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KEEP COOL Mobile and Urban Climate Action – Comparing Real-Life and In-Game Action Situations

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1.1   Background

„Climate targets – 'We need the cities, to be able to reach them' (Rana Adib)" (Deutschlandfunk 2021) calls the executive director of the Renewable Energy Policy Network for the 21st Century (REN 21). When we talk about climate targets, the discourse often focuses on national governments and international treaties like the Paris Agreement. These international negotiations on climate change and the activities of involved national governments are failing to address and act upon issues properly (UNEP 2016). REN 21 calling on cities to act, presents a new and interesting addition to the discourse on battling the climate crisis. The underlying article (Deutschlandfunk 2021) discusses the importance of cities as actors in climate action for several reasons, that are supported by the literature on cities and climate change: First of all, cities are responsible for around 30-40% (producer-based calculation) of all greenhouse gas emissions (UN-Habitat 2011, 51f). With a projected increase from a current 55% of the world population living in urban areas to 68% by 2050 (United Nations 2019) these emissions will even increase, if cities don't take action. Second, cities are extremely vulnerable to the impacts of climate change due to location (often near the coast or waterways) and population density (Sherbinin et al. 2007). Climate change impacts are not just restricted to physical hazards like extreme weather events, flooding or storms but are also impacting various other social-economic areas like human health, migration, poverty, gender, water security, and many more. Inequality and injustices are increasing through these impacts accordingly (UN-Habitat 2011). To varying degrees local governments can play a role in decreasing emissions and fighting inequalities through implementing policies in areas like energy, waste management and transportation, but also through channels like lobbying with national governments or exchange with other cities (Betsill and Bulkeley 2003). The article by *Deutschlandfunk* mentions several examples of cities around the world using different ways to lead a green transition:

> "I'll give the example of Cape Town, for example, they've gone so far as to take the national government to court so they can decide where they can buy their electricity." Rana Adib (translated by the author) (Deutschlandfunk 2021)

Furthermore, cities, due to their high population and economic density, are centres of innovation and knowledge that have high potentials for the creation of new, sustainable technology, and local bottom-up initiatives that can lead the transformation of our economy and politics (UN-Habitat 2011) to a green future. Therefore, local governments, as the article from *Deutschlandfunk* suggests, are valuable actors for implementing climate action.

Local governments around the world are already stepping up and have created ways to deal with the prior mentioned issues and challenges. An important part of this action is the creation of transnational networks: Cities around the world are self-organizing in networks like the Cities Climate Leadership Group (C40) with 97 member cities (https://www.c40.org/) or the Cities for Climate Protection (CCP) with more than 650 local governments (Cities for Climate Protection Campaign 2021) to collectively deal with climate change and its impacts. These networks can create several mechanisms for its members to increase their actions towards a sustainable city. Mechanisms include knowledge and information transfer (Bouteligier 2013a), best-practice exchanges (Toly 2008), platforms for monitoring and technical assistance (Betsill and Bulkeley 2004), and a platform for connections to external partners and relations (Bulkeley et al. 2014).

There are various other solutions that cities have found to deal with climate issues that can be summarized under the term urban climate action. Urban climate action itself is a very complex topic because at the global and local level it includes many actors who collectively want to achieve a certain outcome, fighting climate change, but often fail to do so because of their own interests (Johnson 2015, 9f). This represents a form of collective action problem (Olson 1965). Urban climate action therefore is an example of collective action, which holds many complex situations that research has covered to some degree. When studying collective action, economics research has a long tradition in using games to study actor groups, and how they behave and interact in certain social dilemma situations (Ostrom et al. 2008). Since cities, as established before, take up an important role in the transition to a green and sustainable future, research on collective action and cities can contribute to the current discourse.

A simulation of the collective action situation of cities is the online game KEEP COOL mobile. It is a serious game where players act as city mayors in a global game context, taking up the roles of governing and developing a city, while interacting with other mayors. The increasing temperature in the game represents the increasing temperature in the real-world, therefore

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simulating a climate change collective action situation. So far, KEEP COOL mobile has been primarily used as an educational tool for teaching about climate change and cooperation, and in research for studying the learning and educational effects on the players. This thesis wants to go beyond that and explore, whether KEEP COOL mobile is also suitable for research on urban climate action and collective action as an experimental arena. By comparing in-game action situations and real-life action situations, it aims to be a contribution to the literature on urban climate action and collective action. If the game can help researchers understand how actor groups behave and interact in certain action situations, this can be a valuable tool for research on urban climate action and the interactions of local governments and other actors in a local and global arena. If we need cities to reach climate targets, it is valuable for research on urban climate action to understand the interactions of involved actors.

1.2   Problem statement

A recent report by the UN Climate Change (UNFCCC 2021) shows that nation states fail to address and handle the climate crisis: Nations commitments to reduce greenhouse gas emissions are failing to reach the 1,5°C or even the 2°C goal from the Paris Agreement. If national governments fail, there is a possibility and need for alternative options and solutions. As mentioned in the last section, the possibilities, and chances for cities to act upon climate change are manifold. On the other hand, the literature on urban climate action suggests that cities are nevertheless facing various challenges that halt them from successful climate action (Tänzler et al. 2017; Madsen and Hansen 2018; C40 Cities Climate Leadership Group 2015b; Satterthwaite 2007; Betsill and Bulkeley 2007; Reckien et al. 2014). The social dilemma involves many actors and various action situations arise. Cities can be leaders in climate action, but this depends on various factors: One example is that cities with more capacities and resources are often more ambitious and successful at climate action than cities from low- or middle-income countries (Satterthwaite 2007).

Since gaming can be a form of simplification of real-world structures (Meijer 2009), it can help us understand interactions between players and the way they deal with issues. KEEP COOL mobile is a simplification of the real-world structures that cities face when dealing with climate change. Researchers being able to understand these challenges and draw conclusions for local governments by using KEEP COOL mobile as a research tool can be valuable for research on urban climate action. Since games are a form of experimentation but not in a

laboratory setting, they offer an area for research on human interaction and behaviour. For being able to draw conclusions from the game KEEP COOL mobile to local governments, the game design and structures first must represent the action situations that local governments face in real-life. Understanding the way those actions situations are represented in the game and how actor groups deal with these situations accordingly is a first step to establishing the suitability of KEEP COOL mobile for experimental research on urban climate action. This thesis aims to analyse the game structures and the experiences of its players, for determining this suitability.

1.3   State of the art

Research on urban climate action is not scarce (van der Heijden 2019). When entering "urban" "climate" "action" into the literature search web-tool Google Scholar (https://scholar.google.de/), there are over 2,5 Million results for papers, books, or articles with these search entries. Research on urban climate governance is varied and manifold but the gap between policies, measures and real local action is still high (van der Heijden 2019). As this thesis wants to study urban climate action and collective action with the online serious game KEEP COOL mobile, the existing literature in this area becomes much more scarce. Serious gaming is gaming with a purpose other than just entertainment (Susi et al. 2007). This form of gaming is currently becoming more commonly applied in research, especially in the form of research on the educational and learning factor of these games, but is also used in the military, in health care, in the government and in corporations for training (Susi et al. 2007). Using games as an experimental arena is not the most common practice, but has found some applications in the form of simulation gaming: The game serves as an experiment for testing hypotheses and studying a model-world with the behaviour of its players to study real-world systems (Meijer 2009). Collective action, as mentioned before, is commonly studied using games in institutional economics research. Using a gaming simulation to study urban climate action and create knowledge for the researcher about real-world structures creates a novel form of using this method. Often, simulation gaming and natural resource management is focusing on decision-makers and their training (Barreteau et al. 2007). Therefore, this thesis aims to contribute to the existing literature on serious games as an experimental arena for research on collective action. Since the underlying game KEEP COOL mobile is focusing on cities or mayors as actors, the research is focusing on urban climate action. I will compare real-life action situations from urban climate action to in-game action situations and structures, to

find similarities and differences. This can help establishing the representation of urban climate action in the game and identifying whether KEEP COOL mobile can be a suitable tool for research on urban climate action especially concerning collective action.

1.4   Research question

In this thesis I will compare action situations from the literature on urban climate action, established and analysed with the IAD-Framework, with action situations in the game. The overarching research question is: **Is KEEP COOL mobile a suitable tool for research on action situations in urban climate action?** The intermediate research question is: **How do in-game problems and solutions reflect the problems and solutions real local governments are confronted with?** And the Operative Research Questions are:

1. What are the action situations local governments face in urban climate action?
2. How do local governments deal with those action situations or what does the literature suggest as possible solutions to deal with these action situations?
3. How are the action situations that local governments face represented in the game KEEP COOL mobile?
4. Are there differences in how players in KEEP COOL mobile deal with action situations in the game compared to actors in city governments and to suggested solutions from the literature on urban climate action?

1.5   Summary and Structure of the thesis

Cities and climate change have been increasingly studied in the literature due to the role they can play in tackling its causes and impacts. Urban climate action is a playground for various action situations. Research has focused on the many ways local governing can be improved but action is still lacking in many areas (van der Heijden 2019). Therefore, research on the interactions of actors in different action situations can help understand some of the underlying issues in urban climate action. The online game KEEP COOL mobile lets players take on the role of city mayors that deal with an increasing global temperature and developments to their own city. This game design creates a valuable arena for interaction between players. The thesis uses a qualitative research design in the form of focus group discussions with players of the game. This can identify whether KEEP COOL mobile can be used as a research tool for urban climate action and collective action situations therein.

Chapter 2 will lay the theoretical basis for the thesis with an introduction to collective action theory and the IAD– Framework. This will be the basis for analysing the action situations in

urban climate action. The theoretical introduction is followed by a systematic literature review on urban climate action to identify the action situations from the literature as well as how local governments deal with these issues or what is suggested by the literature as a solution. This will answer the operative research questions 1 and 2. After an introduction to the game design of KEEP COOL mobile I will establish, based on the design, how action situations are represented in the game to conclude with initial propositions on how actor groups experience and deal with these action situations from the literature in the game. I will continue in chapter 3 with the overall research design, formulated hypothesis and lay out the methods for testing these hypotheses and answering the operative research questions 3 and 4. In chapter 4 I will lay out the results of the empirical data collection and analyse these results according to the theoretical background: I will compare action situations from the literature with action situations in the game, to answer my research questions. Lastly, I will discuss the results and the implications for research on urban climate action and KEEP COOL mobile in chapter 5 to come to a general conclusion in chapter 6.

2 Theoretical Background & Literature review

In this chapter I will provide a brief theoretical background of collective action theory and introduce the IAD- Framework. Then I will establish the most important action situations that cities face dealing with climate change through a systematic literature review of urban climate literature. Furthermore, I will describe which solutions or strategies cities have found to deal with those situations as well as some suggested solutions from the literature. By introducing KEEP COOL mobile and its game design, I will compare how the action situations I have established from the literature can be represented in the game. Finally, with this background, I am going to make some propositions on how players in the game are going to deal with the action situations that may or may not be fully represented in the game.

2.1 Collective action & IAD- Framework

Olson's research on collective action (Olson 1965) became a milestone in research on group behavior, rationality and the commons. He was studying the following issue: In groups that work together achieving an optimal outcome, there is a conflict between individual rationality and group outcome. This is also described in the "Tragedy of the commons" introduced by Hardin (Hardin 1968) dealing with the social dilemma on the extraction of common-pool

resources: He argues that a group of users of a resource will eventually lead to overexploitation due to their own self-interests. The classic solution or the "conventional theory of collective action" to this issue is the creation of private property or a central authority (Ostrom 2014). Further research has provided an alternative solution in the form of self-organization (Ostrom et al. 1961; Ostrom 2005, 2014).

Dealing with climate change is a form of collective action problem because it involves multiple actors. Collectively a better outcome could be achieved, but all actors have their own interests, that might collide with the desired group outcome. Everyone profits from a reduction in greenhouse gas emissions even if some actors are not contributing to the public good (a good that is non-rivalrous and non-excludable) (Ostrom et al. 2012; Ostrom 2009). The individual rational actor can chose to maximize its benefit in the short-term, therefore not providing to the public good and resulting in lower group outcome (Ostrom 2014).

An analytical tool for dealing with social dilemmas provided by Elinor Ostrom is the IAD-Framework. This tool uses an action situation as the focal point of analysis, wherein the action situation is described as the following: "Whenever two or more individuals are faced with a set of potential actions that jointly produce outcomes, these individuals can be said to be "in" an action situation" (Ostrom 2005, p. 32). Other basic components of the IAD-Framework are the contextual factors that serve as inputs to the action situation and lay the social, economic, political, cultural and biophysical foundation for the action situation. This consists of biophysical conditions, attributes of community and rules-in-use. The working parts of the action situations are influenced by these factors and accordingly interact to come to a certain outcome under the evaluation of certain aspects. The outcome is moreover affected by and affects the contextual factors (McGinnis 2011). The action situation itself is the space " where operational, collective, or constitutional choices are made" (McGinnis 2011, p. 177). In this arena, there are several working parts which characterize the situation: The **participants** are the actors in the situation. They are making decisions, chose their **actions** and act either individually or collectively as an organization. They are taking up specific **positions** which are directly linked to the **actions** that they are capable of making. Those **positions** describe how **participants** can act according to their role in the system. One **participant** can have several **positions**. The **participants** have a certain amount of **control** over the situation, which is influenced by power and opportunity, and are limited in their actions by the **information** they have about the

different variables of the situation. There are potential **outcomes** to the action situations which are linked to **costs and benefits** for all actions and outcomes to the **participants.** These structures are similar to the structures or rules and parts of a game (Ostrom 2005, 32f).

2.2 Collective action & Games

Games are commonly used to analyze collective action problems because they represent a simplification of real-world problems, and the elements of the game can represent some elements that the IAD-Framework consists of. The more complex the game, the more elements exist, and the more analytical tools are present (Ostrom et al. 2008, pp. 27–29). Using games to study social dilemmas furthermore lets you create an experimental arena for studying group interactions, applying treatments to the research, and controlling the system in a way that observations can be made (Meijer 2009). One of the most commonly used examples of a social dilemma game is the Prisoner's Dilemma: When two people are charged with a crime and are interrogated separately without being able to communicate, they face a coordination problem. They will achieve the group optimum (shortest total length of jail time) if both stay silent, but their individual incentive would be to confess, nevertheless. When staying silent you bear the risk of the other one confessing and therefore receiving the worst individual outcome (Sally 1995).

Research using games to analyze how people deal with these kinds of dilemmas has shown that, contrary to the believe that groups are not capable with dealing with the provision of a public good or the usage of a common-pool resource without private property or an external authority, there are many examples of groups finding a way of self-organizing to sustainably manage their resources. Players cooperate to achieve a common goal and deal with occurring issues (Cárdenas and Ostrom 2004). Research has also revealed that one major influence on the success of dealing with collective action problems is communication. When introducing a form of communication to a game where players deal with a social dilemma, efficiency increases (Ostrom and Walker 1989; Cardenas 2000; Ostrom et al. 1992). This includes forms of sanctioning and punishment, discussing game strategy, verbal agreements and more (Ostrom et al. 2008, pp. 145–169).

Since the purpose of this thesis is studying the public-good game KEEP COOL mobile as a tool for urban climate action research, I intend to observe some of those forms of self-

organization, cooperation, and communication. The thesis attempts to show how well these ways of dealing with collective action problems are actually represented in the game.

2.3 Urban climate action: Action situations from the literature

Local governments have found different ways to deal with climate change. Those actions are often limited by external factors like national policies or funding possibilities. The literature on urban climate action presents the following collective action problems as the most pressing issues that cities face in dealing with climate change. The next section will answer the operative research question 1: What are the action situations local governments face in urban climate action? I am applying the IAD-Framework to these issues to establish the different working parts of these situations for analysing these complex systems:

1. **Emissions reductions: Cities dealing with the public good climate change are not successful at sufficiently reducing greenhouse gas emissions.**

One question that often comes up in urban climate action literature is whether climate action is successfully dealing with climate change. As mentioned before, cities have self-organized in the form of transnational city networks to collectively battle climate change. Often these networks are criticized on whether they are sufficient in reducing greenhouse gas emissions (Bansard et al. 2017). There are high variations in emissions reductions comparing different European cities; one study has found that 35% of European cities have no dedicated mitigation plan (Reckien et al. 2014). Cities often focus on areas that they are familiar with and already knowledgeable in, when implementing climate policies (Betsill and Bulkeley 2004). This creates gaps in developments to other areas of city development. Furthermore, the focus of transnational networks often lies in best-practice exchanges and the learning potential that the networks offer and the networks lack binding contracts (Acuto 2013b; Bouteligier 2013a). Free-riders can evolve when cities are only acting in areas that they are most suitable to them (Acuto 2013a). Table 1 shows the different variables of the IAD- Framework for this action situation.

Table 1: IAD- Framework variables for action situation 1: Emissions reductions

IAD- Framework variable	Action situation 1: Emissions reductions	
Participants	City governments as a collective	City networks
Positions	Governmental entities Part of the city network in global climate action arena	Network organizations

	More active or passive position	
Actions	Climate action policies	Monitoring
	Greenhouse gas emissions reductions	Reporting
	Free-riding – benefit from the reductions of others	Criteria for its members
	Self-organization in city networks-exchange of best- practices	Information & knowledge provision
Control	Control on how much climate action is established locally - effect on other cities through global impacts.	Control the members through network criteria
	Cannot control other cities' actions	
Information	Some cities have more information (knowledge and resources) than other cities	Information can be shared through the network
Potential Outcomes	Cities reduce their emissions.	
	Cities free ride.	
	Cities don't reduce their emissions and bear the consequences of increasing global temperatures	
Costs & Benefits	Costs include investing resources in climate action and the costs of negative impacts of climate change.	
	Benefits are the potential co-benefits of climate change and saving resources through mitigation measures in the long-term	

2. Navigating resources: Navigating between own city resources and financing climate action

Local governments are restricted by their own financial, human, and political resources. Cities are generally more active in climate action when they have sufficient local resources, political actors and national policies supporting climate action (Kern 2018; Betsill and Bulkeley 2004; Bouteligier 2013b). This leads to power asymmetries between cities of the Global North and cities of the Global South (Torney 2019). Low- and middle income countries, and their respective cities, lack the institutional and financial capacities to act on climate change (Satterthwaite 2007). Those cities struggle to get into positions of leadership for climate action because they are focusing on other issues to their city development (Bulkeley 2010). An important role in determining the available resources of cities is played by national policies or subsidies which can either support or hinder climate action (C40 Cities Climate Leadership Group 2015c). This can furthermore influence another pressing issue concerning resources, which is the lack or inaccessibility of funding. A report by the network C40 Cities Climate

Leadership group has found that "21% of the challenges cities face are related to Resources and Funding" (C40 Cities Climate Leadership Group 2015b, p. 38). Often local governments lack the knowledge and capacities to access suitable funding for climate programmes. In Table 2 you can find the different variables for this action situation.

