Individualists* or *Collectivistic*.

The choice was made to use surveys. Indeed, while countries as a whole can generally have a certain degree of *individualism* or *collectivism* (G. Hofstede et al., 2010), each individual from that country can have a different degree of *individualism* or *collectivism*. Therefore, the strategy of asking the country of origin of participants was not chosen. Furthermore, when participants are to pinpoint whether they are *individualists* or *collectivist*, they may be biased towards one of the two options, thereby influencing their choice.

Surveys use constructs that lead to a score in *individualism* and *collectivism*. The constructs consist of many factors that, together, indicate to what extent a person is individualistic or collectivistic. The disadvantage of surveys is that they need more time to be filled in and to be analysed. Nevertheless, it remained the better option.

Thereupon, a survey needed to be selected. Literature established that there are many possible scales to choose from, none of which is currently accepted is the better one. Three scales were evaluated: the Individualism – Collectivism Scale of G. Hofstede et al. (2010), the Horizontal and Vertical Individualism and Collectivism Scale (HVIC) by H. Triandis (1995), and the Auckland Individualism Collectivism Scale (AICS) by Shulruf, Hattie, and Dixon (2007).

The survey developed by G. Hofstede et al. (2010) is not suitable because it is aimed at measuring the differences between groups, not the level of individualism or collectivism of individuals. Furthermore, the HVICS (H. Triandis, 1995) is not selected because it differentiates between vertical and horizontal individualism and collectivism, thereby adding an extra element of complexity to the analysis. The AICS has the advantages that is based on the domains pertaining to individualism and collectivism identified by Oyserman et al. (2002) (also described in section 2.2). Of the 15 domains, 5 proved to be significant and unrelated to one another, these are: Competitiveness, Uniqueness and Responsibility, relating to individualism and Advice and Harmony, relating to collectivism. As a consequence, it is possible to look further, at the effect of the underlying domains, rather than only *Individualism* and *Collectivism*. Moreover, the questions ask participants to react to the frequency to which they show a certain behaviour rather than how much they believe in a principle. According to Shulruf et al. (2007), this is more reliable. Indeed, one can agree with a statement, but not act by it, making the frequency of action the more relevant question. As a consequence, the AICS will be used.

The AICS survey consists of 30 items with a 6 point-Likert scale ranging from never or almost never to always. The questions can be found in D.2.

The factor structure represented in Figure 3.10 below Shulruf et al. (2007) will be used to calculate the score of each participant on the five domains calculated, resulting in *individualism* score and a *collectivism* score. The standardised scores can then be compared to one another. If a person scores higher on *individualism* than *collectivism*, they are *individualistic*, and vice versa for *collectivism*.

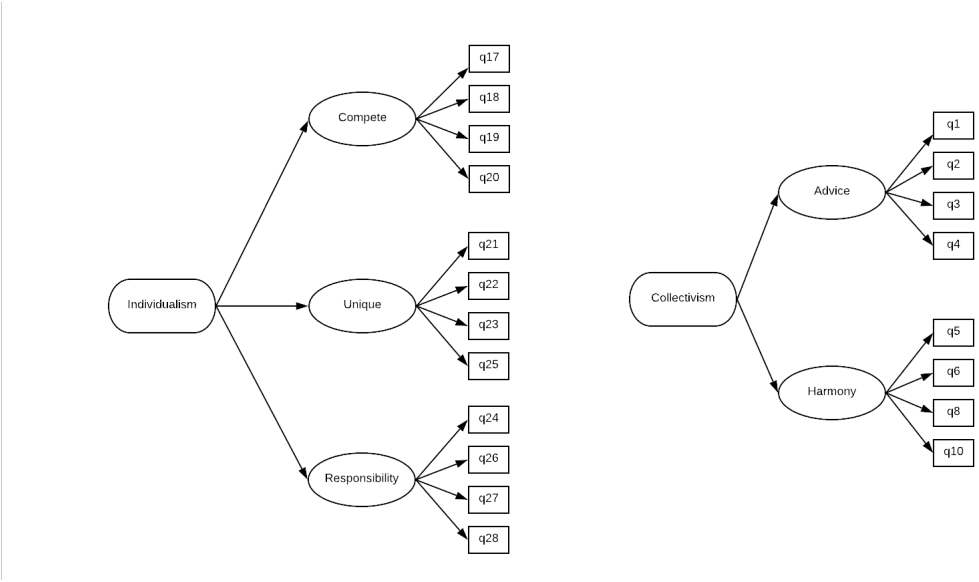

Figure 3.10: Higher Order Factor Structure of the AICS (Shulruf, Hattie, & Dixon, 2007)

However, Shulruf et al. (2007) do not define a minimum score needed to be qualified as either *Individualistic* or *Collectivistic*. As the scores are standardised compared to the other score of the particular sample, the scores are relative to one another. For example, if the group is mostly *individualistic*, individuals that are in fact *Individualists* but are relatively *Collectivistic* compared to the sample, will be qualified as *Collectivistic*. Shulruf et al. (2007) does not raise this issue and therefore does not propose a way to deal with it. As a consequence, it be considered a limitation of this research.

Furthermore, by labelling people as either *individualistic* or *collectivistic*, one neglects that some people might not fall in either category. A person could score similarly on both *individualism* and *collectivism*. Shulruf et al. (2007) and other researchers do not elaborate on what to do in those cases.

Therefore, in cases where the *individualism* score and *collectivism* score are close to one another, the person will be labelled 'neutral'. The maximum difference in *individualism* and *collectivism* score will be determined based on the results of the survey. The result will be that only the responses of participants that are notably *individualistic* or *collectivistic* will be taken into account when computing the degree to which they are persuaded by different variations of PGDP.

3.4.2. Measuring Perceived Persuasiveness

The goal of persuasive games is to encourage attitude or behavioural change. However, measuring attitude change is a very complex issue best left to psychologists. Perceived persuasiveness has a positive impact on the intention someone has to use the system (Drozd, Lehto, & Oinas-Kukkonen, 2012). Therefore, the research will concentrate on the perceived change in attitude, in other words, on how much the players say they believe their attitude could/has changed. Before determining whether the PGDPs were persuasive, it is necessary to compute whether the persuasive game for complex systems itself was perceived as such. Indeed, if the game is not persuasive, there is no reason to believe the PGDPs in the game were persuasive. If they had been, the game, in turn would have been persuasive.

Perceived persuasiveness of the game

The persuasive message of MSPC is the necessity of long-term planning in maritime spatial planning. In order to evaluate the change in attitude, questions will be asked to determine the attitude of participants towards long-term planning before and after playing MSPC. A side effect of asking questions before players have played the game is that it may influence their behaviour during the game. This is accepted as a limitation of the research.

> **Example of a survey influencing how a play a game**
> The persuasive game '*Where is buddy*' is a picture game to reflect on one's listening skills. The players initially do not know the game is about listening and believe it is solely on communication. They realise the importance of listening because they fail at the game when they do not. However, when a survey is handed out beforehand asking questions about their attitude towards listening, players realise they should be listening in the game.

In order to minimise the effect of the pre-game survey, the question asked to measure the attitude towards the importance of long-term planning in maritime spatial planning will be accompanied by two other questions. These questions are related to the game but do not correspond to the persuasive message of the game. Only the reaction to the statement on long-term planning (marked bold) will be used to determine whether the game has led to an attitude change. A t-test will be used to calculate whether the attitude towards the necessity of long-term planning in maritime spatial planning has changed significantly.

The participants will be asked to what extent they agree with the following statement using a 7-point Likert scale will be used ranging from 1 = 'Strongly disagree' to 7 = 'Strongly agree'. The three statements are as follows:

- **To what extend do you think users of the sea should have a long-term plan for how they want to use the sea?**
- To what extend do you think maritime spatial planning is necessary?
- To what extend do you think different users of the sea should discuss their goals with one another?

In addition to measuring attitude change, the players will be asked whether they have learned something by playing MSPC, and if so what, or why not. The players will also be asked what message was conveyed to them through MSPC if so, what or why not. Asking these questions is a more in depth way of learning what the players took away from MSPC. The responses will also be compared to the attitude change to discover if there are discrepancies between what players report and what is measured. This information can be used to evaluate the value of self-reporting which is also used with the storyboards. If the results from the measured attitude change are very different from what players indicate themselves they have learned, it means the results used to compute the persuasiveness of the PGDPs, which also stems from what players report themselves, should be taken lightly.

Furthermore, the participants are asked both what they learned and what message was conveyed to them because some players may already know the lesson MSPC tries to teach. These players will indicate they did not learn anything from the playing MSPC. Also asking what they feel MSPC tried to convey to them solves this problem. Moreover, some players might feel the game tried to convey a certain message, but learned something different or vice versa. By asking about message learned and message conveyed, all possibilities are covered.

Questions for perceived persuasion of the PGDPs

In the survey, the players are shown the six storyboards presented in section 3.3.2. The questions asked are based off of those used by Orji et al. (2014) in their research using storyboards to determine persuasiveness.

First, it is necessary to ascertain whether the storyboard is understood how it is meant. This is done by asking the participants to describe the scenario depicted. By analysing the responses, cases where the storyboard was not understood should be discarded. Orji also asks participants to select the name of the design principle from a list of design principles. This is not done to limit the size of the survey and to prevent the participants from being steered in one direction, only understanding a storyboard as a result of possible titles. Only asking participants to describe the storyboard already indicates whether they have understood it.

In order to measure the perceived persuasiveness of each PGDP (portrayed through the storyboards), the following questions were asked:

- This scenario influenced me in believing that long-term planning is necessary in maritime spatial planning
- This scenario convinced me that long-term planning is necessary in maritime spatial planning

Participants answered using a 7-point Likert scale ranging from 'Strongly disagree' to 'Strongly agree'. The two questions are treated as a construct to measure perceived persuasiveness, meaning the average of the responses is the perceived persuasiveness. The validity of the construct is tested using Cronbach's alpha.

When the persuasiveness of the six PGDPs as perceived by individualists and collectivists are known, they will be compared to one another. The comparisons will be used to determine:

- Whether the variant aimed at individuals or aimed at groups is preferred by a group with a specific cultural background
- Whether individualists or collectivists are most persuaded by a specific variant of a PGDP
- What PGDP is most effective overall for a group of a specific cultural background

The significance of the difference will be calculated using a t-test, or if the samples are too small, a Mann-Whitney test.

Note: originally, the goal was also to differentiate between results from players indicated that they had experienced the PGDP and those that had not. However, because the sample sizes were small, the difference was not made. The question is still visible in the survey filled in by the participants.

3.5. Procedure of game sessions

The game sessions start by welcoming the participants and asking them to fill in the pre-game survey online on their mobile phones. When the participants are done, the presentation starts in which MSPC is explained. The presentation can be found in C.1. The presentation starts with a video explaining the concept of maritime spatial planning. Then the basic rules of the game are explained: the board, the countries, the roles, the placing of tokens, the spanning of string, the rounds and the goals. The six roles are presented in more detail to help the

players immerse themselves in the maritime world. The presentation is ended by explaining the opportunity maps and information given by the board such as the scale of the tokens, the wind direction and the borders between countries. Only then are the players handed out keycords with cards indicating what country and role they will play (see C.6). Because of the size of the groups, many roles are doubly occupied. In order to reduce the number of people at the board, the rule was instituted that only one person of every role was allowed at the board. Players are given five to ten minutes to read the cards describing their roles in detail C.2, find out what tokens are relevant for them, and think of a strategy. They are also encouraged to talk to other players to discuss their plans.

Two facilitators direct the game, one takes care of the questions the players have, keeps track of time, ensures the rules are followed and gives suggestions and praise to individuals and groups. In order to verify what interventions are done (how many times is an individual praised, what type of suggestions are done, etc) the facilitator is recorded. If necessary, the audio recording is later used in the results. The second facilitator is in charge of the opportunity maps: keeping track of which are requested by the players and handing them out the following round. Furthermore, the second facilitator is asked to regularly take pictures of the board so the evolution of the sea can be analysed at a later stage.

After the players have thought about possible strategies, the actual playing starts, the players can start putting tokens on the board, building maritime activities and linking them to nearby ports. Four rounds, each lasting five minutes are held. In between the rounds, small breaks are held during which the facilitator can redirect the group if necessary and make suggestions as to what they could be doing. After the first four rounds, a short intermediate debrief is held. During the debrief, participants are asked to reflect on how they have been doing and how they could improve on that. Suggestions are done by the facilitator. These suggestions can be about the need of making long-term plans and discussing these with others, working together with people from other countries that have the same role, thinking who might prevent your plans from happening and discussing that with them early on.

The game then resumes for another four to five rounds. Afterwards, a general debrief is held to discuss the experiences. The focus of the debrief is not only on the details of the game but also on the process and group dynamics that emerged. The explanation of the rules, game-play, and debrief takes between 90 minutes and two hours, depending on the length of the plenary sessions.

This concludes the game-session part of the experiment. The post-game survey is then handed out electronically, using a QR code the participants can scan with their phones. The survey consists of the AICS questions, the questions to evaluate the overall persuasiveness of the game, and the storyboards to measure the perceived persuasiveness of the PGDPs. The survey takes 15 minutes to fill in.

3.6. Conclusions

This section summarises the important decisions described in this chapter in order to define good parameters for an experiment measuring the effectiveness of PGDPs. This is an answer to the second research question: *What are good parameters for an experiment measuring the effectiveness of PGDPs?*

Because of the dynamics involved in persuasive games for complex systems, it can be complicated to measure the effect one single element of the game has, in this case, the persua-

siveness of a PGDP. By using storyboards depicting the PGDPs, participants will be able to indicate to what extent each PGDP has persuaded them of what it is the game in question wants to persuade them of. The participants play a persuasive game for complex systems beforehand to experience the PGDPs and their persuasiveness. The PGDPs that will be tested rely on the game that is used for testing. They need to be present in the game for the players to pick up on them.

The design of the storyboards should align with how they are present on the game, and made a clear and neutral possible so the participants understand what is depicted without being distracted, which is hard to achieve. The perceived persuasiveness of the PGDPs is measured by asking the participants to what extent the scenario shown in the storyboard influenced them in believing the persuasive message of the game, and to what extent it convinced them of the persuasive message of the game.

The surveys in which the storyboards are included should also have questions to measure the persuasiveness of the game as a whole. If the game is not persuasive, it can not be expected the PGDPs f the game are persuasive.

For this research, the game MSPC was chosen. It was first adapted so it was playable by the students who would participate in the experiment, which need to be guided more than the usual players of the game due to there lack of experience in the system. The PGDPs in the game that would be analysed are Praise, Suggestion and Comparison each subdivided into a variant aimed at individuals and a variant aimed at groups.

4

Results

In the following chapter, the results of the research are described. Data was collected through by observing the players during the game sessions, and the use of two surveys as described in Chapter 3. One survey was filled in by the participants prior to playing MSPC, and the other after playing the game. First, a general assessment of the game sessions is given, describing how the game sessions went and what the characteristics of the participants are. Then, the persuasiveness of the game as a whole is determined, followed by the persuasiveness of the PGDPs Praise, Suggestion and Comparison specifically as perceived by *Individualists* and *Collectivists*. This last section is the answer to the third sub-question: *How effective are the PGDPs as perceived by individualists and collectivists?*

4.1. General assessment of game sessions

This section describes the setting of the game session, the characteristics of the participants, the evolution of the first game session and the changes necessary as a results of the first session to make the second session easier to understand for the players.

4.1.1. Setting of game sessions

The game sessions were held during the orientation week of the EPA master programme of TU Delft, in Ommen in the Netherlands. The participants had already spent their previous afternoon and evening playing serious games and were ready for another day of serious games, one of which was MSPC. The day started with splitting up the group into two; one would play MSPC in the morning, the other in the afternoon. The game sessions took place in a renovated cow stable that had sufficient place for the large board, and three additional tables to stall the necessities of the three countries (role descriptions, tokens, etc), as partially visible in Figure 4.1.

Figure 4.1: Board and room setup for game sessions

4.1.2. Characteristics of participants

A total of 64 people played the game MSPC. Of those 64, 57 filled in the pre-game survey and 51 the post-game survey. After merging the two surveys and deleting the information from the surveys that were not filled in, the answers from 50 participants remained. Note that one player did fill in the post-game survey but not the pre-game one, and 7 filled in the pre-game survey, but not the post-game one.

From this group, 21 participants were females and 29 males. The minimum age was 20 and the maximum 34, with the average being 23.4. This information is also shown in Table 4.1. All participants are students starting with their master EPA at the TU Delft. Because of this, the assumption is made that none have knowledge on the sector of maritime spatial planning as it is not part of their curriculum. Because the participants are similar on these accounts, the sample can be considered as primarily homogeneous. Therefore, it can be assumed that the variables ‘Gender’, ‘Age’ and ‘Occupation’ do not influence other variables.

Table 4.1: Characteristics of participants

	Male	Female	Other
Gender	29	21	0
	Minimum	Maximum	Average
Age	20	34	23.4

4.1.3. Evolution of the first game session

The players were eager to start experimenting with the board and tokens and dive into the world of maritime spatial planning. Especially in the first session, this meant the players did not plan and discuss with one another but started placing tokens on the board and discovering possibilities as they went. Therefore, it took multiple rounds before the players fully understood what was expected from them.

The main reason students struggled was their lack of knowledge of the maritime world. This made it difficult for them to think about how problems they faced would be solved in real life and use that in their game-play. For example, students would place windmills very close to fishing areas, not realising a buffer area is needed between the two. Because they did not see this as an issue, not many conflicts arose and planning was not as paramount as should be.

Ignoring the rules in play

Furthermore, students had a hard time respecting some rules. The rule dictating only one person of each role was allowed near the board was hardly respected. After being reminded of that a couple of times by the facilitator, a whole 'country' was sent back to their table for the remainder of the round. This served as a warning for all players afterwards and the rule was respected. The other rule that was not respected was the break between rounds. Initially, it was instituted to allow the facilitator to say things to the group. However, the players were so focused on the task at hand -placing tokens and linking them with string- that they did not stop playing when asked. The rule was therefore not enforced, as it would have cost more effort than was worth. The suggestions were shouted so they could be heard by all players.

