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CLIMATE CHANGE GAMES AS BOUNDARY OBJECTS: FOSTERING DIALOGIC

COMMUNICATION WITHIN STAKEHOLDER ENGAGEMENT

by

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ABSTRACT

CLIMATE CHANGE GAMES AS BOUNDARY OBJECTS: FOSTERING DIALOGIC
COMMUNICATION WITHIN STAKEHOLDER ENGAGEMENT

Megan L. McKittrick
Old Dominion University, 2020
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Rising waters and the increasing devastation of flood events make coastal resilience a significant issue in the Hampton Roads region of Virginia, particularly in the city of Norfolk. Enhancing resilience requires ongoing stakeholder engagement designed to invite dialogue while encouraging cross-jurisdictional collaboration and comprehensive problem-solving. Climate change games have been employed to support these endeavors. This dissertation provides a response to the following research questions: 1) What is the origin of the climate change game genre? 2) Why are key stakeholders in coastal resilience using climate change games? And 3) how do these games operate for these key stakeholders? To answer these questions, I focused on two games used in resilience-related stakeholder engagement workshops in 2018 in Coastal Virginia: the *Multi-hazard Tournament* (MHT) and the *Game of Floods*. I conducted semi-structured observational field notes and survey research, including interview and questionnaires, followed by thematic analysis according to notions of Susan Leigh Star and James Griesemer's (1989) boundary objects.

Designed for a wide range of contexts, including public outreach, education, training, and stakeholder engagement, I found that the CC game genre emerges from (and is a manifestation of) a number of related traditions: technical communication, urban planning, modeling and simulation, and game studies—fields that are, themselves, intertwined with a broad array of disciplines. These games are complex and idiosyncratic; while no one disciplinary tradition can

adequately explain their work, the notion of boundary objects can. These games are boundary objects (a manifestation of a range of disciplinary traditions), and they operate as boundary objects for these key stakeholders (encouraging dialogic communication among diverse audiences). I merge multidisciplinary scholarship with data from survey research to generate a rhetorical boundary work heuristic that articulates the goals of these games: foster boundary work for varied audiences within intense design periods using charrette and game design strategies. I analyze the MHT and the *Game of Floods* according to this heuristic, demonstrating that, while both games work toward these goals, more could be done to enhance their boundary work, and I close with key takeaways for practitioners to use as they continue developing and employing CC games.

This dissertation is dedicated to my mother, Melody Edwards,
who embodies resilience.

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Honors Independent Study. Our conversations were enlightening and productive, and it was a privilege to learn along with her.

I am grateful for my fellow students in Old Dominion University's PhD in English program, as well: Dr. Matthew Beale for our countless discussions, Dr. Suzanne Sink for our annual work sessions, Dr. Jessica Saxon for her help with formatting, and Dr. Megan Mize for organizing supportive dissertation boot camps both in person and online, as well as the many others I have had the joy of working with in this program. There are too many to name here, but my peers have all been, and continue to be, a source of endless motivation.

So many have played such an important role in this work, and I am grateful to them all for driving me toward successful completion. My family, without whom none of this would be possible, deserves special recognition. I want to thank my husband, Jimmy McKittrick, for his endless support and encouragement, and I am indebted to my parents, Melody and Douglas Edwards, as well as my sister, Katie Reaves, my in-laws, Pam and Jim McKittrick, and Jimmy again for caring for my children while I wrote. I am especially grateful for Nolan and Hannah, my beloved children, for helping me keep my work in perspective and to my parents for always modeling hard work and determination. Thank you, Mom and Dad, for encouraging me to finish my homework all those years. I finally finished!

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INQUIRING AFTER THE ORIGIN, PURPOSE, AND USES OF CLIMATE CHANGE

GAMES IN COASTAL VIRGINIA

In 2005, I moved from California's Central Valley to Coastal Virginia, and I began the

PhD in English program at Old Dominion University in Norfolk, Virginia, in 2012. No two

regions are alike, but it quickly became apparent that one significant difference involved the

regions' relationship to water. In California, there is rarely enough; in Virginia, it seems, there is

often too much. The cities of Hampton Roads, Virginia (including Norfolk, Virginia Beach,

Chesapeake, Franklin, Poquoson, Portsmouth, Newport News, Hampton, Williamsburg, and

Suffolk) are dependent on their relationship to the water and simultaneously vulnerable because

of it. Bordered by the Chesapeake Bay and the North Atlantic Ocean and surrounded by a vast

network of rivers, lakes, and estuaries, this region grapples with a range of issues from nuisance

flooding and repetitive loss to widespread devastation depending on the event. The tide, the

winds, the severity of a storm, the reliability of a locality's drainage system, compounded by

subsidence and sea level rise: so many factors combine to put the shorelines of Coastal Virginia

in constant flux, and circumstances are getting worse. According to data drawn from the Sewells

Point tide gauge in Norfolk, "nuisance flooding (...) has averaged nearly 40 hours a year so far

this decade. That's about a fivefold increase from the average of the 1980s" (Mayfield, 2017),

and "floods are the most common and costly hazard affecting communities" (qtd. in United

States Army Corps of Engineers, 2015, p. ii). Sea level rise further enhances the threat of

flooding and is particularly problematic for Coastal Virginia: "sea level in Norfolk is rising at

twice the global average rate, in part because of the subsidence (sinking) of Chesapeake Bay"

(Association of State Floodplain Managers, 2020) . In fact, Norfolk is surpassed only by New Orleans in the threat of sea level rise (Montgomery, 2014). Rising waters and the increasing devastation of flood events make coastal resilience a significant issue in Hampton Roads, Virginia, particularly in the city of Norfolk. As a newcomer to Virginia and a doctoral student in English studies, I wanted to learn more about the unique risks affecting my new home by exploring the communication surrounding coastal resilience: the authors, the audiences, the purposes, contexts, and media therein.

Resilience, as defined by the Infrastructure Systems Rebuilding Principles (established by NOAA and USACE), is the "ability to adapt to changing conditions and withstand and rapidly recover from disruptions due to disasters" (United States Army Corps of Engineers, 2015, p. ii). The UK Cabinet Office defines community resilience as "communities and individuals harnessing local resources and expertise to help themselves in an emergency, in a way that complements the response of the emergency services" (qtd. in Patel, et al., 2017). Researchers tend to agree, however, that the definition of resilience is tied to a given region and its unique set of community-defined risks and goals (Patel, et al., 2017). As a social construct, then, resilience is a result of communication where stakeholders negotiate the meaning of the concept according to their values and perceptions. As I prepared for this dissertation, my research moved through two key branches of resilience-related communication: communication designed for public outreach and stakeholder engagement. Fostering community resilience requires ongoing, targeted, and carefully designed public outreach measures aimed at educating audiences about risks and adaptation strategies, while modern stakeholder engagement workshops aim toward inviting dialogue among key stakeholders (such as NFIP coordinators, floodplain managers, or mitigation planning specialists, among others) to foster cross-jurisdictional collaboration and

comprehensive problem-solving. Most research in the technical communication branch of English Studies examines public outreach and the dynamics between speakers and audiences therein; this dissertation focuses on stakeholder engagement and emergent practices with alternative media: namely, the use of climate change (CC) games.

CC games have been emerging in classrooms, stakeholder workshops, and public outreach contexts since the 80s (Ouariachi, et al., 2017; Reckien & Eisenack, 2013), and their growing use is natural given their relationship to the discipline of modeling and simulation (M&S). M&S has long been applied to contexts involving training, decision support, education and learning, as well as entertainment (Banks, 2009). It's useful in these contexts because M&S generates an approximation of a real-world system, enabling repeatability for observation and experimentation (Banks, 2009). M&S provides safe and inexpensive means for experiential learning. The boundaries between games and simulations are somewhat porous, and their histories are intertwined; for example, in tracing the origins of military simulations, scholars often point to tabletop games, such as chess (Banks, 2009; Loftin, 2009; Hill & Tolk, 2017). Likewise, as a variation of business simulations, business games have been described accordingly:

> Basically a business game is a model which reproduces parts of specific economic, political or social systems, and offers a simplified access to the complex correlations in these systems. Through a system of rules and interfaces the participants have possibilities of interacting with the model and thereby determining the outcome of the game. As the consequences of their actions are limited to the contexts of the game, the participants can experiment with new strategies (Nohr, 2011, p. 1).

CC games operate in much the same way, enhancing accessibility to the issue of climate change, the actor relations therein, and the consequences of players' actions over time. CC games add layers of game design (such as role-playing, points, and competition) onto established approaches to simulation, and such work is helpful as climate change is a complex issue with a wide range of environmental impacts, affecting a diverse spectrum of stakeholders over an extended period of time. In a special issue of *Simulation & Gaming*, dedicated to the topic of CC games, authors Diana Reckien, a professor of Geo-Information Science and Earth Observation (ITC) and Urban and Regional Planning, and Klaus Eisenack, a professor of resource economics with research interests in simulation and gaming, (2013) argue that "games can simulate quite complex actor relations, between nation-states and between transnational, subnational, individual, and hybrid actors. (...) Games can offer new ways to raise awareness and empower people to deal with climate change" (p. 246). As a manifestation of M&S, therefore, CC games are uniquely suited for educational, training, and decision support contexts.

Scholars have indicated that practitioners turn to CC games as a means of achieving informational and motivational goals (Eisenack & Reckien, 2013; Froehlich, 2014; Katsaliaki & Mustafa, 2015). Influenced in part by educational serious games, CC games are designed for the purpose of either raising awareness about the challenges and impacts of climate change and/or influencing the player to adopt pro-environmental behaviors or adaptive strategies (Eisenack & Reckien, 2013; Froehlich, 2014; Katsaliaki & Mustafa, 2015). This dissertation will further complicate current understandings of this genre, shedding light on additional uses. CC games have been adapted to various audiences and contexts, serving a wide range of purposes. As this dissertation will demonstrate, CC games designed for stakeholder engagement contexts are a complex manifestation of various influences—urban planning communication models (such as

charrettes and shared vision planning), modeling and simulation, gamification and game design—and they respond to a rhetorical exigence rooted in technical communication—distilling the complexity of coastal resilience into a workable model while facilitating dialogic communication.

Project Summary

This dissertation addresses the following research questions:

- What is the origin of the climate change game genre?

- Why are key stakeholders in coastal resilience using climate change games?

- How do these games operate for these key stakeholders?

To answer these questions, this dissertation examines two games employed in stakeholder engagement workshops focusing on coastal resilience in Hampton Roads, Virginia: the *Multi-hazard Tournament* and the *Game of Floods*. I conducted semi-structured observational field notes during gameplay (Drachen, et al., 2018) and conducted survey research via interview and questionnaire after gameplay: I interviewed game designers and workshop organizers (n=6), and collaboratively produced a post-test questionnaire with members of the United States Army Corps of Engineers to collect feedback from players of the MHT. I also used a post-test questionnaire designed and conducted by FEMA as source material. I performed inductive thematic analysis of interview data in an initial round of coding and deductive or theory-driven thematic analysis (Boyatzis, 1998), according to notions of Star and Griesemer's (1989) boundary objects, and I report out the results of thematic analysis. I use storytelling as a methodology throughout the dissertation, according to Emily Legg and Patricia Sullivan's (2018) approach, as a means of telling the story of the CC game genre, its history and trajectory, the practitioners' stories of uses and design, and the story of my research as I slowly (and, I admit,

clumsily) explored the many facets of these unique cases. In what follows, I summarize my findings as a response to my research questions above.

What is the Origin of the Climate Change Game Genre?

While CC game formats vary from tabletop to computer games, this genre is defined primarily according to themes and objectives. To be considered a CC game, aspects of climate change must be a main element of the game's theme (Reckien & Eisenack, 2013). From there, a divide emerges. According to Reckien and Eisenack (2013), who claim to offer the first "comprehensive, structured collection and analysis of climate/CC gaming", (p. 255), "themes covered by the games show a split: most focus either on the global scale or on local ways to deal with climate change. Few games bring together both scales" (Eisenack & Reckien, 2013, p. 249). In communicating information about climate change, "most games convey basic declarative knowledge on climate-change issues, and focus, in particular, on reductions of GHG emissions" (Eisenack & Reckien, 2013, p. 249); however, a significant number of games "focus on policy processes, on impacts of and adaptation to climate change, and on energy related issues" (Eisenack & Reckien, 2013, p. 249). Generally speaking, CC games focus primarily on the subject of climate change, either from a global or local perspective (rarely a combination of the two), and they tend to focus on greenhouse gases, policy, impacts, and adaptation. Their purpose is largely to educate and raise awareness, inviting players to engage in problem-solving. The three primary objectives of CC games, as articulated by the Houston Advanced Research Center, are to "1) teach knowledge and provide familiarity with the issue of CC; 2) to make the players aware of the challenges associated with global warming, and 3.) to encourage players to develop solutions" (qtd. in Reckien & Eisenack, 2013, p. 266). CC games are, therefore, designed to educate, call attention to issues related to climate change, while motivating audiences to respond

by problem-solving (within the game and, hopefully, beyond).

When I defended my prospectus in 2016, I originally intended to explore the way CC games affected the speaker-audience dynamic in public outreach contexts. I planned to begin with the 52 CC games listed in Reckien and Eisenack's (2013) review of climate change games, and winnow it down to English-language computer games; however, many distracting and joyous life events followed, slowing down progress on my dissertation, and by 2018, I could only access seven of the computer games from this original list. The rest were either no longer available, or I was unable to track them down online. However, I could see that tabletop games from this list were still in use and began the process of locating local events that might feature examples of such games (a challenging process as these events are not widely publicized).