Table 2: IAD- Framework variables for action situation 2: Navigating resources

IAD- Framework variable:	Action situation 2: Navigating resources			
Participants	Local governments	National governments	Development banks & private funding organizations	City networks
Positions	Governmental entity Can be a part of the city network. Some can easily acces funding, others are restrained by their resources	Governmental entity	Funding entities	Network organization
Actions	Decision on how much to invest in climate action. Approach external actors for funding.	Provide funding possibilities	Provide funding possibilities	Can create private partnerships for making funding available to its members
Control	Local governments are dependent on other actors. Cities with more resources have more powers and opportunities and therefore more control than cities with fewer resources available	Can control how much funding local governments get		
Information	Some local governments lack the information on how funding can be made available Networks can serve as an information hub for making funding possibilities visible			
Potential Outcomes	Funding is made available, which in turn leads to an increase in climate action policies. When no funding is available, climate action halts.			
Costs & Benefits	There are transaction costs involved in finding the right funding choices, but those can be reduced through networks or national governments. Benefits in this situation are the co-benefits of climate action and possible beneficial partnerships with external actors for the local governments.			

3. Internal conflicts: conflicting interests inside city governments

Local governments are collective actors with different departments representing different interests. This leads to a conflict of interests inside the governments. The C40 report mentioned before states that institutional, regulatory and legislative challenges make up 17% of challenges towards climate action. This includes "fragmented or 'silo-ed' working by city agencies ", and "unclear roles/ responsibilities for climate action" which leads to insufficient or ineffective action (C40 Cities Climate Leadership Group 2015b). Due to the complexity of the issue, there are often problems of coordination within the governments and interests at the department level are pushed before other interests (Monstadt 2007). There are many stakeholders involved in the process of climate action, which include local citizens (interests), local versus national governments, political fractions and neighbouring municipalities, all representing conflicting interests (Madsen and Hansen 2018; Coutard and Rutherford 2010; Monstadt 2007). Table 3 lists the variables for the action situation according to the IAD-Framework.

Table 3: IAD- Framework variables for action situation 3: Internal conflicts

IAD-Framework variable:	Action situation 3: Internal Conflicts			
Participants	Members of local governments			External stakeholders: citizens
Positions	Mayors	Ministries for each department	Local government as collective	Voting citizens
Actions	Mayors can initiate city-wide initiatives on climate action that reach several departments	Can work collectively in a climate programme. Decide on how much investments are made into climate action. Actions of the departments can reach across other departments.	Ministries can work collectively in a climate programme	Citizens act as voters to the city government
Control		Each department has control over their representative agenda but is limited by city-wide policies and available resources		Local government controlled by the election of their citizens
Information	There might be missing information about the co-benefits of climate change, applicable for various departments			

Potential Outcomes	An outcome of the situation is that cities create capacities to coordinate through climate action programmes that affect all significant departments.
	Departments might put their individual interests first or citizens might vote out the government, when unhappy
Costs & Benefits	Evolving costs are transaction costs for communication and coordination between the departments and direct costs for building capacities in the form of staff and knowledge.
	Benefits are the long-term co-benefits of climate action on the government and the citizens.

4. Political challenges: political and leadership challenges when dealing with climate change.

Apart from institutional and resource issues, local governments are defined by their political leaders and governing parties. The C40 Report states that political challenges make up 20% of all challenges concerning climate action (C40 Cities Climate Leadership Group 2015b). Political leaders, parties and their interests shape the directions of the government and how much investments are made towards climate change adaptation and mitigation measures. The C40 Report lists "short mayoral terms / electoral cycles", "climate change scepticism" and "business lobbies" as influencing factors of political action. Apart from political interests, governments often struggle with the complexity of climate change and are not capable of promoting sustainable development to their cities. Some governments are corrupt or unwilling to focus on the issues of their population and urban elites want a modern city which in their view doesn't align with climate action (Satterthwaite 2007). The capability to deal with certain issues is also constrained by the power or control that cities have over their resources; some local governments cannot fully control their assets, making them unable to act (C40 Cities Climate Leadership Group 2015a). In Table 4, I list the different variables for this action situation.

Table 4: IAD- Framework variables for action situation 4: Political challenges

IAD- Framework variable:	Action situation 4: political challenges		
Participants	Political leaders	Lobby groups	Citizens
Positions	Governmental leader Party member	Part of the lobbying group	Voting citizens
Actions	Act corrupt Put their own interests before climate issues or	Act as an influence on the decision-making of political leaders.	Citizens vote

	issues concerning their population, which in turn influences policies		
Control	Political leaders are in control over climate action policies	Control over decisions of political leaders	Control over the government formation
Information	In some cities citizens lack information on the governmental institutions because of corruption		
Potential Outcomes	Political leaders put their interests first and ignore the issues of their population and climate action. Political leaders can be voted out of office and governments can consider the benefits of climate action for the collective and reduce issues		
Costs & Benefits	Climate action policies can lead to job creations, therefore wealth for the city and satisfied citizens as a potential benefit. Costs involve the investment into climate action policies and upsetting lobby groups, when not matching their interests.		

5. Citizens interests: the citizens interests do not match with climate action policies.

Local governments are influenced by the interests of their citizens because they are hoping for re-election. Citizens do not want negative influences on their lifestyle and can have a negative attitude towards climate action policies. Due to their hope for re-election, this might lead local governments to not implementing climate action policies. Social and cultural interests of citizens, that are not necessarily aligned with sustainable actions, are an important factor influencing political choices. In Houston, USA, for instance, taking the public transport is culturally considered a low-income activity. The car serves as a status symbol for richer people and improving public infrastructure is not widely accepted (C40 Cities Climate Leadership Group 2015b). Local governments are faced with the decision of satisfying their citizens or implementing climate action, nevertheless. Table 5 lists the IAD- Framework variables of this action situation.

Table 5: IAD- Framework variables for action situation 5: citizens interests

IAD- Framework variable:	Action situation 5: citizens interests	
Participants	Population of cities	Governments
Positions	Citizens	Local governmental entity
Actions	Act as voters	Governments are creating policies

Control	Citizens control the government through voting. They influence the governments decisions because it wants to be re-elected.	Governments by making policies have control over certain aspects of the citizens actions.
Information	Citizens lack the information of the various co-benefits of climate action	
Potential Outcomes	An outcome of the situation would be for the government to implement educational institutions on the benefits of climate action, resulting in more acceptance of climate policies	
Costs & Benefits	This involves short-term costs for the government through capacity-building but can reduce costs for both sides of actors resulting in benefits in the long-run.	

6. Information gap: Closing information / knowledge gaps on climate action.

A very valuable factor of successful climate action are the co-benefits associated with climate adaptation and mitigation measures. These benefits, which run through many different departments of governments, are often not calculated when considering climate policies (C40 Cities Climate Leadership Group 2015b). Information and research at the local level is often missing and local data is not recorded (Galford et al. 2016). There is a gap between cities which have more resources and cities with fewer resources on available information and the opportunity to invest in technologies and research (Bulkeley 2010). In Table 6, there are the different variables from the IAD-Framework of this action situation.

Table 6: IAD- Framework variables for action situation 6: Information gap

IAD- Framework variable:	Action situation 6: information gap	
Participants	Local governments	Research institutes
Positions	More or less informed about the co-benefits of climate action, often connected to the resources a city has available	Information provider
Actions	Cities can share their best-practices, knowledge, and information. Cities can potentially share their knowledge especially through a network	Provide best-practices, knowledge, and information
Information	Cities with more capacities have more information on climate action and are often more successful in implementing those actions. Other cities lack information to implement successful climate action programmes	
Potential Outcomes	Some cities are stuck without the capacities and knowledge about climate action. Knowledge is shared	
Costs & Benefits	Costs involved are the transaction costs of sharing and distributing information.	

	Benefits are the learning effects that can reduce costs by using more sustainable and efficient programmes.

The prior analysis with the IAD-Framework shows that the action situations for local governments are often connected but result in several different issues at multiple levels. The gap between cities with more resources compared to cities with fewer resources is a great hindering factor of urban climate action. Often many actors are involved that have varying interests, hindering climate action.

2.4 Urban climate action: Strategies for dealing with action situations

Local governments have established solutions to deal with the action situations they face concerning climate action. There are several structures in practice in which those action situations are addressed and dealt with. Often the solutions are presented through city networks, which can, if successful in its operations, create multiple benefits to its members. The literature and research on urban climate action also suggest some theoretical solutions to the underlying issues. Due to the complexity and connectedness of climate change, many of the solutions are connected and are re-occurring in different action situations. This section will answer the operative research question 2: How do local governments deal with those action situations or what does the literature suggest as possible solutions to deal with these action situations?

1. Emissions reductions

One way for transnational city networks to deal with free riders is to create strong monitoring structures for measuring, for example, greenhouse gas emissions. Some networks have rules on reporting and monitoring (Bansard et al. 2017). The CCP (Cities for Climate Protection program) for instance has an emphasis on evaluation and monitoring and offers a monitoring software for member cities. Cities which establish these monitoring structures tend to be more active in the network and successful at climate action (Betsill and Bulkeley 2004). A praxis example from the C40 Cities Climate Leadership group highlights the importance of monitoring: Mexico City, a city that is part of the network, is reporting all their emissions in almost half of their climate action measures (C40 Cities Climate Leadership Group 2015a). Networks can furthermore create criteria for entering the network. The C40 for example has three categories for network participation (Lin 2018) and since 2010 (implementation of the

Hong Kong Strategy) the organisational structures of the C40 have become much more structured and formal (Acuto 2013a). The most successful cities in climate action are often the most active in the city networks. Strong network ties and cooperation can increase successful climate action (Betsill and Bulkeley 2003). Literature on urban climate action suggests that highlighting the co-benefits of climate action can be an efficient strategy in successful climate action. Cities that understand the importance of co-benefits report more mitigation actions. Moving from climate policy programme to a specific project or incentives also entails fruitful climate action (C40 Cities Climate Leadership Group 2015a).

These solutions are nevertheless subject to some difficulties. There is the pre-existing gap between cities of the Global North and the Global South, which is also manifested in monitoring (Satterthwaite 2007). Network membership is voluntary and control over the members is difficult and intensive (Gordon 2013).

2. Navigating resources

When local governments are considering implementing climate action, they often don't consider the co-benefits that climate action brings to multiple areas of the government. Defining and understanding that these actions have benefits for topics like air quality, local economy, liveability (by creating green spaces), reducing equity, energy savings, transportation and many more is crucial for local governments. Calculating the benefits that actions can have on costs in the long term is severely needed. (Betsill and Bulkeley 2003; C40 Cities Climate Leadership Group 2015b). Concerning funding, cities need to be provided with the proper information on funding availabilities, funding opportunities and its efficient use (Tänzler et al. 2017). Funding availabilities include less traditional funding sources like green bonds or grants, taxes and subsidies (C40 Cities Climate Leadership Group 2015a). This can be established through a transnational network. These networks can create partnerships with external partners like private organizations. Public-private partnerships can make resources available and reduce costs (Lin 2018; Bouteligier 2013a) or help financing a pilot project (C40 Cities Climate Leadership Group 2015a). Other partners that the network establishes are other transnational networks, or international organizations like the World Bank, which for example provides financial or infrastructural resources (Lin 2018). Especially the less active members, with fewer resources, profit from these partnerships (Acuto 2013a). The membership in a

network can facilitate funding from international organizations like the EU: The network can lobby the cities' interests with these organizations (Kern 2018).

Challenges in this area are that different networks compete for the same funding (Kern and Bulkeley 2009) and efficient use of funding. Often one department of the government profits and others lack behind (Tänzler et al. 2017).

3. Internal conflicts:

One solution to battling internal conflicts within a local government is to create capacities to push communication throughout the local government. Creating a city-wide climate change programme increases communication and involves all departments. An example for successful climate communication comes from Durban: The city government implemented a "Headline Climate Change Adaptation Strategy" after several natural disasters causing high costs to the government showed the importance of acting on climate change. This strategy included various departments like infrastructure, human health, food security and more and therefore showed the relevance of the issue (Satterthwaite 2007, pp. 55–58). Cities as part of the C40 Network are also investing in staff, knowledge and time on climate action through all departments to prevent internal conflicts (C40 Cities Climate Leadership Group 2015a). As mentioned in the prior two action situations, highlighting the co-benefits of climate action also helps with solving internal conflicts. Examples are improving resource efficiency, quality and security, greening the economy, sustainable behaviour, circular economy, access to transportation and mobility and job creation (Bachra et al. 2020).

A challenge concerning co-benefits and climate programmes is that they often involve some form of short-term investment. This is especially an obstacle for low-income cities (C40 Cities Climate Leadership Group 2015a, p. 30).

4. Political challenges

Fighting political challenges is a complex issue since convincing corrupt governments or political leaders that deny the existence, or the threats of climate change is a challenging task. One solution suggested by the literature is research across disciplines. Research on the socio-economic context of climate change and the impacts it has on social and economic development is crucial for understanding the urge for climate action at the local level. In India, for example, the 2004 Indian Ocean Tsunami created a discussion on risk management and

environmental sustainability which led to the implementation of management plans (Satterthwaite 2007). Pairing climate change research with risk disaster management can be a successful measure to increase climate change consciousness (ibid.). Concerning political capabilities and institutional capacities: When local governments lack the capacities to implement climate action policies, higher levels of government can provide incentives and aids (Satterthwaite 2007). Apart from that, networks can create capacities through public-private partnerships and other partnerships with external actors (C40 Cities Climate Leadership Group 2015c). Even though short mayoral cycles on the one hand can lead to less climate action, the opposite phenomenon can occur when elected parties are eager to show progress in the short amount of time (C40 Cities Climate Leadership Group 2015b).

5. Citizens interests

A recent study by the CDP (Carbon Disclosure Project) (Bachra et al. 2020) highlights the co-benefits of climate change that influence citizens directly: Climate action can entail poverty reduction, improved resource quality & security, social community and labour improvements, enhanced resilience, security of tenure, social inclusion and social justice and many more (Bachra et al. 2020, p. 10). A recent C40 Report states that "In 2015, ten cities alone reported employing more than 485,000 people in green jobs and industries" (C40 Cities Climate Leadership Group 2015a, p. 11). These benefits need to be presented to the citizens so that they understand the importance of climate action. Furthermore, the discourse should move away from natural science and towards environmental justice and human rights related to climate action (Moser and Dilling 2007, pp. 119–131). A study found that framing the issue as a local issue of injustice creates more acceptance in the community (Moser and Dilling 2007, 130f). For changing cultural and lifestyle values of citizens, education and information can be helpful (Bulkeley et al. 2009, 28f) as well as addressing the collective and not the individual when educating (Moser and Dilling 2007, p. 254).

When educating on climate action to the public, a major challenge is the right messenger: Outsiders or experts might not be trusted (Moser and Dilling 2007). Education only also does not necessarily entail behavioural change (ibid.).

6. Information gap

For closing the information gap on climate action, a solution can be communication through the transnational networks. Best-practice exchanges between cities (Lin 2018), workshops and information exchange within the network (C40 Cities Climate Leadership Group 2015a, p. 47) and collaborations between different cities are some of these methods. The C40 Report, mentioned earlier, states that "In 2015, cities reported that a substantial 30% of all actions they have delivered involve collaboration with other cities" (C40 Cities Climate Leadership Group 2015a, p. 52). Cities are often part of many networks and can learn from other cities with the same conditions, because there are less transaction costs involved than in learning from cities that are different (Lee and van de Meene 2012). The networks also provide technical assistance for monitoring, reporting and measuring greenhouse gas emissions (C40 Cities Climate Leadership Group 2015a). Furthermore, research can contribute by establishing climate models and data combined with an understanding of the local circumstances (Knutti 2019).

Non-network cities can be excluded from these benefits.

To sum up, there are multiple reoccurring themes when studying the research on urban climate action and ways that local governments deal with action situations: These include highlighting the co-benefits of climate action, the benefits that are provided by a city network and the gap between cities of the Global North and the Global South.

2.5   KEEP COOL mobile: Game design

KEEP COOL was originally designed as a board game for teaching about climate change and cooperation on climate action. It was developed by scientists at the Potsdam Institute for Climate Impact Research (PIK) to establish a dialogue in the research community and especially between sciences and the public, mainly in the form of teachers and students but also journalists, people interested in gaming or sustainability or NGO's (Eisenack 2013). In 2016 the game was developed into a mobile version, which is available for free online. There are a German and an international version (available in: German, English, Romanian, Ukrainian or Russian) available online and this thesis is using the international version found under the domain: http://www.keepcoolmobile.org/ .

In the game the players are mayors of world cities that can win the game by gaining points through various developments to their city. At the beginning of the game, you are randomly allocated to an alliance or country group (USA & Partner, Europe, BRIC countries or G 77) and can then chose which city you want to govern. The game has a time limit: It starts in the year 2000 and lasts for 100 years. Depending on the settings by the game initiator this translates into around 45-60mins per game. Some developments to the city entail the negative externality of increasing emissions and rising global temperatures, which increase natural disasters that costs the players money. If the global rising temperature reaches two degrees, the game ends for all players and no one wins. Players therefore have to coordinate and cooperate to stop the ongoing temperature increase.

The main functions in KEEP COOL mobile are: Construction, sending or receiving money, voting in a climate conference, research and answering citizens' political demands. With the construction function you can either build or tear off black factories, which emit greenhouse gases or green factories, which do not emit. With the factories you earn money, yearly. You can also build adaptation or protection measures to protect your city in case of a natural disaster due to climate change, or plant trees, which reduce greenhouse gas emissions, act as a protection measure, and earn you money. All functions cost a certain amount of money to build; black factories start off cheaper than green factories. Adaptation measures become more expensive as the game progresses and the temperature increases. In KEEP COOL mobile you start the game with four black factories and have money units to spend on developments. Trees and factories earn you victory points. Another way of earning victory points is through the political demands of the citizens. They will ask the player for various actions like building factories or starting a research project. The victory points from meeting political demands are secret and can therefore not be seen by other players. Another function is to send money to other players and receive money from them. Players can use the research tool for starting a research project by investing money into a technological development, that, if successful, will lead to lowering the price of building either green or black factories. Research projects can be done collectively by multiple players. The game furthermore includes a climate conference. In the conference you are part of your country group and vote for or against various political topics, policies, sanctions, or other measures.