4.1.4. Adapting MSPC for second game session

After the first session, the facilitators held a small evaluation session to discuss possible changes to the game. It had taken long for the players to understand what has expected of them. It had taken a lot of energy to guide the players, which could not be put into observing the effect of the PGDPs. A couple of small changes were agreed upon. First, the tables of the countries were placed further away from the board to spread out the noise. Chairs were placed around the tables to make the players sit during the explanation of the rules, making them more attentive. The result was that the players had more questions before starting to play, these could be dealt with the whole group, instead of during the game and on an individual basis. The groups, therefore, had a better understanding of what they had to do. It also encouraged them to stay around their country-tables more and discuss things with one another.

Furthermore, the first round was changed. In the first session, the players could start putting tokens on the board directly. They were given individual goals to reach, they wanted to utilise every round fully and place to a maximum number of tokens each time. Because of this, they hardly made plans before acting on them. Therefore, for the second game session, players were not allowed to place tokens on the board in the first round. They were instructed to take the time to think of a strategy as a country and decide how they were going to organise themselves. Accordingly, many questions were asked about the game that could be answered and heard by all players.

As a result of the above-mentioned changes, the players had a better understanding of the rules and had already thought of how they were going to play.

Furthermore, an attempt was made to increase the chances of conflicts occurring. One of the reasons conflicts did not arise is that the sea could not be filled up within an hour due to the size of the playing field. Hence, the scale of the tokens and the board was changed. Initially, one token had a size of 10 nautical miles, this was changed to 1 nautical mile. As a result, more space is needed between tokens of different activities. For example, more than one nautical mile distance is needed between fishing grounds and a fossil fuel mining field. The players needed to have at least 1 nautical mile distance between two 'clashing' activities.

The board filled up slightly faster, but not enough to lead to conflicts. Part of the reason is that the players did not apply the rule consistently and many 'errors' were found on the board.

As the two sessions were different, the data should be analysed to verify whether the data can be merged. If the sessions are too different, the players were persuaded to different degrees, merging the data would make the results unreliable. This will be described in section

4.2.

The figures below show players playing MSPC and the board at the end of a game session.

Figure 4.2: Players playing MSPC during the first game session

Figure 4.3: Board at the end of the second game session

4.2. Merging the data of the first and second game session

Of the 50 participants that filled in both surveys, 28 took part in the first session and 22 in the second. In essence, the difference between the two sessions is the timing of the suggestion to make a plan as a group. In the first session, players were suggested to do so after the intermediate debrief, while in the second session they were suggested to do so in the first round (during which they could not build anything on the board) as a results of the changes made described in section 4.1.4. Therefore, it cannot be denied that the two sessions were different. Consequently, the data should be analysed to verify whether it can be merged. This is done by looking at the change in attitude towards the necessity of long-term planning in maritime spatial planning.

Participants were asked to what extent they believe in the necessity of maritime spatial planning prior to playing MSPC and after having played MSPC. The change in attitude of the two sessions can then be compared to one-another using an independent-samples t-test.

There was not a significant differences in the change in attitude of first session (M = 0.50, SD = 1.575) and the second session (M = 0.68, SD = 1.460) conditions; t(48) = -0.418, p = 0.678. Therefore the data from the two sessions can be merged and analysed as one whole for the remained of the research.

4.3. Persuasiveness of MSPC as a whole

Before being able to analyse the persuasiveness of the separate PGDPs, it is necessary to know whether the game itself was persuasive. If the game was not effective in changing the attitudes of the players towards maritime spatial planning, it cannot be expected that the PGDPs were effective either. The persuasiveness of the game as a whole is based on what the players say they learned, followed by an analysis of their attitude change towards the persuasive message of the game: the necessity of long term planning in maritime spatial planning.

4.3.1. Observed persuasiveness of MSPC

During the two game-sessions, it was possible to observe a learning curve in the players. They started out focusing on placing tokens on the board, not thinking of consequences of their actions. This was partly because they did not understand the world simulated by the game fully. While playing they learned more about maritime spatial planning in general and how they could play the game MSPC and started to organise themselves efficiently. The intermediate debrief especially helped them realise the importance of taking one step back before placing activities on the board. In other words, they starting planning more.

One group that played in the first game-session shared during the debrief that they started out by 'winging-it', and only started understanding what was necessary after a three to four rounds. The two other group of that session had similar experiences. Because it took a while to grasp how to play, the players of the first session hardly worked together with players of other countries despite this being suggested. They therefore did not experience making plans with different types of groups, but remained mostly within their countries. Nevertheless, the players did plan more at the end of the session than in the beginning.

The groups of the second session had a slightly different experience because they were not allowed to place tokens during the first round and could only make plans. While not all groups were able to follow the plans they initially formulated, all groups got more efficient each round. One group had difficulties organising themselves, the planners taking a very hands on approach in stead of managing the group, as a result when they did try and take a step back and make plans with he whole group, they were not listened to. The players were used to making plans on an individual basis in stead of doing this as a group. Furthermore, as the whole group had started planning early on, they did follow the suggestion to work together with other countries, either as individuals, or as countries, forcing them to plan ahead more.

In conclusion, the observations suggest that the participants were persuaded by the game of the importance of planning in maritime spatial planning.

4.3.2. Perceived message taught and conveyed by MSPC according to participants

In order to determine what the participants perceived they had learned from playing MSPC and what message they perceived the game wanted to convey to them, two questions were asked. These questions were (1) whether they had learned anything from playing MSPC and (2) whether MSPC had conveyed a message. As shown in Table 4.2, 22% of the participants indicate they did not learn anything from the game, while 78% did. 26% did not feel the game conveyed a message, while 76% did. Moreover, Table 4.3 shows the percentage of participants that both learned something and were conveyed a message through playing MSPC (72%),the percentage of participants that neither learned something, nor were conveyed a message (20%), participants that did learn something, but were not conveyed a message

(6%) and vice versa (2%).

Table 4.2: Percentage of participants having learned something or having been conveyed a message by MSPC

	Yes	No
Did you learn something through playing Maritime Spatial Planning Challenge?	78 %	22 %
Did the game convey a message to you?	76 %	26 %

Table 4.3: Overlap between learning something and being conveyed a message

	Were conveyed a message	Were not conveyed a message
Learned something	72 %	6 %
Did not learn something	2 %	20 %

Beside the yes or no questions, participants were asked to explain what they had learned and what message was conveyed to them. The main message of each response was extracted in order to be evaluated. The 36 responses of the participants that indicated they had learned something or a message had been conveyed to them. In 15 cases, what a participant learned was the same as what they believed the game conveyed. In 19 cases it was not the same, and in two cases, one of the questions was not answered.

As a result, the responses from the two questions are described separately. The graphs below show what was learned and what message was conveyed. A detailed explanation can be found in E.1. As can be seen Figures 4.4 and 4.5, in most cases the participants learned the importance of planning in maritime spatial planning, which is the message the designers wanted to come across. Interestingly, two participants argued that not having a plan is better in maritime spatial planning. This is probably a result of the chaotic nature of the game, players could have had to change their plans because they could not be executed. This shows those players did make plans, but not in consultation with other players.

Figure 4.4: Message learned as perceived by participants

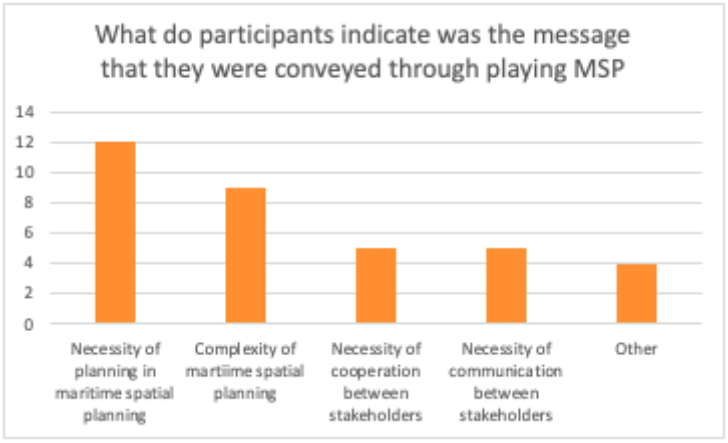

Figure 4.5: Message conveyed by MSPC as perceived by participants

Moreover, the reasons given by participants for not having been able to learn anything or not having a message conveyed to them were analysed, these can also be found in E.1. The two main reasons were (1) that the game was too easy because players already knew how to act, and (2) the game was too chaotic and players had trouble understanding the rules.

4.3.3. Attitude change towards the necessity of long term planning in maritime spatial planning

As explained it section 3.4, the attitude change of the players towards the necessity of long-term planning in maritime spatial planning is measured prior to playing the game, and after having played it in order to determine attitude change. A 7-point Likert scale was used where 1 means 'Strongly Disagree' and 7 'Strongly agree'.

The significance of the difference between before and after playing was calculated using a paired sample t-test. As presented in Table 4.4, there was a significant attitude change towards the necessity of long term planning in maritime spatial planning prior to playing (M=5.69, SD=0.196) and after playing (M=6.16, SD=0.005) conditions t(48)=-2.473, p=0.017.

Table 4.4: Average attitudes towards the necessity of long term planning in maritime spatial planning prior and after having played MSPC

	Prior to playing	After playing	Sig (2-tailed)
Mean range 1-7)	5.69	6.16	0.017
Standard deviation	0.196	0.157	

4.3.4. Discrepancies between message learned by participants and attitude change

The responses of the participants to the question about what they learned by playing MSPC and the measured attitude change are compared. This leads to the following discrepancies: 10 participants indicated they neither learned something nor were conveyed a message. Of these 10, six have an improved attitude towards the necessity of long-term planning as a result of playing MSPC. In other words, these participants did not realise the game had conveyed a message to them. Furthermore, 2 participants showed a decline in their attitude towards the necessity of long-term planning in maritime spatial planning but did indicate they had learned something, and a message had been conveyed to them. 13 participants showed no improvement in attitude towards the necessity of long-term planning but did say they had learned

something, and a message had been conveyed.

4.3.5. Conclusion

Despite the discrepancies, both the results from what participants reported was the message they learned or had been conveyed and the attitude change as a results of playing MSPC show that the MSPC is indeed persuasive. Therefore, the persuasiveness of the separate PGDPs Praise, Suggestion and Comparison can be analysed.

4.4. Determining the persuasiveness of the three PGDPs

In order to measure the persuasiveness of the PGDPs it is necessary to evaluate if the construct used to measure the perceived persuasiveness is internally consistent (section 4.4.1), compute the cultural background of the participants (section 4.4.2), and evaluate the degree to which the storyboards where understood as they were meant (section 4.4.3).

4.4.1. Evaluating the construct for measuring the persuasiveness of a PGDP

The persuasiveness of the PGDPs is measured with two items: (1) ”The scenario influenced me in believing that long term planning is necessary in maritime spatial planning and” (2) ”The scenario convinced me that long term planning is necessary in maritime spatial planning”. A 7-point Likert scale is used. The internal consistency of the two items is computed for the six PGDPs. In all the cases Cronbach’s alpha is above 0.7. This means the two items can be used as a construct to measure the persuasiveness of the PGDPs. The specific Cronbach’s alphas can be found in Appendix E.2.

4.4.2. Cultural background

The *Individualism* or *Collectivism* of some players was visible during the game. Some players were always surrounded by others, discussing plans, possibilities, helping one another. These players were primarily occupied by ensuring their whole country did well. Other players did not follow the group but operated on their own, they would not take part in group discussions but would be near the board, silently placing tokens. This does not mean that they did not communicate with others, but took part in discussions relevant to their own situation. These players were focused more on their personal goals that the goals of the country as a whole.

As explained in section 3.4.2, the AICS factor structure is used to calculate the *individualism* and *collectivism* scores of the participants. As Shulruf et al. (2007) did not suggest what to do when a participant had similar scores for *Individualism* and *Collectivist*, these will be label as neutral. Based on the data, the (arbitrary) decision was made to label 10-20% of the participants as ‘Neutral’. This resulted in a threshold of value of 0.20, meaning if the difference between the individualism score of a participant and their collectivism score is less than 0.2, they are labelled ‘neutral’. Otherwise, participants scoring higher on individualism than collectivism are labelled *Individualistic*, and participants that score higher on collectivism are labelled *Collectivistic*.

This results in 19 *Individualists* (38%), 24 *Collectivists* (48%) and 7 neutral participants (14%), see Table 4.5. As stated in section 3.4.1, only the results from participants notably *individualistic* or *collectivists* will be taken into account when computing the different degrees to which they perceive different variations of PGDPs as persuasive. In other words, neutral participants will be ignored.

Table 4.5: Number of Individualists, Collectivists and Neutrals having participated in the experiment

	Number of participants	Percentage
Individualist	19	38 %
Collectivists	24	48 %
Neutral	7	14 %

4.4.3. Participant's interpretation of the storyboards

Participants were asked to describe the scenarios depicted in the storyboards in order to verify whether the storyboards were interpreted how they were supposed to be interpreted. The answers to this question were analysed manually and are described in E.2. When the scenario was not understood correctly, the data was left out of further research as it is not valid. Table 4.6 shows the cases when the scenario was understood and thus used for the remainder of the research.

Table 4.6: Responses accepted as a participant having understood a storyboard as it was meant

Name of PGDP	**Responses accepted as the PGDP being understood**	**Total number of responses accepted**
Praise of individual	Facilitator praising individual Planner praising individual Individual discussing plans with planner	17 (34 %)
Praise of group	Facilitator praising group Planner praising group Group discussing plans with planner	18 (36 %)
Suggestion to individual	Facilitator doing a suggestion Planner doing a suggestion	18 (36 %)
Suggestion to group	Facilitator doing a suggestion Planner doing a suggestion	17 (34 %)
Comparison between individuals	Comparison between individuals	42 (84 %)
Comparison between groups	Comparison between groups	30 (60 %)

In four cases, participants described the storyboard 'Praise of an individual' as 'Praise of a group', describing it as either the facilitator, of the planner praising the group. However, they had not understood the storyboard 'Praise of a group' as such. Therefore, for those cases, the data from the PGDP aimed at an individual is used as data for PGDP aimed at a group, ensuring more data can be used.

4.5. Persuasiveness of the PGDP Praise

Firstly, the observations made during the game are described. Next, the data from the surveys is analysed. The persuasiveness of 'Praise of individual' is compared to the persuasiveness of

'Praise of group', as perceived by either individualists or collectivists, and the persuasiveness of each variant of Praise as perceived by individualists is compared to the persuasiveness of the same variant as perceived by collectivists.

Due to the small sample sizes (resulting from the fact that the storyboards were not understood by all participants and thus left out of further analysis), it is necessary to use a non-parametric test to determine the significance of the results. The Mann-Whitney test is used to verify whether two independent samples were selected from a population with the same distribution.

4.5.1. Observing the persuasiveness of Praise during the game

During the two game sessions, participants were praised on an individual basis, as a subgroup (their country), and as a whole group, depending on the situation at hand. Hardly any praise was given in the first half of the two game sessions because the players were still struggling to understand the game. The audio recording of what was said by the facilitator shows praise was given in the following cases:

- A group of players from the same country making plans at their table;
- A group of players from the same country thinking of what comes ahead;
- An individual for making plans with their country;
- An individual for making plans with another country;
- An individual for doing well in the game;
- An individual for how they divided tasks with their co-planner and knowing what to do next round;
- A group of players from the same country for having written down their plan;
- A person for the way they communicate with others;
- A group of players with the same role for working together;
- An individual for knowing what they are going to do in the coming rounds;
- The whole group for doing good planning throughout.

Participants reacted to the praise with smiles and nodding their heads. There were no cases in which the participant openly showed they did not understand or did not agree with the praise. This suggests that in general, the Praise was appreciated. As praise is given for showing a certain behaviour, it is hard to determine whether the behaviour was reinforced after being praised, or whether it remained unchanged. As a consequence, it was not possible to observe cases in which praising an individual was particularly effective or cases in which praising a group was particularly effective. Therefore, based on the observations during the game, no conclusions can be made as to the difference in persuasiveness of variants of Praise as perceived by *Individualists* or *.*

4.5.2. Persuasiveness of Praise based survey responses

The persuasiveness of 'Praise of individuals' and 'Praise of groups' as perceived by *Individualists* and *Collectivists* is computed. The data is presented in the box-plots in Figure 4.6 bellow. As can be seen, the data suggests, 'Praise of individual' is perceived as more persuasive than 'Praise of group' by both groups. Furthermore, it seems that, *Individualists* are persuaded more strongly by 'Praise of individuals' than that *Collectivists* are. The persuasiveness of 'Praise of individual' as perceived by *Collectivists* is spread out over a bigger range

(4-7) with an outlier at 2.5, whereas the persuasiveness of 'Praise of individual' as perceived by *Individualists* is over a smaller range (5-7). The persuasiveness of 'Praise of group' is spread out over a larger and similar range (2.5-6 when perceived by *Individualists* and 2-5.5 when perceived by *Collectivists*). Moreover they have similar medians (between 4.5 and 4.7), this makes it difficult to compare the two.

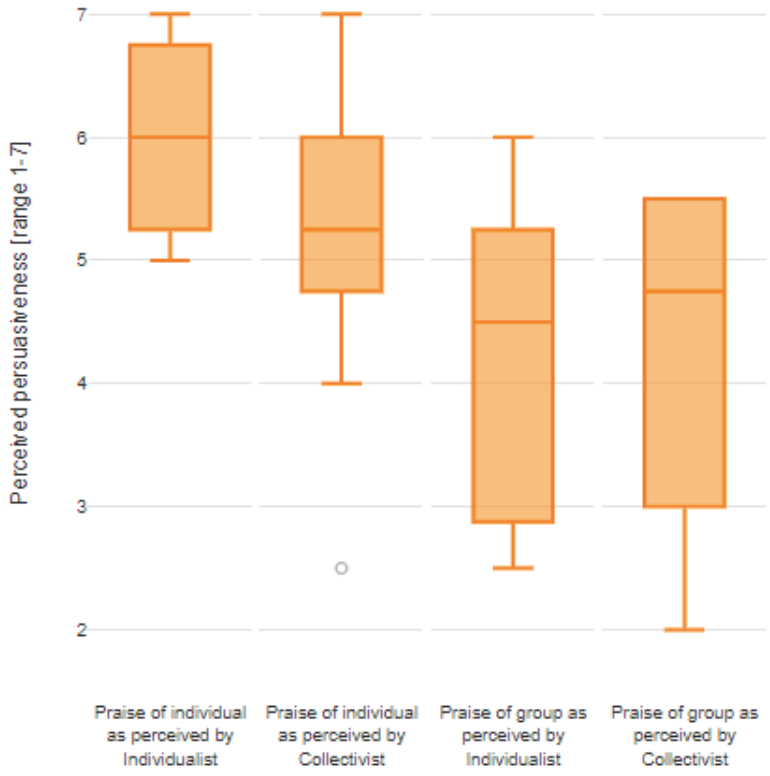

Figure 4.6: Box-plots showing the persuasiveness of the two variants of Praise as perceived by Individualists and Collectivists

In order to determine whether the trends described above are significant, statistical tests are needed. The results are reported bellow.