With a little luck and the help of local contacts, I had the opportunity to observe two tabletop CC games designed for two stakeholder engagement workshops hosted by separate agencies. On June 5th, 2018, *The Lower Virginia Peninsula Multi-Hazard Tournament* (MHT) was featured in a workshop hosted by the Silver Jackets of the U.S. Army Corps of Engineers in Hampton, Virginia, and the *Game of Floods* was featured in a workshop hosted by FEMA and the Hampton Roads Planning District Commission on June 14th, 2018, in Chesapeake, Virginia. These games are representative examples of CC games: they focus primarily on a theme related to climate change (coastal resilience) and local ways to deal with it; they engage players with actions related to policy, impacts, and adaptation. Their purpose is, *in part*, to train, to raise awareness, and encourage players to develop solutions. These games conform to the generic conventions of CC games in regard to theme, but they begin to diverge in regard to purpose: as articulated by Reckien and Eisenack (2013) and the Houston Advanced Research Center the list of three purposes of CC games (train, raise awareness, and develop solutions) falls short of

capturing the complexity of this genre as it operates in stakeholder engagement contexts. The MHT and the *Game of Floods*, as manifestations of a number of disciplinary influences, attempt to accomplish much more: they work toward inclusive, dialogic cooperation without pursuing consensus; they simulate mitigation and adaptation by presenting artificial conflict for the audience to address; and they adapt to varying audiences and contexts. In the sections below, I introduce the two games that serve as the subject of study for this dissertation, providing details about their origin and implementation in local workshops in 2018.

***The* Lower Virginia Peninsula Multi-Hazard Tournament**

According to a flyer describing a previous iteration of this event, "The *Multi-Hazard Tournament* (MHT) is a table-top or simulation exercise designed to aid decision-making by playing out potential strategies" ("Cedar Rapids," 2018) for enhancing resilience in a given region, specifically Hampton Roads in the 2018 version. It was advertised as having the goal of generating new ideas in a "fun, team-centered learning environment" while "reducing barriers to innovative and productive decision-making" ("Cedar Rapids," 2018). The MHT has gone through several adaptations, with iterative design processes employed to adapt them to each unique, local context. It dates back to 2011 in Canada and has been adapted to institutions, risks, and contexts across the globe. The first iteration of this event took place in Calgary in Alberta, Canada, in February of 2011 (Participant A, personal communication, June 7, 2018). It took the form of a Drought Tournament, focusing on drought-related systems thinking, for an audience that included the following institutions: Agriculture, Agri-Food Canada, Canadian Water Resources Association, Environment Canada, Provinces of Saskatchewan, Alberta, British Columbia, Universities of Alberta and Saskatchewan, and Intersol Consulting ("List of … Tournaments," n.d.). Since then, variations of the Tournament have been conducted in

Saskatoon, Saskatchewan, Denver, Colorado, Kelowna, British Columbia, Nepal, Geneva, Switzerland, Oklahoma, Floresville, Texas, St. Kitts, Washington, D.C., Rabat, Morocco, Cedar Rapids, Iowa, Grenada, Nebraska, San Antonio, Costa Rica, and Hampton, Virginia ("List of … Tournaments," n.d.).

MHT Gameplay

The MHT is a tabletop simulation that "asks participants to collaborate in teams of 5-6 players, competing against other teams to find the best ways to reduce the effects of" a given risk, such as flooding ("Cedar Rapids," 2018). As recorded in observational field notes, in the case of the June 2018 MHT in Hampton, VA, the risk that participants responded to was storm surge and sea level rise. Participants were arranged in teams, seated at round tables, which held printed inundation maps, playbooks and agendas, and a laptop with monitor for access to an electronic Decision Support Tool (DST). In round 1, participants were tasked with enhancing resilience in New Market Creek and Salter's Creek, which are regions located in Hampton Roads facing frequent flooding and repetitive loss, and participants could assess the regions by examining the printed inundation maps on their tables. In the scenario players were given in round 1, there were no disaster relief funds available as no disaster had occurred yet, so they had a tighter budget to work with as they determined adaptation strategies. In round 2, participants were tasked with responding to Hurricane Isabel in the same geographical regions, opening up disaster relief funding options. In both rounds, players had to develop a plan, with management measures, to respond to these risks while weighing the impact of these measures, considering how their actions could be "sustainably funded without increasing the risk to the community by overstretching their finances" (Participant A, personal communication, June 7, 2018).

During gameplay, teams were required to answer the following questions: "which management measures does your team want to invest in? How do you want to fund those investments? Are there other measures not listed in the [Decision Support Tool] you want to invest in? Can you make your investment within your given budget? Or does your team need to raise property taxes?" (Playbook). To answer the first question, teams could select from specific management measures, including structural measures (such as tide gates, breakwaters, drainage improvement, beach restoration, or a living shoreline) and non-structural measures (such as vents and elevating utilities, the acquisition of properties, with recreational and wetland options, and the elevation of properties) (Playbook). To answer the second question, funding options included the local government budget, USACE funds, FEMA funds, and the National Resources Conservation Service (NRCS) (Playbook). Players used the DST to navigate and weigh the cost and benefits of the strategies they came up with as a team.

There were two framing sections—an introduction before gameplay, wherein the group collectively determined the scoring system to be used for rating each team, and a wrap-up reflective session at the end of gameplay, wherein a winning team is declared—as well as two timed rounds of gameplay. Teams used the DST, proposal questions, and a Playbook to guide decisions, and they could ask questions of referees, individuals dressed in black-and-white striped referee t-shirts with red and yellow flags that were occasionally tossed in jest.

The Decision Support Tool (DST) was an Excel platform that incorporated damages for households in the affected areas, "and as participants select investment strategies, it would [calculate] those damages as 'benefits reduced,'" as it pertains to a local budget and other funding options (Participant B, personal communication, June 16, 2018). While participants used the tool to work through the scenario, "at some point, they may run out of budget and then that

starts to require maybe some taxes that are raised, (...) and that has a citizen response. They're either happy with that, generally not, or they're really very unhappy, so as a politician, or as an elected official, (...) that shapes how [they] move forward" (Participant B, personal communication, June 16, 2018). The DST, therefore, served as a complex budget calculator and political approval rating system, influencing the strategies each team developed.

Once a plan was determined, teams reflected on their strategies by answering a series of proposal questions listed in the playbook and submitted their proposal via email to a data collector (seated at a computer station in the back of the room). Teams then presented their proposal to the group, while their peers rated them based on "consideration of tradeoffs, feasibility, and resiliency" on a scale of 1-5: 1 being "not well at all" and 5 being "very well" ("Playbook," 2018). A technical score was generated from inputs to the DST and a peer score was generated by peers and referees to determine a leaderboard. Two categories were awarded at the end of the Tournament: a winner, and a most-improved-team, showing the biggest improvement in their score from round 1 to round 2.

The MHT: Hampton, Virginia Event Characteristics

At the 2018 event in Hampton, there were 24 players, dispersed across 5 teams with 4-6 players. Each table had 1 facilitator, 1 laptop and monitor (for access to the DST), printed playbooks, agenda, and printed inundation maps. There were five workshop facilitators dressed as referees who walked around the room, available to answer questions and guide players. There were six "fans," who were either observing the event (I counted as one of the "fans") or assisting the referees by answering questions or facilitating discussion within the groups. The room was arranged with five tables set up for the teams, a station for the presenter, a station for data collection (where a workshop facilitator received team DST reports via email and processed

scores), a table for food and beverages, and two easels with a poster board (one for requesting

feedback in the form of handwritten post-it notes and the other for recording team names) (See

Figure 1 below).
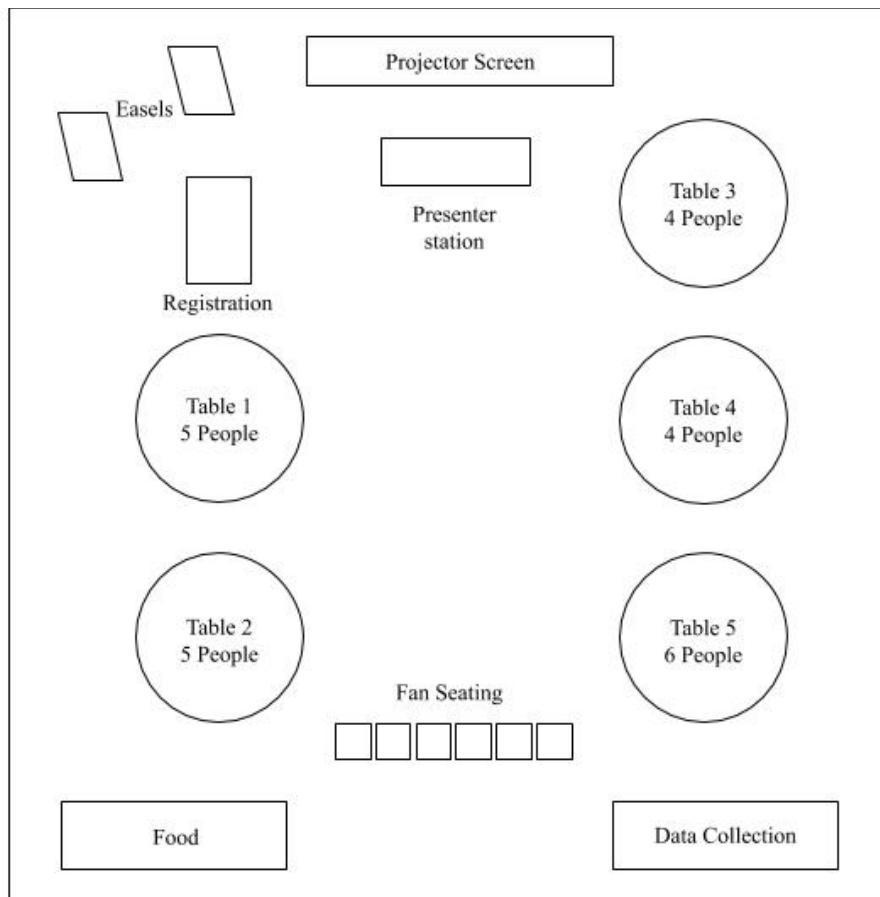
Figure 1: Room setup for the Hampton Multi-hazard Tournament *in 2018*

Participants were made up of a "mix of interested stakeholders in the community[, such

as researchers in the academy interested in this subject], state agencies, and federal agencies"

(Participant A, personal communication, June 7, 2018). As listed in Table 1 (p. 13), participants

represented the Hampton Roads Planning District Commission, the city of Hampton and

Newport News, the Institute of Marine Science, corps districts from the federal side, state

representation from the Virginia Department of Emergency Management (VDEM), and the

Virginia Department of Conservation and Recreation (VDCR), which serves "as the flood risk

managers for Virginia. VDCR is the national flood insurance program manager for Virginia, and

VDEM manages the response to events in Virginia, so having those two key stakeholders was

very important" (Participant B, personal communication, June 16, 2018).

Hampton Roads Planning District Commission
City of Hampton
City of Newport News
Institute of Marine Science
USACE
Virginia Department of Emergency Management
Virginia Department of Conservation and Recreation
Old Dominion University

Table 1: State and federal agencies and research institutions represented at the Hampton Multi-hazard Tournament *in 2018*

The general public was not represented (Participant A, personal communication, June 7, 2018):

"We were going to invite local officials and even have some people from the communities and

from other businesses, but it unfortunately didn't work out that way. We wanted that cross-

pollination across the groups because they have diverse needs and backgrounds" (Participant B,

personal communication, June 16, 2018). As a result, stakeholder backgrounds and perspectives

were ultimately less varied than the organizers had originally intended: "we did have a good

cross-section, but I think it may have been people who already understood essentially what

flooding is, so it would have been great to have that broader perspective" (Participant B, personal communication, June 16, 2018).

The Game of Floods

The *Game of Floods* was originally designed in 2014 for a workshop in Richardson Bay, on the bayside of Marin County, California (Participant E, personal communication, June 29, 2018). The goal of this initial workshop was to generate stakeholder discussion around adaptation, and the game featured "an actual map of Richardson Bay" (Participant E, personal communication, June 29, 2018), where around 100 participants, in groups of about 10 people, "identified where different adaptation strategies should be placed around the Bay, and those included things like seawalls and levees, restored wetlands, horizontal levees, zoning changes, building elevation, and several others" (Participant E, personal communication, June 29, 2018). Because workshop planners found this approach successful, they decided to develop this into a game with a more generic, fictional landscape (called Marin Island) for upcoming workshops in West Marin (County of Marin, 2015).

As is the case with the MHT, the *Game of Floods* has been adapted for a variety of audiences and contexts. Across its lifetime, the game has been featured in stakeholder workshops in West Marin, in classrooms throughout Marin County as part of a sea level rise program for approximately 300 youths, and the game has been introduced at professional conferences and various agencies, such as the Bay Conservation Development Commission and FEMA (Participant E, personal communication, June 29, 2018). The game has been played "in at least 50 different states, everywhere from Hawaii to Maine," and creators have received requests for copies of the game from people nationwide (Participant E, personal communication, June 29, 2018). A board game version was released in 2019 and is available for purchase. It was featured

in WIRED magazine (Bliss, 2017), and it has won an American Planning Association Award (ResilientCA, 2020; Participant E, personal communication, June 29, 2018).