Some additional tools of the game are the game chat, which lets you communicate with other player and the world map, where you can explore other cities and see how many factories the other players have built. There is also the game statistics which shows you how many factories every player has built and some more insight into the game, like total factories, trees or protection levels around the world.

This game is a representation of the social dilemma of climate change. It shows the importance of cooperation, highlights the free-rider phenomenon, and teaches about climate change impacts. Therefore, this thesis wants to establish to what degree collective action problems appear inside the game compared to collective action problems from urban climate action and especially how players deal with these issues. Most importantly, it features a diversity of interdependent action situations which may or may not match with the one's real mayors and local governments face. Furthermore, the complex network of action situations within the game raises the question of the players' awareness: players may or may not be aware of the strategic interactions at play, affecting both their individual and collective strategies in dealing with the game's different social dilemmas.

2.6   Representation of action situations from the literature in the game

Even though the game KEEP COOL mobile is a representation of urban climate action, a game is a simplification of a very complex real-world situation and cannot fully represent all action situations that local governments face. The game design already gives some insights in what kind of action situations can be represented and where there are some limitations. I will compare the action situations I have established in chapter 2.3 with the game design to get a first understanding of how much of the real-life structures are represented in the game. This is a first look at my operative research question 3: How are the action situations that local governments face represented in the game KEEP COOL mobile? The empirical data of the focus groups after the game sessions will then help identify what kind of situations the players are faced with and how they experience and deal with interactions in the game, to learn whether these findings can be helpful for further research on urban climate action.

1.   **Emissions reductions**

An important feature of KEEP COOL mobile is the representation of the collective action situation of climate change for cities. Through the increasing global temperature, which is

influenced by and influences everyone, the game design creates a social dilemma in which actors are faced with dealing collectively with this problem of emissions reductions. In Table 7 the variables of this action situation and its in-game representation are listed. The **position** of city networks which are very present in the literature on urban climate action, is not fully represented in the game. Communication between the players is a form of self-organizing. The game statistics and world map somewhat represent the **position** of an external monitoring or reporting institution.

Table 7: IAD- Framework variables for action situation 1: Emissions reductions - in KEEP COOL mobile

IAD- Framework variable:	Action situation 1: Emissions reductions	
Participants	Game players	Citizens - a participant, who is not as present in the real-life action situation
Positions	Mayors	Demanding citizens
Actions	Building green or black factories Investing in a research project Voting in climate conferences Planting trees Communicating with other mayors about their actions Act as free riders	Limited to the action of randomly demanding different kinds of actions of the players / mayors
Control	Since mayors are the only governmental institution present in the game, they have a high control over the increasing temperature, higher than in real-life action situations. Controlling the level of local climate action, similar to real-life mayors	Determine and therefore control climate action of their mayors through their demands
Information	Information is the same for all cities, differentiating the in-game action situations from the real-life structures, where cities have varying prerequisites	
Potential Outcomes	The different actions determine how much emissions actively (factories and trees) or passively (reducing costs for climate action, communication in the form of social sanctions) each city has. Outcomes are the same as in urban climate action: Emissions can be reduced or not.	
Costs & Benefits	Co-benefits are represented in the game through the benefit of trees creating a form of adaptation which leads to less costs when natural disasters occur. Costs are directly included in the game in the form of investment costs for different climate actions.	

By only looking at the game design, it is not apparent whether players will also experience cities that are not successful at reducing emissions like in the real-world action situation. The game results and focus group discussions may show whether players will be successful in reducing emissions.

As potential in-game strategies for this action situation players can cooperate through their prior mentioned actions (communication, research projects, climate conferences) and they can monitor other players by looking at the game map or game statistics. The game, since not fully representing city networks, does not offer any criteria for entering networks as a measure for reducing global emissions. The co-benefits of climate action are quite simplified in the game and cannot be highlighted for the players.

2. Navigating resources

Table 8 represents the variables of this action situations based on the game design of KEEP COOL mobile. National governments and external private entities are not represented in the game, which leads to a reduced set of **actions** and **control**. Power-asymmetries are another important part of this real-life situation that the game does not fully represent. Only through the course of the game, depending on the mayors' **actions** concerning their resources in the beginning of the game, they can take up a **position** of a city with restricted resources in the later part of the game.

Table 8: IAD- Framework variables for action situation 2: Navigating resources - in KEEP COOL mobile

IAD- Framework variable:	Action situation 2: Navigating resources	
Participants	Players	
Positions	Mayors having to deal with the cities' resources but interacting with other mayors for reaching an outcome of the game beneficial for everyone as well as the climate	Position of funding entity: The game offers climate conferences as an institution for the mayors to reach consensus on cost reductions for different actions.
Actions	Players have to coordinate their votes. Building of green or black factories and planting trees and buying protection measures. Research projects and conferences by reducing costs and the option to send money to other players	
Information	Information is somehow linked to the players' knowledge of the game strategy, which results in the availability of resources over the course of the game.	
Potential Outcomes	The outcomes in this situation are mayors either investing less or more money in climate action.	

Costs & Benefits	Benefits are the costs saved when building protection measures or the co-benefits of building trees as a form of protection when natural disasters occur.

As a strategy for dealing with this issue, players in the game have the option to ask other players for money and send money to others, which is a simplified representation of funding availabilities that urban climate actors face through for example a city network in dealing with limited resources. The climate conferences include some ways of reducing costs for climate-friendly activities. National funds or external private partners are not reflected.

3. Internal conflicts

This action situation observed in the literature becomes an internal conflict in the game. Since the game only allows for single mayors and not local government with various actors the conflict is limited to internal conflicts within one player's decision-making process. By looking at the game design, I have analysed the following variables from the IAD-Framework in Table 9.

Table 9: IAD- Framework variables for action situation 3: Internal conflicts - in KEEP COOL mobile

IAD- Framework variable:	Action situation 3: Internal Conflicts	
Participants	Players	Citizens
Positions	Mayors	Citizens demanding their interests
Actions	Mayors can align with the citizens interests or reject their demands	Demanding political measures
Control		Have some control over the decision-making process the players face
Information	The internal conflicts for the players might depend on the information they have on the benefits of each action or strategy that they can play.	
Potential Outcomes	The mayors and citizens might have the same interests or conflicting interests leading to different outcomes, depending on the demands that the game assigns.	
Costs & Benefits	Benefits of strategies	

For dealing with these internal conflicts, similarly to local governments, mayors can invest time or capacities towards choosing the best strategy or making the right decisions. Like the other action situations, co-benefits are a form of solving these internal conflicts, which are somewhat represented in the game. Players can calculate different options and their positive or negative

outcomes for the situation. Since there are no different departments, city-wide climate programmes are not reflected in the game design.

4. & 5. Political challenges & Citizens interests

These two action situations from the literature on urban climate action are already closely linked in real-life but become more connected when looking at the game structure. Since political attitudes towards climate change are an internal and not collective issue and lobbying groups are not present in the game design, the only influence on the players decisions in the game regarding climate action, that is external, is the citizens. The citizens interests are represented through the political demands. The action situations in the game KEEP COOL mobile are therefore reflected through the political demands of the citizens, the players internal struggles with making decisions on climate action and the interaction with other players. Table 10 shows the analysis with the IAD-Framework of this action situation based on the game design. **Participants** missing from this situation are lobby groups.

Table 10: IAD- Framework variables for action situation 4 & 5: Political challenges & Citizens interests - in KEEP COOL mobile

IAD- Framework variable:	Action situation 4 & 5 Political challenges & Citizens interests	
Participants	Players	Citizens
Positions	Mayors	Citizens demanding
Actions	Deciding on policies	Demanding action
	Accepting or rejecting the demands of their citizens	The game code determines what kind of demands and therefore their actions the citizens propose
Control		Citizens don't get the control of voting their mayors.
		Control the trajectory of the players in the game by determining how many winning points the players get and therefore potentially the decisions of the players
Information	The decision of the players can be influenced by their own information on and their political attitudes towards climate action or the information they get from other players.	Citizens do not have any information and are not subject to potential missing information, like in urban climate action situations
Potential Outcomes	Citizens are unhappy, when demands are rejected,	
	Players accept the demand and complete the mission	
Costs & Benefits	Players have the cost of waiting and not getting a point for completing the mission	

	Players get the benefit of a winning point but have to pay the costs of implementing the demands.

A potential in-game solution is that players might get aware of the impacts of climate change through the occurrence of natural disasters, which can impact their own actions towards climate action potentially positively. When dealing with unknowledgeable citizens, the only strategy of dealing with these citizens in the game is rejecting their demands and waiting for the next demand. The mayors cannot implement a form of education to their citizens. Players can, instead, calculate or estimate the co-benefits that some climate actions in the game have, to make their decisions on citizens demands. In-game communication can also be a way of dealing with their respective decisions.

6. Information gap

When looking at the game design of KEEP COOL mobile, I have established the following variables for this action situation, presented in Table 11.

Table 11: IAD- Framework variables for action situation 6: Information gap - in KEEP COOL mobile

IAD- Framework variable:	Action situation 6: Information gap	
Participants	Players	
Positions	Mayors to their local government	Research institutes are represented in the position of research projects that the game design provides
Actions	The players can act by communicating with each other on the benefits of the different research projects	
Control	Have control over the resources that are invested in either form of research	
Information	The information on the benefits of the different projects is provided through a short text on the game screen for the players, but the only benefits are the reduction of costs for factories. Players can have varying information depending on how many times they have played the game and know the game structures or generally their understanding of the "best" game strategy for successful climate action. Not all players might be aware of the benefits of the different actions like the protection measures, the importance of the research projects or the importance of climate action in general.	
Potential Outcomes	An outcome can be the closure of the information gap through best-practice and knowledge transfer between players in the form of advice.	

Costs & Benefits	Benefits can be the learning effects through in-game communication. The transaction costs of sharing this information are not critical for the in-game situation

Regarding a possible solution to dealing with the problem of missing information, players might share their knowledge or best-practices and what is working for them.

From solely looking at the game design, there are some action situations that are more present and similar to the literature on urban climate action than others. Action situations 1 (emissions reductions), 2 (navigating resources), and 5 (citizens interests) are more similar to the literature than action situations 3 (internal conflicts), 4 (political challenges) and 6 (information gap). In the focus group discussion with the empirical data collection, I am expecting to find out more about those action situations and how actor groups actually perceive them.

2.7   Propositions on in-game strategies for action situations in KEEP COOL mobile

With regards to the literature on urban climate action and the game design of KEEP COOL mobile, I have established some propositions, to be found in Table 12, on how players in the game will experience and deal with action situations that are represented in the game. For every action situation and representative issue, I have listed the ideal-typical solution from the literature and the likely in-game strategy with regards to the game design. These propositions will be the basis for establishing hypotheses to test in the empirical data collection.

Table 12: Propositions on how players experience and deal with action situations in the game

Action situation	Issue	Ideal-typical solution from the literature	Likely in-game strategy	
Emissions reductions	Cities are not actually reducing emissions. There can be free riders in the game.	Monitoring, Network creation, Cooperation	The players will cooperate through a form of self-organization to tackle climate change through for example communication, research projects, planting trees, and voting in climate conferences	Players will look at the game map & game statistics to see how many black factories the others have built
Navigating resources	The players will be constrained by the resources available for implementing climate action	Network creation & information/ knowledge sharing, Co-benefits	Players will cooperate with other players and use the network they have built to ask for help when resources are sparse (through sending money & investments in research).	Players will calculate or estimate the importance of co-benefits of climate action (planting trees).
Internal conflicts	Players must decide what department is most important for their city, coordinate	Investments in staff & knowledge, co-benefits calculations	The players will invest time on how to coordinate and navigate their decisions properly	
Political challenges	Political views and the capability to deal with complex situations will influence the players ability to deal with climate change	Focus on socio-economic impacts of climate change	Impacts of climate change that affect the resources (money decreases) will lead to more climate adaptation	
Citizens interests	The political demands of the citizens in the game do not always represent climate friendly / cooperative activities	Co-benefits of climate change are presented.	Some players will reject the political demands of their citizens when they involve climate unfriendly practices because they know of the co-benefits of climate action	
Information gap	Not all players know the benefits of protection measures, the importance of research or the importance of climate action	Network-creation, information sharing	They will share their knowledge or best-practices and what is working for them.	

3   Methods

In this chapter I will describe my methods for studying the underlying research questions. First, I will introduce the overall research design including game design and choice of participants. I will then, lay out my hypotheses which I have developed from the propositions from chapter 2.7 for testing the research questions. Then, I will introduce the focus group method as a research tool and describe my guidelines for the focus group discussion based on the hypotheses.

3.1   Overall Research Design

3.1.1   Overview

This thesis is trying to provide insights into collective action situations in the game KEEP COOL mobile and how these compare to collective action problems in urban climate action. Furthermore, it studies how players in the game deal with occurring action situations and the reasoning behind these actions. The operative research questions 3 and 4 are answered using a qualitative research design with focus group discussions after playing the game with the participants of the study. Three groups (half of all groups) were treated with specific questions around the action situations I established from the literature (see chapter 2.3), to observe how they dealt with those situations (if they experienced them). The other three groups were used as control groups, and the guide followed a less structured and more freely moderated guideline. This control group can therefore serve as some form of control on whether the players simply reconstruct experiences in the group, when being asked about them specifically. An entry-questionnaire containing some demographics was used to study the uniformity or variation within and between the groups. This allows to identify outliers and better contextualize specific game and focus-group outcomes.

Due to the ongoing Covid-19 pandemic the games and group discussions were held online in a video conference with the video communication program Zoom (https://zoom.us/). The communication during the game was protocolled and analyzed after the sessions in comparison to the focus group results, for creating a full picture of the game experience. An additional tool for analysis was the gameplay data from the game to reference and compare the focus group results to the actual actions in the game.

3.1.2 Hypotheses

From the propositions in chapter 2.7, I formulated the following hypotheses for testing the operative research questions.

For answering the question "How are the action situations that local governments face represented in the game KEEP COOL mobile?" I have established the following hypothesis:

> H1. Focus group participants report action situations similar to those identified in the literature: Focus group participants are likely to report action situation 1, 2 and 5 (where KEEP COOL mobile is similar to the action situations in the literature) and are less likely to report on action situation 3, 4 and 6.

For answering the question "Are there differences in how players in KEEP COOL mobile deal with action situations in the game compared to actors in city governments and to suggested solutions from the literature on urban climate action?" I will use the following hypotheses:

> H2. To prevent free riders and successfully reduce emissions in the game, players will start or increase cooperation and monitoring. Increase in the game: Communication, Research projects & voting in climate conferences, monitoring / checking the game statistics.
>
> H3. When money is limited for players in the game, cooperation between the players increases and calculations about co-benefits of climate action increases.
>
> H4. When the players struggle to choose between different actions in the game, the investment of time into proper decision-making increases.
>
> H5. As negative climate impacts increase in the game, players will increasingly focus on climate change measures.
>
> H6. Players that consider the benefits of rejecting a political demand that is harmful to the climate, will reject those demands.
>
> H7. The struggles that players have with the decision-making process in the game and struggles due to fewer resources will be reduced by knowledge or best practice sharing.

3.1.3 Game design & Participants

The game design is closely linked to the focus group design described in chapter 3.2.2. I recruited 35 participants for the study, five participants for the test game and 30 participants for the six game sessions, each game with five players. In recruiting I followed the "most similar" design approach. In this approach, originating in the political sciences (Mill 2012/1843), when using a small sample study, the independent variable is held constant whereas the dependent variable is edited to test our hypotheses (Quinn 2009). In this case I wanted to keep the participants most similar, so that the players game experiences serve as the dependent

variable and I can measure the differences and similarities in those experiences. I originally selected university students from Berlin from a similar student field (Natural Resource Management, Geography, Sustainability groups) as the most similar group. The recruitment process therefore started with contacting several different university mailing lists from the Humboldt-Universität zu Berlin. Response through these channels were quite limited. Due to time and resource restrictions of this thesis making recruitment more difficult, I expanded this group to other students from different fields. I also used social media channels to look for students as participants. With this expansion, more respondents followed, also by snowball-method when participants reached out to their peers to ask for participation. The entry-questionnaire mentioned in the last chapter, will be used to look for similarities in between the resulting groups.

I played one test game with five participants prior to the game sessions to test my focus group guidelines (see chapter 3.2.5), the game design and the suitability of the hypotheses. After the test game, I refined the guidelines and reformulated some of the questions to make them clearer. The games were played over the course of two weeks in March 2021. Due to the ongoing Covid-19 pandemic all games were played online in the video online conference tool Zoom. I started the video call with a quick introduction round and a question on their prior experience with online games and games on climate change for creating a comfortable atmosphere. Then, the participants filled out the online entry-questionnaire. Afterwards, I showed a YouTube video of the game instructions (https://www.youtube.com/watch?v=j5phiD1DC5E). Showing the video helps explain the different game features using the game surface and additionally providing all groups with the same instructions, reducing biases through different explanations. After the video, I started the game. The Zoom Call was open during the game session allowing for communication during the game. I selected 20 seconds per year. The time schedule was tested in the test game, where the participants found the game and the focus groups a suitable time. When permission was given (in all six games permission was granted), I recorded the game sessions and focus groups for later evaluation.

3.2 Focus groups

3.2.1 Focus groups as a research method

When focus groups where first created as an alternative method to the traditional interview, in the 1930's in the social sciences, the method didn't initially come into much usage. Only in the 1950's it became a frequently used tool in marketing research. Now it has become a common tool used in market research (Krueger and Casey 2015, pp. 27–28). In the social sciences focus groups as a research method have only started being frequently used in the 1980's. While the majority of focus groups were used in combination with other methods like in-depth interviews, individual interviews or surveys, focus groups now are accepted as a "self-contained" research method, meaning a research method where "the results of the research can stand on their own" (Morgan 1994, p. 25). Compared to quantitative research, they have a relatively small sample size and are therefore often used for exploratory research (Bhattacherjee 2012).