Comparing the persuasiveness of Praise of individual to Praise of group using statistical tests

The comparison is made between how collectivists perceive the persuasiveness of 'Praise of individual' to how they perceive 'Praise of group'. The results are in the third column of Table 4.7. The results are insignificant, meaning the Mann-Whitney test does not indicate that *collectivists* are more persuaded by 'Praise of individual' (median=5.25) than 'Praise of group' (median=4.75), U=14.5, p=0.244.

Moreover, the same comparison is made for individualists, visible in the fourth column in Table 4.7 . Here also, the results are insignificant, meaning 'Praise of individual' is not perceived as more persuasive (median=6) than 'Praise of group' (median=4.75), U=2.50, p=0.095. This is the same as for collectivists.

Table 4.7: Comparing the persuasiveness of the two variants of the PGDP Praise

		Collectivistic participants	Individualistic participants
Praise of individual	Median(Range 1-7)	5.25	6
	Mean Rank	9.29	7.17
	N	12	3
Praise of group	Median (Range 1-7)	4.75	4.75
	Mean Rank	6.13	3.92
	N	4	6
Mann-Whitney U		14.5	2.5
Exact Sig. (2-tailed)		0.244	0.095

Comparing the persuasiveness of Praise as perceived by individualists to that perceived by collectivist using statistical tests

The persuasiveness of 'Praise of individual' as perceived by *individualists* and *collectivists* is compared to one another, this corresponds to the third column of Table 4.8. Due to insignificance of the results, the Mann-Whitney test does not indicate that the persuasiveness of 'Praise of individual' was greater for *individualists* (median=5.25) than for *collectivists* (median=6), U=12, p=0.376.

Furthermore, the persuasiveness of 'Praise of group' as perceived by *individualists* and *collectivists* is compared to one another. This corresponds to the last column of Table 4.8. Again, due to the insignificance of the results, the Mann-Whitney test does not indicate that the persuasiveness of 'Praise of group' was the same for both *individualists* and *collectivists* (median=4.75 and mean rank=5.5), U=12, p=1.000.

Table 4.8: Comparing the persuasiveness of the PGDP Praise as perceived by collectivists and individualists

		Praise of individual	Praise of group
Collectivistic participants	Median(Range 1-7)	5.25	4.75
	Mean Rank	7.5	5.5
	N	12	4
Individualistic participants	Median (Range 1-7)	6	4.75
	Mean Rank	10	5.5
	N	3	6
Mann-Whitney U		12	12
Exact Sig. (2-tailed)		0.376	1

4.5.3. Conclusion

As none of the results concerning the persuasiveness of the variants of Praise are significant, the conclusions can only be based on the trends shown by the descriptive statistics. These suggest that 'Praise of individual' is more persuasive than 'Praise of group' for both *Individualists* and *Collectivists*. Furthermore, the data suggests that *Individualists* are persuaded more than *Collectivists* by 'Praise of individual'.

4.6. Persuasiveness of the PGDP Suggestion

Firstly, the observations made during the game are described. Next, the data from the surveys is analysed. The persuasiveness of 'Suggestion to individual' is compared to the persuasiveness of 'Suggestion to group', as perceived by either individualists or collectivists, and the persuasiveness of each variant of Suggestion as perceived by individualists is compared to the persuasiveness of the same variant as perceived by collectivists.

Again, the Mann-Whitney test is used to determine significance.

4.6.1. Observing the persuasiveness of Suggestion during the game

During the two game sessions, the facilitator gave suggestions to individuals, to different subgroups and to the whole group. The suggestions were mostly to direct the player(s) towards making long-term plans, thereby helping them in successfully playing MSPC. Suggestions were done throughout the sessions. The audio recording of what was said by the facilitator shows suggestion was given in the following cases:

- A group of players from the same country should discuss their plans at their own table
- A person should think ahead what possible conflicts can arise and plan ahead
- The whole group should have the people staying at the table making plans for the next rounds while the others build during this round;
- The whole group should think ahead of the roles they communicate with most often and make plans with those people;
- A person should think of what to do in the next rounds as they cannot do anything more this round;
- A planner can force the players of their country to formulate plans before being allowed to build something;
- An individual should become partners with other individuals having the same roles and makes plans together;
- Countries should discuss and make plans with one another;
- Planners should define their roles and tell the other players;
- Planners should be less hands-on and look at the situation from a distance, discussing with all the players of their country;
- Players should include the planner in their discussions;
- Two players wanting to work together should determine what they want from each-other and what they want to keep separate.

In most cases, the suggestions give to players on an individual basis were effective, the player would start to do what was suggested. Suggestions that were aimed at the whole group and given in the short time between rounds were less effective. These were not always taken on by the players. When suggestions were made to the group, some players reacted positively, while others did not react at all, which could be a result of some players being *Collectivistic* and being persuaded more by suggestions to group than *Individualists*. Furthermore, it is unknown whether suggestions given to an individual that pertained to the group were transmitted to the group and whether the group then followed the advice. In those cases, it is not known if the Suggestion was effective. Nevertheless, the observations do suggest that different people are

persuaded to different extents by 'Suggestion to individual' and by 'Suggestion to group'. As it was difficult to determine the cultural background of the players during the game-play, the observations do not indicate whether it was cultural background that lead to the difference in persuasiveness of the two variants of the PGDP Suggestion.

4.6.2. Persuasiveness of Suggestion based survey responses

The persuasiveness of 'Suggestion to individual' and 'Suggestion to group' as perceived by *Individualists* and *Collectivists* is computed. The data is presented in the box-plots in Figure 4.7 bellow. As can be seen, the responses are distributed over a large range, except for 'Suggestion to group as perceived by *Collectivists*', the range is from 2 to 6. Especially the persuasiveness of 'Suggestion to group' as perceived by Individualists shows an interquartile range between 2.5 and 5.2. Because of the large ranges, there is a large probability that the results are inconclusive, the significance will be tested using the Mann-Whitney test.

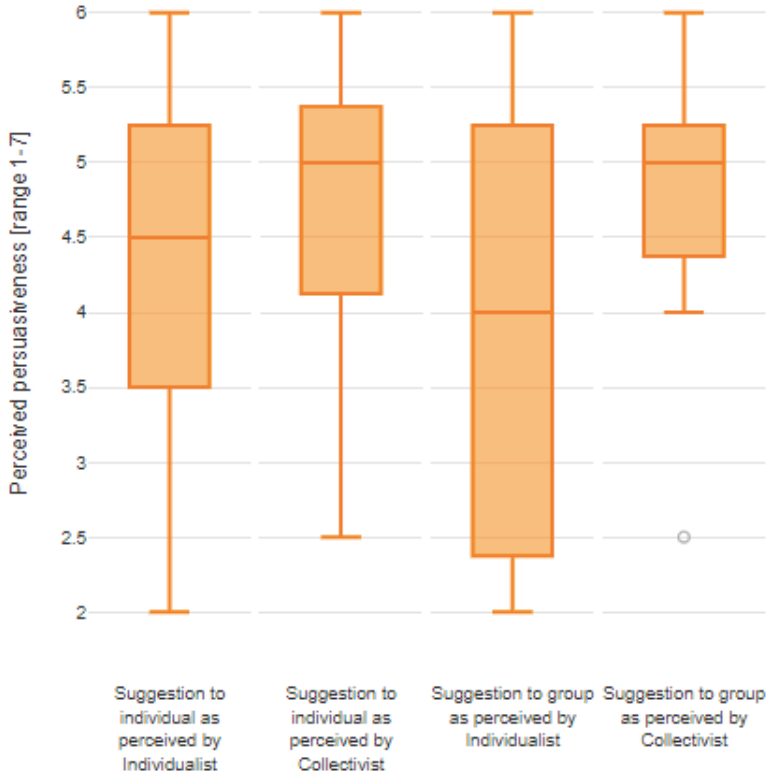

Figure 4.7: Box-plots showing the persuasiveness of the two variants of Suggestion as perceived by Individualists and Collectivists

The data shown in the box-plots suggests that in general, *Collectivists* are persuaded more by Suggestion than *Individualists* are. Indeed, the medians of the persuasiveness of both variants of Suggestion are perceived as higher by Collectivists (MD=5 in both cases) are higher than the median of the persuasiveness of the same variant as perceived by *Individualists* (MD=4,5 and MD=4).

While the median persuasiveness 'Suggestion to individual' and 'Suggestion to group' as perceived by *Collectivists* is the same (MD=5), the minimum score is higher for 'Suggestion to group'. As a result, it can be said that the trend is for 'Suggestion to group' to be more persuasive to *Collectivists* than 'Suggestion to individual'.

The median persuasiveness of 'Suggestion to individual' as perceived by *Individualists* is slightly higher than that of 'Suggestion to group' (4.5 versus 4). Furthermore, the value of the 25th percentile is higher of 'Suggestion to individual (3.5 versus 2.9). As a result, it can be said that the trend is that *Individualists* are persuaded more by 'Suggestion to individual' than by 'Suggestion to group.
In order to determine whether the trends described above are significant, statistical tests are needed. The results are reported below.

Comparing the persuasiveness of Suggestion to individual to Suggestion to group
The comparison is made between how collectivists perceived the persuasiveness of 'Suggestion to individual' and 'Suggestion to group'. The results are in the third column of Table 4.9. In this case, as the medians were the same, the mean rank needed to be examined to determine which variant of 'Suggestion' was the most persuasive. As the results are not significant, the Mann-Whitney test does not indicate that collectivists are more persuaded by 'Suggestion to group' (mean rank=8.72) than 'Suggestion to individual' (mean rank=8.21), U=29.50, p=0.827.

Moreover, the same comparison is made for individualists, corresponding to the fourth column in Table 4.9. Again, the results are not significant, 'Suggestion to group' is not perceived as more persuasive (median=4.75) than 'Suggestion to individual' (median=4), U=11.50, p=0.516. This is the same as for the collectivists.

Table 4.9: Comparing the persuasiveness of the two variants of the PGDP Suggestion

		Collectivistic participants	Individualistic participants
Suggestion to individual	Median(Range 1-7)	5	4.75
	Mean Rank	8.21	6.58
	N	7	6
Suggestion to group	Median (Range 1-7)	5	4
	Mean Rank	8.72	5.3
	N	9	5
Mann-Whitney U		29.5	11.5
Exact Sig. (2-tailed)		0.827	0.516

Comparing the persuasiveness of Suggestion as perceived by individualists to that perceived by collectivists
The persuasiveness of 'Suggestion to individual' as perceived by individualists and collectivists is compared to one another, this corresponds to the third column of Table 4.10. As the results are not significant, the Mann-Whitney test does not indicate that the persuasiveness of 'Suggestion to individual' was greater for collectivists (median=5) than for individualists (median=6), U=21, p=1.

Furthermore, the persuasiveness of 'Suggestion to group' as perceived by individualists and collectivists is compared to one another. This corresponds to the last column of Table 4.10. Again the results are not significant, the Mann-Whitney test indicated that the persuasiveness of 'Suggestion to group' was not also greater for collectivists (median=5) than for individualists (median=4), U=15, p=0.303. This is the same as for 'Suggestion to individual'.

Table 4.10: Comparing the persuasiveness of the PGDP Suggestion as perceived by collectivists and individualists

		Suggestion to individual	Suggestion to group
Collectivistic participants	Median(Range 1-7)	5	5
	Mean Rank	7	8.33
	N	7	9
Individualistic participants	Median (Range 1-7)	4.75	4
	Mean Rank	7	6
	N	6	5
Mann-WhitneyU		21	15
Exact Sig. (2-tailed)		1	0.303

4.6.3. Conclusion

As none of the results concerning the persuasiveness of the variants of Suggestion are significant, the conclusions can only be based on the trends shown by the descriptive statistics. These suggest that *Collectivists* are persuaded more by Suggestion than *Individualists*, independent of the variant of Suggestion used. Moreover *Collectivists* are persuaded more by 'Suggestion to group' than by 'Suggestion to individual'. The trend is opposite for *Individualists*, they seem to be persuaded more by 'Suggestion to individual' than by 'Suggestion to group'.

4.7. Persuasiveness of the PGDP Comparison

Firstly, the observations made during the game are described. Next, the data from the surveys is analysed. The persuasiveness of 'Comparison between individuals' is compared to the persuasiveness of 'Comparison between groups', as perceived by either individualists or collectivists, and the persuasiveness of each variant of Comparison as perceived by individualists is compared to the persuasiveness of the same variant as perceived by collectivists.

Again, the Mann-Whitney test is used to determine significance.

4.7.1. Observing the persuasiveness of Comparison during the game

As briefly explained in 3.2, the PGDP 'Comparison between groups' is implemented by having the players listening to the plans and experience of the other countries during the intermediate debrief. The atmosphere during the intermediate debrief was noisy, part participants were not listening to what the other groups had to say, but were whispering amongst themselves. Other participants did pay attention during the discussion. It is possible the participants that were listening did so in part to compare their group with the others, and that participants that were not listening were not interested in comparing themselves with the other groups. As the participants were not asked whether this this was the case for them, this will remain unknown.

Further observations did not tell to what extent participants compared themselves to other individuals, or their group to other groups. It is possible that these took place ans lead to a change in attitude towards the necessity of planning, but this was not observed. Therefore, based on observations, it cannot be stated nor denied to what extent Comparison persuaded the players of the importance of long term planning in maritime spatial planning.

4.7.2. Persuasiveness of Comparison based survey responses

The persuasiveness of 'Comparison between individuals' and 'Comparison between groups' as perceived by *Individualists* and *Collectivists* is computed. The data is presented in the box-plots in Figure 4.8 below.

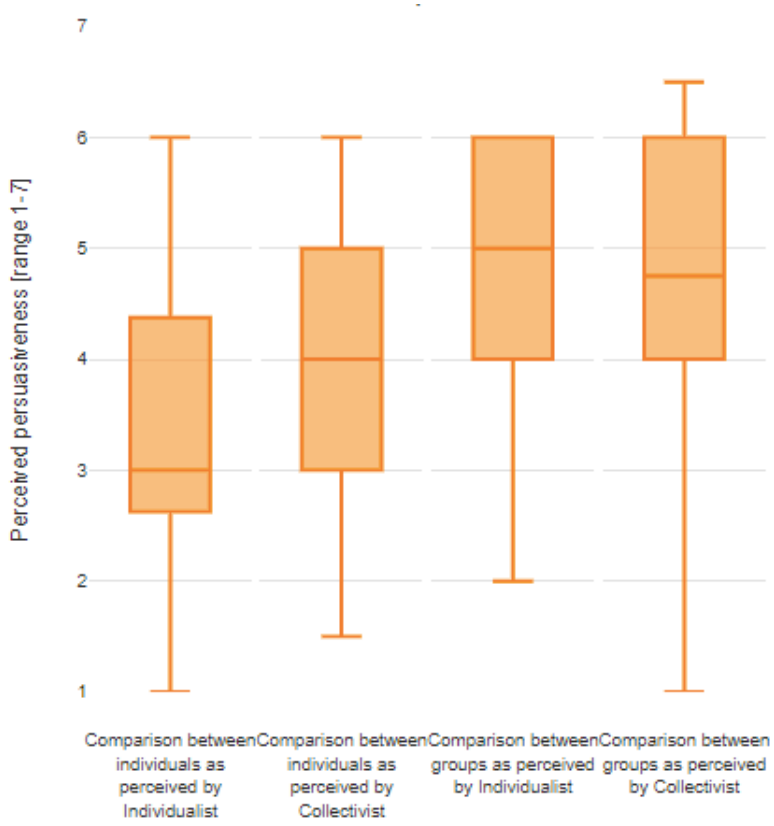

Figure 4.8: Box-plots showing the persuasiveness of the two variants of Comparison as perceived by Individualists and Collectivists

Comparing the persuasiveness of Comparison between individuals to Comparison between groups

The comparison is made between how collectivists perceived the persuasiveness of 'Comparison between individuals' and 'Comparison between groups'. These results are not significant, the Mann-Whitney test does not indicate that *Collectivists* are more persuaded by 'Comparison between groups' (median=4.75) than 'Comparison between individuals' (median=4), U=90.00, p=0.093.

Moreover, the same comparison is made for individualists, corresponding to the fourth column in Table 4.11. The results are significant, the Mann-Whitney test shows that 'Comparison between groups' is perceived is more persuasive (median = 5) than 'Comparison between individuals' (median=3), U=45.50, p=0.015.

Table 4.11: Comparing the persuasiveness of the two variants of the PGDP Comparison

		Collectivistic participants	Individualistic participants
Comparison between individuals	Median(Range 1-7)	4	3
	Mean Rank	15.29	11.03
	N	21	15
Comparison between groups	Median (Range 1-7)	4.75	5
	Mean Rank	21.08	18.5
	N	12	13
Mann-Whitney U		90	45.5
Exact Sig. (2-tailed)		0.093	0.015

Comparing the persuasiveness of Comparison as perceived by individualists to that perceived by collectivists

The persuasiveness of 'Comparison between individuals' as perceived by individualists and collectivists is compared to one another, this corresponds to the third column of Table 4.12. The results are not significant, the Mann-Whitney test does not indicate that the persuasiveness of 'Comparison between individuals' was greater for collectivists (median=4) than for individualists (median=3), U=124.5, p=0.282.

Furthermore, the persuasiveness of 'Comparison between group' as perceived by individualists and collectivists is compared to one another. This corresponds to the last column of Table 4.12. In this case also, the results are not significant, the Mann-Whitney test does not indicate that the persuasiveness of 'Comparison between groups' was greater for individualists (median=5) than for collectivists (median=4.75), U=74.5, p=0.845. This is the opposite for 'Comparison between individuals'.