In 2018, the Eastern Shore Land Conservancy in Maryland was awarded a grant for a project involving the *Game of Floods* in urban planning in the city of Baltimore ("CRF 2018 Grants," 2018). This adaptation was the version I observed, employed in the Hampton Roads 2018 Plan Implementation and Grants Development Workshop, hosted by FEMA and the Hampton Roads Planning District Commission, in Chesapeake, Virginia in June of 2018. The game covers topics related to beach and wetlands restoration, levees, seawalls, green infrastructure, policy or zoning changes (County of Marin, 2018). The *Game of Floods* is designed for small groups, of about 4-6 participants, who are tasked with coming up with a cohesive adaptation plan to protect a given hypothetical region (such as Marin Island) from the threat of sea level rise by 2050 (County of Marin, 2015).

The* Game of Floods*: Chesapeake, Virginia Event Characteristics

The purpose of the 2018 Chesapeake workshop was to "support hazard mitigation planning and (...) mitigation activities," (Participant D, personal communication, June 26, 2018) and explore "what it takes to write a successful project application that would be fundable through FEMA funds through the state and also look at climate resilient mitigation actions, which are now fundable through many of our programs" (Participant D, personal communication, June 26, 2018).

As listed in Table 2 (p. 16), the event was a train-the-trainer stakeholder workshop for community officials representing VDEM, DCR, Army Corps of Engineers, FEMA, local municipalities, ODU, the William and Mary College of Environmental Law, and the Hampton Roads PDC (Participant D, personal communication, June 26, 2018). Participants were made up

of floodplain managers, land use planners, NFIP coordinators, state hazard mitigation officers, communications specialists, environmental planners, and engineers: "so people who had at least a starting knowledge about mitigation and resilience" (Participant D, personal communication, June 26, 2018).

Hampton Roads Planning District Commission
Old Dominion University
William and Mary College of Environmental Law
FEMA
USACE
Virginia Department of Emergency Management
Virginia Department of Conservation and Recreation

Table 2: State and federal agencies and research institutions represented at the Chesapeake Game of Floods *event in 2018*

As pictured in Figure 2 (p. 17), there were 29 players of the game, with 7-8 players seated at four tables, and approximately 40 people in the room (Participant D, personal communication, June 26, 2018). As recorded in my field notes, the workshop facilitator, a representative of FEMA who had played this game in a previous train-the-trainer event, presented a brief slide presentation from a podium at the front of the room before the game began, and circulated through the room during gameplay to answer questions, distribute budgets, and offer advice or reminders.
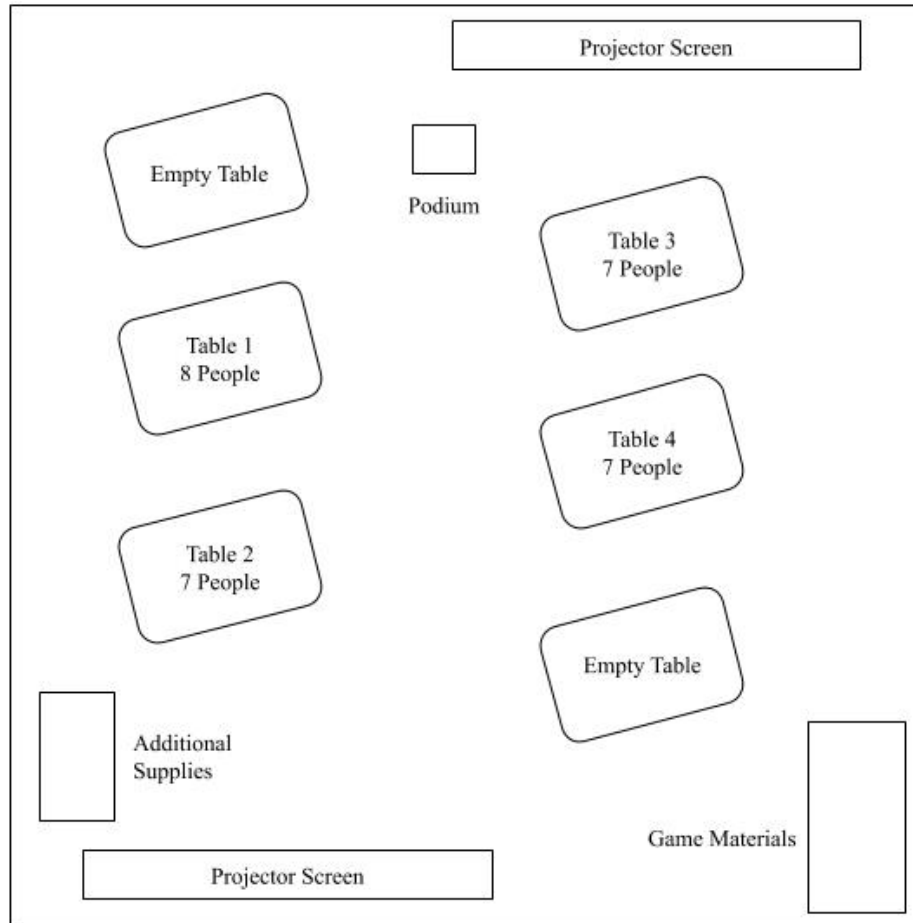
Figure 2: Room setup for the Chesapeake Game of Floods *event in 2018*

Game of Floods *Gameplay*

In the 2018 Chesapeake version, the fictional landscape for the game was called

"Resilience Harbor" instead of "Marin Island." Unlike the MHT, which featured an Excel-based

DST, the *Game of Floods* had no digital component, using tabletop elements such as a printed

game board and workbook. The June 2018 game began with a facilitator reading a scenario

aloud, describing sea level rise scenarios:

Resilience Harbor is a low-lying coastal town originally settled by longline fishermen in

the 1980s. It was heavily farmed in the 1930s and transitioned to a resort community

during the economic boom of the 1980s. The town's economy is now based on a mix of technology-related industry, tourism, and fishing. Historically the town's waterfront has been damaged by large coastal storms and hurricanes. The Abundance River, originating from the headwaters of the Resilience Mountains, also poses a flood hazard and during large precipitation events, it has been known to overwhelm its river bank and flood nearby areas (Facilitator Guide to the Game of Floods, 2016).

As a scenario-driven role-playing tabletop game, players took on the roles of affected stakeholders, tasked with developing a cohesive and potentially feasible plan for flood-related resilience. This work was divided across discrete rounds of play. In round 1, group members selected a role card (such as Director of Public Works, Community Advocate, or Transportation Planner, among others) and introduced themselves. In round 2, they conducted an asset inventory, examining the value of the landscape assets (such as the power plant, transportation hub, stormwater filtration plant, etc.) while considering the impact each asset had on the community. In round 3, they assigned a vulnerability score to prioritize assets, and in round 4, they created a hazard mitigation plan, using adaptation measures such as relocating and raising assets, constructing flood walls, or investing in shoreline protection like mangrove restoration, living levees, and tidal barriers. Players recorded their adaptation strategies on a sheet of paper where they calculated its cost, based on the price tags listed on the sheet. The goal was to develop a plan for the landscape together as a group, but conflicting strategies and debates over the prioritization of assets developed throughout the rounds. One player perceived that debate was encouraged by the game's design, particularly through the roles: "Oh so we're probably supposed to fuss at each other over what we regard as our top assets." One player who chose the mayor role card joked, "I just get to ignore everyone." The facilitator welcomed debate as a part

of the process, saying to one group, "I don't hear arguing; arguing is good." The sharing of multiple perspectives appeared to be welcomed and encouraged by the game's design and the facilitator, as well.

As recorded in my field notes, during the first hour, each group worked without knowing their community's budget. The purpose behind withholding budgetary information was to discuss, more broadly, their sense of asset prioritization and adaptation strategies. Then after an hour passed, budgets were handed out by the facilitator, enabling groups to more specifically identify adaptation strategies, calculate costs, and lay out a plan. At the end of gameplay, groups reported out their plan and rationale. The game took two hours to complete and served as the opening exercise on the first morning of this 2-day Plan Implementation and Grants Development Workshop.

What are These Games, and Why are They Used?

Once I understood what these games were (CC games according to their content and theme) and where they came from (the product of several iterations across professional and educational contexts), I was interested in exploring why these practitioners were using these games. It was clear that they aligned with the generic conventions of the CC game genre in regard to their topic (local adaptation to coastal resilience), but from what I observed of their use, they didn't appear to align with the CC game genre in regard to purpose, at least not entirely. The three purposes of CC games (to educate, to raise awareness, and to develop solutions) (Reckien & Eisenack, p. 266) only applied in part. These games are certainly designed to encourage participants to develop solutions; however, the audience (as professionals involved in resilience in some way) didn't need much training and were already aware of the issue to varying degrees, so why were these practitioners using these games?

Why are Key Stakeholders in Coastal Resilience Using Climate Change Games?

Risk communication genres and media vary widely, from government reports to nature writing, televised documentaries (Herndl & Brown, 1996), and CC games (Froehlich, 2014). The purpose of the CC game genre is generally to respond to perceived knowledge and attitudinal deficits within a given audience (usually a student audience), and these challenges are the focus of much literature related to the interdisciplinary subject of environmental risk communication. While the terminology varies across scholarship and across disciplines, risk communication generally faces two types of communication challenges: an informational challenge and a motivational challenge (Froehlich, 2014). Put simply, risk communication practitioners wish to educate an audience about a risk and motivate them to change their attitudes or behaviors to avoid that risk (Froehlich, 2014); however, researchers suggest that information alone fails to motivate pro-environmental or resilient behaviors (Bord, et al., 2000; Kellstedt, et al., 2008), and this urge to inform inherently creates a well-researched and problematic gap between experts (those authorities who educate) and non-experts (those who need educating) resulting in a power imbalance that negatively affects open communication across stakeholders (Simmons, 2007).

When scholars from technical communication and rhetoric entered the field of risk communication, they brought with them a set of rhetorical theories, models of communication, and an understanding of risk as a social construct (Grabill & Simmons, 1998; Simmons, 2007; Staggers, 2006). These theories and models challenged traditional approaches to communication that divided the expert from the non-expert, reaching for dialogic, inclusive communication models that put all stakeholders on equal footing in these conversations (Simmons, 2007; Staggers, 2006). And this interest in dialogic, inclusive communication spans disciplines, as urban planning communities have long pursued public participation and have been

experimenting with participatory workshop models (Palmer, et al., 2013), as well as alternative modeling and simulation tools (Gordon & Shirra, 2011), including games and gamification (Poplin, 2012). The problem is that, especially within the intersection of rhetoric and technical communication, much of the literature tends to focus on models of communication related to public outreach, involving an expert/non-expert dynamic.

Public outreach isn't unrelated to the games I observed. Interviewees indicated that a secondary goal for these workshops was to introduce a new communication tool that audience members could take with them and adapt for their own public outreach efforts, and as stated earlier, the *Game of Floods* has been featured at past events geared toward public outreach; however, the events I observed were not public outreach events themselves. They were considered "shared vision planning" or "train-the-trainer events," inviting "key stakeholders" to engage in a conversation about mitigation and adaptation. As a result, the audience was made up of professions that were at least loosely associated with coastal resilience in Hampton Roads, VA. Tables were populated with city planners, land use planners, emergency managers, researchers, floodplain managers, state hazard mitigation officers, environmental planners, engineers, and National Flood Insurance Program (NFIP) coordinators. The purpose of these events is, therefore, less about raising awareness and inspiring resilient behaviors and more about experts further developing their expertise. As with public outreach, these training events still had educational goals: each workshop was designed to underscore certain learning outcomes related to resilience, such as thinking more creatively about sources of funding. However, interviews indicated that the greater purpose of these events was not to train but to create a shared discursive space where these stakeholders could achieve a holistic view and work the problem collaboratively.

Game designers and workshop organizers felt that games provided the best medium to achieve these purposes. They felt that, unlike traditional media (such as slide presentations), these games offered a more comprehensive look at this multifaceted issue, generating an opportunity to break down departmental boundaries with low-stakes exercises that would engage players in active dialogue. Interviewees indicate they align with Reckien and Eisenack's (2013) view that CC games can "simulate complex actor relations" (p. 246). These practitioners have designed systems that invite players to probe relationships across jurisdictions within an accelerated timeframe, offering a comprehensive, condensed, and accessible perspective of a complex system. Interestingly, within the documents surrounding these events (such as the Participant Workbook), as well as the interviews I conducted with designers and facilitators, the term "participant" is used to describe those who attended and engaged in gameplay, as opposed to terms like "player" or "audience." This dissertation likewise tends to use the term "participant." Using the term "participant" constructs a particular kind of audience, one who actively takes part, and this move underscores the central mechanic (or means of interacting) in the games: participating (through conversation).