A focus group is a group interview but with some distinctive features. They are not naturally occurring conversations, but not a traditional group interview either. They are unique because of their focus on group interactions and group discussion (Morgan 1996). They are a type of qualitative research suitable for studying group interactions and group dynamics to a certain topic (Oates 2000; Morgan 1998). Through studying the interactions between the group members and how they compare, share, and learn from each other's experiences, the data collected is often very rich and uncovers otherwise unknown opinions. The research unit of analysis and therefore the research data is the group and its social interactions. These social interactions create some advantages for the researcher: In a good focus group, participants interacting with each other have to explain their reasoning and their opinions to others, which creates valuable information for the researcher (Oates 2000, p. 187). Another advantage is that the dynamics of the social groups can lead to more intense information being shared compared to in a single interview, because the group can create a comfortable environment (Krueger and Casey 2015, p. 27). Finally, the focus group allows the researcher to gain "reactions from a relatively wide range of participants in a relatively short time" (Morgan 1996, p. 134).

3.2.2 Focus group - Design

When designing a focus group there are several factors the researcher has to consider: How to choose the proper group size, how many groups you use, what is the ideal group composition, how structured is the guideline, what are suitable questions and what is the role of the moderator.

Group size can vary but is often stated to be optimal at around 5 to 12 participants (Krueger and Casey 2015; Smithson 2007; Oates 2000). This concerns live focus groups, though. When doing online focus groups with a video portal the number decreases to 4-6 (Lobe 2017, p. 242). For my research, I therefore chose a group size of five people for the online video and audio focus groups. Concerning the number of groups, data saturation seems to be sufficiently reached after around 4-6 focus groups (Morgan 1996, p. 144). Often after a few rounds, the researcher can observe common threads and patterns, from which you can draw conclusions in the analysis. I have therefore chosen 6 groups as a suitable group number. The focus group composition can be either a natural or a constructed group: Natural groups are groups that already exist as a collective social system, e.g. family members or work teammates. They are used for studying the natural interactions of these specific systems concerning a specific topic. The groups already have some pre-existing social dynamic. Constructed groups on the other hand are groups whose members do not know each other prior to the sessions. In constructed groups the participants are observed to be more active and diverse on the underlying topics, whereas natural groups can be more quiet and cold (Leask et al. 2001). Both forms of group composition have their advantages and dis-advantages and the composition always depends on the research question at hand. This thesis is focusing on the game experience of the players of an online game. It is therefore important that the players have played the game together and what they experienced during the game as a group. The group already presents a form of collective social system as they have shared the game experience. This is their common thread which the research question focuses on. Some of the groups I interviewed were more natural and some more constructed. This was mainly due to the recruitment process and restricted by the time and resource limitations of this thesis.

The focus group guideline is an important tool for the researcher for moderating the focus group. Morgan (Morgan 1998) suggests that for creating a guide, one has to list all the questions that you want to have answered and then formulate those questions into a set of

topics. Each of these topics than contains of a few probing questions. Krueger (Krueger 1998) suggests to start with some "light" introductory questions to get a discussion going and then move onto the "deeper" topics with key questions. He also mentions to use a summary at the end of the groups to collect the most important points and make sure that the moderators points match with the view of the group. A proper guideline is very important to create a successful focus group for several reasons: Since the focus group is focusing on the group as a unit of analysis, the guide needs to be formulated in a way that it can create a valuable group discussion. The guide should be rather unstructured and produce a setting where the participants not only answer the questions but form a group discussion and the moderator is stepping back (Smithson 2007). When developing questions for focus groups the researcher has to keep in mind some design principles. Krueger (Krueger 1998) argues that questions should be short and simple for the group to understand as well as effective and without the usage of jargon which can lead to confusions or misunderstandings. According to Morgan (Morgan 1998) questions need to be interesting for the group to come to an informative and rich discussion.

3.2.3 Focus group – Analysis

The data that is collected in the focus group is still raw data which needs to be analyzed for drawing conclusions. For analyzing the data the researcher should look for similarities and differences between the different groups, which can also be called control and break characteristics (Oates 2000, p. 191). With the research question in mind, one should look for themes and patterns that occur in all groups. I compared the different results I obtained from the groups to look for re-occurring patterns. Krueger (Krueger 1998-2000) suggests to keep the following questions in mind when analyzing focus groups:

- "Frequency - How often was it said?
- Extensiveness -How many people said it?
- Intensity - How strong was the opinion or point of view?"

Since this study is using focus groups as an exploratory form of research, I used a descriptive narrative to analyse the data as suggested by Stewart et al. 2007 (Stewart et al. 2007) while searching for patterns through looking for frequent, extensive and intense themes. First, I watched the recorded interviews and completed the protocols and notes from the focus groups. Then, I intensively studied the protocols of the focus groups to find similar themes of

discussion. Starting with Group 1, I look for categories and or themes that emerge in this group and look for similarities in the other groups, adding themes when they occur. This can lead to several categories that can be used for analysis. The focus group guideline, closely linked to the hypotheses, will structure the analysis by a prior categorisation of topics.

3.2.4 Focus groups and serious gaming

3.2.4.1 Serious games and gaming simulation

Serious games are defined as being "concerned with the use of games and gaming technology for purposes other than mere entertainment" (Susi et al. 2007, p. 7). Due to their entertainment factor, games can provide a valuable tool for teaching about different kinds of topics. Several studies have shown the learning effect the game can have on players (Carson et al. 2018; Sutrisno et al. 2015; Solinska-Nowak et al. 2018; Montanaro et al. 2015) and also the effect of educating on climate change (Neset et al. 2020). Apart from that, games can also serve as a research tool by creating an experimental area to study social interactions, where interactions of the players can be observed (Bluemink et al. 2010), even as "models of social systems" (Klabbers 2006, p. 100) and for studying behavior in management (Clark et al. 2020). The game is creating a small model of complex real-world systems.

Using serious games as an experiment for research is also called gaming simulation. In a gaming simulation, the role of the participant during the game is studied. The role is important for the researcher and the research question. Often the two concepts are used interchangeably Using gaming simulation for testing hypothesis is not a very common research design (Meijer 2009). This thesis is therefore adding to the existing literature in studying the suitability of using the online game KEEP COOL mobile as an experiment for studying urban climate action. Experimental research in science is either conducted in a laboratory setting or a field experiment. Laboratory settings come with the advantage of a high internal validity (causality) due to the controlled environment but tend to have low external validity (generalizability) since their simplification of complex real-world systems. Experiments in the field on the other hand tend to be high for both validities but are often too complex to carry out (Bhattacherjee 2012). Serious games can be a valuable mixture of the two methods since they are controlled settings but involve a simplified model of real-world systems where people interact naturally. I am testing the external validity of the game in my research question and by using a control group I will test for internal validity of my findings. Even though games are more similar to human

systems than laboratory experiments (Porter 1995), when drawing conclusions about social behavior one has to be careful because the game world doesn't fully represent the complexity of the real-world systems.

3.2.4.2 Focus groups in combination with serious gaming

For the successful usage of serious gaming in research, either as an educational tool or as an experiment, some form of debriefing session after the games is important. The debriefing serves as a reflection of the game and can therefore create a more successful learning experience for players (Crookall 2010). This session is useful to put decisions of the players in the game into context and show the researcher exactly how actions in the game influence outcomes. Therefore causalities can be found and validity is tested (van den Hoogen et al. 2014). The literature on serious games finds that debriefing is seldomly used in research using serious games (Solinska-Nowak et al. 2018). This thesis combines the use of a serious game with focus groups to study the context behind the actions of the players; the focus group serves as the debriefing session.

There have been studies using focus groups and serious gaming but most of them focus on the educational effects of the game on the players, like learning and communication (Wibeck and Neset 2020; Asplund et al. 2019). This thesis is adding to the literature and is therefore filling the current research gap in the area of using serious gaming as an experimental tool for research.

3.2.5 Guidelines for the focus groups

By using the focus groups, I want to close the gap of action situations that can be observed in the game design and how players actually experience challenges in the game. I asked about the backgrounds of the players' decisions and through group comparison within the group expected to find rich data on their decision-making processes. Specifically, I asked 1) if the same action situations arose as established in the literature on urban climate action, 2) how players dealt with those action situations and 3) the reasoning behind those actions. The guidelines should test the hypotheses established in chapter 3.1.2 and therefore answer the underlying research questions.

As mentioned in chapter 3.2.2 the focus group discussions are following a guideline, which is structured around the key topics of interest. There are two guidelines: Guideline 1 (find in

chapter 3.2.5.1) is used for one half of the groups, the treatment groups, following a more structured path specifically designed to examine the action situations described in chapter 2.3 and 2.4. Guideline 2 (find in chapter 3.2.5.2) is a more unstructured guide which is used for the control groups. In the test game, the unanimous feedback was that due to the online character and the lengthy time of the session, questions should be displayed during the focus groups. I created a PDF, which I shared during the focus group discussions (see Appendix B).

3.2.5.1 Guideline 1

Both guidelines start with a general introduction and a quick opening statement by all players on their game experience to get people talking and creating a comfortable atmosphere. Then I move on to the main topics:

1. **Challenges:** This topic is designed to ask about the general representation of the action situations of urban climate action during the game. (testing H1)
   - Probing questions
     i. What did you find most difficult about being a mayor? In this case: preventing the temperature increase and developing your city
     ii. What were situations where your interests collided with the interests of the group?
     iii. How could you collectively prevent the temperature increase?
2. **Actions:** These questions are intended to find out about the players' actions in the game. It tests how the action situations **internal struggles, navigation resources, political challenge and citizens interests** are represented in the game and the way actors deal with these situations.
   - Probing questions
     i. There are several different actions in the game (Building the factories, research projects, protection measures, political demands, planting trees). Did you find it difficult to decide which are the most important actions? Did you spend more time considering the decisions when you had difficulties deciding? (testing H1 & H4)
     ii. If you had little money available, how did that...? (testing H3)
       - ...influence your actions on climate change (planting trees, protection measures, green factories instead of black factories)? How important were these actions to you?
       - ...influence your communication and cooperation (research, climate conferences) with other players?
     iii. How did your own views on climate change influence the way you acted in the game? (testing H1)

      iv. At some point, the negative effects of climate change / natural disasters increased. What impact did this have on your actions in the game? (testing H5)

      v. How did you decide whether to reject or accept a political demand? (testing H6)

2. **Group behaviour:** This topic shall observe the action situations **emissions reduction** and **information gap** and how actor groups deal with these in the game

   - Probing questions

     i. Were there measures you took together as a group to prevent the temperature from getting too high? (testing H2)

     ii. When you had trouble making decisions, did you ask each other for advice? (testing H7)

1. **Challenges**

   - Probing questions

     i. What did you find most difficult about being a mayor? In this case: preventing the temperature increase and developing your city

     ii. How could you collectively prevent the temperature increase? Find what were common problems for the groups (inside the group)

     iii. What were situations where your interests collided with the interests of the group?

     iv. Did some players experience some problems more strongly than others?

2. **Dealing with problems:** addressing the problems that came up in part 1

   - Probing questions

     i. If the same problems come up as the action situations (AS) of urban climate literature; go back to guideline 1

     ii. How did you deal with the challenges (from the last question)?

     iii. What were the strategies you developed as a group or alone?

Both focus groups have a similar ending: I present a summary of the main points to establish if the most important issues are the same to the moderator and the participants.

3.3   Additional tools for analysis

3.3.1   Communication during the game

The communication during the game was protocolled in the game sessions and after the game sessions by re-watching the recorded sessions. I then established the most frequently communicated-on topics by all six groups and structured them accordingly. First, this helped for guiding the focus groups, since I could come back to and ask about specific comments

made in the game sessions and second, it can strengthen the focus group results by showing specific remarks made in the game.

3.3.2 Gameplay data

The KEEP COOL mobile admin interface lets you download a CSV file for each game including several game statistics: It includes a time frame of 100 intervals per player with information on green or black factories built, protection measures, political missions completed, winning points, costs of factories and protection, city budget, climate damages, city income, CO_2-emissions, research projects completed, the temperature and the votes on climate conferences. In chapter 4.3.1 I will present some statistics per group and compare the results in relation to the focus group discussions. Especially under consideration will be the following data points: The black factories to compare the group's investment into climate-unfriendly activities and the city budgets to test for economic development of each group. The green factories and protection measures to compare climate action as well as research projects and climate conferences for cooperation and climate action. I will also look at political demands, total winning points per groups and lastly the temperature increase and CO_2 emissions for comparing the overall results of emissions reductions of each group. This helps to put into context the results of the focus groups and reduce reporting biases.

3.3.3 Entry-Questionnaire

I have created an entry-questionnaire using the online platform SoSci Survey which is a free online web-application for creating online-questionnaires (https://www.soscisurvey.de/). The first part of the questionnaire contains some demographic questions about age, gender, educational and employment status. Then, I created a few questions on environment and the importance of the environment compared to economic growth. I also asked about general political orientation, civic engagement, and generalised trust. This data will specifically show differences or similarities in between the groups on the crucial topics at hand. For some of the questions I used the European Value Survey (EVS 2018) as a guide for a proper question formulation. Since I have used the most-similar approach I am expecting that the groups will be quite similar in their demographics and potentially in political orientation, concern about environmental topics and trust.

4 Results

In this chapter, I will describe and analyse the results that were found through the empirical data collection from the focus group discussions. First, the action situations that the players reported during the focus groups will be established. I will analyse these results with the IAD-Framework variables from chapter 2.1. Through this analysis I can establish similarities and differences to the action situations from the literature on urban climate action. Then, I will focus on how the players dealt with those action situations. Similarly, I am going to look for similarities and differences to the literature. To put these results into context and check for biases, I will compare the focus group data to the data of the entry-questionnaire and the gameplay data. I will establish uniformity or variety between the groups.

4.1 Comparison of action situations in the game to urban climate action

In this section, I will test Hypothesis 1: Focus group participants report action situations similar to those identified in the literature: Focus group participants are likely to report action situation 1, 2 and 5 (where KEEP COOL mobile is similar to the action situations in the literature) and are less likely to report on action situation 3, 4 and 6. First, I will list all action situations that the players report in the focus groups after their game experience as well as other challenges that they faced during the game. Then, I will compare the action situations from the literature (chapter 2.3) with the reports on those during the game to test my Hypothesis 1.

4.1.1 Action situations from the perspectives of the players

The focus group guideline I followed during my data collection, started with a question on the issues or challenges that the players in the game have experienced, especially considering that they were acting collectively as mayors of cities interacting with other mayors, experiencing an increasing global temperature that influences them all. I also asked about issues concerning individual interests colliding with group interests. Table 13 shows a summary of these results, structured by action situations, frequency, extensiveness, and intensity of this action situation reported by each group in the focus groups.

Action situation	Groups that discussed the action situation	Frequency	Extensiveness (high, medium, low)	Intensity (high, medium, low)
Emissions reductions	1, 2, 3, 4, 5, 6	frequent	medium	medium
Navigating resources	1, 3, 4, 5, 6	very frequent	high	high
Internal Conflicts	1, 2, 3, 5, 6	frequent	medium	low
Political challenges	not mentioned	/	/	/
Citizens Interests	2, 3, 4, 5, 6	very frequent	high	high
Information gap	3, 4	not very frequent	low	low
Coordination problems (not present in the literature)	1, 2, 3, 4, 5, 6	frequent	low	medium

All groups were quick in agreeing on a kind-of group strategy. They reported that they experienced some form of group consensus or agreement in the game, concerning climate action and keeping emissions low. The increasing temperature was experienced as a threat. This was reported by both treatment and control groups. I will elaborate on how they dealt with this situation in chapter 4.2. Two players from different groups reported that they found it difficult to keep their black factories considering the group agreements and the resulting group path. It was often stated that this path also influenced the actions and the direction of the game because of the conferences and the research projects, which made it difficult to deviate from that group path. This consensus to follow a "green path" (Group 3) often in turn influenced the players decision on the political demands, decision-making, and resource allocation. When asked specifically about group and individual interests, five out of six groups (Groups 1, 3, 4, 5, 6) stated that the interests of the group were often aligned with their own interests. There were no major conflicts since they agreed on a group strategy or group path towards greening the economy and reducing emissions.

„Nobody acted very egoistically" (Group 1)

Almost all the groups, except for one (Group 1) reported on the difficulty of meeting the political demands, which are the citizens interests. It was frequently stated, that when the citizens interests did not match their own interests or the group interests, they rejected them. They often found it difficult to match these interests with the group interests, since they didn't want to upset the citizens, but at the same time, had to follow the group path of acting climate friendly. They found themselves in a situation with conflicting interests to their own development and the group outcome.

> "My citizens were demanding black factories all of the time [...] I found that a difficult decision: Carry through a decision, where the majority of the population is against it." (Group 2)

Five groups (Groups 1, 2, 3, 5, 6) reported on the decision-making processes in the game as a challenge. They stated that they found it difficult to decide on certain actions and decisions in the game and what benefits they would bring for their own or the group strategy. They experienced specific difficulties considering the climate conferences and research projects, where they were not sure about the consequences and benefits of those actions. This also represents some form of information gap on the consequences of activities in the game. Furthermore, it was frequently mentioned that players were influenced in their decision-making process by the general group consensus, because they wanted to achieve a good group outcome.

> "What do the conferences bring, what do the research projects bring? I wasn't sure what that would bring me" "Having the feeling not to know, what will be the long-term consequences on the game trajectory and for our group." (Group 5)

Another challenge that all groups except for Group 2 faced in the game was the availability of resources. Players had a strong opinion on this topic stating it as a very influential issue. Some players who were really struggling with resources would decrease climate action or even tear off trees. The resource restriction had influences on cooperation and the overall group strategy, the green path. Chapter 4.2 will give some more insights into this topic and how players dealt with these situations. In relation to the availability of resources most players mentioned the impact of natural disasters or catastrophes on their city's resources and how this turned out to be a major challenge in the game. The decisions of the other actors in the game had an

influence on their own resources due to the occurrence of natural disasters. All groups mentioned the impact of these catastrophes as one of the biggest challenges especially since they had such an influence on their resources. This on the other hand resulted in an inability to act in certain situations for some players. This inability or incapacity to act was mentioned in and agreed upon participants of four groups (1, 2, 4, 5). One player felt that the influence of the decisions in the beginning of the game led to a state of powerlessness at some point because he had no resources to make any actions; his groupmates agreed. Another player from a different group stated the importance of the impact of the catastrophes leading to the inability to act due to fewer resources.