Table 4.12: Comparing the persuasiveness of the PGDP Comparison as perceived by collectivists and individualists

		Comparison between individuals	Comparison between groups
Collectivistic participants	Median(Range 1-7)	4	4.75
	Mean Rank	20.07	12.71
	N	21	12
Individualistic participants	Median (Range 1-7)	3	5
	Mean Rank	16.3	13.27
	N	15	13
Mann-Whitney U		124.5	74.5
Exact Sig. (2-tailed)		0.282	0.845

4.8. Comparing the three PGDPs as perceived by Individualists and Collectivists

Despite the previous results not being significant, the data of individualists and collectivists are analysed separately in order to give an indication which PGDPs is more effective for either group. As can be seen in Table 4.13, the data suggests that individualists are persuaded

most by the ‘Praise of individuals’ (median=6), followed by ‘Comparison between groups’ (median=5. ‘Comparison between individuals’ is the least persuasive (median=3). However, the Kruskal-Wallis test determined that the differences are not significant, meaning the results cannot be assumed to be true for the whole population

Table 4.13: Persuasiveness of different PGDPs as perceived by Individualists

	N	Median	Mean Rank
Praise of individual	3	6	39.83
Praise of group	6	4.75	24.25
Suggestion to individual	6	4.75	26.67
Suggestion to group	5	4	20.5
Comparison between individuals	15	3	17.27
Comparison between groups	13	5	29.96
Kruskal-Wallis Test (Asymp. Sig)	10.424 (0.064)		

As can be seen in Table 4.14, collectivists are most persuaded ‘Praise of individual’ (median=5.25) followed by ‘Suggestion to individual’ (median=5,00) and ‘Suggestion to group’ (median=5). ‘Comparison between groups’ is the least effective (median 4).). However, the Kruskal-Wallis test determined that the differences are not significant.

Table 4.14: Persuasiveness of different PGDPs as perceived by Collectivists

	N	Median	Mean Rank
Praise of individual	12	5.25	40.18
Praise of group	4	4.75	29.5
Suggestion to individual	7	5	32.5
Suggestion to group	9	5	37.05
Comparison between individuals	21	4	25.9
Comparison between groups	12	4.75	28.14
Kruskal-Wallis Test (Asymp. Sig)	6.049 (0.301)		

4.9. Conclusions

The most important conclusions from the section above are summarised in this paragraph. This is the answer to the third research question: *What is effectiveness of the PGDPs as perceived by individualists and collectivists?*

The only significant result is that *Individualists* are persuaded more by ’Comparison between groups’ than ’Comparison between individuals’. The other results were not significant, however, trends can be observed by analysing the box-plots created with the data. These suggest that both *Individualists* and *Collectivists* are persuaded more by ’Praise of individual’ than ’Praise of group’. Furthermore, *Collectivists* are persuaded more by Suggestion than *Individualists* are, and more by ’Suggestion to groups’ than by ’Suggestion to individual’. The opposite is true for *Individualists*. Lastly, *Collectivists* are persuaded more by ’Comparison between groups’ than by ’Comparison between individuals’.

5

Discussion, Limitations and Conclusions

This chapter starts with a discussion of the results described in Chapter 4 and a discussion of the method used during this research. Next, the limitations of the research are described. In the third section, the research question as formulated in the first chapter is answered, as well as the four sub-questions. The following section describes recommendations for further research. The chapter ends with a short personal reflection.

5.1. Discussion

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5.1.1. Comparing the observed and measured persuasiveness of the three PGDPs

As it was not possible to known whether a player is *Individualistic* or *Collectivistic* during the game sessions, making it is difficult to compare the results of the observations to the results of the surveys.

When it comes to the PGDP Praise, the data from the survey suggests that 'Praise of individual' is perceived as more persuasive than 'Praise of group' by both *Individualists* and *Collectivists*. The observations, however, did not lead to any conclusions and can therefore not be compared to one another.

The observations did suggest the variants of the PGDP Suggestion were not as persuasive to everyone. This is corroborated by the results of the survey which showed *Individualists* are persuaded more by 'Suggestion to individual' and *Collectivists* more by 'Suggestion to group'. Unfortunately, the observations did not yield more details which can be compared to the survey data.

The survey data suggests that both *Individualists* and *Collectivists* are persuaded more by 'Comparison between groups' than by 'Comparison between individuals'. The observations however suggested that 'Comparison between groups' would not be persuasive for part of the group as they were not paying attention when other groups talked. This goes to showing the limits of the observations, and the necessity of more sources of data.

Nevertheless, it would have been valuable to have one person concentrate solely on observing the behaviour of the players during the game sessions. This would have resulted in more observations, which would would increase their reliability.

5.1.2. Explaining the results of the persuasiveness of the three PGDPs

In order to explain the results described in 4.5, 4.6, and 4.7, the trends founds are compared to the findings of Khaled, Barr, et al. (2006) claiming that *Individualists* are more persuaded by PGDPs aimed at individuals and *Collectivists* more by PGDPs aimed at groups. An explanation will be given in the cases where the trends are not in line with these expectations.

To the best knowledge of the writer of this report, no research has been done measuring the persuasiveness of the PGDPs Praise, Suggestion and Comparison as perceived by *Individualists* and *Collectivists*, especially not when split up into a variant aimed at individuals and at groups. Therefore, the trends found in this research cannot be compared other research.

Praise

Comparing the persuasiveness of Praise of individual to Praise of group

According to the trends described in section 4.5, both *Individualists* and *Collectivist* are persuaded more by 'Praise of individual' than by 'Praise of group'. For, *Individualists*, this is in line with the expectation. *Individualists* relate the world to them as an individual and not as a group, giving praise to them as a person is a more effective way of persuading them. However, for *Collectivists*, the results are not in line with the expectations. It was expected that 'Praise of group' is more persuasive than 'Praise of individual'. It is believed that this is because the players might not have felt included in their group.

Collectivists give a lot of importance to groups they are a part of such as their family or their community. It is logical that the ties with those types are groups are stronger than with a group of students they are assigned to play a game with. If the ties with the group are strong, one feels part of the group, therefore, when the group is addressed, it is as if oneself is addressed. However, when this is not the case, praising the group would not feel to the collectivistic individual as if they are praised. There are two reasons for which the players might not have felt included in their group. The first is that players do not know each other well and have little ties between them to start with. The second is that the groups were large. Indeed, the players were part of a country with ten others. Had the group been smaller, the players would possibly have felt a greater responsibility for the things the group is praise for.

Comparing the persuasiveness of Praise as perceived by Individualists to that perceived by Collectivists

The trends, presented in section 4.5, indicate that 'Praise of individual' is perceived as more persuasive by *Individualists* than by *Collectivists* and that 'Praise of group' is perceived as more persuasive by *Collectivists* than by *Individualists*. This is in line with the expectations.

It is interesting that *Collectivists* are more persuade by 'Praise of groups' than *Individualists* are. The previously discussed results suggested they did not feel very included in the group. In other words, even if the ties within a group are not strong, it would seem that *Collectivists* feel them more strongly than *Individualists* when the group is praised.

Suggestion

Comparing the persuasiveness of Suggestion to individual to Suggestion to group

When it comes to the persuasiveness of the different variants of the PGDP Suggestion, de-

scribed in section 4.6 , the results are in line with the expectations. *Individualists* are more persuaded when the suggestions are given to them personally, while *Collectivists* are more persuaded when the group is given a suggestion. However, the findings are not in line with the results concerning Praise.

As explained above, it is presumed that *Collectivists* are not persuaded by 'Praise of group' as much as expected because they do not feel part of the group. The results of 'Suggestion' are different as they suggest *Collectivists* do feel enough part of the group for 'Suggestion to group' to be more persuasive than 'Suggestion to individual'. As both results are not significant, and the explanations for the findings do not align, it should be assumed that for one of the two cases, the results cannot be generalised. It is most probable that the outcome not in line with the research of Khaled, Barr, et al. (2006), in this case concerning Praise, is incorrect.

Comparing the persuasiveness of Suggestion as perceived by Individualists to that perceived by Collectivists

The trend described in section 4.6 that *Individualists* are less persuaded by Suggestion to group' than *Collectivists* is in line with the expectations.

However, contrary to expectations, *Collectivists* are more persuaded by 'Suggestion to group' than *Individualists* are. It can be explained by assuming that *Collectivists* are, in general, persuaded more by Suggestion than *Individualists*. This could be because *Collectivists* are more prone to accepting help in order to reach the target set by supervisors, thereby following the norm, whereas *Individualists* are less persuaded by input from outside and want to find solutions on their own.

Comparison

Comparing the persuasiveness of the variant aimed at individuals and aimed at groups

The trend, described in section 4.7 suggest that *Collectivists* are persuaded more when they compare their group to an other, than when they compared themselves as individual to another individual. This is in line with the expectation as *Collectivists* value the group they are part of more than they value their individuality.

Surprisingly however, *Individualists* are also persuaded more by 'Comparison between groups' than by 'Comparison between individuals'. Furthermore, this is the only significant result when it come to the persuasiveness of the PGDPs. An explanation for this phenomenon is not obvious. It is possible that the claims of Khaled, Barr, et al. (2006) are not true for games for complex systems, at least not when it comes to comparison. It is also possible that this is a result of the game MSPC, that the group was more important than individuals in the game, making 'Comparison between individuals' less relevant.

Comparing the persuasiveness of Comparison as perceived by *Individualists* and *Collectivists*

The trends presented in section 4.7 indicate that *Collectivists* are persuaded more than *Individualists* by 'Comparison between individuals', which is contrary to expectations. It could be explained by assuming *Collectivists* are persuaded more by Comparison in general. This is possible as, if one values what the group does, comparing oneself to the group becomes important. However, the results also show that *Individualists* are more persuaded by 'Comparison between groups' are than *Collectivists* are. This is both contrary to expectations and contrary to the explanation that *Collectivists* value Comparison more because it allows them to adjust themselves to the group.

As both trends are not corroborated by significant results, and are contrary to one another, it should be assumed that one or both are incorrect. It should either be so that the findings

correspond to the claims of Khaled, Barr, et al. (2006), or that *Collectivists* are more persuaded by Comparison in general, or that *Individualists* are persuaded more by Comparison in general.

5.1.3. Discussing the combination of game and storyboards

In this research, the use of a persuasive game for complex system was combined with storyboards to determine the persuasiveness of the PGDPs present in the game. This method has not previously been used and is based of Orji (2016), Orji et al. (2017), Orji et al. (2018), Orji et al. (2014)'s use of storyboards.

Combining experienced persuasiveness and imagined persuasiveness

As previously explained, the method used by Orji (2016), Orji et al. (2017), Orji et al. (2018), Orji et al. (2014), having participants look at storyboard and indicate to what extent the scenario depicted would have been persuasive, has it's limits. The main limitation is that participants base their answer on how they think they would have been persuaded by the PGDP presented, instead of basing it on how they experienced it in an actual game. For this reason, in this research, participants first played a persuasive game for complex systems containing PGDPs and were then presented with storyboards showing the PGDPs in question. Therefore, they could base their answers on their experience in the game.

The participants were asked whether or not they had experienced a PGDP in the game. By doing this, the aim was to differentiate between cases when participants could base their answers of their experience and the cases where the participants had to base their answers of their imagination because they had not experienced the PGDP. However, the sample sizes became too small to keep the two groups separate in the analysis. This means that the data used to compute the persuasiveness consists of experienced perceived persuasiveness and imagined perceived persuasiveness. It could not be tested whether the two groups can in fact be merged because of the small sample sizes. It is possible data used is not reliable as a result of merging the two sets. The consequence is that the results should be verified with a large sample size making it possible to differentiate between the two groups and analysing the influence of having to imagine persuasiveness. These results would in turn shed new light on the research of Orji (2016), Orji et al. (2017), Orji et al. (2018), Orji et al. (2014) in which all claims are based of imagined persuasiveness.

Differences in interpretations of the storyboards

The data from the survey shows how few participants understood the storyboards in the way they were meant to be understood. The PGDP that was understood most is 'Comparison' which was depicted with a more general scenario than was done for 'Praise' and 'Comparison'. The disadvantage of using general portrayals of PGDPs is that they can be understood differently by the participants. There are subtle differences between how participants interpret storyboards, these differences in turn influence the validity of the results.

For example, the storyboard for 'Praise of an individual' shows a player ('you') saying 'I should start with doing this, then I can do that in a few years/rounds from now.'. The facilitator is shown to react with 'Good job, you are planning ahead'. Participant that interpreted this as the facilitator praising them when they comes for reassurance, will indicate to have been persuaded differently than participants that interpreted the board as the facilitator praising a player without being asked to do so.

As participants were asked to describe the storyboards, part of the differences are known. For instance, many participants thought the facilitator was in fact the planner. However, more

subtle differences are not described because the participants are not aware of what their assumptions are. The consequence of the various interpretations of the same storyboard is that the results are not necessarily reliable. Further research should therefore verify the influence of the portrayal of storyboards on the interpretation. Furthermore, experienced storyboard makers should be used when storyboards are to be used in larger research.

Validity of self-reporting

The participants were asked to indicate to what extend they were persuaded by the design principles shown on the storyboards. The responses are therefore a result of self-reporting. Self-reporting was also used in order to evaluate if the game was persuasive, when the participants were asked to describe what they had learned and what message was conveyed to them through the game. However, the measurements of their attitude change towards the persuasive message, which was also used to measure the persuasiveness of MSPC as a whole, resulted in different conclusions. This goes to showing the limits of using self-reporting. Therefore, it is necessary to take into account that the reported persuasiveness to a PGDP is not necessarily the same as the actual persuasiveness of the PGDP. In summary, the conclusions about the persuasiveness of the PGDPs should be taken lightly.

It must be noted that using self-reporting was done because it is the same method as used by Orji (2016), Orji et al. (2017), Orji et al. (2018), Orji et al. (2014). Another option is measuring the difference between a game being played with a specific PGDP included and without. This method is challenging in a different way because removing a PGDP often influence the playability of the game. This means it is necessary to use a game that can be played with and without that PGDP, only then can the influence of the PGDP on the persuasiveness be measured, and not the influence on the playability of the game.

5.1.4. Design recommendations for game designers

Despite the results of the persuasiveness of the different PGDPs being inconclusive, design recommendations can be made for designers of persuasive games for complex systems. As they are based on the trends found, these recommendations are to be taken lightly. This section forms tha answer to the fourth sub-question: '*What design recommendations can be made to game designers for per-suasive games for complex systems?*'

First an foremost, it should be stated that the designers should choose PGDPs in harmony with the overall experience they are creating. Including a PGDP because it is more persuasive but disturbs the game flow will not only harm the persuasiveness of the game, but also the extent to which the game represents the system at hand.

This research primarily guides designers in choosing between the variant aimed at individuals or the variant aimed at groups of the PGDPs Praise, Suggestion and Comparison dependent on the cultural background of the players. For the most part, designers will not be able to measure the degree to which the players are *Individualists* or *Collectivists* before designing. In stead, they are advised to look at the country of origin of the future players, using the research of G. Hofstede et al. (2010). As described in section 2.1.2, Hofstede ranked countries according the the degree to which their inhabitants are *Individualists* or *Collectivists*. While some individuals from *Individualistic* countries might be *Collectivistic* and vice versa, this is assumed to be the most feasible option for game designers.

According to this research. When choosing a variant of Praise to implement, 'Praise of individuals' is considered to be most persuasive by both groups, meaning this variant can be

used whenever Praise is given. When Comparison is used, this results suggest the 'Comparison between groups' is most effective, again for both groups. This variant can therefore also be used independently of the player's cultural background. When designers plan on using Suggestion, they need to take into account the cultural background of the players. For *Individualists*, 'Suggestion to individual' is most advised, and 'Suggestion to group' when the players are *Collectivists*.

Furthermore, this research does not answer the question how game designers should take into consideration the fact that some groups of players will consist of both *Individualists* and *Collectivists*. It is not an issue when using Praise or Comparison, as both groups are persuaded most by the same variant of the PGDP. However, it is not the case for Suggestion. What is more, the data suggest that for part of the *Individualists*, 'Suggestion to group' was perceived as not being persuasive at all. As little *Collectivists* had the same experience with 'Suggestion to individuals', it would seem that for mixed groups, 'Suggestion to individuals' is advisable. Nevertheless, more research should be done on the persuasiveness of PGDP a perceived by a group of players consisting of different cultural backgrounds.

Finally, when designers are to chose only one of the PGDP (variants) for a game, the trends found in the data suggest that 'Praise of individuals' is to be used for *Individualists* as well as *Collectivists*.

5.2. Limitations

In the following section, the limitations of the this research are described.

5.2.1. Widely used PGDPs in persuasive games for complex systems

In order to answer the first sub-question concerning widely used PGDPs, a literature research was executed. This literature research lead to the list of widely used PGDPs by Orji et al. (2014), which was expanded to include variants of the PGDPs aimed at individuals and at groups. It must be noted that the PGDPs on Orji's list are widely used in persuasive games in general, not persuasive games for complex systems specifically. Indeed, most persuasive games are aimed at healthcare, not persuasive games. If a list was compiled solely from persuasive games for complex systems,there is a possibility a slightly different list would have been compiled. This could possibly have lead to the recognition of another PGDP in MSPC that could have been researched.

5.2.2. Using Individualism and Collectivism to differentiate between individuals

In order to differentiate between cultures, *individualism* and *collectivism* were used in the research. However, *individualism* and *collectivism* are not accepted as valid by all researchers (Fiske, 2001; Oyserman et al., 2002). This is one of the reasons for which Oyserman et al. (2002) defined the underlying constructs upon which the AICS is later based (Shulruf et al., 2007). The underlying construct give a more detailed explanation of *individualism* and *collectivism*.

As *individualism* and *collectivism* consists of separate components, and *individualism* and *collectivism* influence the degree to which the persuasiveness of PGDPs is perceived, it can be stated that the components impact the degree to which persuasiveness is perceived. At this stage, to the knowledge of the writer of this report, it has not been researched to what

extent the underlying components influence the perceived persuasiveness of PGDPs. It is plausible that it is the underlying components of one's cultural background that explain the degree to which a PGDP is persuasive, more so than the cultural background itself.