Overall, the purpose of the MHT and the *Game of Floods* is more complicated than the informational and attitudinal frameworks suggested in most risk communication literature. The MHT and the *Game of Floods* were designed for the following purposes: 1) encourage a holistic awareness of the scope and complexity of adaptation, 2) foster a shared discursive space for networking and the exchange of ideas, 3) motivate key stakeholders to adjust their approach toward resilience in their communities (by considering alternative sources of funding, for example), while 4) introducing them to a novel tool (these games) that could be employed in their own risk communication efforts. The workshop facilitators who employ these games do so

to break up the monotony of traditional approaches to stakeholder workshops, which tend to feature slide presentations, by playing a game that encourages people to think about the multi-faceted issue of coastal resilience comprehensively. They also hope that workshop participants will take this game back to their own communities and employ them for in-house professional development or public outreach efforts. These purposes are rooted in environmental risk communication as they revolve around information and motivation and reach toward inclusive, dialogic participation; however, the expert/non-expert models of communication and the literature on public outreach couldn't fully account for what I observed. The notion of boundary objects, on the other hand, could.

Boundary objects emerged from the social study of science and was adopted by rhetoric scholars Greg Wilson and Carl Herndl (2007) to describe "rhetorical activity [occurring] at the boundaries between diverse communities of practice working on complex sociotechnical systems" (p. 129) at the Los Alamos National Laboratory. While situating boundary objects in technical communication, Wilson and Herndl (2007), refer to expert/non-expert communication models, underscoring a relationship between the work of boundary objects and efforts at creating dialogic communication. Wilson and Herndl (2007) demonstrate, therefore, that boundary objects can be useful metaphors for understanding and working toward inclusive models of communication. As it pertains to CC games, boundary objects are a useful metaphor for understanding rhetorical purposes such as fostering a shared discursive space and a holistic view of a multifaceted issue.

How Do These Games Operate for These Key Stakeholders?

While game designers may not have had the notion of boundary objects in mind when creating and employing these games, the MHT and the *Game of Floods* certainly operate as

boundary objects within the resilience community. The notion of boundary objects was developed to account for interdisciplinary collaboration:

> Most scientific work is conducted by extremely diverse groups of actors—researchers from different disciplines, amateurs and professionals, humans and animals, functionaries and visionaries. Simply put, scientific work is heterogeneous. At the same time, science requires cooperation—to create common understandings, to ensure reliability across domains and to gather information which retains its integrity across time, space and local contingencies (Star & Griesemer, 1989, p. 387).

The MHT and the *Game of Floods* attracted participants from various professional backgrounds, engaging a heterogeneous audience in dialogue and leveraging their unique views to co-construct a comprehensive understanding of coastal resilience. As teams, they cooperatively worked toward solutions that would address this multifaceted issue. These games invite participants to engage in scientific and professional collaboration in a condensed time frame with the hope that their experience will translate across domains.

A prominent feature of boundary objects is their "interpretive flexibility" (Star, 2010, p. 602). Boundary objects have "different meanings in different social worlds, but their structure is common enough to more than one world to make them recognizable, a means of translation" (Star & Griesemer, 1989, p. 393). One way this manifests in the MHT and the *Game of Floods* is the way each game invites teams to develop mitigation plans as a response to a flood scenario. This goal provides enough structure for a given group to cooperate, but each team achieves this goal in unique ways. Together, they develop a common understanding of resilience, but no two proposals match at the end of the game, suggesting a level of interpretive flexibility as teams and individuals influence the outcome of the games according to their background and expertise.

Boundary objects are also flexible in that they are "both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star & Griesemer, 1989, p. 393); the MHT and the *Game of Floods* have been adapted for education, geared toward student audiences, as well as training for key stakeholders. While they've always focused on resilience, their topic has ranged from droughts to flooding. These games have been played in every state in America and in countries abroad. Their adaptability and scalability demonstrate their interpretive flexibility as boundary objects.

Another feature they share with boundary objects is the value found in their design process. The work of producing and playing games like the MHT and the *Game of Floods* is, in and of itself, important for building connections across jurisdictions in the resilience community. According to Star and Griesemer (1989), "the creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting social worlds" (p. 393). The act of creating and using a boundary object broadens perspectives and fosters a greater understanding of a larger system. For example, Bridgit Van Belleghem[*], who was one of the designers of the *Game of Floods* while she served as a land use planner for Marin County, CA explains the research that went into producing the game:

> I went on all these tours of the different flood districts with public works staff, so I think we did one district a month, and they had a lot of new staff themselves, so they were taking everybody around and also having all the zone engineers see things happening in the other zones that they weren't necessarily in charge of, and I got to tag along and learn with them, and we had to call the different firms that we knew about to get information

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[*] During our interview, Bridgit Van Belleghem requested that her name be used in the dissertation.

on the cost impacts of the engineering tools, so that was definitely the biggest learning

benefit for me, personally, and then like I said, you learn a lot about the cultures of

engineering versus planning and maybe the different conflicts that could arise, (...) so

there's this multiple aspect of learning actual engineering material and then sort of the

bureaucratic culture of the different departments that are working together but are not

necessarily approaching things the same way all the time (B. Van Belleghem, personal

communication, July 6, 2018).

This interviewee expresses how much this game designer learned by talking to different

stakeholders about their work and synthesizing it all into the form of a game. It required months

of field work, visiting different districts and interviewing stakeholders as a means of broadening

her perspective. Her research is then infused into the game to help broaden the experience of

players. The creation and management of this boundary object helped achieve a level of

coherence across these social worlds.

The notion of boundary objects can also be a useful metaphor for understanding the

complex nature of the CC game genre. The MHT and the *Game of Floods* were influenced by

multiple fields: game studies, modeling and simulation, and urban planning. Game designers

layered elements of games and gamification onto common approaches to urban planning, such as

charrettes and shared vision planning, to create a playful simulation that responds to the

challenges of risk communication. They adapted these games to varying audiences and contexts

and scaled them to achieve different foci and purposes. These games, with their myriad

influences, these varying audiences and contexts, these multifaceted purposes, don't just operate

as boundary objects, fostering dialogue and broadening perspectives in their community. They

are, themselves, boundary objects.

Chapter Descriptions

Chapter II. The Origin and Nature of the Climate Change Game Genre: A Review of

Literature

This chapter tells an origin story, tracing the roots of the *Game of Floods* and the MHT across four disciplines: technical communication, game studies, modeling and simulation, and urban planning. After pointing to the disciplines that rest on the boundaries of these games, chapter 2 picks up where chapter 1 leaves off, providing a more thorough case for CC games as boundary objects, along with a more detailed definition of boundary objects and their relationship to rhetoric. The MHT and the *Game of Floods* are, themselves, boundary objects in that they merge various traditions. While responding to an exigence rooted in environmental risk communication, they are influenced by urban planning, more specifically the charrette tradition and shared vision planning, and they're influenced by notions of play, by serious games/gamification, as well as modeling and simulation. All of these traditions have come to bear on these two games. They are boundary objects in and of themselves and are used as such by workshop organizers.

Chapter III. Multidisciplinary Methods and Methodology for Grappling with the Complexity

of Climate Change Games

Chapter 3 explains my methods and methodology for responding to my research questions. I lead with the literature on storytelling as a methodology, underscoring its relevance for this unique project. This dissertation tells three concentric stories, positioning CC games at the center: 1) an origin story for the CC game genre and the specific artifacts I examine (the MHT and the *Game of Floods*); 2) a story about the local resilience community's uses for these two games; and 3) the story of my process for writing this dissertation: the roadblocks and false

starts as I navigated this challenging project. I share my research process throughout the dissertation, but it is mainly expressed in chapter 3 as I discuss my approach to answering my research questions. All three stories are necessary to account for the complexity of CC games and the way they manifested in Hampton Roads in 2018.

An explanation of my methods follows. To gather data for this project, I took semi-structured observational field notes, and conducted survey research in the form of interviews and questionnaires. To analyze the data, I engaged in thematic analysis of interview transcripts. I include a discussion of the limitations of these methods and my attempt to diminish the impact of those limitations.

My methods and methodology represent a multidisciplinary approach to a multidisciplinary subject of study. Storytelling methodologies have been featured in science and technology studies (STS), organizational studies, design, feminist studies, as well as technical communication (Legg & Sullivan, 2018). Survey research and observational field notes hearken from the social sciences, educational research, usability studies, and games user research. This multidisciplinary approach positions me as a listener and observer, a visitor in unfamiliar disciplinary territory. It also became fodder for a multidisciplinary analytical framework, a heuristic that infuses data from these interviews and observations while pointing to theories from rhetoric, technical communication, and game studies.

Chapter IV. A Heuristic for Assessing the Rhetorical Boundary Work of Climate Change Games

This chapter seeks to answer why key stakeholders in coastal resilience are using CC games and how these games operate for them. To answer these questions, I interviewed the designers behind the MHT and the *Game of Floods*, the workshop organizers who employed

these games, and one participant who played each game at their respective events for a total of six interviews. This chapter reports the results of thematic analysis of interview data, drawing connections to scholarship in game studies, technical communication, and boundary objects as a means of demonstrating the ways these practitioners align and diverge from current trends in these fields. This chapter concludes by combining scholarship reviewed in chapter 2 with my results of thematic analysis of interview data in chapter 4 to produce a heuristic. In chapter 5, this heuristic is used as an analytical framework to better understand these games according to the literature and their embedded uses in the resilience community. In chapter 6, this heuristic is presented as a tool for assessing and developing future stakeholder engagement games.

As I coded the data, two notable themes emerged in the interviews with these participants: 1) games reflect common goals of the fields of technical communication and game design, and 2) these games operate as boundary objects. The term "boundary object" never comes up during interviews, nor are there any direct references to concepts in technical communication and game design; therefore, these practitioners may not be making these connections intentionally. As I viewed the transcripts from my point of view in English studies, however, common notions of technical communication and game design came to the fore, particularly when they talked about the way the games 1) distilled complex notions of coastal resilience (discussed 14 times across 6 interviews), and 2) provided an alternative communication method that was more engaging than traditional genres of technical communication (discussed 34 times across 6 interviews). The way they described the games also aligned with features of boundary objects: the games' integrative exigence (discussed 37 times across 6 interviews), their interpretive flexibility (discussed 47 times across 6 interviews), and the active nature of the games (discussed 17 times across 6 interviews).

Even though the connection to technical communication, game studies, and boundary objects is perhaps unintentional, this connection is important (made more so *because* it may be unintentional). Shedding light on these unintentional connections presents practitioners with additional traditions that may further inform their ongoing use of CC games. Interviewees indicated that these designers actively draw on traditions in urban planning, such as the charrette and SVP, but technical communication, game studies, and boundary objects are relevant bodies of scholarship that can support them as they continue this important work. By shedding light on these unintentional connections, I also underscore CC games as a subject of study for technical communication and game studies scholars, inviting researchers to attend to this unique genre of games. As unique examples of environmental risk communication, such games have implications for branches of research like health and safety communication, as well.

Chapter V. Applying the Rhetorical Boundary Work Heuristic to the Multi-hazard Tournament *and the* Game of Floods

Thematic analysis of interview data, combined with my observation of gameplay, as well as theories of game design and boundary objects, suggest that CC games designed for stakeholder engagement should work toward the following goal: foster boundary work for a varied audience within an intense design period using charrette and game design strategies. In constructing the heuristic, I filter this goal through the rhetorical concepts of purpose, audience, context, and strategies as a means of better assisting further design and rhetorical analysis. Chapter 5 employs the rhetorical boundary work heuristic I introduce in chapter 4 as an analytical framework for assessing the MHT and the *Game of Floods*. To explore the way these games operate according to this heuristic, I provide, as evidence, responses to post-test questionnaires along with my observational field notes and interview data.

My analysis demonstrates that these games are successful according to all elements of the heuristic, but more could be done to enhance their efficacy. Both the *Game of Floods* and the MHT succeed in capturing the complexity of the network of stakeholders involved, while fostering an inclusive atmosphere for dialogue and collaboration. Both games leverage the charrette tradition to frame the issue of coastal resilience, using game design strategies to promote playful engagement; however, each game could enhance clarity and feedback according to principles of game design, and the MHT may benefit from transitioning to fully physical design tools to align more closely with common approaches to charrettes. Overall, each game succeeds in achieving their purpose in regard to boundary work, but they could be adjusted to better achieve heuristic recommendations in regard to audience, context, and strategies.

Chapter VI. Key Takeaways for Practitioners Who Use Climate Change Games

At the end of my interviews with practitioners, I asked what they needed to make events like those featuring the MHT and the *Game of Floods* more successful. They articulated the following needs:

- A Statement of Purpose
  - Objectives need to be articulated clearly to make a case for their use and (once approved and planned) attract audiences.

- A Review of Literature
  - Sources are also needed to make a case for their use, while influencing further design and development.

- A List of Existing Games
  - A collection of games would help practitioners efficiently select appropriate tools for their needs, while influencing further design and development.

- A Tool for Designing and Assessing CC Games

  o A heuristic can drive design and assessment in ways that enhance the boundary work these games aim to achieve.

This chapter responds to this list by offering key takeaways: artifacts that practitioners can take away for their own purposes. I present a statement of purpose, a condensed review of literature, a list of existing CC games, and my rhetorical boundary work heuristic. Practitioners may be interested in mining these takeaways for proposals or marketing materials; they might be interested in reviewing other CC games that are available, or they might wish to use this heuristic for future design and development.

I close this chapter by discussing the challenge this project presented to me, and my attempt to come to terms with the complexity of the CC game genre. I argue that boundary objects are a useful metaphor for understanding these unique multidisciplinary artifacts and the work they do in such diverse communities of stakeholders, and I underscore the importance of experimenting with models and media of communication, of designing good games that effectively invite audiences to engage in dialogue while working toward solutions that will better our communities.