"I had the problem of not being able to do anything" (Group 5)

Some frequently (by all Groups) mentioned and in the game-communication observed action situations that players experienced during the game were the coordination of research projects and climate conferences. Since all groups established a form of consensus on their game direction towards more green technology and climate action, they often agreed on the research project and conferences, but there were some difficulties in coordinating the projects. Sometimes, more than one research projects was started at the same time or there were disagreements about the topic of choice in the conferences. The game communication supports these situations through several specific communications on these decisions. Often, they were debating on what conference topic to choose or exclaimed whenever they have started new research projects and invited and encouraged others to participate.

"That was stupid, that we started two projects" (Group 5); "I would be in favour of disaster funds if you've already been hit by something" (Group 2); "There is X amount of money missing in the research project" (Group 1)

4.1.2 Similarities and differences to urban climate action

Now that I have established the action situations that players experience in the game KEEP COOL mobile, I will compare those to the literature on urban climate action. There will be a focus on the variables of the IAD-Framework to establish the differences and similarities. This is an empirical extension of the analysis from chapter 2.6 and will test the Hypothesis 1.

Action situation 1: Emissions reductions

As mentioned before (chapter 4.1.1) all groups reported that they had some form of group consensus to deal with the increasing temperatures. The **participants** being the players of the game in the **positions** of mayors to representative cities, found themselves in a situation, where they collectively had to deal with the potential **outcome** of emissions being reduced or not. Players' **actions** are increasing or decreasing CO_2-emissions. They did report on the importance of dealing with emissions reductions in the focus groups, which shows that they all experienced this as a pressing issue. But generally, there was an agreement on what actions should be taken. Since all groups mentioned keeping temperatures low as a main objective of the game, this leads me to the conclusion, that they have experienced this action situation quite different to the action situation from urban climate action. The gap between real emissions reductions and informal goals made by local governments is sometimes significant and free riders are a real problem. The game participants experienced the same increase in temperature but only rarely reported on free riders that differed from the group strategy. In Group 4 the participants reported that they had to "convince player X to tear off his black factories", so free riders did occur. But generally, the consensus was clear. The groups also reported that it was not an option to deviate from the group consensus because of the conferences and research projects. You would have to have some like-minded players to change the game into a certain direction because voting in the conferences and investing in research makes a high impact on the costs of the different actions. All groups reported on the importance of the political demands or citizens interests on their own decisions. By resulting in winning points, they have a high power or **control** over the players actions. The **position** of the citizens therefore makes up a much more powerful role in the game than in real-life. Differing **information** between the players was not reported on. Since players have found a way of self-organizing, by the mentioned group path, which resembles the **position** of city networks. This action situation is somewhat similar to the real-life situation, because players are facing the increasing temperature as a pressing issue that they collectively need to deal with, but some positions are missing. The players also reported that they didn't disagree on the importance of dealing with this issue nor did they very much try to benefit from other players actions. For this action situation, the gameplay data will show more insights since it can show whether players reported differently to their actions.

Action situation 2: Navigating resources

There was a great consensus of the players, from treatment and control groups, on the significant impact that the availability of resources had on their actions in the game including climate actions. This shows that they experienced a similar situation to local governments in urban climate action. But, as pre-analysed in chapter 2.6, results show that some of the **participants** and **positions** of this action situation are missing from the game design: National governments and private funding entities. The conferences and the research projects play an important role in the game since they can lead to cost-reductions. Players as **participants** in the **positions** of mayors interacting with other mayors, can therefore **control** the **costs** of climate action by for example lowering costs for or increasing the **benefit** of green factories, which are climate friendly. This interaction between the players shapes the **outcome** of this situation due to its influence on **costs** and **benefits**. Therefore, players in the game have more **control** than local governments have in real-life. Concerning **information** participants did report that they had difficulties understanding the mechanisms of the conference- topics. A big difference to the literature is, that cities do not have different capacities or resources depending on their geographical position or their national government, which is a major influence in this real-life situation. But throughout the game, some players who had difficulties in accumulating resources in the beginning of the game or did not focus on climate adaptation were hit harder by catastrophes in the end of the game and therefore reported in the focus group on their inability to **act** due to resource problems in the later part of the game.

Action situation 3: Internal Conflicts

This action situation that local governments face is not fully represented in the game due to the simplified representation of the government as a single actor. Therefore, decision-making is internalized to that actor. The focus group showed that many players did have difficulties choosing the most suitable action in the game for various situations. This was not influenced by other members of their own government. The players did report that their own decisions were influenced 1) by the other players and 2) by the political demands of the citizens. Therefore, this situation changes. **Participants** are the players, **positioned** as mayors and the citizens being able to **control** the path or direction of their mayors' decisions. Since there was the group consensus of following a green path, the players **controlled** other players decisions in a climate-friendly direction. The **outcome** often resulted in players rejecting demands that

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did not fit with the group consensus. For all groups, the group consensus had a higher influence on the players decisions than the demands of the citizens. The research projects and conferences are one example of where the decision-making process and potential **benefits** to the group or own strategy were not clear and resulted in an internal conflict.

Action situation 4 & 5: Political challenges and Citizens interests

As mentioned before, these two action situations merge into one in the game due to the simplification of the representation of local governments. Players from control and treatment groups were unanimously reporting on the significance of the citizens' demands on the game trajectory. This situation is consisting of **participants** players of the game in the **position** of mayors. The other players in the game are additional **participants** by taking up a **position,** that is not as present in the literature. They are influencing each other through the **action** of in-game communication and **controlling** each other's decisions. The citizens are in the **position** to have some **control** on the mayors' **actions** and success in the game through their demands, which are their only **actions**. There are various parts missing from the action situation political challenges: **Positions** are reduced and therefore **control,** and **actions** are missing, respectively. Mayors cannot educate or influence the demands of their citizens. Also, political interests are very simplified in the game: There is a greener and a more economic path, but it is not very varied. Mayors are not up for re-election decreasing the **control** of the citizens. Furthermore, the focus groups showed that the group consensus, again, influenced and had more **control** over the players actions than the demands themselves influencing the **outcome** of the situation: Most players rejected political demands in favour of economic development and only accepted the climate-friendly demands. This represents a difference to the literature, where mayors do not have such an influence on each other's political agenda and attitude towards their population. Rejecting demands has the **cost** of losing a winning point and the implementation costs of the demand, but the **benefit** of reducing emissions. The randomness of the political demands and therefore the game code serves as a new **control** since players can get lucky or unlucky in their demands in relation to the group consensus. Apart from that, most players did report in the focus groups that they were influenced by their own political values and views regarding climate change. Many players said that they acted accordingly:

"I personally think that we need to go towards green technology, so I wanted us to go green in the game as well." (Group 3)

Action situation 6: Information gap

Half of the groups (Group 2, 3, 5) reported on the missing information or knowledge about the consequences of the climate conference votes. Other groups reported that they weren't sure about the impact of the umbrellas as adaptation measures (Group 2, 5, 6). The game provides, as always, the participants **players** in the **position** of mayors but there are no research institutes. The focus group showed that understanding the conferences can be an issue for some players, but this is mainly an internal and not collective action situation. The game provides **information** in the form of text for the different conference topics but does not provide **information** on the specific impact of the umbrellas. In this situation players can **act** by sharing their knowledge on the conference topics through communication with other players.

4.1.3 Summary

In summary, the focus groups showed that some of the action situations from real-life urban climate action are also occurring in the game KEEP COOL mobile but often they are reduced in complexity or differ from the real-life structures. These results can be found in Table 14. When looking at these action situations with the variables of the IAD-Framework, those differences are highlighted. The video call during the games provided a platform for communication between the players, which influenced the game outcome and the players actions in the game. Specifically, this can be observed in the game strategy in the form of a consensus in between the groups on a more or less green path, which influenced the decisions in all forms of actions in the game. This is reflected in most of the action situations found in the game. Group interests and individual interests were often aligned. Action situation 1 (emissions reductions) is represented in the game design but only to a certain extent. Players do face the global temperature increase as the most important issue, but in my study, there were only seldom reports of players deviating from the group strategy. This will be further tested by looking at the gameplay data in chapter 3.3.2, where words can be compared to actions. Action situation 2 (navigating resources) is represented in the game but also lacks some of the important structures of real-life struggles, especially in missing positions. Players report that when resources were scarce, they were trapped and couldn't concentrate on climate action, similar to local governments, where some cities face resource restrictions. Most groups did

agree that even when struggling with resources in the game, climate action was still important. The gameplay data can give some more insights on the relation of low resource availability and climate action. Action situation 3 (internal conflicts) is not accurately represented in KEEP COOL mobile since there are many positions missing from this action situation that are highly important for the real-life issue. Action situation 4 political challenges is not reported on. Action situation 5 (citizens interests) is somewhat presented in the game but again presents a simplified version of the real-life structures especially since the game code makes up an actor (the citizens) which cannot fully represent real-life structures. Lastly, the focus groups showed that there is an information problem in the game, but it doesn't involve other actors, making this an internal issue and very different from the real-life action situation 6 (information gap). Many of the actions and decisions are more interconnected in the game and therefore create different problems than what real-life actors must deal with. The communication throughout the game also offers a different form of communication than what can be observed between local governments. Apart from that, as mentioned in chapter 2.6, one big difference of the game and real-life urban climate action is that there are no differences between the cities. In urban climate action a lot of the most pressing issues are in relation to power asymmetries between cities of the Global North and the Global South. This is not an issue in KEEP COOL mobile.

Table 14: In-game representation of action situations from the literature on urban climate action

Action situation	In-game representation	Differences to action situations from urban climate action	Missing variables / working parts of action situations
Emissions reductions	Dealing with the global increasing temperature Importance of reducing emissions Some free riders	No major conflicting interests High control by citizens High influence of group strategy Different resources per city not represented	Information not relevant Limited actions of citizens High control by mayors
Navigating resources	Impact of availability of resources on climate action	Other players have more control	Positions: National governments Funding entities
Internal Conflicts	Internal decision-making process between different actions in the game	Not collective but internal decisions Added participants: other players, citizens	Positions: Departments of local governments
Political challenges & Citizens Interests	Merge of two action situations from the literature	Citizens don't have any information Citizens have different control (not voting but demanding)	Positions: Lobby groups

		Additional participants: other players (high control)	No information provision to citizens possible
		Political interests simplified	
		Luck factor	
Information gap	Missing information / knowledge about the consequences of the climate conference votes	In-game: internal issue of understanding the game	Positions: Research institutes
		Real-life: information on climate action	

4.2 Dealing with action situations in KEEP COOL mobile

In this chapter I want to establish how actor groups deal with the action situations that are represented in the game. I have asked the treatment groups specifically how they deal with the action situations that I've established in the literature as far as they are represented in the game. The control groups were asked about dealing with certain issues if they were reporting on the same action situations than the ones from the literature. This will test hypotheses 2, 3, 4, 5, 6, and 7.

4.2.1 Player's strategies

After establishing the action situations that players deal with in KEEP COOL mobile in the first part of the guideline, I then asked the groups specifically on how they dealt with these situations. Since most control groups mentioned similar action situations to the treatment groups, I could ask them about their strategies as well.

Action situation 1: Emissions reductions

As mentioned in the last chapter, there was a significant amount of communication on how to deal with the increasing temperature. There was especially a lot of talk on some form of agreement on tearing down the black factories as soon as possible, to be able to switch to green factories and halt the rising temperature. This was mentioned in the focus groups and supported by the in-game communications. This was especially influential in Group 1, where participants reported in the focus groups, that the statement of one player in the beginning of the game influenced their whole game strategy and the game outcome.

"Should we just make a strategy that we do not build black factories and not destroy the future?" [..] "Her statement in the beginning influenced the whole game" (Group 1)

Apart from communication on agreements, some of the groups (1,3,6) reported that they were monitoring other players by looking at the game map and the game statistics to look at the number of black factories each player has. The in-game communication also often revolved around the numbers of black factories and the rising temperature. Other than that, participants agreed that research and conferences was an important way to deal with this issue because rising costs for black factories and similarly lowering costs for green factories would mean that free riding is not as appealing. All groups stated in the focus groups that they had no difficulties in agreeing on the research projects. Furthermore, almost all groups reported that communication was generally high around this issue.

Action situation 2: Navigating resources

As mentioned in the last chapter, the availability of resources and how to navigate those resources while fighting climate change was a significant issue frequently mentioned in many groups. When asked about this situation in the focus groups, players reported that often the consequence was waiting for money to come in (Groups 2, 3, 4, 5, 6) and being unable to act. They frequently stated that they waited until they had enough money to build another green factory. In-game communication often increased when players had little money, there were often calls like "I am missing so much money", "I need money" (Group 1). This sometimes resulted in players sending each other money, which the groups (Group 1, 3, 4, 6) also reported in the focus groups. In two groups there were one or two players who were tearing off trees when their resources were limited so that they could build factories:

"Towards the end, the disasters were accumulating, then in a gap, I demolished trees and tried to build a new green factory" (Group 5)

But in general, all groups stated that they were sill focusing on climate action even when they had limited money. They would still focus on and be mainly influenced by the group agreement and concentrate on reducing emissions. Concerning research, Group 1 and 2 were focusing less on research, since it involved investing money, but Group 6 stated that the waiting aspect made them able to concentrate more on other things like research and conferences. Only

Group 1 also stated that they focused more on conferences, when money was scarce. Apart from that, one group (Group 1) reported in the focus group that they used communication in the form of asking for or giving advice, when they had difficulties with their resources. This is also seen in the in-game communication for Group 1, 4, 5, and 6.

"What is your income? You need to build more factories." (Group 4)

Action situation 3: Internal conflicts

The focus groups showed that internal conflicts were a situation differing from the situation found in the literature on urban climate action. Many groups did report difficulties in choosing between the different actions of the game and what would be the best for their own and the group strategy. The groups that did have difficulties in the decision-making process (Group 1, 2, 3, 5, 6), had different ways to deal with this issue. In almost all groups were some players who decided relatively intuitively and some players who invested time into a proper decision-making process. The latter players sometimes were doing some form of calculation to consider the benefit of each action.

> "40 also seemed really expensive for an umbrella and then I thought, maybe it's worth more putting 75 into three trees because then I have one more victory point with another 25 and if I put even more in, then that's also worth a factory." (Group 2)

In general, it was a major theme that players acted rather intuitively than with a proper time investment into the decision-making.

Action situation 4: Political challenges

Political challenges describes an action situation which players in the game KEEP COOL mobile did not mention in the focus groups. However, players did mention that they are influenced by their own positions towards climate change. Since all groups were generally favourable of climate action, (see chapter 4.3.2) they all concentrated on a green path in the game. A more important aspect that they reported on was the influence of the political demands, which I will cover in the next section, and the influence of the natural disasters on their actions. All groups mentioned the disasters as a high influence on their actions in the game mainly due to the availability of resources. In-game communication showed that they

would regularly call out when they experienced a natural disaster and start talking about the importance of umbrellas. For half of the groups (Group 2, 3, 4) the impact of the natural disasters led to an increasing concentration on building trees.

"I started building more trees" (Group 3)

Action situation 5: Citizens interests

Since the political demands did play an important role for all groups, they had to find a way of dealing with this situation. They specifically mentioned this as a big influence on the game results, since the rewards for accepting and implementing the citizens demands were rewarded with winning points. Some players reported that they got lucky and received demands that were the same as their general game trajectory, whereas others stated that the demands did not fit into their own strategy. Generally, this action situation was mainly influenced by the group consensus mentioned before. Very rarely did players mention that they accepted demands that were favouring a climate unfriendly action. Consensus between all six groups was that those climate unfriendly demands were almost always rejected. Players then waited for the next demand to be called. Three groups (Group 1, 3, 6) also mentioned that when demands were too expensive, or they could not fulfil them, they were rejected.

"I rejected all that I could not fulfil and categorically rejected climate-damaging demands." (Group 1)

Action situation 6: Information gap

Missing information or knowledge did pose as an issue for some players in the game. The in-game communication shows that players asked the other group members for advice when they were unsure about certain topics.

"How many umbrellas did you build?" (Group 3), "How are you earning your money, how are you doing this?" (Group 5) "I think on an individual level it's the smartest to build more and more factories to get money first and then tear down the black ones one by one" (Group 1)

When asked about this in the focus groups, some groups (Group 1, 3, 4) did report on giving each other advice in certain areas. This was mostly on problems concerning money, but

another prevalent topic, also when looking at in-game communication, were the umbrellas or protection measures. Since the natural disasters had such a great impact for some players they wanted to know, how to prevent these disasters for their cities. In-game communication and focus group discussion also showed that communication about the conference topics and research projects were a form of information exchange that players used to decide.

Table 15 summarizes the results and shows a comparison of the solutions established in chapter 2.4 and the results from the focus groups.

Table 15: Comparison of solutions from the literature on urban climate action to the strategies by players in the game KEEP COOl mobile

Action situation	Solution from the literature	In-game strategy	Groups mentioning the strategy	
			Treatment groups	**Control groups**
Emissions reductions	Monitoring, Network creation, Cooperation	Monitoring: Game map or Game statistics	1, 3	6
		Conferences & Research projects	1, 3	4, 5
		Communication & Group path – Creation of network	1, 2, 3	4, 5, 6
Navigating resources	Network creation & information/ knowledge sharing, Co-benefits	Waiting for money	2, 3	4, 5, 6
		Communication	1,3	4, 5, 6
		Sending money	1, 3	4, 6
		Tearing off trees	1 (only one player)	5 (only one player)
		Conferences	1	
		Advice	1	4, 5, 6
Internal Conflicts	Investments in staff & knowledge, co-benefits calculations	Acting intuitively	1, 2, 3	
Political challenges	Focus on socio-economic impacts of climate change	Focus on climate action when natural disasters increase	2, 3	4
Citizens Interests	Co-benefits of climate change are presented.	reject climate-unfriendly demands	1, 3	6
Information gap	Network-creation, information sharing	Advice	1, 3	5

4.2.2 Similarities and differences to the literature on urban climate action

Now that I have established the strategies that actor groups in KEEP COOL mobile find to deal with certain action situations, I will compare these strategies to the solutions from the literature that I have established in chapter 2.4.