For example, *collectivism* is a result of the components 'Advice' and 'Harmony' and more (see section 2.1.2). The results from this research suggest that *Collectivists* are more persuaded by 'Praise of individuals' than 'Praise of groups'. However, it is possible that while players that have a strong degree of 'Advice' are persuaded more by 'Praise of individuals', players that have a strong degree of 'Harmony' might be more persuaded by 'Praise of groups', or vice versa.

If it is the underlying components that influences the persuasiveness of PGDPs and not *individualism* and *collectivism* themselves, it explains why results are mitigated. For example, by using *individualism* and *collectivism*, the consequences of the distinctive components might cancel one another out. Using the above-mentioned example: by averaging the persuasiveness of 'Praise to individual' perceived by 'Advice' and 'Harmony' as being that of *Collectivists*, the effect is not significant. However, the separate effect could be significant.

Moreover, the underlying constructs of *Individualism* and *Collectivism* defined by Oyserman et al. (2002) are universally accepted in literature. Other constructs might be better to measure the degree to which an individual is *Individualistic* or *Collectivistic*, leading to different scores in the experiment of this research.
In conclusion, had underlying constructs been used, it would have been possible to pinpoint with more exactitude what influences the persuasiveness of PGDPs. Furthermore, it remains unknown what other factors influence persuasiveness of PGDPs. Orji's research shows that personality type and player types of an individual also influences the degree to which they are persuaded by PGDPs (Orji, 2016; Orji et al., 2017, 2018). In other words, research is needed to determine whether cultural background, personality type, player type or any other variable is the decisive factor to explain the degree to which someone is persuaded by PGDPs.

5.2.3. Generalisibility of the results

Certain choices were made to execute the research, these choices have consequences for the extent to which the results can be assumed to be representative of persuasive games for complex systems in general. This sub section discusses what the consequences are of using the game MSPC for the research and the influence of the facilitator.

Consequences of using MSPC

For this research, the persuasive game for complex systems MSPC was used. This choice has consequences for the results, and more specifically for the generalisibility of the results. Choosing MSPC lead to the selection of three PGDPs that are present in the game and help persuade the players of the persuasive message of the game (Praise, Suggestion and Comparison). Another game would have meant other PGDPs would have been researched. The question is whether a different game which would have allowed to research the same PGDP would have led to the same results. In order to start giving an answer to the question without needing to do experiments, the characteristics of MSPC are inspected.

MSPC is played with a large group of players. A game with less players could have consequences for the persuasiveness of the PGDP 'Comparison'. The more players are active, the more chaotic the game. This can mean an individual will not know who is doing well and who is not. The individual will not know who to compare themselves with, because there are too

many players. There is a chance this makes the PGDP less persuasive than it would have been for a game with fewer players. This is the case for 'Comparison between individuals' as well as 'Comparison between groups'.

Furthermore, the size of the group of players also has an impact on the persuasiveness of 'Praise of group' and 'Suggestion to group'. As touched upon in section 4.3.5, the group that either receives praise or a suggestion can be large as sometimes whole countries consisting of 10 players are addressed. The individual players that are part of that group may therefore not feel the praise or the suggestion is aimed at them, making the PGDP less persuasive. Therefore, there is a chance that these two PGDPs would have been more effective if they had been tested in the context of a game with fewer players and smaller groups.

Another aspect of MSPC that has impact on the persuasiveness of the PGDPs is the chaotic nature. The chaotic nature is a result of the size of the group of players, the lack of a structured game-play (for instance: players having to wait there turn before being allowed to do something), and the fact that the players cannot win the game. A result of the chaos is that players do not always know what they are doing. They might receive praise for doing things they did not intend to do, or did not know they were doing. Similarly, they might be given suggestions that are not relevant to them because they did not understand the basics yet. This has consequences for the persuasiveness of the PGDPs 'Praise' and 'Suggestion'. In a game with less chaos, that is easier for the players to understand from the beginning, 'Praise' and 'Suggestion' could have more impact because the player understand why they receive praises or suggestions. However, it is also possible that if the game is too simple, the praises and suggestions have no value to the players.

It can therefore be concluded the impact of the game itself on the persuasiveness of the PGDPs is probably not negligible.

5.2.4. Influence of facilitator

Another factor that largely influences not only the game-play but also the persuasiveness of the PGDPs is the facilitator. In MSPC, 'Praise' and 'Suggestion' were implemented by the facilitator. However, each facilitator has a different way of praising and of doing suggestions, and different types of praise and suggestions work differently for each individual. It cannot be assumed that the way this facilitator acts is representative of how facilitators acts on average. The influence of the facilitator has not been compared to that of other facilitators, meaning it is unknown what the effect is on the persuasiveness of the PGDPs.

Moreover, not all persuasive games for complex systems use a facilitator. Other games use pop-ups, scoreboards, or other ways of praising, doing suggestions and making players compare themselves. The results of this research cannot automatically be used for those situations.

Students as representation of general population

Note: this paragraph remains to be written Discuss influence of using students as test subjects? See: Chen and West (2009)

5.3. Conclusion

A popular way of getting stakeholders of complex systems around the table and discuss the challenges they face is through the use of serious games. The stakeholders play a game

simulating the complex system at hand, and thereby are given insights in the system which was previously lacking. The insights can then be discussed with all participants, leading to new collective resolutions or agreements. Oftentimes, such games aim to change attitudes and behaviour of the stakeholders towards the system; they have a subtle, indirect persuasive message. They achieve the attitude change thought the use of PGDPs. Research by Orji (2016) and Khaled, Barr, et al. (2006) indicates that, in the case of persuasive games for healthcare, players with an individualistic cultural background are more persuade by certain PGDPs than players with a collectivistic cultural background. The research aims to explore whether the same holds for persuasive games for complex systems. The following research question was formulated:

> To what extent does the effectiveness of widely used persuasive game design principles used in persuasive games for complex systems between Individualists and Collectivists?

In this section, the sub-questions that were defined to answer the main research question will be treated.

SQ 1. What are widely used PGDPs relevant for persuasive games for complex systems?

As explained in more detail in section 2.2.1 Orji et al. (2014) was able to enumerate ten widely used PGDPs through literature research. These principles, mostly used in persuasive games for healthcare but also used in persuasive games for complex systems are ‘Competition’, ‘Co-operation’, ‘Self-monitoring’, ‘Comparison’, ‘Suggestion’, ‘Simulation’, ‘Customisation’, ‘Personalisation’, ‘Praise’ and ‘Reward’. However, Khaled, Barr, et al. (2006) argue that these principles, and others listed as widely used, are used by and used for *Individualists*, see section 2.2.2 . In the way they are explained by Orji, the principles are aimed at single individuals, whereas *Collectivists* would be persuaded more by principles aimed at groups, according to Khaled. Therefore, in section 2.2.3 , each principle defined by Orji was split into two or more variants: either aimed at individuals, or at groups. The total list can be found in chapter 2 in table 2.7.

SQ 2. What are good parameters for an experiment measuring the effectiveness of PGDPs?

Measuring the effectiveness or persuasiveness of an isolated PGDP in a serious game is complex. Games are dynamic, therefore, changing one element to measure its effect often has consequences for other parts of the game. One way to deal with this is by using storyboards: visual representations of scenarios. Participants can indicate in through a survey what the effect of what is shown in the storyboard was. This method is also used by Orji (2016), Orji et al. (2017), Orji et al. (2018), Orji et al. (2014). The storyboards are combined with a persuasive game for complex systems so the participants can base their responses on their experience during game-play. This method has, to the best knowledge of the writer of the report, not been used before. More details can be found in the third chapter.

The PGDPs must be sufficiently present in the game for the players to pick up on them. In other words, the selection of PGDPs to be analysed depends greatly on the game to be used

in the research. In this case, the PGDPs were Praise, Suggestion and Comparison, each consisting of a variant aimed at individuals and a variant aimed at groups.

SQ 3. How effective are the PGDPs as perceived by *Individualists* and *Collectivists*?

As can be read in sections 4.5, 4.6, and 4.7 Due to the small sample size, the results were mostly insignificant. The only result that was significant is that *Individualists* are more persuaded by 'Comparison between groups' than by 'Comparison between individuals'.

The other conclusions had to be based on the trends founds in the data of the surveys. These are as as follows: *Collectivists* are more persuaded when they are praised as individuals than as a group. However, they are more persuaded by suggestions made to the group and comparisons between groups than between individuals. When it comes to *Individualists*, the results showed that when praise and suggestion were aimed at individuals, this was perceived as more persuasive than when they were aimed at groups.

SQ 4. What design recommendations can be made to game designers for persuasive games for complex systems?

When designers are (re)designing a persuasive game for complex systems for *Collectivists* and focus on the persuasiveness of their product, the results from this research carefully advises them to use 'Praise of individual', and 'Comparison between groups', independently of the cultural background of the players. However, they should use 'Suggestion to individual' for *Individualists* and 'Suggestion to group' for *Collectivists*. If designers can only use of the PGDPs researched, they are advised to use 'Praise of individual', as it persuades both groups most compared to the other PGDPs. This can be read in more detail in section 5.1.4.

Answer to the main Research question

The answers to the sub questions lead to an answer to the main research question:

> To what extent does the effectiveness of widely used persuasive game design principles used in persuasive games for complex systems between Individualists and Collectivists?

As the results are not significant, no definite answer can be given to the main research question. The insignificant results suggest that there is indeed a difference between the effectiveness of PGDPs as perceived by *Individualists* and *Collectivists*. The biggest difference is that *Individualists* perceive 'Suggestion to individuals' as more persuasive than 'Suggestion to group', whereas the opposite is true for *Collectivists*. When it comes to 'Praise' and'Comparison' both *Individualists* and *Collectivists* indicate 'Praise of individual' of 'Comparison between groups' are more persuasive than the other variant of the PGDP. However, 'Praise of individual' is more persuasive for *Individualists* than *Collectivists*, and 'Comparison between groups' is most persuasive for *Individualists* than *Collectivists*.

These conclusion are a result of a new promising method combining the use of a persuasive game for complex system and storyboards to determine the persuasiveness of the PGDPs separately from one another.

5.4. Recommendations for further research

The following recommendations are a result of points made in the discussion and the limitation section above.

5.4.1. Doing research on PGDPs using game and storyboards

The method used in this research is the combination of a persuasive game for complex systems and storyboards. Previous research used only storyboards, or only a game to measure the persuasiveness of separate storyboards. Research should be done to compare the three methods. This would verify the validity of using solely storyboards as Orji (2016), Orji et al. (2017), Orji et al. (2018), Orji et al. (2014) has done. Indeed it is as of yet unknown whether the imagines persuasiveness aligns with perceived persuasiveness. If using storyboards is indeed a valid method, then the combination with games is not necessary. This makes research on PGDPs easier as game session need not be organised.

However, researchers wanting to use the game-storyboard combination should first explore the impact of how the PGDPs are represented. For example, the participants will have experienced different individual praises during the game. One will have been praised as a result of a conversation with the facilitator, another will be praised as a results of the facilitator observing them. The various ways leading up to praise are not depicted in the storyboards. On one hand, it remains unknown whether that influences the persuasiveness of the PGDP Praise as a whole, which should be researched. On the other hand, it should be tested whether storyboards presenting a PGDP should depict the general situation in which praise is given, or a more specific situation showing the reason for which praise is given, and how the praise is delivered. In this research, a general depiction was understood more often by the participants than specific depiction. However, this should be verified with larger samples, and different depictions of the same PGDP.

Furthermore, one of the challenges faced in this research was the the sample sizes resulting from the bad interpretations of the storyboards. In their research, Orji (2016), Orji et al. (2017), Orji et al. (2018), Orji et al. (2014) did not encounter this problem. They used experienced storyboard designers to make the storyboards. This is probably the reason the boards were understood correctly. Therefore, when using storyboards, it is important to have the boards be designed by experienced designers. If this is not possible, researchers are advised to name the storyboards to increase the chance of them being understood.

5.4.2. Further research on persuasiveness of PGDPs

This research tested the PGDPs 'Praise', 'Suggestion', and 'Comparison' as present in the persuasive game for complex system MSPC. The same PGDPs should be tested with other persuasive games for complex systems in order to verify to what extent the game influences the persuasiveness of the PGDPs.

Moreover, in further research, the influence of the facilitator should be taken out of the equation as much as possible. This can be done by organising multiple test sessions with different facilitators. Furthermore, the medium used to praise participants and give suggestions should be researched. It would be valuable to know whether praise/suggestion coming from the facilitator is more or less persuasive than when it comes from an other player, or an impersonal source such as a pop-up'. Also, the participants of the experiment should be from other backgrounds than only students, increasing the generalisablility of the results. Finally,

the other PGDPs listed in Table 2.7 should be tested.

By increasing the knowledge on the persuasiveness of PGDPs used in persuasive games for complex systems, the games will become more persuasive. When the players of such games become persuaded to change their attitude or behaviour towards an element of the complex system, the stakeholders will be one step closer to facing the challenges of the system successfully.

5.5. Personal Reflection

I also personally learned much doing my master thesis research. First an foremost is the importance of not isolating oneself while doing research. Having people around going through the same process, or knowing the environment that can help with the small daily problems such as having a word on the tip of your fingers, or needing someone to brainstorm with for two minutes. Oftentimes, those people end up just listening to you asking a question and coming up with the answer yourself. But without them, it would have taken longer. This is also called the rubber duck concept Supervisors are there for the longer discussions about your research, but the daily small ones are also very important.

Content-wise, I learned, yet again, the importance of doing tests before the real experiment. Testing things is always part of the plan, but is often the first thing that gets reduced on when there is time pressure. However, many problems would not have occurred if the testing had been done more thoroughly. In my case, this was the case with testing the storyboards. The final test-panel was one person, who knew what my research was about and knew which PGDPs I was testing. Therefore, that person described the storyboards exactly how they were meant. The real experiment showed that this was not how most participants fared. In other words, testing should not be economised on, and should be done with a test panel that has the same information as the real participants.

Lastly, I learned that statistics are not as complicated and difficult to come to grasp with as I feared. Statistics, and SPSS, are so much used that they are very well documented on the internet. It was easily to find explanatory posts on how to analyse data using SPSS. Something unknown is mostly scary because it is unknown, not because it actually is scary.

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A

Adapting Maritime Spatial Planning Challenge

A.1. Description of game test sessions

Two game test sessions were held, each with different players. The players were all students or alumni of the TU Delft with various study backgrounds. It was not possible to find sufficient people to play the game at its full scale. Nevertheless, the experiences were valuable in learning how MSPC is played and how it can be optimised for the research.

First test session

Goal of session

- Initial discovery of the game being played
- Determination of the persuasive message
- Verification of roles chosen to include
- Determine necessity of goals

Setup

The players were distributed over the two countries Bayland and Peninsuland. Island was left out of game-play. As there were 6 players, it meant not all roles were played in both countries.

Conclusions

- Goals are necessary to guide players in what they should do
- Players need more background information on the roles and the activities of each role
- Players indicate they want to be given information on the location of fish/birds/oil and gas etc.

- Selection of roles is sufficient, neither too little or too much
- Persuasive message is necessity of long term planning in maritime spatial planning, but is not very strong
- Players like to play and become fanatic, not letting themselves be restricted by time limits
- Players be guided in not placing many tokens at once, eg through time or monetary limits
- Playing two roles at once is too much
- The role of the planner is very demanding, it needs to be played by two players
- Players from different countries do start to play with one another to work together
- The policy standpoints of the countries are too much

Second test session

Goal test session

- Test goals assigned to each role
- Test opportunity maps and different ways of handing them out
- Test rounds
- Test building limits per rounds
- Test background information given for each role
- Test business of sea if all roles of one country are occupied
- Test having two planners
- Test intermediate debrief

Setup

The seven players were all assigned to the same country, Island. The game was described and the roles were explained. The players could then choose what role they wanted to play and were given time to read the cards with background information before the game started.

Conclusions

- Opportunity maps should be handed out
- Need to spilt up opportunity maps into sections players can ask for
- Environmentalist need a higher building limit per round
- Need to think how long a shipping line may be that can be built in one round
- It can be worthwhile keeping track of what happens each round
- Planners need more guidance as to their role: the necessity of keeping balance
- Time should be stopped shortly after each round
- Praise and Suggestion should be given during the breakes between rounds
- The two planners do not necessarily spilt the work, should be given suggesiton to do this
- Planners need more time at the beginning to define a strategy
- There needs to be a timer to keep track of time

A.2. Explanation of adaptations of MSPC towards being playable by students

namely changing the number of roles to be played and providing goals to guide the players in their actions. Two play-test sessions were held. The first one showed it was also necessary to add small rounds to limit the amount of tokens players would try to place in one go. The players also communicated they needed opportunity maps showing them what can and cannot be done in an area. Lastly, the predefined policies of the countries could be left out. This was tested and approved in the second play-test session.

Adapting roles of MSPC for students

Many different parties use the sea for their industry. As MSPC aims at getting all parties around the table to engage in discussion and discover the necessity of maritime spatial planning, everyone needs to be included in the game. For example, there are many ways to win energy in/from the sea. Some companies concentrate on oil and gas, while others prefer renewable energy. When players are assigned a role, they can choose between 10 different options, greatly increasing the complexity of the game. For students, roles will be combined or left out completely to make the game more simple. The main industries will remain. Table A.1 enumerates the roles provided by the game designers and shows which have been combined or left out. The tokens that would have been used by the roles that are being left out will not be used either. The list of tokens that will be used can be found in Appendix C.3.

Table A.1: Roles in initial game and in game used for experiment

Initial list of roles	**Corresponding roles in version of MSPC made for the experiment**
Local Business	Local/Toursim
Tourism and recreation	Local/Toursim
Aquaculture	Fishers
Fisheries	Fishers
Nature	Nature
NGO	Nature
Maritime industry	-
Ports	-
Shipping	Shipping
Energy infrastructure	Energy Producent
Oil&Gas	Energy Producent
Deep Sea mining	-
Renewable Energy	Energy Producent
Planner	Planner

Adding goals of MSPC for students

In MSPC, the players are not given specific goals. They are instructed to populate the sea of RICA with their different industries. Each country has a slightly different objective to guide players, but it is not obligatory to pursue them. People with maritime backgrounds will be

able to copy their normal behaviour in the game or experience with new behaviour. Their real-life experience will give them enough incentive to behave the way intend in the game. For example, a fisher will know how much he needs to fish, how far he is willing to go to get the fish and will do so in the game. A student that is given the role of a fisher needs more guidance. If a goal is given saying 'A fisher needs to fish quantity X of fish, corresponding with Y tokens to place, the student will have a clear task to accomplish. Thus, for each role of the three countries, a goal was defined. At the beginning of the game, players are given a couple of minutes to take in the game and think about the goal they are given, whether they want to be more performing than that, and what strategies they will use. The goals were determined through playtesting and can be found in Appendix C.2.