Conclusion

I have imagined two audiences for this dissertation: 1) scholars of technical communication and game studies, particularly those interested in games and related media that focus on scientific and professional topics, and 2) practitioners involved in stakeholder engagement as it pertains to resilience, particularly those interested in leveraging CC games (chief among them, the impressive group of people I had the privilege of interviewing in 2018).

For practitioners of risk communication interested in leveraging games, this dissertation offers a review of literature that may serve them as they experiment with novel media and inclusive models of communication. It may also serve them as they defend such experimentation within their community. I include a catalog of games that operate akin to what I observed in 2018 to further record this unique genre of games and encourage practitioners to continue their experimentation. I hope my analysis of these games brings into focus the nature of their goals and their trajectory, and that the recommendations I offer in the rhetorical boundary work heuristic assists in the design and assessment of future CC games. While I offer a case study of only two games, I believe these games are applicable to a small but expanding movement across multiple disciplines (including technical communication, game studies, urban planning, as well as modeling and simulation), and this work can scale to any number of contexts, from health to environmental communication. I was humbled by the practitioners I interviewed and admire them for their interest in engaging in this difficult work: designing, implementing, testing, and redesigning games for the purpose of moving beyond PowerPoint toward the collaborative sharing of varied perspectives and greater understanding of this multifaceted issue. I thank them for giving me their time and their thoughts, and I hope this dissertation gives something of value in return.

These practitioners are developing an emerging practice with an emerging genre, and such innovation makes it challenging to understand. This dissertation is an attempt to come to terms with this complexity. Tracing the origins of the genre sheds light on the mire while helping to sort through it, adding scholarly traditions for practitioners developing and defending these games, while inviting scholars across disciplines to attend to CC games as a unique subject of inquiry. Although most theories and frameworks from relevant disciplines fall short of capturing

the work these CC games are doing in stakeholder engagement contexts, the notion of boundary objects does not. Boundary objects respond to the trajectory in the literature (as boundary objects help facilitate communication models that foster inclusive dialogue). They help capture the complexity of CC games as an amalgam of multiple disciplinary influences, and they help explain their varied uses in stakeholder engagement contexts. Viewing CC games through the lens of boundary objects gives us, as researchers interested in games and environmental risk communication, a structure for understanding how these people have developed new practices designing complex systems.

CHAPTER II

THE ORIGIN AND NATURE OF THE CLIMATE CHANGE GAME GENRE: A

REVIEW OF LITERATURE

The *Game of Floods* and the MHT are boundary objects, as they exist at the center of a number of related traditions: technical communication, urban planning, modeling and simulation, and game studies. As games designed to communicate complex messages about environmental risk and management processes, they rest on the boundary of technical communication, more specifically environmental risk communication (fields that are, themselves, intertwined with a broad array of disciplines, such as rhetoric, communication, education, psychology, sociology, political science, and environmental science). Game designers infused elements of the charrette tradition, as well as shared vision planning, thereby connecting these games to the larger field of architecture and urban planning. By representing an imaginary event and inviting participants to engage in decision-making processes (while using a Decision Support Tool in the case of the MHT) the games also draw from the field of modeling and simulation (M&S). During interviews, designers indicated they were also influenced by games when developing game mechanics and dynamics, bringing in notions of play, serious games and gamification, as well as common approaches to game design. As a result, these games rest on the boundary of game studies, as well (which is, itself, a multidisciplinary field intertwined with anthropology, history, sociology, film studies, and more). These traditions, and their myriad disciplinary connections, are simultaneously unique and cosubstantial (Burke, 1969/2001): they each have a history of their own, along with their own artifacts of study, yet there are times when they address similar rhetorical exigencies and employ common approaches to achieve their goals. With such

interdisciplinary complexity behind the MHT and the *Game of Floods*, it's challenging to trace the origins and influences of these games. In attempting to map out the boundaries surrounding these games, this chapter highlights conversations in these fields that are most relevant to climate change (CC) games, while later chapters show how these fields manifest in these remarkably idiosyncratic artifacts.

An (Incomplete) Interdisciplinary Origin Story

Across the literature in technical communication and urban planning, there's an emphasis on working toward dialogic models of communication, and the notion of rhetorical boundary objects can help scholars and practitioners continue on this trajectory. This chapter begins with a discussion of the literature on boundary objects, particularly in connection to technical communication and rhetoric, as a means of expressing how these games are, themselves, boundary objects: artifacts infused with elements from a wide range of disciplines. This review of literature then traces the roots of CC games across technical communication, urban planning, modeling and simulation, and game studies, and it does so according to a problem-solution structure that emerges in the literature. The field of technical communication and risk communication presents the problem: the divide between the speaker and the audience and the dual concerns of education and engagement. To respond to this problem, researchers and practitioners turned to CC games for a solution. Scholars have framed CC games as serious games, as well as educational games, thereby connecting this genre to broader conversations about serious games and the long history of scholarship on the educative power of games; however, fewer connections have been made between CC games and the role of play in urban design fields, CC games and the charrette tradition, as well as CC games and military and business games, all of which manifest in the MHT and the *Game of Floods* in important ways.

To clarify the structure of this literature, I list headings and sub-headings below:

- Climate Change Games as Rhetorical Boundary Objects

    o The Boundary Object as Rhetorical Construct

- The Communication Problems that Spurred the Use of Climate Change Games

    o Environmental Risk Communication and the Problem with the Gap

    o Rhetorical Models of the Gap

    o A Tradition of Exploring Problematic Models of Technical Communication

    o The Problem with the Deficit Model

- Solving Communication Problems with Climate Change Games

    o The CC Game as a Unique Genre and Medium of Environmental Risk Communication

    o Enthusiasm about the Educative Power of Climate Change Games

    o Connections to the Long-Standing Tradition of Games and Learning

    o Enthusiasm about the Participatory Nature of Games

    o Connections to Broader Conversations about Participation in Games

    o Gamification as a Means of Influencing Behaviors and Opinions

    o Green Gamification as a Means of Influencing Proenvironmental Behaviors and Opinions

    o Connections to the Field of Urban Planning

        - Playful Public Participation as a Manifestation of Gamification in Urban Planning

        - Charrettes as a Manifestation of Playful Design and Planning

- Shared Vision Planning as a Manifestation of Playful Design and Planning

- Situating Charrettes and Shared Vision Planning in Conversations about Play and Games

  o Connections to the field of Modeling and Simulation

  - Climate Change Games as a Manifestation of Modeling and Simulation

- Conclusion

This chapter argues that games are boundary objects in that a number of fields are manifested in them, then explores those fields according to a problem-solution structure: the problem is rooted in technical communication, and the solution (CC games) is a manifestation of game studies, urban planning, and modeling and simulation. I organize the literature according to this problem-solution structure as a means of creating a narrative, one that will help make sense of this multidisciplinary subject. Organizing it this way is also a constraint, however: I'm only selecting scholarship that fits this narrative while speaking to origins and influences, and there's far more in the literature across these fields.

I close this introduction with a disclaimer: this literature review is inherently incomplete, and as an outsider to many of these fields, I have surely overlooked major conversations while failing to capture their nuances. Interdisciplinary work is challenging, but I offer an attempt and invite further research at this rich intersection of fields. This topic brings a disciplinary complexity that is worthy of multiple looks from multiple perspectives.

Climate Change Games as Rhetorical Boundary Objects

The MHT and the *Game of Floods* are, themselves, boundary objects because they rest between multiple disciplinary boundaries, but they also operate as boundary objects within multidisciplinary and multijurisdictional communities. The notion of boundary objects was developed to describe collaborative projects, where contributors must negotiate experiences and agendas from different disciplinary backgrounds, and these games invite players to engage in such collaborative negotiations (Star & Griesemer, 1989; Wilson & Herndl, 2007). According to Greg Wilson and Carl Herndl (2007), "the concept of the boundary object was proposed by Star and Griesemer (1989) to explain the activity in just these sorts of interactions in which people from many different communities participate on a common project" (p. 134). Star (2010) explains that she and Griesemer were interested in unseating the belief that interdisciplinary scientific collaboration must start from consensus:

> My initial framing of the concept was motivated by a desire to analyze the nature of cooperative work in the absence of consensus. Many models, in the late 1980s and continuing today, of cooperation often began conceptually, with the idea that first consensus must be reached, and the cooperation could begin. From my own field work among scientists and others cooperating across disciplinary borders, and two historical analyses of heterogeneous groups who did cooperate and did not agree at the local level, it seemed to me that the consensus model was untrue. Consensus was rarely reached, and fragile when it was, but cooperation continued, often unproblematically. How might this be explained? (604).

For Star and Griesemer (1989), boundary objects helped to explain how cooperation could occur among professionals with different disciplinary ways of seeing and doing. In particular, how

these groups achieve this work without necessarily arriving at consensus. They define boundary objects accordingly:

> [A boundary object] is an analytic concept of those scientific objects which both inhabit several intersecting worlds (…) and satisfy the informational requirements of each of them. Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual-site use. These objects may be abstract or concrete (Star & Griesemer, 1989, p. 393).

Star (2010) explains that they considered the term "marginal" instead of "boundary" as their intention was to highlight a shared space rather than a dividing line, and "object" refers to something that actors can "act toward and with" (p. 603), focusing on action rather than "stuff or 'thing'-ness" (p. 603).

Star and Griesemer's (1989) definition is broad. Wilson and Herndl (2007) point out that "as critics within science studies have argued, almost anything can be seen as a boundary object. (...) It seems to be a metaphor that can be instantiated in almost unlimited range of objects" (p. 135). Star (2010) felt compelled to write a defense and offer further explanation nearly twenty years after its introduction in her piece titled "This is Not a Boundary Object: Reflection on the Origin of a Concept." In it, she addresses questions she's received about the concept since its debut in 1989, underscoring the characteristics of boundary objects while pointing out examples that don't fit (thus noting what is *not* a boundary object). Instead of getting entangled in the slippery nature of the concept, she encourages researchers to be pragmatic (Star, 2010). Narrow the possibilities by scale (boundary objects shouldn't be too broad, like a word) and scope (the

more specific the object, the better) (Star, 2010). For example, in regard to whether the American flag is a boundary object, she writes, "I believe that the most useful level of scope for the concept is more specific. I think it would be more interesting to study people making, advertising, and distributing American flags, and their work arrangements and heterogeneity than to simply say that many people have different interpretations of the American flag" (Star, 2010, p. 613). Focusing on specific work arrangements (such as gameplay) offers more practical value than broader objects that generally feature interpretive flexibility (such as a flag). The notion of boundary objects is difficult to work with in practice. Nevertheless, Wilson and Herndl (2007) believe it can be "a useful metaphor for understanding rhetorical activities in complex sociotechnical systems," (p. 135). Boundary objects demonstrate that there are artifacts that create opportunities for more integrative communication models. They demonstrate that we can design artifacts that transcend boundaries—that we should design things that transcend boundaries—and the literature we have on their characteristics indicates how.

The Boundary Object as Rhetorical Construct

Wilson and Herndl (2007) make the argument that the boundary object operates as a rhetorical construct (p. 132). To do so, they point out two "rhetorically important" aspects of Star and Griesemer's (1989) notion of the boundary object: the first is "the metaphor of ecological systems" (Wilson and Herndl, 2007, p. 136). While Star and Griesemer (1989) admit that boundary objects are "still biased toward the management of activity by some central figure," (Wilson & Herndl, 2007, p. 136), they work toward a more dialogic exchange rather than a deficit model of communication. Wilson and Herndl (2007) argue that this emphasis on the relationship between parties during an exchange correlates with arguments about models of technical communication in the field of rhetoric.

The second rhetorically significant aspect that Wilson and Herndl (2007) identify in Star and Griesemer's (1989) work is that a boundary object maintains a "common identity across different sites" (qtd. in Wilson & Herndl, 2007, p. 138). They argue that this "corresponds to the dialectical relation between division and identification in Kenneth Burke's (1969) understanding of rhetoric," (Wilson & Herndl, 2007, p. 138). To Wilson and Herndl (2007), a boundary object "recognizes difference and division, but it also provides identification across the sites of action" (p. 138). Notions of division and identification highlight the forces at work between individuals with different backgrounds, views, and agendas (as is often found in stakeholder workshops or public outreach events). Burke (1969/2001) describes identification in the following way:

> A is not identical with his colleague, B. But insofar as their interests are joined, A is identified with B. (...) In being identified with B, A is 'substantially one' with a person other than himself. Yet at the same time he remains unique, an individual locus of motives. Thus he is both joined and separate, at once a distinct substance and cosubstantial with another (p. 1325).

Being simultaneously distinct and cosubstantial is a fundamental characteristic of boundary objects, as boundaries represent both a dividing line and a shared space. Boundary objects invite their users to engage in this duality, balancing individual motives with shared interests.