Action situation 1: Emissions reductions

As I have mentioned in chapter 4.1.2, players in the game experience this action situation somewhat differently to local governments. Nevertheless, they are experiencing the increasing temperature and report on strategies how to deal with this issue. Cooperation is a similar strategy to the literature. Cooperation in transnational city networks is a form of dealing with this issue for cities (see chapter 2.4.). The players find a group strategy and cooperate in the game through communication as well as in the climate conferences and research projects. In the game, communication on climate unfriendly activities like building black factories is very prevalent. Local governments do not have this form of communication between each other, but through the city networks and the criteria to enter these networks these structures are to some extent existent. For example, players in the game reporting on the number of black factories that they have, is similar to local governments reporting on their emissions. Apart from that, monitoring was a similarity to the literature. Players in the game can specifically find out how high emissions of other players are through the game map and game statistics. This is not possible for local governments, but by creating monitoring structures through the networks, they have found a similar way to deal with this issue (see chapter 2.4.).

Action situation 2: Navigating resources

When faced with restrained resources in the game, players strategies in the game were often to increase communication on this issue. Players would also send other cities money, which can be compared to local governments using funding entities for funding climate activities. There are similarities to local governments, where cooperation is a way of dealing with navigating resources for climate action (see chapter 2.4.). Climate conferences and research projects are another way of decreasing climate action costs. This was only partly reported in the focus group discussion as a measure to deal with scarce resources. Since research projects are connected to investments, most groups did not concentrate on this action when resources were scarce. Engaging in conferences were only mentioned in two groups as a

strategy to deal with this issue. Therefore, this is not a common way of dealing with this action situation. There was no report on estimating the co-benefits of planting trees in this situation. Generally, the strategy was to focus on a green, climate friendly path, except for some minor exceptions. This is in difference to the literature, where cities with few resources often are less active in climate action (see chapter 2.4.). Another strategy that local governments have found to deal when struggling with resources is information exchange or best practice sharing. This is not reported in the focus groups but is shown in the in-game communication.

Action situation 3: Internal conflicts

Concerning the internal conflict that players have in making decisions, they reported that those decision-making processes were mostly based on intuition and seldomly involved proper time investments. There were some examples of players estimating or calculating the benefits of the different actions, but the most frequent strategy was dealing with this issue intuitively.

Action situation 4: Political challenges

This action situation lacks representation in the game due to several factors discussed before. The socio-economic impacts that natural disasters have in real-life on local governments are represented through the loss of money in the game when a natural disaster occurs. All groups reported the importance and impact these disasters had on the game, including their strategy, the availability of money and the importance of protecting against climate change. Therefore, I see a similarity in the way of dealing with the impacts of natural disasters, when comparing real-life actors (see chapter 2.4.) and in-game strategy. Specifically, the impact of the disasters led to more trees and umbrellas being built. Additional roles in this situation are the group consensus that influenced climate change measures and the political demands through their influence on the players strategy. This will be elaborated in the next section.

Action situation 5: Citizens interests

Since this action situation involves an actor in the game that is based on the game code, this limits several actions. When citizens demand a policy that the mayors do not agree with or find harmful to the climate, there is no way of educating the citizens. They will be "upset" if the players reject their demands. Therefore, the co-benefits cannot be presented to the public. One significant difference to real-life local governments is that the mayors in the game KEEP

COOL mobile are not up for re-election, which influences the way they deal with their populations' demands. The focus groups showed that the group consensus that all the groups had towards climate change influenced this action situation very significantly. This is a difference to the literature, where other cities do not take up such a big role (see chapter 2.4.). The general strategy of the players was to reject political demands that were harmful to the climate. It must be mentioned though, that the influence of the group consensus was a considerate part of that decision by the players.

Action situation 6: Information gap

When faced with uncertainties or missing information in the game, players often consulted their group members to ask for advice. Even though only half of the groups report this, the in-game communication provides evidence. It is possible, that players did not find this adequately important for reporting in the focus groups as a strategy. Most of this communication revolved around issues concerning money or protection measures.

4.2.3   Summary

Even though action situations are only somewhat represented in the game, they are often interconnected, and simplified, in-game strategies can be similar to the strategies of local governments and solutions from the literature on urban climate action. This is especially true for cooperation as a strategy to deal with climate change issues.

4.3   Additional tools for analysis

4.3.1   Gameplay Data

To put the collected data from the focus groups into context, I have collected the gameplay data that can be downloaded from the game KEEP COOL mobile. The data shows information about all actions in the game for each player. Therefore, I can compare the focus group discussion to this data to test for validity of the results. Furthermore, I can establish differences between the groups, that might have led to differing results. The temperature increase shows that all groups experienced an increasing temperature during the game, but the increase becomes lower for the majority of the groups at around 40 years (see Figure 1). All groups managed to stay under the 2°C goal. There is a difference in the end temperature (temperature at the end of the game, year 2100) of the six groups. Group 5 finished very close to the two degrees goal with 1,915°C (see Table 16). This does not reflect any results from the focus

groups, since Group 5 did not report differently on the difficulty of the increasing temperatures than other groups. Even though all groups mentioned in the focus group that their main goal of the game was stopping the temperature increase, only one group managed to stay under 1,5°C. But, for all groups, the CO2-emissions decreased over time, with Group 2 being somewhat of an outlier with increasing CO2-emissions towards the end of the game (see Figure 2).

Table 16 shows the number of black and green factories and the CO2- emissions by the end of the game per group. Group 2 stands out, with a significantly higher number of black factories than the other groups and net-positive CO2- emissions. All groups have significantly more green factories than black factories by the end of the game, which supports the group consensus that all groups reported on during the focus groups.

Figure 2: Temperature increase over time in Groups 1-6
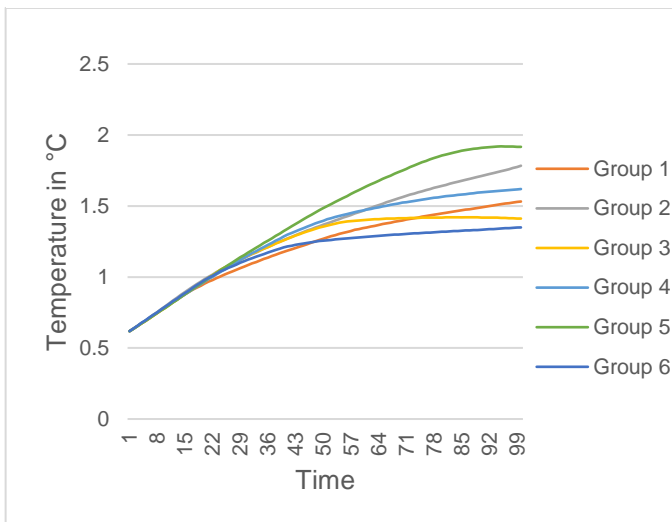
Figure 1: CO2- emissions over time in Groups 1-6
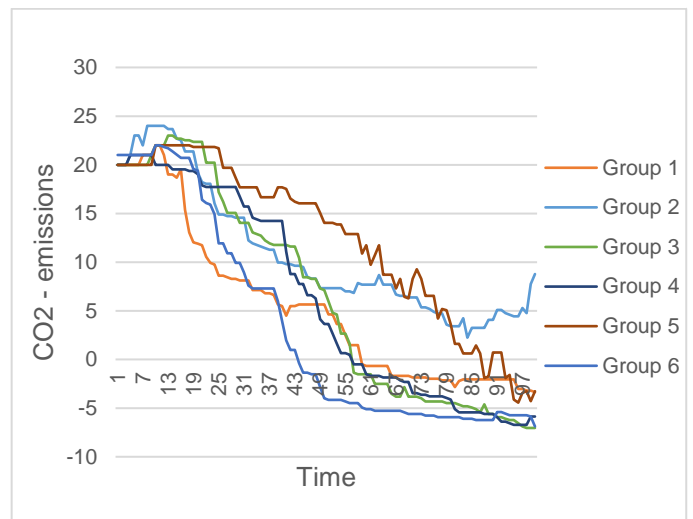
Table 16: Gameplay data – Temperature, black and green factories per game session at the end of the game

Group	Temperature in °C	Black factories total	Green factories total	CO2 – Emissions
1	1.53147	0	29	-3.36
2	1.78344	15	25	8.76
3	1.41062	0	41	-7.04
4	1.6194	1	41	-1.64
5	1.91541	2	14	-3.28
6	1.34881	0	33	-6.56

When comparing the relation of the availability of resources to climate action, I found some examples where CO2– emissions increase for some players, when resources become very scarce (one example, see Figures 3 & 4; more examples see Appendix, Figures 23-26).

Figure 3: Budget of Player 3 - Group 2
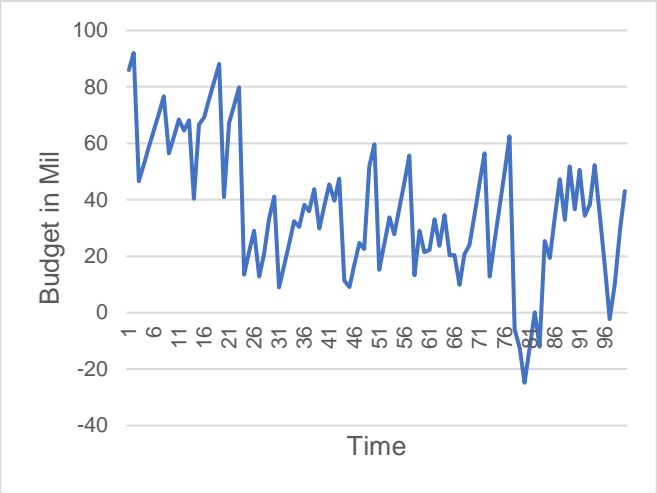
Figure 4: CO2 - emissions of Player 3, Group 2
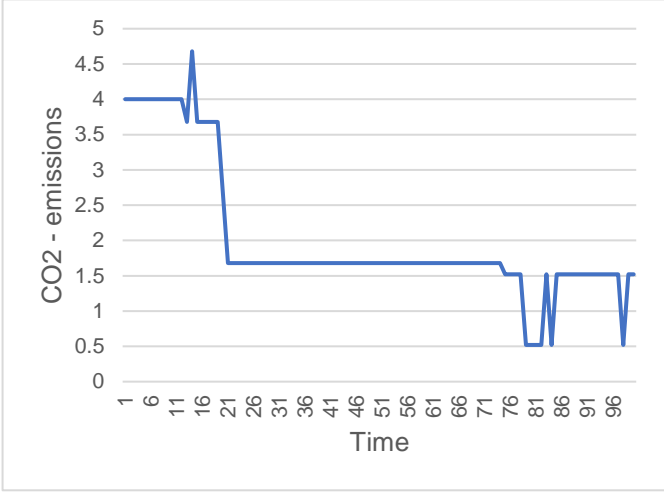
Concerning the number of black factories, all groups generally show a trend in decreasing numbers (see Appendix, Figures 5, 8, 11, 14, 17, 20), with a few players that are outliers in groups 2, 4 and 5 (see Appendix, Figures 8, 14, 17). Aligned with the CO2- emissions, in Group 2 a few players started building black factories again over the last couple of years in the game (see Appendix, Figure 8). This puts into question the importance of the group consensus for this group and shows that there is a gap between reporting and data. It is possible that, by the end of the game, when it was clear that the temperature would not reach two degrees, players decided to concentrate on their own path rather than concentrating on the group consensus and climate action. This is in support of the focus group results, where Group 2 was the only group that did not mention that their individual interests being always aligned with the group interests. Nevertheless, green factories show a general upward trend; numbers are generally increasing for all players over the course of the game (see Appendix, Figures 6, 9, 12, 15, 18, 21). Same holds for number of protection levels, where you can observe an increase which becomes stronger during the end of the game (see Appendix, Figures 7, 10, 13, 16, 19, 22). This supports the focus group discussions, where groups mentioned that the impact of natural disasters by the end of the game led to an increase in protection measures built accordingly.

Other valuable data points are the climate conferences and the research projects. Table 17 shows that all groups have around 10-12 accepted climate conferences by the end of the game for all players in total. Since the game included 12 conferences, almost all the groups have a high completion rate (10 or more completed). Group 2 stands out with only five accepted conferences. Concerning the research projects, only the green projects are listed, because only one black research project was completed in all the groups, which was in Group 2. The amount of completed research project also shows to be quite similar for all groups at around 3-5. Groups are acting cooperative during the game. The only group that stands out is Group 2. This group shows more black factories than the other groups and less cooperative behaviour. When comparing this to the focus groups, what stands out is that this group did not report on issues concerning resources as much as the other groups. Apart from that, the results from the focus groups did not find that they reported to be less cooperative. Table 17 also lists the political demands accepted and completed total per game session. All groups show a higher amount of total completed green and red (climate- friendly) demands. Group 2, again, has completed significantly more black demands than the other groups. The amount of political demands completed varies quiet a lot between the different groups.

Table 17: Gameplay data - Climate conferences, Research Projects -green, Political Demands (black, green & red)

Group	Climate Conferences (total accepted)	Research Projects – green (completed)	Political Demands – black (total completed per Game)	Political Demands - green & red (total completed per Game)
1	11	3	2	16
2	5	4	9	17
3	10	5	4	23
4	10	5	2	13
5	12	5	1	9
6	10	4	3	16

4.3.2   Entry- Questionnaire

The Entry- Questionnaire was designed to find out about certain demographics of the participants and ask more specifically about opinions on the environment, generalised trust, and political orientation for contextualizing the results from the focus groups and showing uniformity between the groups. I will use descriptive statistics to get an overview of the data (see Table 18). Since I used a most similar approach to designing the research, the participants

should be very uniform in their demographics. The data supports this: All participants, except one participant from Group 1, were between 25 – 34 years old. Gender was split 50/50 (15 female and 15 male participants). Half of the groups were almost evenly shared female and male and the other three were a ratio of 1:4. This doesn't seem to have an influence on game results, though: The groups that were mostly male didn't show any exceptions in the focus group results. 16 of the 30 (53,3%) participants have attained a Bachelor's degree, 7 (23,3%) have a Master's degree and 5 (16,7%) a High School Diploma. This supports, again, the uniformity of the group, since educational level is generally quite high. Another factor showing the uniformity within the participants is the employment status: 66,7% of the participants are students. When comparing between the different groups, the educational status is quite similar. The participants are mainly positioning themselves politically between centre-left and left, with only one participant in the centre group and all others between centre-left and left, showing, again, a quite uniform distribution. Concerning the environment, all participants except one would prioritize protecting the environment over economic growth (1 don't know) and all 30 participants either disagree or disagree strongly about environmental threats being exaggerated. When asked about the importance of the environment compared to other things in life, the distribution is somewhat more scattered but generally trends towards the importance of the environment over other things. This supports the findings of the influence of the political orientation on the game strategy, where players stated that they were influenced by their own ideology towards protecting the environment on actions in the game. The majority (73,3%) have participated in a volunteer activity or community work. As expected, the total group of 30 participants shows to be mostly uniformly distributed. The participants are generally young adults, with a high educational level, mostly students and politically centre-left to left oriented. They share the view that the environment is important and have to the most part engaged in some form of civic engagement.

Table 18: Entry-Questionnaire Data

Age	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
15-24 years	1	0	0	0	0	0
25-34 years	4	5	5	5	5	5
35-44 years	0	0	0	0	0	0
45-54 years	0	0	0	0	0	0
55-64 years	0	0	0	0	0	0
65 years and more	0	0	0	0	0	0

Gender						
male	1	4	3	3	1	3
female	4	1	2	2	4	2
non-binary	0	0	0	0	0	0
prefer not to answer	0	0	0	0	0	0
Educational Status						
High-School	1	0	1	0	1	2
Bachelor	3	5	1	3	1	3
Master	0	0	3	1	3	0
PhD	0	0	0	0	0	0
Other	1	0	0	1	0	0
Employment status						
Student and Employed Full-time	1	0	0	0	0	0
Student and Employed Part- time	0	2	0	3	0	1
Student and Unemployed	0	0	1	0	0	0
Employed Full-Time	0	0	3	0	2	1
Employed Part-Time	1	1	0	1	0	0
Student	3	2	1	1	2	3
Unemployed	0	0	0	0	1	0
Other	0	0	0	0	0	0
Environment - importance	There are more important things to do in life than protect the environment					
don't know	0	0	0	1	0	0
agree strongly	0	0	0	0	0	0
agree	0	3	1	1	0	1
neither agree nor disagree	1	1	2	1	1	1
disagree	3	0	2	1	1	2
disagree strongly	1	1	0	1	3	1
Environment - exaggerated	Many of the claims about environmental threats are exaggerated					
don't know	0	0	0	0	0	0
agree strongly	0	0	0	0	0	0
agree	0	0	0	0	0	0
neither agree nor disagree	0	0	0	0	0	0
disagree	1	2	2	1	0	2
disagree strongly	4	3	3	4	5	3
Environment & Economic growth	Here are two statements people sometimes make when discussing the environment and economic growth. Which of them comes closer to your own point of view?					
don't know	1	0	0	0	0	0
protecting the environment is a priority, even if slower economic growth and loss of jobs	3	5	5	5	5	5

economic growth and creating jobs is a priority, even if environment suffers	1	0	0	0	0	0
Political Orientation						
don't know	0	0	0	0	0	0
left	2	3	3	3	3	3
centre left	3	2	1	2	2	2
centre	0	0	1	0	0	0
centre right	0	0	0	0	0	0
right	0	0	0	0	0	0
Civic Engagement	Have you ever spent time participating in any community service or volunteer activity?					
yes	3	3	3	5	5	3
no	2	2	2	0	0	2
Generalised Trust	Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?					
don't know	1	1	2	0	2	1
most people can be trusted	3	4	0	4	1	1
cannot be too careful	1	0	3	1	2	3

When comparing between groups, all six groups have at least three members with a higher education than High-School, making up half of the participants. There are no outliers to be found in this category. In the category employment status, Group 3 stands out, because it has 3 group members that are employed full-time and non-students. When asked about the importance of the environment over other things in life, Group 2 is an outlier, with 3 participants, 60% of the group, agreeing, that there are more important things than the environment. This aligns with some of the results from the gameplay data, where Group 2 has the highest number of black factories. The categories priority of the environment over economic growth, exaggeration of environmental threats and political orientation show no outliers. For civic engagement, as mentioned before, all groups have in the majority engaged in volunteer or community services. Two groups (Group 4 and 5) stand out because all members answered with yes. When comparing this with gameplay data and focus group results, this isn't reflected in the results. Groups 4 and 5 do not show a more cooperative or selfless behavior. When looking at the data on generalized trust, groups are varying in this category: Group 1 & 2 have more trust and Group 3, 5 and 6 have less trust. This is not reflected in the gameplay results, because all groups except for Group 2 were rather cooperative in climate conferences, in research and in supporting the group consensus. In general, all groups are mostly uniform,

and no group stands out, which supports the validity of the results from the focus groups. In addition, control groups mostly reported on similar themes as the treatment groups, which also adds validity to the study.