Adding time element to MSPC for students

A play session with students showed another element was needed to guide players that do not have much background in maritime industries, namely the aspect of time. The players would not realise how much time is needed to build things on the sea and would put many tokens on the board at once. Students need to be given boundaries to demarcate how fast they can put tokens on the board. This was done by adding five-minute rounds representing increments of two years during which each role is only allowed to place a certain amount of tokens. This rules guided students more than the rule 'Think about how much time is needed to build what you are building'. The quantities were were determined through play-testing and can be found in Appendix C.2.

Adding opportunity maps to MSPC for students

To help the players choose where they can place activities, opportunity maps were designed. Opportunity maps were part of the initial MSPC game but were left out of further versions because people from the industry had enough experience to play the game. After a play session, students emitted the wish for more data to guide them. Opportunity maps can be requested by players. They go up to a facilitator an say they want research done on a certain area of the RICA sea. They receive the Opportunity maps of that area in the next round, simulating the time necessary to do research in real life. The maps indicate where certain animals can be found, such as fish, birds, coral and crustaceans, and where oil and gas can be found. Furthermore, each area of each country is split up into two. Players must not only specify what they wish to research but also what area. One request can be done per role per round. The Opportunity maps can be found in Appendix C.4.

Moreover, at the beginning of the game, the facilitator tells the players what direction the wind comes from. The players need to take this into account when placin windmills.

Leaving out the different policy viewpoints of countries

In the original game, the three countries of MSPC had different policy standpoints. This guided players in how they could play. For example, Island had the objective to 'safeguard accessibility of the Islands and become the world leader in sustainable fishing and in the super yacht industry. When students are playing MSPC, the predefined policies were ignored. The complexity of the game is such that the players could not handle this additional element. As it is not fundamental to the game-play, it can be left out easily.

B

Analysis of PGDP for selection for the experiment

Simulation

The PGDP simulation entails showing cause and effect and the link with reality. It is present in MSPC in different ways. Primarily, players are encouraged to use real word logic in the game. Therefore, placing a token/activity on the board/sea has consequences for what can be placed nearby. For example, ‘Swimmers paradise’ and ‘Commercial fishing’ cannot be adjacent, as fishing vessels or swimmers do not always stay inside the area allocated to them. Safety margins are needed between activities. Margins between activities such as nautical tourism and windsurfing are smaller between ‘Scenic view’ and ‘Military area’.

Allowing the game to have ’Simulation aimed at individuals’ and ’Simulation aimed at groups’ clearly would mean the game would have to be adapted. This is not necessary for other PGDPs, therefore, Simulation will not be used in the storyboards.

Reward

In MSPC, there is nothing to give or take from players that is important to the gameplay or to measure their performance. There are no points, there is no money, etc. Adding them would make the game to complex, players would have another element to take into account. Therefore, this principle will not be portrayed in the storyboards.

Monitoring

(Self-)Monitoring is a allows a player or the group to see his/her own progression. It is not present in MSPC explicitly. Players can see they built something where there previously was nothing, but they cannot track their behaviour and progress through time. Periodical shot of the board or tiles/shipping lanes placed would need to be recorded. Changing the game to add monitoring options would make the game less fluid and dynamic, which is not desirable. Therefore, this principle will not be used in the storyboards.

Competition

While goals are given to the players, these are to help guide their actions more than to encourage competition. The principle will be left out of the experiment because the principle is not present enough in the game. Increase competition would change the nature of the game too much.

Cooperation

The players of MSPC are encouraged to work together on several levels: when they represent the same country when they represent the same occupation, and as a whole as utilisers of the sea of RICA. The groups are not given specific goals to achieve together, but the game is created in such a way that cooperating is the best way to reach personal goals. However, as there is no individualistic variant to this collectivistic principle, it will not be used in tests. Other principles that have individualistic and collectivistic variants are more relevant for the research.

Customisation

Customisation is when players can adapt the content and functionality to their taste. It is primarily the planner than can adapt the functionality of the game by limiting how much the other players are allowed to do. The planner can decide other players are not allowed to put tokens on the board and that every decision must go through the planner, or players can get more freedom. As not every player will experience the same degree of customisation, the PGDP will not be used in the storyboards.

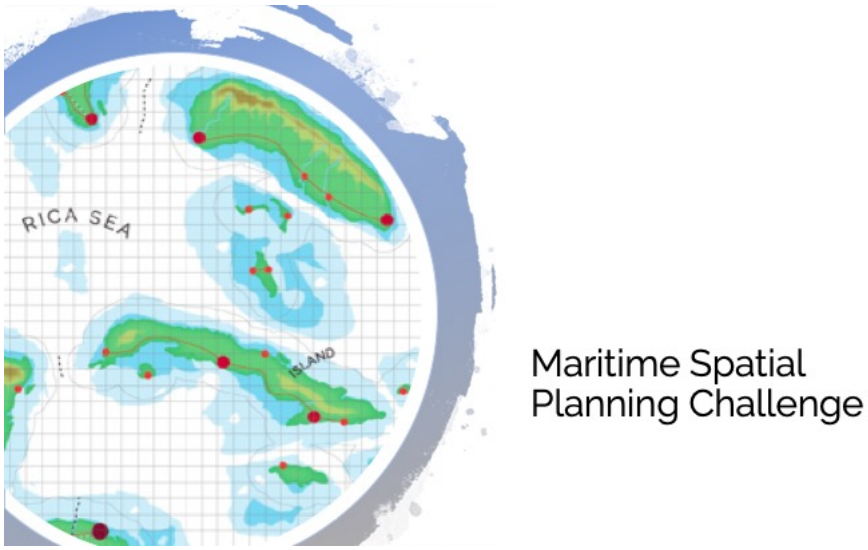
Personalisation

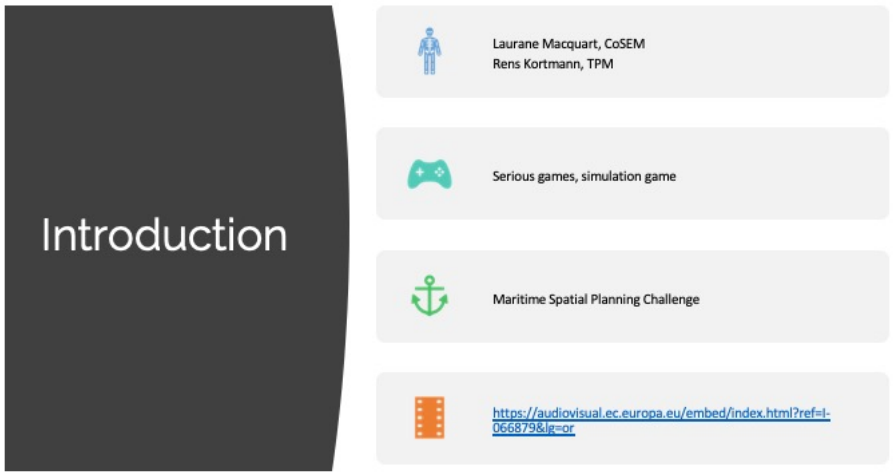
Personalisation is present in MSPC in the form of the many tokens players can choose to use to represent maritime activities. If a player with the role of someone from the energy industry wants to focus on renewable energy, this is possible. They can choose to use tokens representing renewable energy instead of other energy winning tokens. The way personalisation is in MSPC is for individuals and not for groups. Personalisation for groups needs to be done during the designing of the game, basing the board on the specific situation of the players. It will not be possible to compare the two variants of the PGDP; therefore, it will not be used in the storyboards.

C

Game Necsessities

C.1. Introductory Presentation





- Sea of RICA
- Bayland, Peninsuland, Island
- Role
  - Fisher
  - Local
  - Energy producer
  - Environmentalist
  - Shipper
  - Planner
- Tokens for maritime activities

- Many tokens per role
- Economic activities need to be linked to a port, pins
- No valuta in the game
- Rounds 5'
- Real world logic
- Goals

Fisher

- Representative of branch organization of fishers
- Fishers can fish anywhere
- Types of fishing
  - long-line fishing, commercial fishing, creel fishing, aquaculture, seaweed cultivation and saline agriculture

Local – Tourism

- Representative of branch organization of locals tourism-entrepreneurs
- No big lifestyle changes
- Profit from tourism

Energy Producent

- Representative of branch organization of energy producers
- Types:
  - Wind energy, marine energy, geothermal energy, subsea carbon capture & storage and fossil fuel mining
- 15% renewable energy

Environmentalist

- Representative of branch organization fighting for the environment.
- RICA sea and coastline.
- Approval of the planner
- Use multiple kinds of tokens

Shipper

- Representative of branch organization of shippers
  - Passenger transport, Container transport, Bulk transport
- Short sea shipping
- Ships from outside the board.

Planner

- Oversees everything for their country
- In charge of balanced growth: max 5 tokens difference
- Control
- Overarching goals

Opportunity maps, other rules

- Other tokens
- Opportunity maps
  - Research in one area
  - Get map one year later
  - North/south/east/west
    - Birds
    - Coral reef and turtles
    - Crustaceans
    - Carbon
    - Oil and gas
    - Fish

Opportunity maps, other rules

- Scale: 1 nm
- 1 nm distance between different types of tokens
- Country borders
- Types of coast
- Wind
- Say aloud what you are doing

Planning

1 st Round

- Discussion with your country
- Planner is leader of discussion
- What are you planning on building where?
- How are you going to organize yourselves?
- What research are you doing?
- Present at end of brainstorm to group

C.2. Role Descriptions

Planner

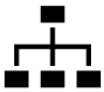
Goal
Ensure your country grows in a balanced way

There should be no more than 5 tokens difference between the amount of tokens representing economic activities the various roles have placed on the table.

Building limit per round
4 tokens

Background information

- Oversees everything for their country
- Need to decide how much control they want over what other stakeholders are doing.
- Are in charge of defining overarching goals



Possible actions of the planner:

- Monitor and evaluate (review) – What is going well and what is not? Observe conflicts among different uses of space.
- Persuade – Come up with a vision where the country wants to go. Talk to the industry representatives to get them into a certain direction. Use scientific data.
- Legislate – Ban or restrict certain activities in certain areas for instance to protect the marine environment or guarantee safety.
- Stimulate – introduce economic incentives (subsidies) or technological innovations, promote multi-functional use of space.
- Mediate – Solve conflicts among industry representatives and country interests.
- Coordinate – Work together with other countries to introduce new transnational planning institutions (organizations, rules, and harmonization).

Energy Producer

Goal

Bayland	Peninsuland	Island
18 tokens	10 tokens	16 tokens

Building limit per round

3 tokens

Information for gameplay

- Represent the different energy producers that make use of the sea
- Use many types of energy-producing while playing as you represent many energy producers.
- At least 15% of the energy must be renewable
- The activities must be linked to the main port using string representing ships doing building and maintenance, and using string representing cables and pipelines.
- Use cables/pipes to link parts of the country with one another to ensure all citizens have electricity

Information about tokens

- Wind energy: Windmills. Cannot be built in water more than 50m deep.
- Marine energy: using the force of the current, waves and differences in ocean temperature. Need to be installed in water deeper than 10m
- Geothermal energy: Using heat from the core of the earth
- Fossil fuel mining: Large platforms extracting oil or gas from the seabed. Can lead to oil hazardous substances in the water.

Environmentalist

Goal

Bayland	Peninsuland	Island
50 tokens	25 tokens	35 tokens

Building limit per round

8 tokens

Background information

- Represent the different groups that want to protect the environment.
- Ensure parts of the RICA sea and coastline are protected so no activities that harm flora or fauna will take place there.
- Decisions to make an area protected can not be made alone, but need the approval of the planner
- Use multiple kinds of tokens as you represent many types of environmentalists

Information about tokens

- Marine protection: no marine activities can take place in that area
- No take zones: specific kind of marine protection zone, totally prohibit the extraction or significant destruction of natural or cultural resources. Activities that do not destroy the local flora and fauna are allowed. Eg: scuba-diving
- Coastal protection: protect coast from erosion
- Cetaceans: whales and dolphins

Fisher

Goal

Bayland	Peninsuland	Island
14 tokens	6 tokens	10 tokens

Building limit per round

3 tokens

Information for gameplay

- Represents the different types of fishers of the sea of RICA
- The various types of fishing are long-line fishing, commercial fishing, creel fishing, aquaculture, seaweed cultivation and saline agriculture
- Use as many types of fishing as possible while playing, as you a representing many fishers.
- Areas where fishers are active need to be linked to a marina or main port using string

Information about tokens

- Longline fishing: commercial fishing method using hundreds of hooks on a single line, which can be up to 100km long. Takes a lot of time
- Commercial fishing: uses large nets that are dragged over the seafloor.
- Creel fishing: baskets are put on the seabed to catch crustaceans. The baskets are emptied every once and awhile. This method is a very species selective from of fishing with very little by-catch.
- Aquaculture: farming of fish, crustaceans, algae etc. The fish are cultivated (as opposed to commercial fishing where wild fish are fished)
- Seaweed cultivation: cultivating and harvesting seaweed. Management of naturally found algae. Cannot go deeper than 7m depth
- Saline Agriculture: food being grown on salt-affected soil. Has a very small impact on freshwater supplies. Needs to be on the coastline

Shipper

Goal

Bayland	8 shipping lanes
Peninsuland	6 shipping lanes
Island	7 shipping lanes

Building limit per round

One or more shipping lanes with a maximum length corresponding to 10 tokens

A shipping lane with a length longer than 8 tokens counts as 2 lanes

Background information

- Represents types of shippers: passenger transport, container transport, bulk transport
- Can have short sea shipping, from one defined port to another, as well as shipping lanes coming in from outside the board.

- Common practice is to have shipping lanes in which certain kinds of ships are allowed to navigate.
- Busy shipping lanes are prone to shipwrecks as a result of collisions
- Think about what type of port needs to be used depending on what is being transported. Ferries depart from marina, whereas transport of goods is from a terminal
- Want shipping lanes to go as strait as possible

Local & Tourism

Goal

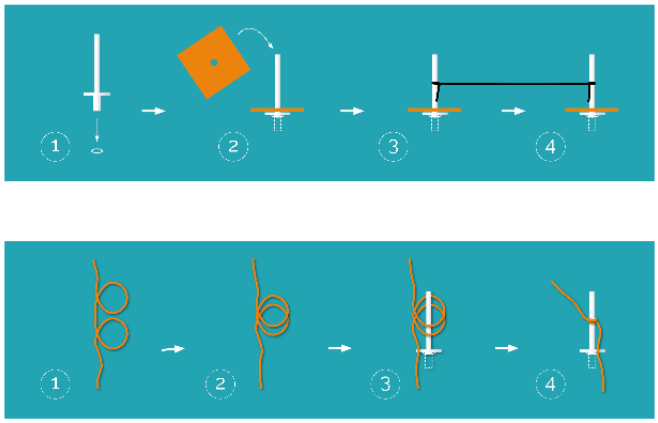
Bayland	Peninsuland	Island
18 tokens	10 tokens	12 tokens

Building limit per round

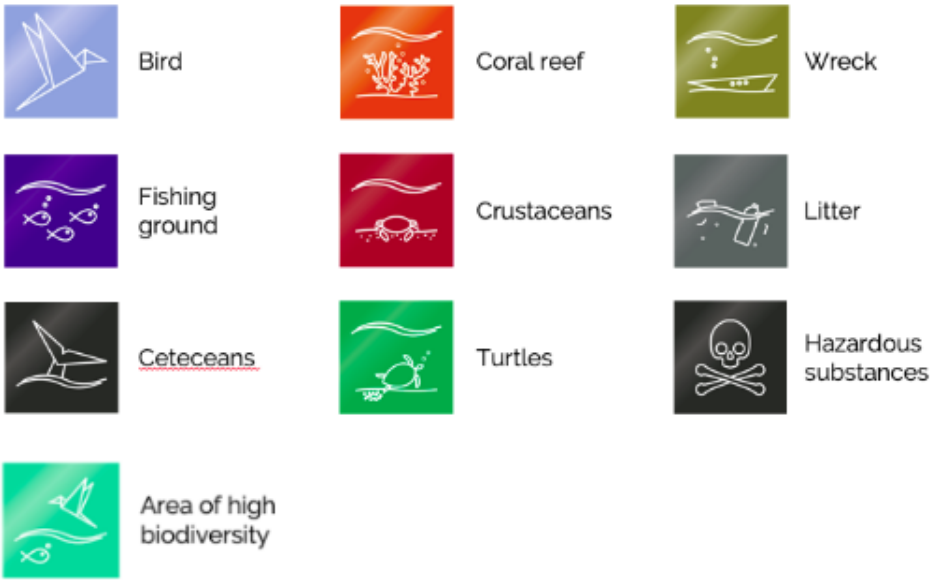
3 tokens

Information for gameplay

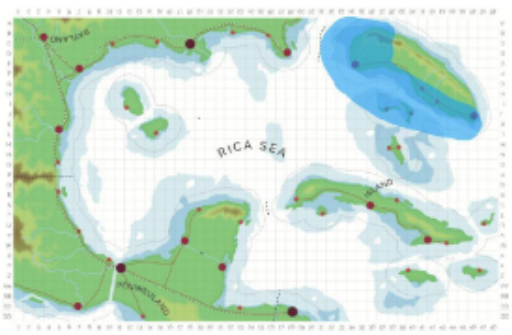
- Represents different types of locals living in Island/Peninsuland/Bayland
- Locals do not want their lifestyle to change too much and want to profit from tourism
- Use many types of tokens representing ways of profiting from tourism, as you are representing many entrepreneurs.
- Some tourists may come for nature. Therefore, remember to keep an eye on the preservation of flora and fauna.
- Tourists do not always want to travel far to go from place to place. Keep activities clustered and near cities.
- Activities on sea need to be linked to a marina or main port using string
- Locals and tourists may need to be transported using ferries, discuss with the shipper