In *A Rhetoric of Motives*, "Burke defines rhetoric as the use of language to form attitudes and influence action" (Bizzell & Herzberg, 2001, p. 1295). This definition frames rhetoric in an argumentative way, where a speaker is working to influence an audience and enact change through a text. While texts like the MHT and the *Game of Floods* are designed with specific goals and learning objectives in mind, and thus designed to "form attitudes and influence action," there is another side to boundary objects worth considering from a rhetorical perspective: the

shared space (the boundary or margin) that boundary objects are working within. Wilson and Herndl (2007) identify this aspect as "the metaphor of ecological systems," (p. 136) tying notions of shared space to scholarship in technical communication calling for democratic, dialogic models. For example, W. Michele Simmons (2007), a prominent voice in this camp, grounds her discussions of power and participation in Porter's (1998) "rhetoric of democratization," where an audience is capable of participating in dialogue and co-construction of knowledge. Porter's (1998) rhetoric of democratization highlights the way people construct their identities and realities as a result of navigating their relationships, which is facilitated by spaces that allow equal access to meaning making. This notion of constructing identities and realities also frames rhetoric as invention, exploration, and discovery. It's a view of rhetoric akin to the nature of boundary objects, as described by Star and Griesemer (1989): active, collaborative meaning making and invention.

The Communication Problems that Spurred the Use of Climate Change Games

Calls for more inclusive, dialogic communication exist in a number of fields, inspiring practitioners in the resilience community to adopt CC games as a response. This exigence can, therefore, be examined from the perspective of a number of disciplines. As indicated by rhetoric scholars in technical communication, risk communication itself is an interdisciplinary subject, spanning English studies, communication, medical and health sciences, as well as political science (Cagle & Tillery, 2015; Grabill & Simmons, 1998; Simmons, 2007; Staggers, 2006). In order to focus on the communication challenges faced by the practitioners involved in the use and development of these CC games, I focus on models of communication as articulated by researchers in rhetoric, particularly those involved in technical communication, and I will discuss

the ways in which scholars have critiqued problematic information deficit models over time, pointing to calls for dialogic models of communication.

Environmental Risk Communication and the Problem with the Gap

The workshop efforts described in this dissertation represent a form of environmental risk communication, depicting complex systems related to coastal resilience. While these games have been adapted for different contexts, including public outreach, the MHT and the *Game of Floods* were used in workshops designed for shared vision planning and stakeholder engagement. These were train-the-trainer contexts that are commonly attended by professionals in the field, yet much of the literature in technical communication, particularly from the field of rhetoric and composition, focuses on risk communication for public outreach, where experts are communicating environmental risk to non-experts.

Risk communication can be defined simply as communication about safety, health, or environmental risk (Walaski, 2011), but further efforts to define risk communication and articulate the nature of its work have revealed some of its most persistent challenges within public outreach contexts, namely the gap between the "expert" and the "public" (Simmons, 2007). Definitions of risk communication have evolved over time, but Simmons (2007) argues that there is no definition that creates a space for negotiation between experts and affected individuals. The earliest definition, in fact, states that risk communication "would furnish the lay public with information to convince them to agree with the experts" (as cited in Simmons, 2007, p. 39). Simmons (2007) points out that a definition offered by the National Research Council in 2002 appears to be more considerate of the role of the public, calling it an "interactive process" with "an exchange of information and opinion," (as cited in Simmons, 2007, p. 41), but further reading into the document "reveals that the attitudes toward the public have changed little since

the earlier definitions" (Simmons, 2007, p. 41). Experts are still set apart, often placed in the role of educating affected individuals in the general public, and this separation creates a power imbalance that negatively affects the way citizens engage in decision-making processes (Simmons, 2007).

The primary goal of risk communication also represents its most significant challenge: inform the public about safety, health, or environmental concerns, while inviting citizens to participate in decision-making processes and policy development (Grabill & Simmons, 1998; Simmons, 2007; Staggers, 2006). Staggers (2006) points out that this CERCLA-mandated inclusion of citizens as active co-participants, not just passive audience members, was brought about through the accountability efforts of federal and local governments in the aftermath of disasters like Three Mile Island and Hanford, and this new mandate changed the shape of risk communication, as well as the disciplinary stakeholders involved (Staggers, 2006).

Rhetorical Models of the Gap

Risk communication was, and still remains, largely a part of disciplines like risk assessment, cognitive psychology, and communication (Staggers, 2006). Initial research in these fields focused mainly on risk assessment, determining problems and solutions, and then resorting to communication to get this information out to the public (Grabill & Simmons, 1998; Simmons, 2007; Staggers, 2006). Referring to the work of Barbara Mirel, Sheldon Krimsky, and Alonzo Plough, as well as Steven B. Katz and Carolyn R. Miller, Staggers (2006) points to an issue with these early approaches:

> Grounded in the assumption that understanding yields acceptance, the risk assessment-based approach to risk communication had education (of the public) as its primary goal. It soon became apparent, however, that risk assessment scholarship alone was insufficient

to the demands of risk communication. Frequently, the public's perception of the risk and

the acceptability of the proposed solution were out of sync with the risk assessment

experts' views of "reality" (p. 40).

Historically, risk assessors have turned to cognitive science to understand the causes and depth

of the gap between the public and the experts, using affect heuristics (Slovic, 2000; Slovic,

2010), frameworks like the social amplification of risk (Slovic, 2010), or universal psychometric

scales to predict perceptions across audiences (Grabill & Simmons, 1998); however, doing so

situates experts apart from the public (expert views vs public views of risk), rather than

coordinating perspectives through two-way communication (Grabill & Simmons, 1998;

Simmons, 2007)—a problematic divide from the perspective of rhetoric and technical

communication.

It wasn't until the 1990s that scholars in technical communication and rhetoric began to

take an interest in risk communication as a field of study, due to the number of similarities in

practices and the applicability of rhetorical theory (Grabill & Simmons, 1998; Staggers, 2006).

Green Culture (Herndl & Brown, 1996) is one of the first major works to situate environmental

discourse within the field of rhetoric, and by extension technical communication. This edited

collection explores the way environment manifests in language, using rhetorical analysis to

examine a variety of contexts and artifacts of science writing, scientific writing, and

environmental risk communication. For example, in the introduction, Herndl and Brown (1996)

indicate that the "environment is not a thing you could go out and find in the world. Rather, it is

a concept and an associated set of cultural values that we have constructed through the way we

use language (…) we can define the environment and how it is affected by our actions only

through the language we have developed to talk about these issues" (Herndl & Brown, 1996, p.

3). *Green Culture* establishes the importance of attending to environmental discourse: the way we talk about the environment has a significant impact on the way we understand, relate to, and act for/against the environment.

      Green Culture paved the way for later scholars like Jeffrey Grabill (1998), W. Michelle Simmons (2007), Julie Staggers (2006), and Beverly Sauer (2002), among others. Like Herndl and Brown (1996), who underscore the role of culture and language in the construction of notions of "environment," Grabill and Simmons (1998) argue that "risk" is socially constructed, which affects the nature of risk communication and the way technical communicators operate in these contexts. They assert that if "risk is socially constructed, then the separation between expert/public and assessment/communication cannot hold" (Grabill & Simmons, 1998, p. 425). Staggers's (2006) dissertation responds to a niche highlighted in Grabill and Simmons's (1998) piece, that power is undertheorized in risk communication literature. With theoretical grounding in Foucault, Staggers (2006) underscores problematic power differentials at work in the history of risk communication and its efforts to involve citizens as active co-participants and merely recipients of a message. Akin to Grabill and Simmons (1998) and Staggers (2006), Sauer's (2002) work focuses on the role of the citizen stakeholder and the way risk specialists and rhetoricians alike "share a common interest in discovering how their intended audiences think about risk" (p. 12). Because risk communication is, at its core, an exercise in rhetoric, bringing rhetorical theories to bear on this work highlights the relationship between the speaker, the audience, and the text. What these scholars demonstrate is that this relationship is fraught with problematic power differentials.

A Tradition of Exploring Problematic Models of Technical Communication

Technical communication has long pondered the relationship between the expert, the communicator, and the audience. Jennifer Daryl Slack, David James Miller, and Jeffrey Doak (1993) have indicated that there are three common views of technical communication that affect the power and role of the technical communicator: transmission (a one-way model where the communicator becomes the invisible conduit for information), translation (which emphasizes the role of the end user while still de-emphasizing the role of the communicator), and articulation (which flattens the hierarchy and emphasizes the role of the communicator in articulating knowledge and coordinating interchange between experts and end users). Historically, the transmission model was "dominating the field from the late 1800s until the 1950s but persisting into the present" (Slack, et al., 1993, p. 17). Success in the transmission model means achieving the intended effect on (or response from) the audience: "communication is successful when the meaning intended by the sender is received accurately, where accuracy is measured by comparing the desired response to the message with the actual response" (Slack, et al., 1993, p. 16). Within this view, the technical communicator is virtually invisible, acting as a "surrogate engineer" that doesn't "[add] or [contribute] to meaning" (Slack, et al., p. 18), yet they are held responsible if the message fails. Translation became more common from the 1950s on, and within this view, the technical communicator must "understand how (...) audiences decode. Hence rhetoric (as the art of persuasion), composition, audience-analysis, and reader-response research" (Slack, et al., p. 23) are employed to leverage language to achieve success. Similar to transmission, within the translation view, the technical communicator contributes little to meaning making. The difference lies in the role of the audience: "communication is not a linear process that proceeds from sender to receiver, but a process of negotiation in which sender and

receiver both contribute—from their different locations in the circuit of communication—to the construction of meaning" (Slack, et al., 1993, p. 20). Within the articulation view, meaning isn't transmitted or negotiated across nodes on a circuit: "from sender through channels and receivers, each individual, each technology, each medium contributes in the ongoing process of articulating and rearticulating meaning" (Slack, et al., 1993, p. 28). Slack, Miller, and Doak's (1993) views of technical communication represent an early attempt to articulate common models of communication, highlighting the relationships between speakers and audiences and the locus of power therein.

Conversations about models of communication and the relationships among speakers and audiences continued in branches of technical communication research related to risk communication. Grabill and Simmons (1998) place these various models within two categories—technocratic and negotiated: "Borrowing a term from Craig Waddell, they called the first approach 'technocratic.' Technocratic forms of risk communication rely on a one-way flow of information from technical 'experts' to the public" (Staggers, 2006). Among the technocratic, there is the information deficit model (Gottschalk-Druschke & McGreavy, 2016), which suggests a knowledge and/or attitudinal deficit on the part of the audience. There is also Plough and Krimsky's "technical model" of communication (as cited in Simmons, 2007), which is a one-way flow of educational information from the expert. In addition, there is Iacafano, Moore, and Goltsman's (as cited in Simmons, 2007) pseudo-participation model, which is an illusion of participation designed to limit negative backlash, similar to Katz and Miller's (1996) elitist participation model.

Alternative approaches to communication emerged as a response to the failures of technocratic models, and Grabill and Simmons (1998) identify these as negotiated models, which

emphasized "the public as important—even essential—participants in the decision making process and by their support of widespread integration of the public early in the decision making processes. What the negotiated approaches lacked, however, was a true sense of risk as a social construct" (Staggers, 2006, p. 44). Among negotiated approaches, Plough and Krimsky's (as cited in Staggers, 2006) cultural rationality model frames risk communication as a social process, encouraging a view of risk embedded in cultural contexts as opposed to being separated from it. Katz and Miller's (1996) engineering model operates much like Waddell's (1996) social constructionist model: while these involve a successful two-way communication of values and information, there is still a belief in the neutrality of scientific or political entities and a general disregard for the citizens' reactions. Nancy Coppola (2000) offers a stakeholder analysis model requiring more careful attention paid to the feelings of the citizen, yet it is still intended to inspire "desired behaviors" (p. 33) among citizens. The contextual model underscores Bitzer's (1992) rhetorical situation, using an understanding of audience, arguer, medium, and strategic approaches to communication to build trust and craft messages that are more personally relevant for audiences (Gottschalk-Druschke & McGreavy, 2016). While negotiated models represent a step in the right direction, they still maintain a problematic division between the expert and the user, and, as Staggers (2006), Grabill and Simmons (1998), and Simmons (2007) point out, they still fall short of framing risk as a social construct.

The Problem with the Deficit Model

Further literature on the expert/non-expert dynamic, as it relates to educational contexts, points to the persistence of the deficit model. One-way communication that separates experts from non-experts is referred to as the deficit model by researchers in science communication and public understanding (Bauer, 2016; Meyer, 2016; Simis, et al., 2016; Suldovsky, 2016), and this

model has been a prominent subject of interest since the1980s (Bauer, 2016; Meyer, 2016; Simis, et al., 2016; Suldovsky, 2016). The deficit model "suggests that the wider public suffers an interest deficit, a knowledge deficit, an attitudinal deficit or a cognitive deficit in processing scientific information and statistical probabilities, which 'scientific experts' are unlikely to exhibit in the same way" (Bauer, 2016, p. 398). Ultimately, "a deficit model assumes a passive and trusting public, and imagines communication flowing one way—from scientific expert to lay public," (Gottschalk-Druschke & McGreavy, 2016, p. 47); however, there exists more than 20 years of scholarly discourse positioned against the deficit concept in science communication and public understanding (Bauer, 2016). Despite these ongoing arguments, "it seems that this concept has an unusual staying power" (Bauer, 2016, p. 398). Its staying power is attributed to a lack of training in public communication in the STEM disciplines, the expectation that the public will process information in a rational, scientific way, and the ongoing success of the deficit model in influencing public policy (Simis, et al., 2016). Researchers are still examining the driving force behind its persistence, looking for innovative ways to move past this model.