5   Discussion

In this chapter I will start summarizing the results from the empirical data collection and test the hypotheses. Then I will critically discuss these results, find limitations and implications for urban climate action, implications for KEEP COOL mobile and the possibilities for future research.

5.1   Summary of the results

5.1.1   Representation of action situations - Hypothesis 1

The online game KEEP COOL mobile does not fully represent the same action situations that local governments have to deal with. There are some similarities in the game design and real-life structures that presents similar issues for players in the game that local governments face, but they often vary significantly when comparing these situations with the IAD- Framework. Because the game only allows for mayors as actual human actors, several participants from real-life are missing in the action situations leading to differing structures in general. The players in the game are often primarily influenced by a) their own city development and most importantly b) the group strategy, which in this case was mainly a consensus on transitioning to a green and sustainable future. This is not the case for local governments, mainly because of various other factors that influence their decision-making processes like external actors, internal governmental structures, national policies, geographical location, political and institutional structures and many more. This is only somewhat represented in the game through features like the climate conferences, acting as a funding entity, cost-reduction or sanctioning mechanisms, the possibility to send money and research projects, acting as a cost-reduction mechanism.

Action situations that are represented in the game are the problem of reducing emissions, the navigation of resources, the internal conflicts, and the citizens' interests. These action situations play a significant role for player groups in the game KEEP COOL mobile, but their structures vary from real-life action situations. Especially internal conflicts and citizens interests in the game are situations that players either deal with internally or through interactions with

other participants than the participants in real-life action situations. The game, due to its simplification of real-world processes and the reduction on only mayors as human actors, leaves out significant structures that are apparent in real-life action situations. Reducing emissions is an in-game action situation that is similar to the real-life action situation. Even though the focus groups results showed that players in the game experienced a group consensus towards a green transition, the gameplay data shows that emissions are reduced but only to a certain extent and only one group managed to stay under a 1,5°C rise in global temperature. The CO2-emissions on the other hand show that most groups did successfully reduce emissions. For action situation 2, the navigation of resources, the gameplay data shows that when resources are very scarce, some players struggle investing in climate action. Additionally, there are two in-game action situations, not established from the most important issues in the literature, which are the coordination of research projects and the coordination of climate conferences.

This leads me to the conclusion to reject Hypothesis 1. The players do report on some action situations similar to those identified in the literature, but they are more likely to report on and experience action situations 1, 2, 3 and 5 then on 4 and 6. To answer the operative research question 3 "How are the action situations that local governments face represented in the game KEEP COOL mobile?", only some parts of real-life action situations are represented in the game KEEP COOL mobile. This adds to the prior analysis of the game design in chapter 2.6, where I have already found that power asymmetries of real-world structures and differences in the capacities and resources, that play a major role in urban climate action, are not fully represented in the game. Since there are no national governments, in-game structures are severely limited.

5.1.2 Dealing with action situations – Hypotheses 2-7

When analysing how actor groups deal with the action situations from the literature, which the game structures represent, there are several similarities that are reported on in the focus groups.

When faced with the action situation emissions reductions, players start creating a network, communication, reporting and monitoring. Since strategies of dealing with emissions reductions are similar to the literature, Hypothesis 2 is confirmed. Players start cooperation and monitoring to prevent free riders and successfully reduce emissions in the game.

The decision on the navigation of resources was mostly dealt with using a different strategy than the literature. The strategy was to wait, meaning no action. Other strategies were increasing communication and cooperation through money transfer between cities, but conferences or research projects was not frequently reported on as a strategy and co-benefits were not calculated. Therefore, players deal with this situation quiet differently. Hypothesis 3 is therefore only partly confirmed. Players do focus on and increase cooperation during the game, when money is limited, but co-benefit calculations is not a common strategy. Since the focus groups also showed that the action situation navigation of resources differs from the real-life action situation, this might explain why players in the game dealt with it in a different way than real-life actors.

When faced with internal decision-making conflicts, actors in the game chose to deal with this intuitively without investing much time. This is different from real-life strategies. Therefore, Hypothesis 4 is rejected. Players do not invest more time into proper decision-making when they are struggling with those decisions. Since internal conflicts is an action situation that is represented differently in the game than in real-life and major participants are missing from this situation, dealing with this action situation also differs from real-life ways of dealing with it.

Political challenges are not represented in the game. When players in KEEP COOL mobile are faced with dealing with increasing climate change impacts their focus on climate action measures increases, which is a similar strategy to the literature. Hypothesis 5 is confirmed: Players will increasingly focus on climate change measures as negative climate impacts increase.

The citizens interests are represented in the game through the political demands. The game design already showed that co-benefits cannot be communicated to the population, showing a significant difference to the literature. Similar to what the literature suggests, when faced with this situation, players do consider the importance of the political demands and reject them, if harmful to the climate. The gameplay data confirms these results. This confirms Hypothesis 6. It has to be mentioned though, that the influence of the group consensus was a considerate part of that decision by the players.

Lastly, a common strategy when dealing with either fewer resources or the general decision-making process, was to ask others in the group for advice. Here, the way players in the game

deal with issues is similar to the literature. Therefore Hypothesis 7 can be confirmed: The struggles that players have with the decision-making process in the game or struggles due to fewer resources will be reduced by knowledge or best practice sharing.

The majority of the Hypotheses were formulated after a first look at the game design (in chapter 2.6) and my propositions on strategies that player groups in the game KEEP COOL mobile apply to certain action situations were confirmed.

With these results, I can come back to the operative research question 4 "Are there differences in how players in KEEP COOL mobile deal with action situations in the game compared to actors in city governments and to suggested solutions from the literature on urban climate action?": First of all, there are differences in the action situations of KEEP COOL mobile and urban climate action, which leaves players in the game facing different situations. The way the groups dealt with the situations found in the literature (somehow represented in the game) nevertheless can be quite similar to the way the literature suggests, especially in the form of cooperation and communication between actors.

The gameplay data supports the focus groups results since all groups showed a transition to green factories and lowering emissions, in line with the group consensus. As mentioned before, this transition in some groups was not as strong as reported, especially when looking at the temperature increase and CO2 emissions, but the general trend is towards a green economy and climate action. Cooperative behaviour (climate conferences and research projects) was quite high and a resistance against black political demands is confirmed. The data from the entry-questionnaire shows a general uniformity within all participants and between the groups. Group 2 stands out in the category on the importance of the environment against other things, which aligns with the gameplay data, where this group has the highest number of black factories. Group 5, though, has the highest temperature increase but shows no exceptions in the questionnaire. Generally, the data from the gameplay and the entry-questionnaire support the results from the focus groups and show no significant outliers or variation between the groups.

5.2 Limitations

There are always limitations to a research design, where this study is no exception. There are some limits to the material and the method, which I will elaborate on in the following sections.

5.2.1 Limitations of the material

The underlying thesis was foremost limited due to the ongoing Covid-19 pandemic in several aspects: The pandemic did not allow for in-present games and focus groups, which especially for focus groups, can be a limiting factor in allowing for a valuable group discussion. Online focus groups are not uncommon, can be helpful through the availability of recording and by decreasing the resources that need to be used, but getting the discussion going can prove to be more difficult for the moderator. Due to the pandemic and limitations in money and time, recruitment of participants was difficult, and I had to use social channels that created a sampling bias. Some of the groups were constructed groups and some of the groups were natural groups; due to the limitations of the study it was not possible, to have this designed in a coherent way. Natural groups behave differently than constructed groups in focus group discussions (Leask et al. 2001), Another limitation was the moderators experience, since this was my first time conducting focus groups. The test group helped to reduce some of the inexperience.

KEEP COOL mobile is designed to be an online game using many different players. This study limited the player group size to only five people. When playing the game with a different group size, results can vary to the results found in this research in several ways: A bigger group might have more difficulties agreeing on a group consensus, than a smaller group. It can also lead to more variation in game strategies and many other results. Further research needs to investigate the influence of the group size on game results. Another difference to the game results, is how many times the players have played the game. In my study all participants were new to the game. As I've found in a recent workshop on the game KEEP COOL mobile, players often may change their strategy after they've played the game once.

There were some minor technical issues I experienced with the game KEEP COOL mobile that occurred in two groups. In the first group two players had difficulties in the game display on their laptop and had to use their smartphones for being able to play. This happened in Group 5 as well, where one player had troubles connecting to the game and had to use a Tablet. In the focus groups the players using the smartphones said that they would have preferred a laptop and found the mobile screen to small, but they did not think that it influenced the game trajectory.

5.2.2   Limitations of the method

Even though focus groups are commonly used in qualitative research, there can be some issues using this type of research: First of all, "measuring strength of opinion from focus group data is problematic" (Sim 1998). This suggests that using the group as the unit of analysis and establishing common trends can lead to a) outliers and outlying opinions being erased and b) the strength of an opinion being irrelevant, meaning that the researcher doesn't take into consideration how important a comment is to the commenter (Onwuegbuzie et al. 2009). I have attempted to include some of the outliers into the results to reduce this issue to a certain extent. Furthermore, focus groups discussion can be dominated by a specific personality, excluding the opinions of not so dominant individuals (Bhattacherjee 2012). Research on combining serious gaming and focus group is scarce (Wibeck and Neset 2020), making it difficult to establish a valid research design. Using games is more common as a facilitator for learning and collective action (see for instance (Salvini et al. 2016; Meinzen-Dick et al. 2018)) but for using it as an experimental tool for research on collective action problems, I had difficulties finding appropriate literature. This contributed to the difficulties in establishing a valid research design.

5.2.3   Limitations of the propositions

The propositions and therefore the hypotheses of this study were based on the literature of urban climate action. Due to limitations of time and money of this study, these propositions were not tested according to other factors of behaviour in serious games. Since this is an exploratory research on the suitability of the game KEEP COOL mobile as an experimental tool for research, the hypotheses represented the action situations of urban climate action. For instance, studying political orientation as an influence on game strategy can be questionable, even though focus groups reported a high influence of their own ideology, because studies have found that players are able to distinguish between in-game roles and their real-life views (Meya and Eisenack 2018). Future research can further investigate the roles of players in the game and how, then, KEEP COOL mobile is useful for experimentation on urban climate action.

5.3   Implications for research on urban climate action

This thesis aim was to compare urban climate action and KEEP COOL mobile to find similarities and differences in real-life and in-game action situation for testing the suitability of

using KEEP COOL mobile as a research tool. The comparison has shown significant differences in the game design and the real-life structures. Therefore, no implications for research on urban climate action can be drawn, yet. Due to the exploratory nature of this research, a different research and study design could provide more insights.

5.3.1 Implications for KEEP COOL mobile

KEEP COOL, the board game, was primarily designed as an interdisciplinary tool for research, scientists, educators, and the general population to learn about climate change, especially about cooperation and international negotiations (Eisenack 2013). Since it serves as a simplification of real-world structures, it has the potential to additionally be used for research on urban climate action and collective action situations. This study found that there are major restrictions in the game for being able to draw conclusions from the game to the real-world collective action situations. For research on urban climate action, the game design could be adjusted so that there are more participants in the occurring action situations. Players in the game could, for instance, take up different roles, like an external funding entity, a national government, part of the citizens, a research institute or many more. Additional roles could be distributed, making the game more realistic. Additionally, there could be a form of representation of power asymmetries between countries of the Global North and the Global South in the game. The board game KEEP COOL, which KEEP COOL mobile is based on, actually distinguishes between the different nation states and attempts to represent real-world structures in this area (Keep Cool Brettspiel – KEEP COOL 2021). Implementing this into the online game also provides some more realistic structures and therefore a better suitability for research on urban climate action. These are changes that could either be implemented into the game design or somehow represented in future research through a specific research design in the game through the researcher assigning roles or responsibilities in the game.

5.4 Future research

Games can provide an interesting and valuable source of information for a researcher to study collective action situations, behaviour of actor groups and cooperation. KEEP COOL mobile, as a climate change game involving city actors, serves as a small and simplified experimental arena for urban climate action, which in real-life is a system with high complexity. This thesis wanted to study the suitability for this form of research on urban climate action through the game. Due to the several limitations of this study, further research is needed to provide some

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more detailed information on this. Using focus groups serves as an exploratory form of research to get a first understanding of the action situations that actor groups face and deal with within the game. A quantitative study involving more variations in the design of the groups could provide more insights and support or negate the findings of this study. These variations can include group size, form of playing the game (through a video call vs. in-person), more varied participants, repetitions of games, longer and shorter game sessions, etc. Another research design could also apply more treatments like forms of monitoring, highlighting the co-benefits of climate change, or having different prerequisites for some cities. Games on climate change, especially online games, have been increasing in numbers for about the last 10 years (Reckien and Eisenack 2013). Most of these games are designed and used primarily as educational tools concerning climate change for the general public (Reckien and Eisenack 2013). Using a game to link real-life structures to game structures is scarce and therefore leaves a lot of room for research. Especially in economics, where gaming as a form for studying collective action, is common, these forms of games can offer some valuable insights. It is important though, as this study shows, that complexity of real-world systems has to be simplified in the game, making room for only a few of the real-life structures to be studied.

Apart from that, further research can also provide some more insights into using focus groups in combination with serious games. This thesis provided a first glimpse into the ways to combine these two methods, but there is a big opportunity in using focus groups to study in-game behaviour after the game. Research has highlighted the importance of debriefing for participants in serious games (Crookall 2010). Focus groups are a form of combining the debriefing process of the game with a qualitative research method to study how groups are experiencing in-game situations.

6 Conclusion

2020 marked another year of tragic records in climate impacts: It was one of the warmest years since recording started, wildfires in the United States led to the largest area burned in the US in 20 years and the Arctic sea-ice is declining to record lows (World Meteorological Organization 2021). National climate targets and commitments are not able to keep on track with the 1,5°C goal (United Nations Environment Programme 2019). Due to this failure, other levels of government, the population, the economy, and other actors are joining the fight. Cities are taking actions to battle the issue through urban climate and organizing in transnational city

networks. Since cities are becoming of interest and importance for the ongoing climate change discourse, research on successful urban climate action is important. Tools to observe international cooperation for cities on the topic of climate change are necessary to develop and evaluate strategies for real-life networks. This analysis aimed to contribute first information on what these tools could look like. More precisely it identified essential factors that would increase the suitability of climate action games like KEEP COOL mobile for research on urban climate action, especially concerning the action situations involved in this area.

This thesis aim was to explore how suitable the online game KEEP COOL mobile is for research on urban climate action by comparing action situations. In conclusion, I find that only some real-life action situations are represented in the game: The problem of reducing emissions, the navigation of resources, the internal conflicts, and the interests of the citizens. But these action situations are not represented in their respective real-world complexity. Therefore, I find that KEEP COOL mobile can be a tool for researching some collective action situations but for drawing conclusions about urban climate action it is not sufficient. The game design does represent some important features of urban climate action, like the collective issue of reducing emissions including the free-rider problem, or the importance of international negotiations and cooperation. A researcher can study these game interactions to study collective action but for research on urban climate action, there are too many parts of the action situations missing to be able to find applicable solutions. Especially the reduction in actors like national governments, private entities, a proper representation of the population or transnational organizations reduce the game interactions to be not sufficiently representative of real-life structures. The in-game action situations are too different from the real-life action situations to be able to use this as a research tool for urban climate action.

The importance of cities in dealing with climate change, as the executive director of the Renewable Energy Policy Network for the 21st Century (REN 21) mentions in the article by Deutschlandfunk (Deutschlandfunk 2021) should create pressure on the scientific community to increase research in this area due to the complexity of the issue and the failure of national governments to address it. Even though this thesis has found that KEEP COOL mobile does not sufficiently represent real-world structures to be able to be used in urban climate research, it still can offer some insights into some areas of collective action research. For example, analysing in-game communication and behaviour can provide some more information on

cooperation of local governments. What are specific communicative phrases or forms or pieces of advice that work better than others? How do players convince other players?

Using online games can be a valuable tool for research due to the experimental arena they offer and create. Continuing the research on how real-life structures can be represented in different games, can provide the scientific community with additional research tools for studying human interactions. This is especially true for the collective action situations involved in climate change, where several actors with varying interests are struggling to find solutions to an optimal outcome.