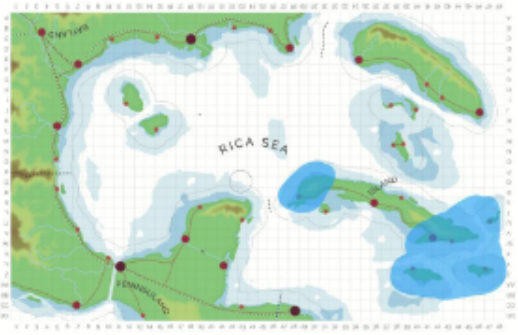
C.3. List of Tokens


Bird
Coral reef
Wreck
Fishing ground
Crustaceans
Litter
Ceteceans
Turtles
Hazardous substances
Area of high biodiversity

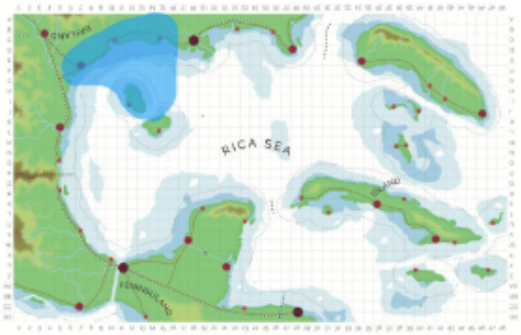
C.4. Opportunity maps



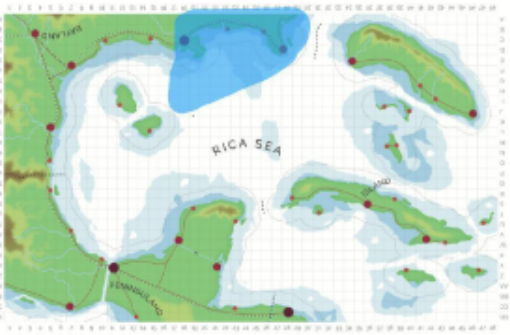
BIRDS ISLAND NORTH



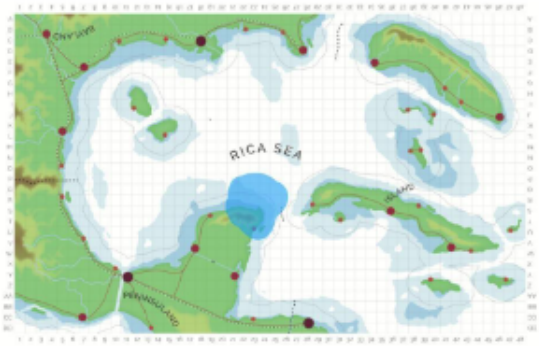
BIRDS ISLAND SOUTH



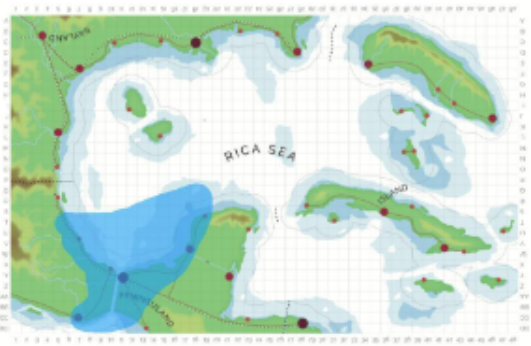
BAYLAND BIRDS WEST



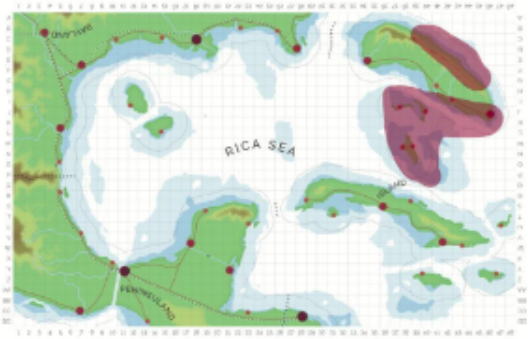
BIRDS BAYLAND EAST



BIRDS PENINSULA EAST

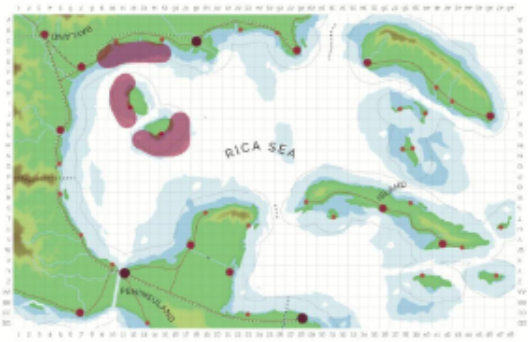


BIRDS PENINSULAND WEST

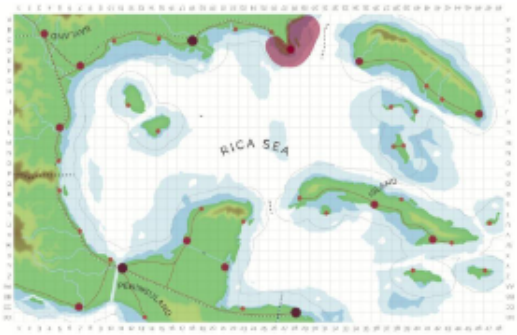


CRUSTACEANS ISLAND NORTH

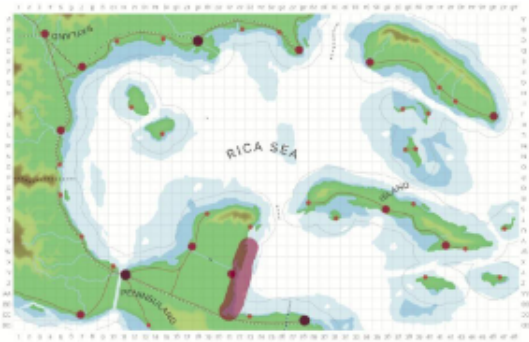
CRUSTACEANS ISLAND SOUTH



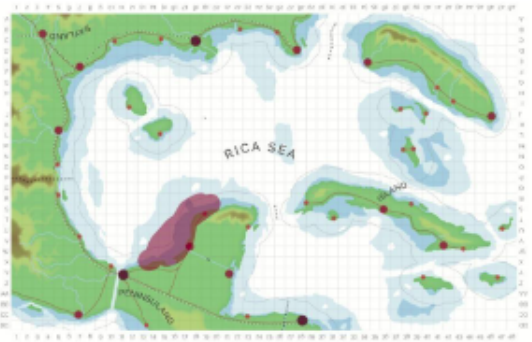
CRUSTACEANS BAYLAND WEST



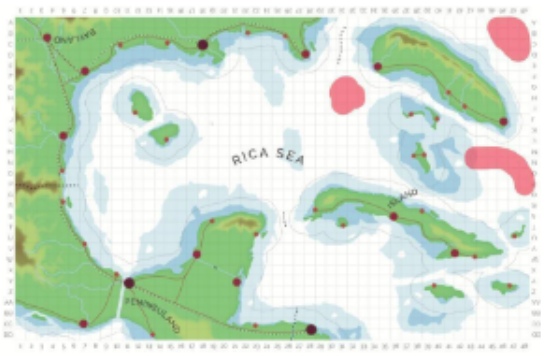
CRUSTACEANS BAYLAND EAST



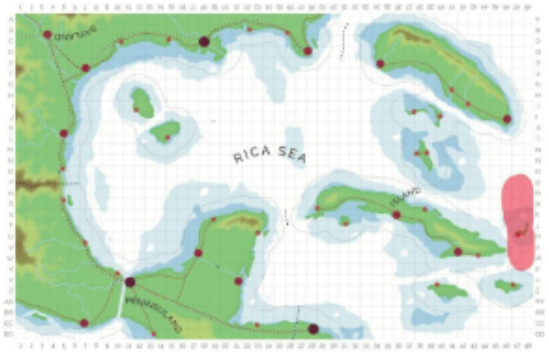
CRUSTACEANS PENINSULAND EAST



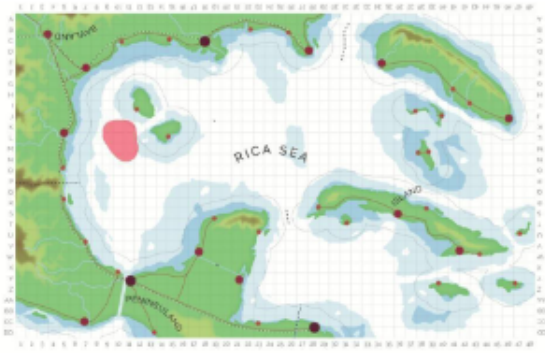
CRUSTACEANS PENINSULAND WEST



OIL&GAS ISLAND NORTH



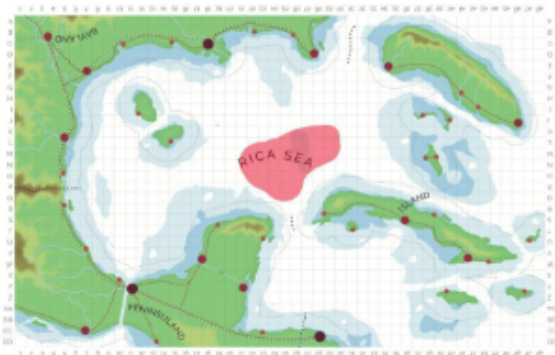
OIL&GAS ISLAND SOUTH



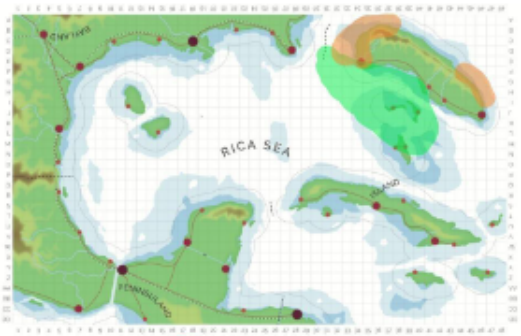
OIL&GAS BAYLAND WEST

OIL&GAS BAYLAND EAST

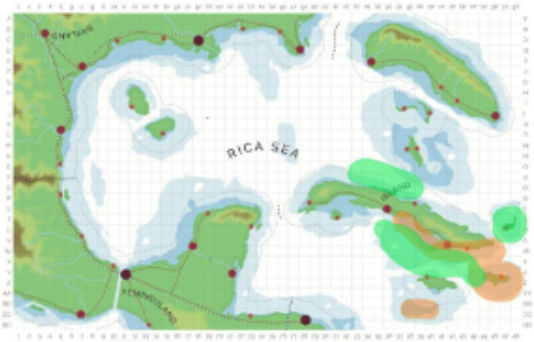
OIL & GAS PENINSULAND WEST



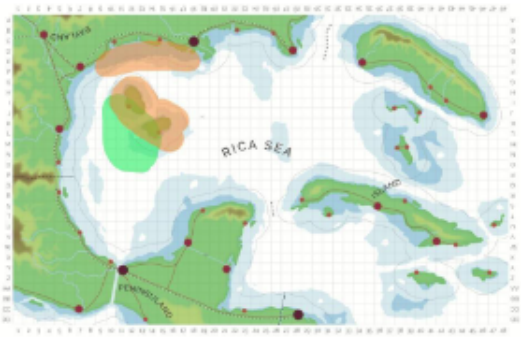
OIL&GAS PENINSULAND EAST



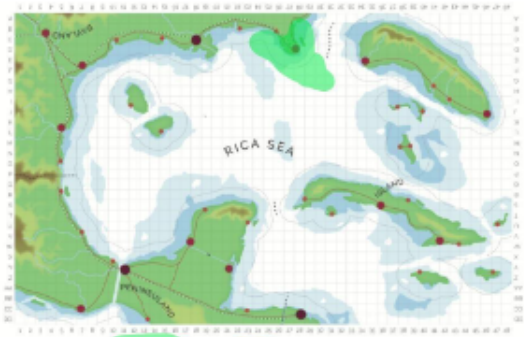
TURTLES & CORAL ISLAND NORTH



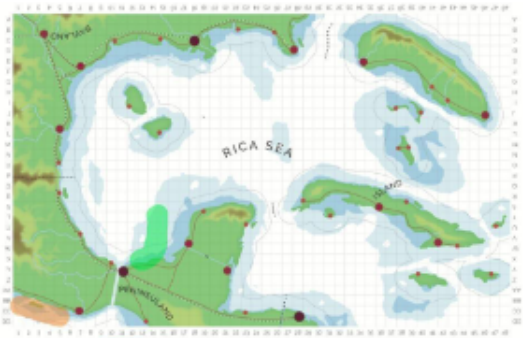
TURTLES & CORAL ISLAND SOUTH



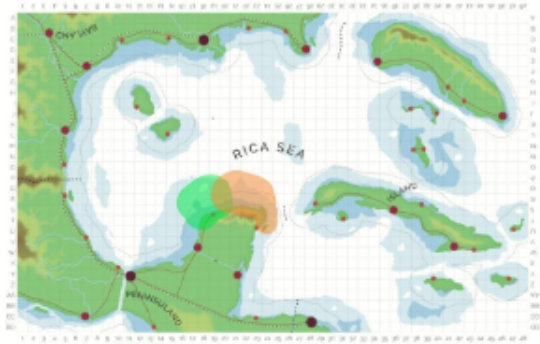
TURTLES & CORAL BAYLAND WEST



TURTLES & CORAL BAYLAND EAST



TURTLES & CORAL PENINSULAND WEST



TURTLES & CORAL PENINSULAND EAST

FISH ISLAND NORTH

FISH ISLAND SOUTH

FISH BAYLAND WEST

FISH BAYLAND EAST

FISH PENINSULAND WEST

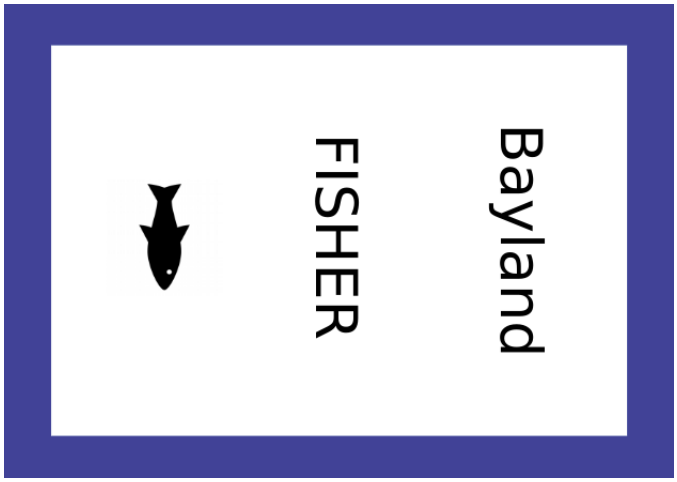
FISH PENINSULAND EAST

C.5. List of possible questions for debrief

1. How do you feel? What did you experience during the game?
2. Are you satisfied with the Rica Sea as it is now?
3. Do you feel satisfied with how it came about?
4. Did you experience or notice any changes/improvements while the game progressed?
5. For instance more or less chaos / control?
6. Was there a vision or strategy? Or, was it first come, first served?
7. Which issues were early on the agenda? Which issues were ignored?

8. Are there any strange decisions in the Rica Sea? Inconsistent, irrational or unlikely uses of space? Why did this happen?
9. Are there any conflicts between different uses of marine space?
10. Do you see any multi-functional uses of space?
11. How much of the Rica Sea is now a marine protected area? Do you think that is enough?
12. Who put environmental protection on the agenda? Was that late or early in the game?
13. How easy or difficult was it to get attention for environmental protection?
14. Do you feel that some interests are more or better represented in the Rica Sea than others?
15. Do you feel there are winners and losers in the Rica Sea?
16. Were there any conflicts between stakeholders?
17. Did the marine planners have control over the process? What did they do to get it?
18. How did it feel to be a marine planner?
19. What policy instruments did the planners use? Which instruments did they not use?
20. Did the planners or other players introduce new institutions in the game (organizations, rules like directive)? Why (not)?
21. How much transnational coordination was there in the game? Where could it have been more or better?
22. Did you have fun playing the game?
23. What did you learn about MSP from playing the game?