Solving Communication Problems with Climate Change Games

As a means of working toward inclusive models of communication while enhancing education and engagement in regard to climate change, science educators, as well as risk communication practitioners and researchers, have turned to the CC game genre (Katsaliaki & Mustafee, 2015; Sadler, et al., 2013; Sadowski, et al. 2013). Applying CC games to risk communication problems complicates the literature necessary for understanding this work. With games come game studies, and as an expansive, multi-disciplinary field of research, scholars have often come to game studies from somewhere else: "from anthropology, sociology, narratology, semiotics, film studies, etc., and the political and ideological baggage we bring from

our old field inevitably determines and motivates our approaches" (Aarseth, 2001, n.p.). Such a broad array of backgrounds is necessary to form an understanding of games, which are extraordinarily varied themselves as they span different genres and media, but it also causes territorial disputes: "existing fields will (...) often respond [to new fields] by trying to contain the new area as a subfield" (Aarseth, 2001, n.p.). Despite this contention within the academy, game studies has become well established, with its own academic journals and degree programs and a long history of academic study (Mäyrä, 2008).

As a multidisciplinary subject of study, this dissertation is situated, in part, within game studies in that it explores common facets of game studies research: it is a study of a genre of games, of developers, and contexts (Mäyrä, 2008, p. 2). As a dissertation that is also situated in technical communication, I present a case study that focuses on purposes and uses of the MHT and the *Game of Floods* (two examples of the CC game genre) in stakeholder workshop contexts: "highlighting the purposes and uses for games are (...) an important part of game studies," (Mäyrä, 2008, p. 24) and examining the purposes and uses of communication media and their influence on workplace practices across disciplinary and professional boundaries represents an important part of technical communication, as well. These CC games are ultimately boundary objects tying technical communication and game studies (as well as urban planning and modeling and simulation) together in significant ways.

In tracing the roots of the MHT and the *Game of Floods*, this chapter provides a history of the CC game genre and its applications. Because the MHT and the *Game of Floods* were designed with training in mind, I review CC game scholarship and game studies literature on games and education, particularly theorists like James Paul Gee and Kurt Squire. Coming from fields of situated cognition, new literacy studies, and connectionism, James Paul Gee (2003)

argues that reading and thinking are social acts, embedded within situations that are tied to social groups, called "affinity groups;" therefore, learning is inherently active and social, situated within the actions of these affinity groups. Squire (2011), with a background in informatics and ongoing work in games and learning, focuses on how game design principles translate to educational contexts, creating "participatory models of learning" (p.213). Gee and Squire are emphasized here due to their work on the social aspects of games and learning. Additionally, because these games were employed to enhance participation, I focus on conversations regarding the way games frame participation, featuring scholars like Ian Bogost and Miguel Sicart (2011), as the latter is well known for his response, "Against Procedurality," to Ian Bogost's notion of procedural rhetoric, and both have contributed to larger understandings of participation in games. In this dissertation, I define games according to the definition offered by game designers Katie Salen and Eric Zimmerman (2003), which derives from a meta-analysis of various influential game studies scholars: "A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (p. 80). I then situate this view of games according to notions of procedurality. There is, of course, far more to the field of game studies, but I highlight what I consider the most relevant to the artifacts of study for this dissertation.

The CC Game as a Unique Genre and Medium of Environmental Risk Communication

Climate change games, also known as global warming games or climate games (Reckien & Eisenack, 2013), are marked by their topic: they "illuminate aspects of CC" (Reckien & Eisenack, 2013, p. 255). Within the broad topic of climate change, they tend to focus on adaptation or mitigation (of greenhouse gases, for example), and they vary according to scale, focusing on either local contexts (such as a specific household, neighborhood or city) or global contexts (such as international negotiations) (Reckien & Eisenack, 2013).

Because they communicate complex messages about climate change, they are often employed for educational purposes, such as science education, for public outreach/public understanding of science, stakeholder workshops, and even as a means of generating PR for a museum exhibit (Reckien & Eisenack, 2013). The CC game genre, therefore, represents a unique example of risk communication. In general, risk communication spans a wide range of genres and media, from Environmental Impact Statements to books like *Silent Spring* (Grabill & Simmons; 1998; Herndl & Brown, 1996) to climate change games, and CC games, themselves, vary widely. CC games come from a variety of sources, but they are generally developed by private companies, government agencies, non-governmental organizations (NGOs), or academic institutions (Reckien & Eisenack, 2013). In its early years, CC games were primarily developed by academics, but academic initiatives have waned in recent years, while private and public organizations have entered the market (Reckien & Eisenack, 2013). CC game formats include gamified exercises and simulations, computer games—online, mobile, or social media games—, as well as tabletop games, such as board or card games (Reckien & Eisenack, 2013). To see further examples of this wide-ranging genre, I offer a list of CC games available in the English language (at the time of writing this dissertation) in chapter 6.

The oldest known CC game first appeared in scholarship in 1983 (Reckien & Eisenack, 2013). Researchers say the CC game industry has grown since 2002, with the majority of known games being released after that date (Katsaliaki & Mustafee, 2015; Reckien & Eisenack, 2013): "2009 was the year with the highest number of releases (14 new games)" (Reckien & Eisenack, 2013, p. 259), which may be driven by the 2005 United Nations treaty targeting climate change (Katsaliaki & Mustafee, 2015) and the 2009 climate conference in Copenhagen (Eisenack & Reckien, 2013). Calls for CC games continued. Al Gore's Climate Reality Project, with the

support of PSFK, a business intelligence platform, put out a call for proposals for "Gaming for Good" in 2011, for the design and development of creative games that convey messages on how to deal with climate change (The Climate Reality Project, 2011). Additionally, in April of 2018, Seattle Indies, the Pacific Science Center, EarthGames, UW Center for Creative Conservation, the Serious & Social Impact Games Meetup, and the Pacific Science Center organized and hosted the Games for Our Future Game Jam: Surviving Climate Change, where researchers and game designers collaborated to develop climate change games.

Reckien and Eisenack (2013) argue that CC games represent a significant and growing part of the game industry. They claim climate change games "are so numerous today that they should be seen as a subfield of simulation/games on sustainability and environmental issues in its own right" (Eisenack & Reckien, 2013, p. 249). These games have increased in complexity, with a variety of formats spreading across multiple platforms. They write, "our analysis has found that CC games are not a niche product anymore. … They make a valuable contribution to efforts to look for solutions to CC" (Reckien & Eisenack, 2013, p. 266). Their significance and growth was not readily apparent to me, however, as I found it challenging to find available versions of the games listed in Reckien and Eisenack's (2013) review. In 2018, I could only access seven English language computer games from their list of 52 climate change games published in 2013. The CC game market may be somewhat unstable, and further research is needed to establish why and to what degree, but I found tabletop games to be more plentiful and easier to locate than computer games.

Enthusiasm about the Educative Power of Climate Change Games

Reckien and Eisenack (2013) categorize CC games as serious games: "Climate games, CC games, or global warming games belong to the genre of 'serious games,'" (p. 255), which are

designed for purposes that extend beyond entertainment, particularly for education and learning. According to Clark C. Abt (1987), who coined the term, serious games "have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement" (p.9). Their goal is to enable a player to experience real-life situations in a safe way while engaging them in a learning experience that offers feedback for self-monitoring (Katsaliaki & Mustafa, 2015). Serious games have been integrated into educational contexts beyond the classroom, including the military and firefighters (Harmon, 2003; Macedonia, 2002; Annetta, 2008), medical fields (Cosman, et al., 2002; Hmelo, et al., 2001; Annetta, 2008), and business education (Bos, et al., 2006; Annetta, 2008).

Most of the existing research on CC games focuses on their power to educate, to raise awareness, and to spur communities to engage in problem-solving strategies and eco-friendly behaviors (Froehlich, 2014; Waddington, 2015). In regard to climate change education, Eisenack and Reckien (2013) argue the following:

> Simulation/gaming offers one toolbox that can be particularly useful to analyze and teach alternative and complementary views on climate change. Games can simulate quite complex actor relations, between nation-states and between transnational, subnational, individual, and hybrid actors. They can focus on individual behavior, but they can also teach political affairs. Games can offer new ways to raise awareness and empower people to deal with climate change (p. 246).

Similarly, Katsaliaki and Mustafee (2015) believe that games are "an effective teaching and training tool for all stakeholders directly affected by the phenomenon (almost everybody), and in particular, those who are called to seek and exercise solutions to the problem, such as governments, academics, organizations, students, and professionals" (p. 650). Sadler, et al.

(2013) provide a review of literature underscoring the positive impact of games in the classroom, underscoring the benefits of a game-based biology curriculum, while Sadowski, et al. (2013) argue for game-based pedagogy as an active learning experience that supports the study of "wicked problems" like sustainability.

When it comes to the educative potential of CC games, however, there is less caution and more optimism: Waddington (2015) holds that "there are a number of compelling reasons to be cautious about the use of video games in education, and …, caution often seems to be in short supply when educational researchers discuss and analyze video games" (p. 19-20). Researchers are more interested in exploring the potential of these artifacts than they are in the potential drawbacks. Researchers in the field of CC s/g do express some hesitation about the educational power of games, however. For example, Reckien and Eisenack (2013) point out the following issue:

> The Houston Advanced Research Center (n.d.) considers that the three primary objectives of CC games are as follows: 1. to teach knowledge and provide familiarity with the issue of CC, 2. to make the players aware of the challenges associated with global warming, and 3. to encourage players to develop solutions. We found all objectives addressed by our selection of more sophisticated climate games, although to our surprise the first of these aims is rarely explicit. Most CC games presuppose familiarity with the topic, thereby not (fully) exploiting the educational and learning potential of games (p. 266).

Reckien and Eisenack (2013) raise the following question: do games effectively teach new concepts, or do they simply reinforce existing knowledge? What else are games implicitly teaching? CC games appear to be designed for the second and third objectives listed above— as a study of the climate challenges and an invitation to act upon these challenges. The fact that

these games and simulations are often used in educational settings in these studies may cause researchers to explore their educational potential as a research question; however, it may be that games aren't necessarily educating players about the concepts of climate change, at least not in large part. It may be that the majority of CC games educate players about problem-solving strategies. This limits their educative potential, but only by narrowing its scope.

CC games themselves are limited in their approach to the topic of climate change, raising further concerns among researchers in CC s/g. Most CC games center on the mitigation of greenhouse gases (Reckien & Eisenack, 2013). Nearly half of the games developed for this purpose focus on localized situations (what individuals can do to mitigate climate change) and nearly half are global (international mitigation strategies). Few games show a connection between both local and global efforts (Reckien & Eisenack, 2013). Driven by risk communication research, CC game scholars (Aleksandra, et al., 2016; Lee, et al., 2013; Nussbaum, et al., 2015) call for localizing game content to better include the public's experiences (Chowdury, et al., 2012), while appealing to the values (Etkin & Ho, 2007) of a targeted, regional audience (Duan & Fortner, 2005). For example, Lee, et al. (2013) argue that risk communication literature is pushing toward action-based learning within local socio-cultural contexts. They point to the game *Greenify* as a "real-world action game" that both educates and motivates audiences (Lee, et al., 2013). Aleksandra, et al. (2016) agree, indicating that people are more motivated by local situations: "Change is more likely to happen at a local level when community perspectives are embedded in the proposed local solutions and positive actions. This involves, for example, a change in process that is clearly linked to local experience in compelling and interactive ways" (p. 7). Nussbaum, et al. (2015) also highlight the importance of local contexts among the design principles they generated to design a game communicating

environmental risk in a specific community. Calls for localized contexts among CC s/g

researchers reveal a level of caution about the educational potential of games. More importantly,

though, they reveal an attention to risk communication scholarship—that which calls for

localized messages—among the simulation and science education scholars who study CC games.

Connections to the Long-Standing Tradition of Games and Learning

In the larger field of game studies, interest in the educative power of games continues to

grow as researchers and practitioners see "the value of games as models of pedagogically rich,

highly motivating learning environments" (Klopfer, 2008, p. viii). Games and simulations have

long been recognized by scholars for their worth as an educational tool (Mäyrä, 2008). In fact,

"learning by playing may even be called the oldest learning method there is. After all, even

animals learn by imitation and play behaviour" (Mäyrä, 2008, p. 7). Games have been used for

learning and teaching for 4-5,000 years (Tobias & Fletcher, 2011, p. 6). The academic journal

Simulation & Gaming "has been published since 1970, making it the oldest regular publication in

the field" (Mäyrä, 2008, p. 7). These long-standing connections made between games and

simulation and learning extend their reach from entertainment contexts to the classroom and

ultimately to professional development contexts, as well (Mitchell, et al., 2004):

> The fact that children, adolescents and adults learn important lessons about themselves
>
> and their surroundings by engaging in game-like activities is uncontroversial. Throughout
>
> social and behavioural science discourse on social and cognitive development, gameplay
>
> is regarded as an important arena for the development and formation of thinking,
>
> identities, values and norms (Cole, 1996; Piaget, 1951; Rogoff, 1990) (Aarseth, 2006,
>
> n.p.).

Alex Games and Kurt Squire (2011) make a similar point, noting the way games have been tied to educational theories that highlight learning by doing, as found in Dewey, Piaget, and Vygotsky.