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Appendix A

Figure 5: Number of black factories per Player - Group 1
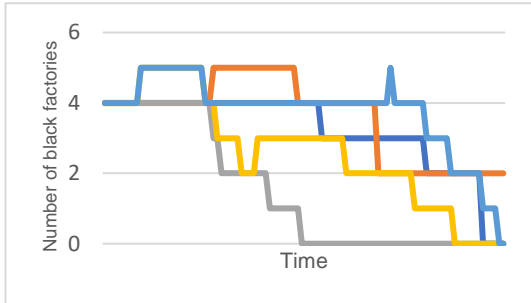
Figure 6: Number of green factories per Player - Group 1
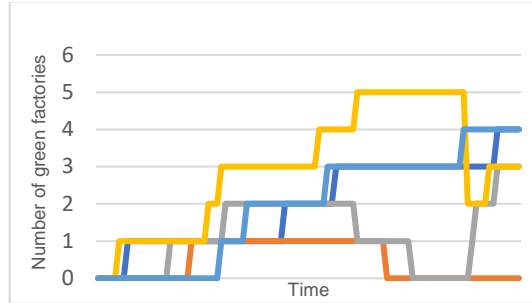
Figure 7: Number of protection levels per Player - Group 1
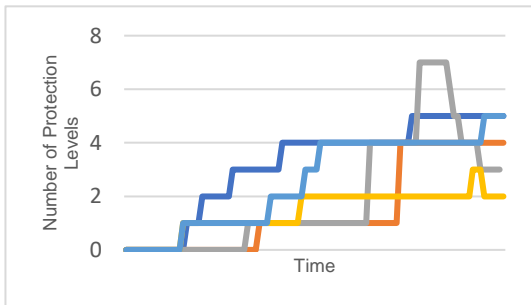
Figure 8: Number of black factories per Player - Group 2
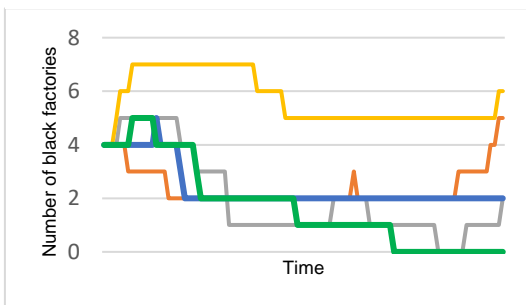

Figure 9: Number of green factories per Player - Group 2
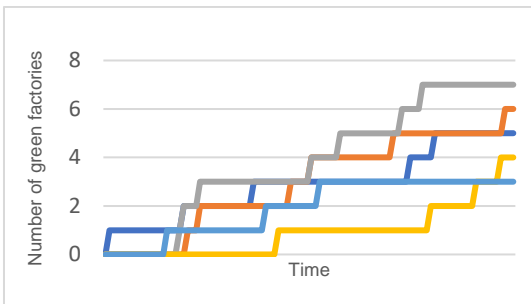
Figure 10: Number of protection levels per Player - Group 2
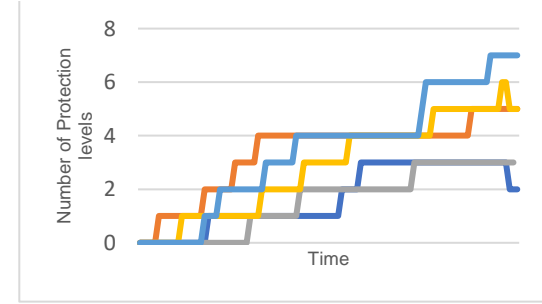
Figure 11: Number of black factories per Player - Group 3
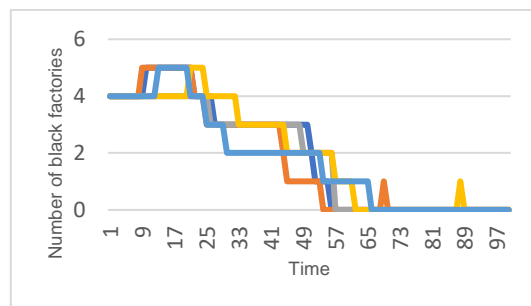
Figure 12: Number of green factories per Player - Group 3
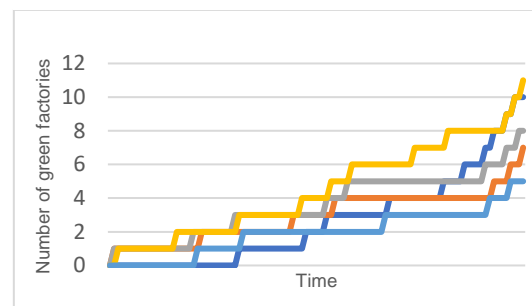
Figure 13: Number of protection levels per Player - Group 3
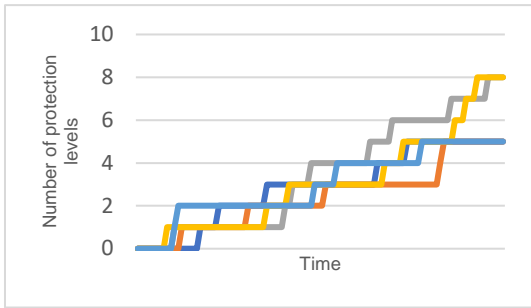
Figure 14: Number of black factories per Player - Group 4
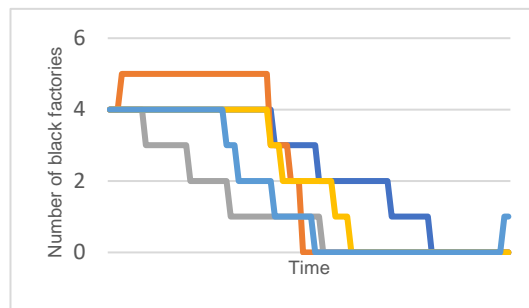
Figure 15: Number of green factories per Player - Group 4
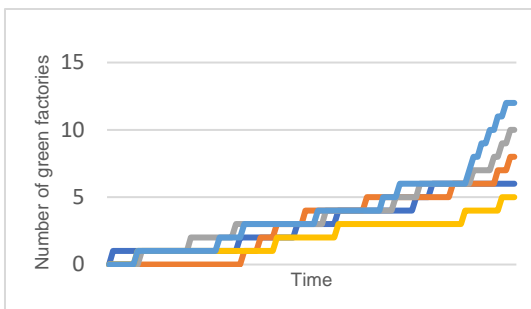
Figure 16: Number of protection levels per Player - Group 4
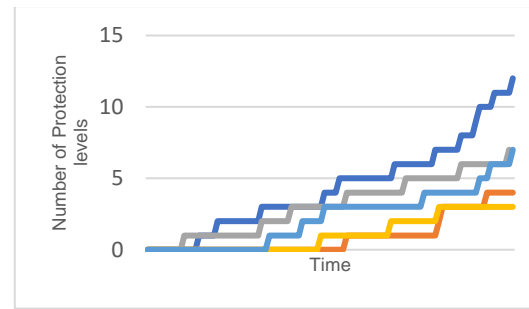
Figure 17: Number of black factories per Player - Group 5
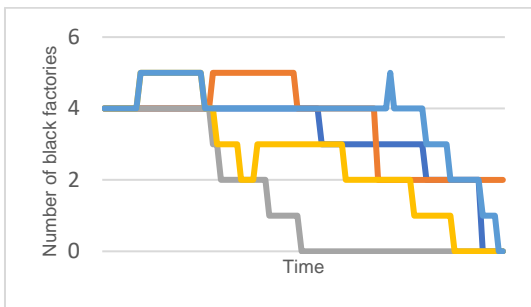
Figure 18: Number of green factories per Player - Group 5
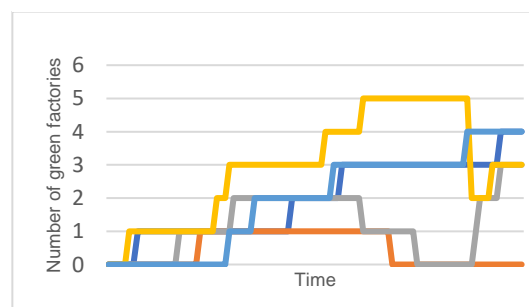
Figure 19: Number of protection levels per Player - Group 5
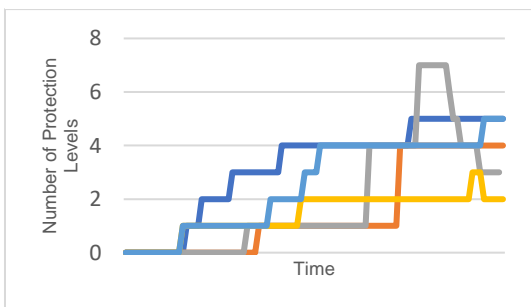
Figure 20: Number of black factories per Player - Group 6
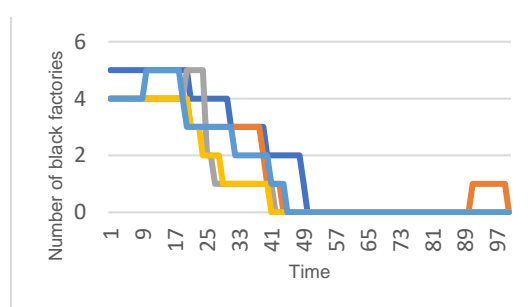
Figure 21: Number of green factories per Player - Group 6
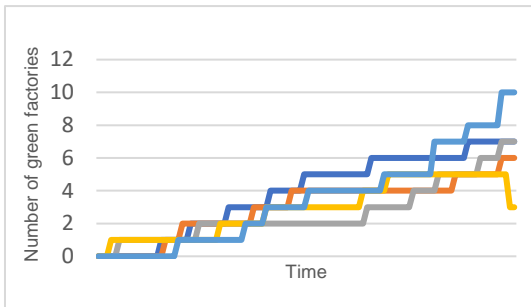
Figure 22: Number of protection levels per Player - Group 6
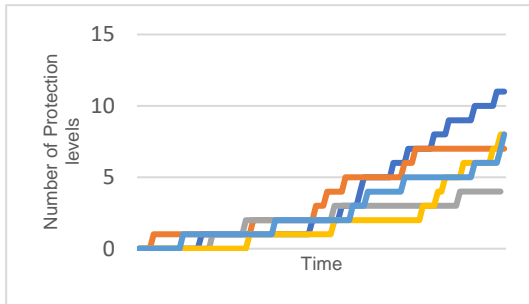
Figure 23: Budget of Player 2 - Group 5
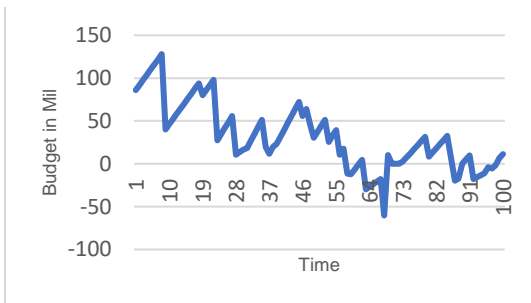
Figure 24: CO2 - emissions of Player 2 - Group 5
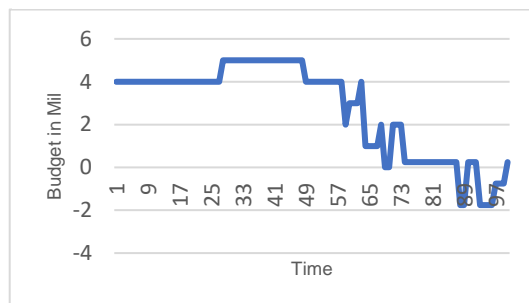
Figure 25: Budget of Player 3 - Group 5
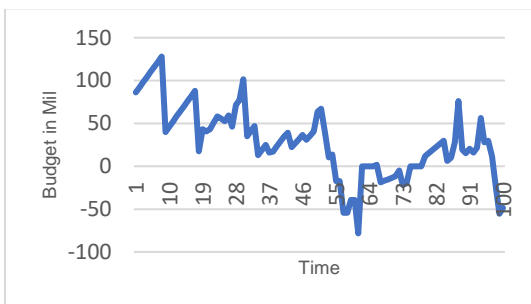
Figure 26: CO2 - emissions of Player 3 - Group 5
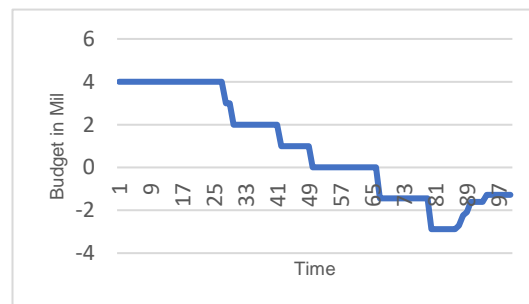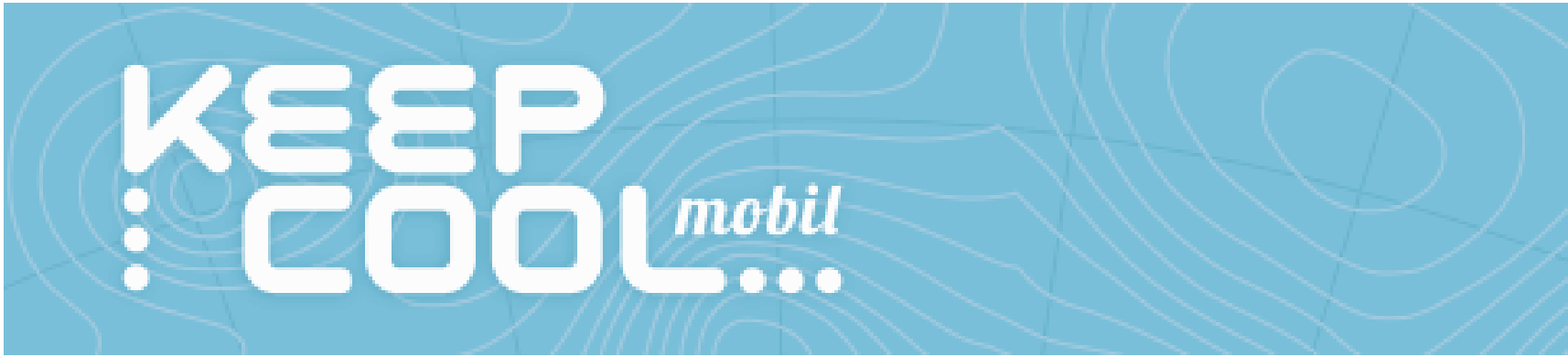
KEEP COOL mobile

Das Spiel zum Klimawandel – Fokusgruppe

Herausforderungen

- Was fandet ihr am schwierigsten daran Bürgermeister*in von einer Stadt zu sein?
  In diesem Fall: Gleichzeitig den Temperaturanstieg verhindern und eure Stadtentwicklung vorantreiben
- Wie konntet ihr gemeinsam den Temperaturanstieg verhindern (oder nicht)?
- Gab es Situationen in denen eure Interessen als BürgermeisterIn mit denen der Gruppe kollidierten?

Handlungen

Es gibt einige verschiedene Aktionen im Spiel. (Bau der Fabriken, Forschungen, Schutzmaßnahmen, politische Forderungen, Bäume pflanzen)

1. Fandet ihr es schwierig zu entscheiden, welche die **wichtigsten** Aktionen sind?

2. Wenn ihr **wenig Geld** zur Verfügung hattet, wie hat das
   a) …eure Aktionen zum Klimawandel (Bäume pflanzen, Schutzmaßnahmen, grüne Fabriken anstatt schwarzer Fabriken) beeinflusst?
   b) …eure Kommunikation und Kooperation (Forschungen, Klimakonferenzen) mit anderen Spieler*innen beeinflusst?

Handlungen

1. Wie haben eure eigenen Ansichten zum Klimawandel die Art und Weise beeinflusst, wie ihr euch im Spiel verhalten habt?

2. Welche Auswirkungen hatten die Naturkatastrophen auf eure Handlungen im Spiel?

3. Woran habt ihr entschieden, ob ihr eine politische Forderung ablehnt oder annehmt?

Gruppen-verhalten

1. Gab es Maßnahmen, die ihr gemeinsam als **Gruppe** ergriffen habt, um den Temperaturanstieg zu verhindern?
   - Gab es Abmachungen?
2. Wenn ihr Probleme damit hattet Entscheidungen zu treffen, habt ihr euch gegenseitig um Rat gefragt?
   - Habt ihr anderen geholfen?
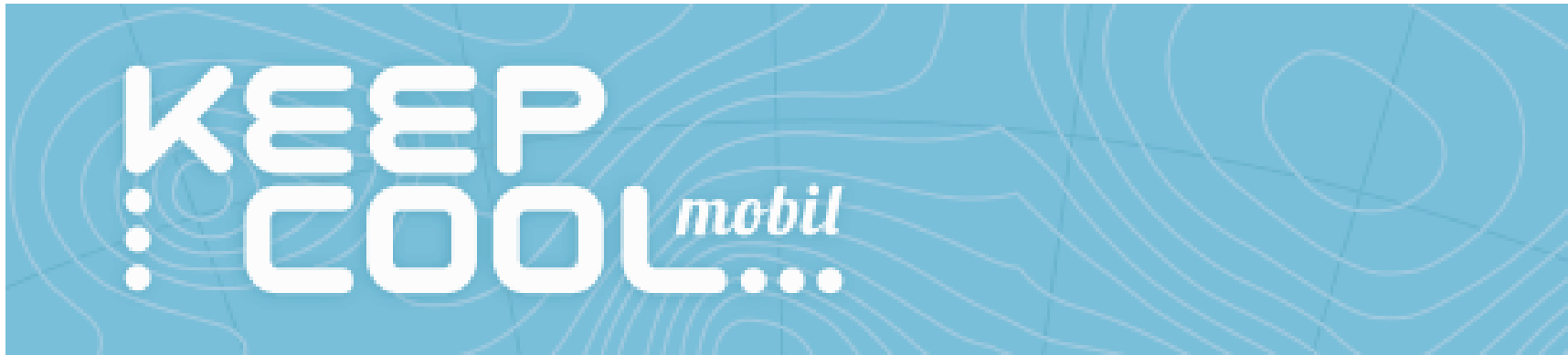
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Das Spiel zum Klimawandel – Fokusgruppe

Herausforderungen

- Was fandet ihr am schwierigsten daran Bürgermeister*in von einer Stadt zu sein?
    - In diesem Fall: gleichzeitig den Temperaturanstieg verhindern und eure Stadtentwicklung vorantreiben
- Welche Schwierigkeiten gab es dadurch, dass ihr als Gruppe verlieren konntet?
- Gab es Situationen in denen eure Interessen als BürgermeisterIn mit denen der Gruppe kollidierten?

Umgang mit Problemen

1. Wie seid ihr mit den Herausforderungen (von der letzten Frage) umgegangen?

2. Was waren **Strategien**, die ihr als Gruppe oder alleine entwickelt habt?

3. Wie haben die Probleme eure **Handlungen** (Bau der Fabriken, pol. Forderungen, Forschungen, Klimakonferenzen, Schutzmaßnahmen) beeinflusst?
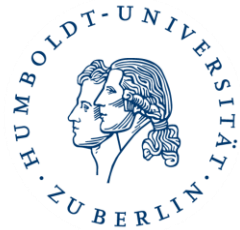
Lebenswissenschaftliche Fakultät
Institut für Biologie
Institut für Psychologie
Albrecht Daniel Thaer-Institut für Agrar- und Gartenbauwissenschaften

Vorlage für die Eigenständigkeitserklärung (auch Selbständigkeitserklärung) für die Abschlussarbeit

Hiermit erkläre ich, dass ich die vorliegende Arbeit selbständig verfasst habe und sämtliche Quellen, einschließlich Internetquellen, die unverändert oder abgewandelt wiedergegeben werden, insbesondere Quellen für Texte, Grafiken, Tabellen und Bilder, als solche kenntlich gemacht habe.

Ich versichere, dass ich die vorliegende Abschlussarbeit noch nicht für andere Prüfungen eingereicht habe.

Mir ist bekannt, dass bei Verstößen gegen diese Grundsätze ein Verfahren wegen Täuschungsversuchs bzw. Täuschung gemäß der fachspezifischen Prüfungsordnung und/oder der Fächerübergreifenden Satzung zur Regelung von Zulassung, Studium und Prüfung der Humboldt-Universität zu Berlin (ZSP-HU) eingeleitet wird.

Ort, Datum, Unterschrift

Berlin, 07.06.2021