C.6. Role card hangers



Bayland

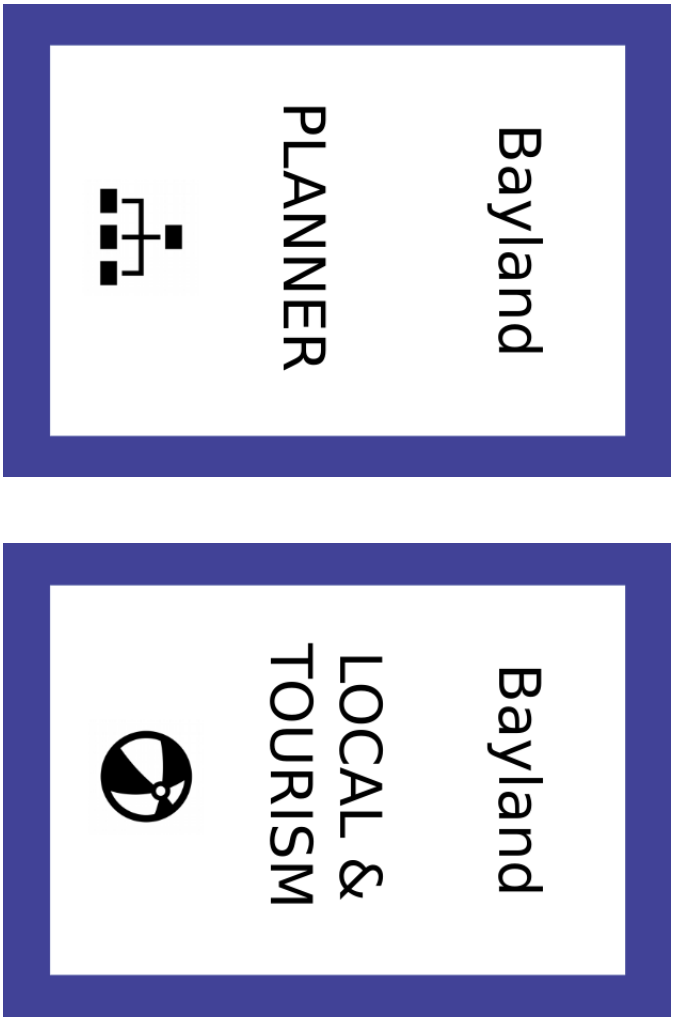
SHIPPER

Bayland

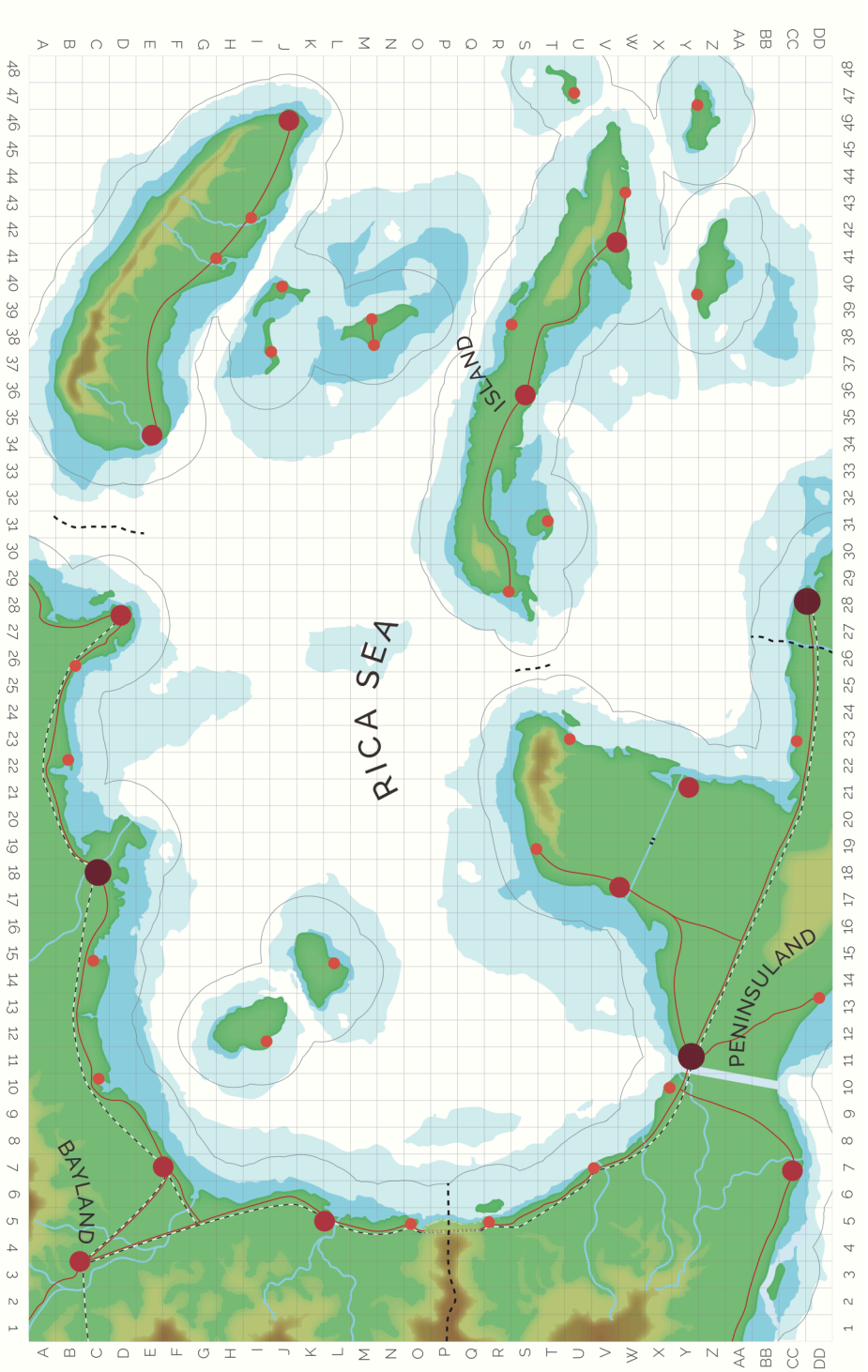
ENERGY PRODUCER

Bayland

ENVIRON-MENTALIST



C.7. Board of MSP: Sea of RICA


RICA SEA
ISLAND
PENINSULAND
BAYLAND

D

Surveys

D.1. Pre-Game Survey

Maritime Spatial Planning Challenge - Q1

Welcome!

You are about to play the game Maritime Spatial Planning Challenge as part of my Master Thesis research at TPM. Thank you for cooperating! Your participation will provide valuable insights into serious game design.

Consent

You have previously filled in a consent form which also covers this research. Please remember that you are permitted to quit the questionnaire and/or game at any moment without the need for explanation. Furthermore, the information you are providing during this questionnaire will be anonymised and stored safely on the servers of the TU Delft.

Questionnaire

Before playing the game you are asked to fill in this questionnaire, which takes 3-4 minutes. If you have any questions, please raise your hand to catch my attention.

Laurane Macquart

There are 4 questions in this survey.

What is your age? *

Only numbers may be entered in this field.
Please write your answer here:

What is your gender? *

Choose one of the following answers
Please choose **only one** of the following:

- ◯ Female
- ◯ Male
- ◯ Other

What is your (TU Delft) e-mail address? *

Please write your answer here:

As previously stated, all data will be anonymised when data collection has been completed

Indicate what you think of the following statements.

*

Please choose the appropriate response for each item:

	Strongly disagree	Disagree	More or less disagree	Neutral	More or less agree	Agree	Strongly agree	I do not know
To what extent do you think a user of the sea should have a long term plan for how they want to use the sea?	○	○	○	○	○	○	○	○
To what extent do you think maritime spatial planning is necessary?	○	○	○	○	○	○	○	○
To what extent do you think different users of the sea should discuss their goals with one another?	○	○	○	○	○	○	○	○

D.2. Post-Game Survey

Maritime Spatial Planning Challenge - Q2

Once more, welcome!

Now you have played the game Maritime Spatial Planning Challenge, you can fill in the final questionnaire. Again, thank you for cooperating! Your participation will provide valuable insights into serious game design.

This questionnaire takes 10-15 minutes. If you have any questions, please raise your hand to catch my attention.

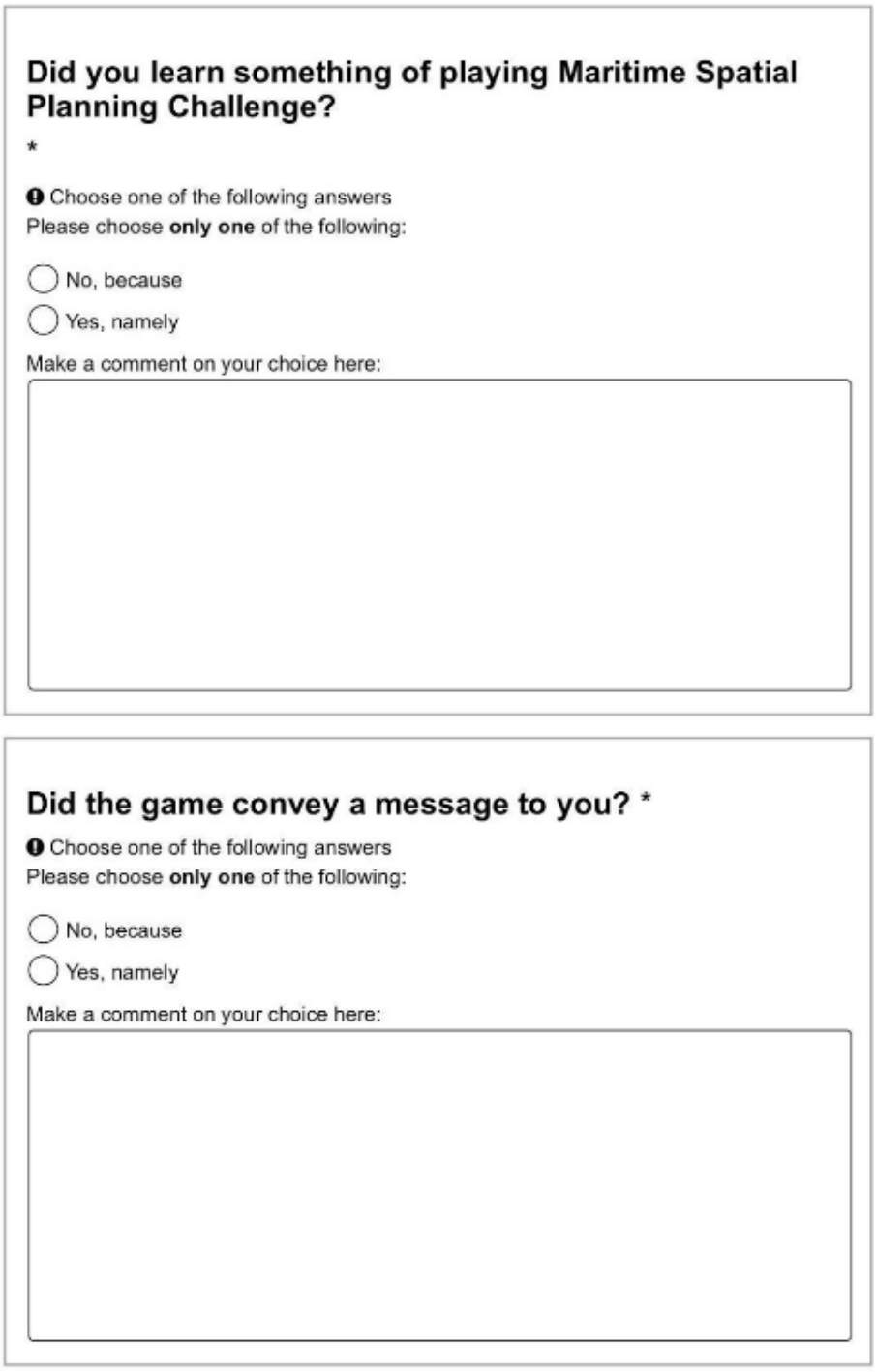
Laurane Macquart

There are 29 questions in this survey.

What is your (TU Delft) e-mail address? *

Please write your answer here:

Please fill in the same address as you did in the previous questionnaire



Did you learn something of playing Maritime Spatial Planning Challenge?

*

Choose one of the following answers
Please choose **only one** of the following:

- ◯ No, because
- ◯ Yes, namely

Make a comment on your choice here:

Did the game convey a message to you? *

Choose one of the following answers
Please choose **only one** of the following:

- ◯ No, because
- ◯ Yes, namely

Make a comment on your choice here:

Repeated for each of the 6 PGDP variants:

Shortly describe what scenario is portrayed above using your own words. *

Please write your answer here:

Have you experienced this scenario while playing the game Maritime Spatial Planning Challenge? *

Choose one of the following answers
Please choose **only one** of the following:

- ◯ Yes
- ◯ No
- ◯ Maybe

Recall how you experienced the scenario and indicate the extent to which you agree with each statement

*

Only answer this question if the following conditions are met:
Answer was 'Yes' at question '5 [PIEXP]' (Have you experienced this scenario while playing the game Maritime Spatial Planning Challenge?)

Please choose the appropriate response for each item:

	Strongly disagree	Disagree	More or less disagree	Neutral	More or less agree	Agree	Strongly agree
This scenario influenced me in believing that long term planning is necessary in maritime spatial planning	◯	◯	◯	◯	◯	◯	◯
The scenario convinced me that long term planning is necessary in maritime spatial planning	◯	◯	◯	◯	◯	◯	◯

Imagine you have experienced the scenario and indicate the extent to which you agree with each statement.

*

Only answer this question if the following conditions are met:
Answer was 'No' *or* 'Maybe' at question '5 [PIEXP]' (Have you experienced this scenario while playing the game Maritime Spatial Planning Challenge?)

Please choose the appropriate response for each item:

	Strongly disagree	Disagree	More or less disagree	Neutral	More or less agree	Agree	Strongly agree
This scenario would have influenced me in believing that long term planning is necessary in maritime spatial planning	◯	◯	◯	◯	◯	◯	◯
The scenario would have convinced me that long term planning is necessary in maritime spatial planning	◯	◯	◯	◯	◯	◯	◯

Indicate how frequently you show the behaviour described. *

Please choose the appropriate response for each item:

	Never	Very Rarely	Rarely	Occasionally	Very Frequently	Always	I don't know
I discuss job or study-related problems with my parents.	○	○	○	○	○	○	○
I consult my family before making an important decision.	○	○	○	○	○	○	○
Before taking a major trip, I consult with most members of my family and many friends.	○	○	○	○	○	○	○
It is important to consult close friends and get their ideas before making a decision.	○	○	○	○	○	○	○
I consult with my parents before making an important decision.	○	○	○	○	○	○	○
I hate to disagree with others in my group.	○	○	○	○	○	○	○
It is important to make a good impression on one's manager.	○	○	○	○	○	○	○
In interacting with superiors, I am always polite.	○	○	○	○	○	○	○

	Never	Very Rarely	Rarely	Occasionally	Very Frequently	Always	I don't know
It is important to consider the needs of those who work above me.	○	○	○	○	○	○	○
I sacrifice my self-interest for the benefit of my group.	○	○	○	○	○	○	○
I reveal personal things about myself.	○	○	○	○	○	○	○
I have the feeling that my relationships with others are more important than my own accomplishments.	○	○	○	○	○	○	○
I like to live close to my good friends.	○	○	○	○	○	○	○
To me, pleasure is spending time with my superiors.	○	○	○	○	○	○	○
To me, pleasure is spending time with others.	○	○	○	○	○	○	○
I help acquaintances, even if it is inconvenient.	○	○	○	○	○	○	○
I define myself as a competitive person.	○	○	○	○	○	○	○
I enjoy working in situations involving competition with others.	○	○	○	○	○	○	○
Without competition, it is not possible to have a good society.	○	○	○	○	○	○	○

Indicate what you think of the following statements. *

Please choose the appropriate response for each item:

	Strongly disagree	Disagree	More or less disagree	Neutral	More or less agree	Agree	Strongly Agree	I do not know
To what extent do you think different users of the sea should discuss their goals with one another?	○	○	○	○	○	○	○	○
To what extent do you think maritime spatial planning is necessary?	○	○	○	○	○	○	○	○
To what extent do you think a user of the sea should have a long term plan for how they want to use the sea?	○	○	○	○	○	○	○	○

E

Results

E.1. Detailed explanation of the message learned by playing MSPC and message conveyed by MSPC

Note: This section needs to be completed

The three messages that were stated most often were the importance of (long term) planning in maritime spatial planning, the importance of cooperation in maritime spatial planning and the importance of communication in maritime spatial planning. 18 respondents indicated that they had learned the importance of planning, 14 learned the importance of cooperation, 13 the importance of communication. Furthermore, four people said they had learned about the complexity of the system, two had learned about the importance of good leadership, one about the importance of standing up for oneself, and one only learned how to play the game itself. Interestingly, two respondents have learned that in maritime spatial planning, having a plan is not relevant, because everything happens ad hoc. This can be explained by the chaotic nature of the game, which can result in a player not being able to execute their plans and needing to make a new plan at every round.

Three did not give any explanation. Two had the role of shipper and felt because of that they were not part of the game, no interacting with the other players. Four respondents felt the game was too easy and that they already knew how to act. There were to little necessities for trade-offs, and to little conflicts that could challenge them. Three respondents would have wanted more time to make decisions, the game was too chaotic and they had trouble understanding the rules.

E.2. Details of interpretation of storyboards

Note: This section needs to be completed

Praise of Individual

Although this information was added to the storyboard, only 2 of the 50 participants referred to the character as the facilitator. 20 interpreted this character as the planner in their responses. A total of four participants understood the scenario as praising going on, whereas 18 felt a discussion was represented. Five participants said the praise was of a group, or the discussion between group members, these results will not be used further. 17 saw 'You' as an individual. The remaining descriptions were either about the content eg. 'Panning process', were qualitative in nature, eg 'Realistic' or indicated when the participants though the scenario had occurred, eg 'Beginning of game'. As it is not clear whether the participants understood the storyboard as meant, these responses will be neglected. The core message of the descriptions are summarised in Table E.1, the last column indicates whether or not those cases are used in further analysis.

Table E.1: Types of descriptions of the storyboard 'Praise of an Individual' and frequencies

Type of description given	Number of responses	Percentage of responses	Used in further research
Facilitator praising individual	1	2%	Yes
Facilitator praising group	1	2 %	No
Planner praising individual	2	4 %	Yes
Individual discussing with planner	14	28 %	Yes
Group discussing with planner	4	8 %	No
Content	23	46 %	No
Qualitative	3	6 %	No
Time of occurrence	2	4 %	No

Praise of groups

Add description of table, similar to praise individual Note data of people that said 'Group discussing with planner' to previous is used now

Table E.2: Types of descriptions of the storyboard 'Praise of group' and frequencies

Type of description given	Number of responses	Percentage of responses	Used in further research
Facilitator praising group	5	10 %	Yes
Planner praising group	2	4 %	Yes
Group discussing with planner	5	10 %	Yes
Content	35	70 %	No
Qualitative	2	4 %	No
Did not understand	2	4 %	No

Suggestion for individual

Add description of table, similar to praise individual

Table E.3: Types of descriptions of the storyboard ‘Suggestion to Individual’ and frequencies

Type of description given	Number of responses	Percentage of responses	Used in further research
Facilitator doing a suggestion	11	22 %	Yes
Planner doing a suggestion	7	14 %	Yes
Content	27	54 %	No
Qualitative	1	2 %	No
Did not understand	1	2 %	No

Suggestion for group

Add description of table, similar to praise individual

Table E.4: Types of descriptions of the storyboard ‘Suggestion to group’ and frequencies

Type of description given	Number of responses	Percentage of responses	Used in further research
Facilitator doing a suggestion	15	30 %	Yes
Planner doing a suggestion	2	4 %	Yes
Content	33	66 %	No

Comparison between individuals

Add description of table, similar to praise individual

Table E.5: Types of descriptions of the storyboard ‘Comparison between individuals’ and frequencies

Type of description given	Number of responses	Percentage of responses	Used in further research
Comparison between individuals	42	84 %	Yes
Comparison between groups	1	2 %	No
Content	4	8 %	No
Did not understand	3	6 %	No

Comparison between groups

Add description of table, similar to praise individual

Table E.6: Types of descriptions of the storyboard ‘Comparison between groups’ and frequencies

Type of description given	Number of responses	Percentage of responses	Used in further research
Comparison between groups	30	60 %	Yes
Content	18	36 %	No
Did not understand	2	4 %	No