Game studies reviews of literature demonstrate that there are several key themes in ongoing discussions of learning games: that games engage/motivate (Dodlinger, 2007; Mitchell, et al., 2004), that games offer unique learning benefits (Dodlinger, 2007; Mitchell, et al., 2004), and that there are opportunities with new and emerging technologies (Mitchell, et al., 2004). Motivation is one of the primary subjects of study in educational games, showing a general consensus that games have the potential to motivate and engage players in ways that are valuable to educators (Dodlinger, 2007). However, there is disagreement over what it is that makes games uniquely motivating (Dodlinger, 2007): some believe narrative context in games are particularly motivating (Dickey, 2005; Dodlinger, 2007; Fisch, 2005; Waraich, 2004); goals and reward systems motivate players (Amory, et.al., 1999; Denis & Jouvelot, 2005; Dodlinger, 2007; Jennings, 2001; Waraich, 2004; Zagal, et al., 2000); and games enable players to achieve a "flow" state (Csikszentmihalyi, 1990; Prensky, 2001). There are also a number of ways scholars believe games educate: they encourage engagement in passive learners (Annetta, 2007; Tanner & Jones, 2000), reaching "learners who may lack interest or confidence" (Mitchell, et al., 2004) or those who struggle with traditional learning styles (Annetta, 2007; Dede, 2004); they offer repetitive scenarios for "drill and practice" (Mitchell, et al., 2004) that often increase in complexity and difficulty in safer and more practical ways through low-cost simulation games (Mitchell, et al, 2004); they allow the "manipulation of objects" (Mitchell, et al., 2004) in a risk-reduced setting (Mitchell, et al, 2004); they foster collaboration and reflective discussion (Mitchell, et al., 2004); Gee (2003) and Squire (2006) argue that, as designed experiences, games

instruct "through a grammar of *doing* and *being*" (Squire, 2006, p. 19), and change the way a player relates to an issue, as well as the way they understand different perspectives (Mitchell, et al., 2004); and they are especially effective when they are designed to focus on a specific issue or learning outcome (Mitchell, et al., 2004). Overall, research indicates that there are a number of ways games educate audiences, and it can be difficult to pin down one specific element.

Enthusiasm about the Participatory Nature of Games

In addition to their enthusiasm about the educative potential of games, researchers are enthusiastic about the way games encourage audience participation, and participation is an important element for understanding the way games operate according to a given model of communication. Researchers in CC s/g are attentive to problematic communication models like the information deficit concept, and they're interested in the way games can move past such models; however, a number of studies have not fully moved toward a dialogic model of communication. Lee, et al. (2013), van Pelt, et al. (2015), and Aleksandra, et al. (2016) point to the pitfalls of a linear scientific literacy or "information deficit model" (p. 5), showing how it creates a gap between the expert and the non-expert in ways that inhibit effective communication. Aleksandra, et al. (2016) argue that the interactive science model is more dialogical, representing "an exchange of information with the public within the context of daily interactions with government, institutions and other social contexts" (Aleksandra, et al., 2016, p. 6). Here they transition to games as a "way of structuring human understanding using interactive experiences as a form of communication" (Aleksandra, et al., 2016, p. 13). However, their diction demonstrates more of a linear model of communication than a dialogical one. The interactive experience "structures" the players' understanding; the game influences the player. Communication is still flowing one way.

One article (van Pelt, et al., 2015) in CC s/g examines games as boundary objects, translating information from experts to non-experts, leveling a critique against a linear, transmission model of communication and moving toward something akin to a "translation" model, to use Slack, Miller, and Doak's (1993) term here. For some researchers, games can represent a common language between students and scientists, whereupon different views and different knowledge sets can be integrated (Eisenack, 2013; van Pelt, et al. 2015). According to van Pelt, et al. (2015), boundary objects are vital for the successful communication of scientific knowledge, and "boundary objects are instruments used to facilitate the interactions between science and practice and function as the operating space between different 'social worlds'" (p. 42). Games have the potential to serve as boundary objects, and "transfer or communicate complex scientific information into understandable and tailored information which is tacitly connected to the target group" (van Pelt, et al., 2015, p. 43). Embedded in the language are references to "transfer" or translation, pointing again to linear communication models where knowledge is transferred from experts to non-experts.

The current research on CC games is attentive to communication models, adopting theories of communication that critique linear, information deficit models (Aleksandra, et al., 2016; Lee, et al., 2013; van Pelt, et al., 2015); however, there is a gravitation toward translation models, particularly when framing games as boundary objects between experts and non-experts, and when grappling with notions of participation, and I feel this is problematic, as it leads to the development of CC games that remediate (Bolter & Grusin, 2000) technocratic approaches to risk communication, while limiting further movement toward dialogic, inclusive models of communication.

Connections to Broader Conversations about Participation in Games

As previously discussed, researchers of CC games are interested in participation as a unique feature of games as a medium, but how is participation manifested in game design and gameplay? Proceduralists argue it's the rules of a game that communicate its meaning and structure participation. In his influential book *Persuasive Games: The Expressive Power of Videogames*, Ian Bogost (2007) offers an "analysis of the way videogames mount arguments and influence players" (p. vii). He argues that "videogames open a new domain for persuasion, thanks to their core representational mode, procedurality[, called] procedural rhetoric, the art of persuasion through rule-based representations and interactions rather than the spoken word, writing, images, or moving pictures" (Bogost, 2007, p. ix). Salen and Zimmerman (2004) appear to be influenced by proceduralism, as seen in their definition of games: "A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (p. 80). Games are systems, defined by rules, and rules govern the choices players can make: "we can use rules to set up choices for players" (Anthropy & Clark, 2014, n.p.). Rules present players with choices, and choices shape the actions they take when participating in the game. Rules can, therefore, communicate a great deal of meaning. Anna Anthropy and Naomi Clark (2014) explain the way rules communicate messages about the possibilities and limitations of agency in general:

> Games can present us with overt choices and ask us what we think—like an interrogator demanding answers or a friend posing questions to help us understand how we feel. What would you do in a difficult situation? What kinds of choices would you make when faced with limited resources? We can also create wider spaces within games where we invite players to come up with their own strategies, reactions, and explorations into territories

that we might never have anticipated as the creators of the game's vocabulary. Or we can

limit those spaces and ask players to listen—to understand that not every system is open

to being changed through the agency of players, not every story can be diverted toward a

happy ending, and not every difficult challenge can be mastered and conquered (n.p.).

Rules require players to make choices, and choices require participation. When players make

choices that generate feedback (points scored, for example), they begin to see that their

participation has an effect; it means something within the boundaries of the game. If players are

afforded an opportunity to reflect on the larger implications of the rules and their response to it,

they can see the larger messages communicated by those rules.

Salen and Zimmerman (2004) call this perception of participation discernibility:

"discernable means that the result of the game action is communicated to the player in a

perceivable way" (p. 34). It helps players understand the effect of their actions. Without

discernibility, "the player might as well be randomly pressing buttons or throwing down cards.

With discernibility, a game possesses the building blocks of meaningful play" (Salen &

Zimmerman, 2004, p. 35). Beyond discernibility, games should also have integration: "whereas

discernibility of game events tells players what happened (I hit the monster), integration lets

players know how it will affect the rest of the game (If I keep on hitting the monster I will kill it.

If I kill enough monsters, I'll gain a level.)" (Salen & Zimmerman, 2004, p. 35). Between the two

(discernibility and integration), "every action a player takes is woven into the larger fabric of the

overall game experience: this is how the play of a game becomes truly meaningful" (Salen &

Zimmerman, 2004, p. 35). When players interact with the designed system of a game, they

engage in a "process of action and outcome" (Salen & Zimmerman, 2004, p. 58). While they

tease out various models of interaction, this suggests that, for Salen and Zimmerman (2004),

interaction amounts to players making choices as a response to a game system and examining the effect those choices have.

Miguel Sicart presents an argument "Against Procedurality" in 2011, to "problematize the validity of procedural rhetoric" (n.p.). He explains that "proceduralism is interested in the ways arguments are embedded in the rules of a game, and how the rules are expressed, communicated to, and understood by a player" (Sicart, 2011, n.p.). He writes, "rules control the meaning of the game, and players, by following rules, create the meaning that is already predetermined by the designer(s)" (Sicart, 2011., n.p.). Sicart (2011) argues, however, that games are not located only in the rules: "games structure play, facilitate it by means of rules. This is not to say that rules determine play: they focus it, they frame it, but they are still subject to the very act of play. Play, again, is an act of appropriation of the game by players" (n.p.). Proceduralism, therefore, places too much emphasis on the rules, overlooking the interactions between the player and the game and meaning therein: "the meaning of a game, its essence, is not determined by the rules, but by the way players engage with those rules, by the way players *play*. The *meaning* of games, then, is played, not procedurally generated" (Sicart, 2011, n.p.). Games structure participation by imposing rules, and players respond to those rules in ways that may go beyond the designers' intentions. Unlike other media, games must be played: "games are both object and process; they can't be read as texts or listened to as music, they must be played. Playing is integral, not coincidental like the appreciative reader or listener" (Aarseth, n.p., 2001). Games require participation:

> Without a player, a game is just a set of instructions, whether executed by a computer or human beings who learn what cards to draw on their turn. An unplayed game is like a piece of sheet music: you can see its potential and imagine what it might be like brought

to life. You can grasp from notation or rules that it's complex and maybe glimpse its

nature. Instructions need someone to carry them out to leap from untapped potential into

a living, changing experience (Anthropy & Clark, 2014, n.p.).

Playing a game, participating through choices and actions, turns game rules into meaningful

experiences.

Overall, researchers of CC games, who often enter the discussion from disciplines related

to science education, as well as modeling and simulation, regard games as boundary objects that

help move science education and scientific communication beyond the deficit model. They

believe games are uniquely participatory, but participation is undertheorized in this particular

branch of research. This niche area of study would benefit from drawing further on theories in

the broader field of game studies, particularly prominent discussions about participation and

notions of procedurality, reflecting on the way meaning is derived by players through play, as

well as the way it's procedurally generated by designers.

Gamification as a Means of Influencing Behaviors and Opinions

Conversations about the participatory nature of games are also found in the literature on

gamification, where game rules and other game elements are infused into non-game contexts to

enhance participation and motivation. Gamification arose in mid-2010 (Walz & Deterding, 2014,

p. 3), and definitions vary, with connections made to serious games, serious toys, playful design

(Walz & Deterding, 2014, p. 7), persuasive games, persuasive technology (Froehlich, 2014), and

gamefulness (McGonigal, 2014). Walz and Deterding (2014) offer the following definition of

gamification or gameful design in their edited collection *The Gameful World: Approaches,*

Issues, and Applications: "'ludic elements or qualities,' or non-game objects and experiences that

use design elements from games and/or are designed to afford gameful experiences" (p. 7). In

short, "the use of game design elements in non-game contexts" (Deterding, et al., 2011, p. 1),

such as points, badges, leaderboards, mayorships, and rewards.

Scholarship is polarized on gamification and its implications, and Walz and Deterding

(2014) summarize the polarity accordingly:

On one side are utopian visions of re-engineering a supposedly 'broken reality'

(McGonigal 2011) into happiness engines: game design will allow us to maximize our

individual potential, organize our 'cognitive surplus' (Clay Shirky), and energize society

to solve humankind's collective challenges. On the other side are dystopian reveries of

Frankensteinian daemon and Skinnerian dictatorships: as algorithms increasingly rule the

world (Slavin) (p. 2).

Overall, it's believed that scholarship tends to focus too narrowly on gamification, ignoring its

part in a long history of techniques and technologies developed to influence behavior; they speak

in absolutes, committing the fallacy of slippery slope in either positive or negative terms

(supporters often ignore pitfalls; critics often ignore affordances), and there is a lack of solid

definitions, analysis, and reflection on what is happening, how or whether it works, and how it

will affect society (Walz & Deterding, 2014, p. 9).

Green Gamification as a Means of Influencing Proenvironmental Behaviors and Opinions

Gamification has a broad—and seemingly ever-broadening—reach, from loyalty

programs, such as frequent flyer miles, (Froehlich, 2013) to health gamification, such as the

"quantified-self" (QS) movement (Whitson, 2013). The Fitbit and its related competitors, such as

the Apple Watch, have gamified health, along with countless smartphone applications, such as

Runkeeper (Froehlich, 2013). This kind of persuasive technology (which refers to "any

interactive computing system designed to change people's attitudes or behaviors" (qtd. in

Froehlich, 2013, p. 564) enables people to record and monitor data, such as their heart rate or calories burned, in order to shape attitudes and behaviors about their health (Whitson, 2013), and it represents a unique form of health risk communication. As a form of environmental risk communication, applications of gamification that are related to the environment are referred to as green gamification or eco-feedback: "in the context of proenvironmental behaviors, persuasive technology that monitors and provides feedback on individual or group behaviors with a goal of reducing environmental impact is called eco-feedback. Many popular commercial examples of green gamification—from the Nest smart thermostat to the Ford Smartgauge—are types of eco-feedback" (Froehlich, 2013). Like their QS movement counterparts in health communication, green gamification and eco-feedback respond to perceived informational and motivational challenges (Froehlich, 2013): in other words, they're designed to get people to understand a risk and influence their behavioral response to that risk.

Connections to the Field of Urban Planning

As games influenced by traditions of charrettes and shared vision planning, they represent a unique manifestation of urban planning. As with technical communication and game studies, urban planning involves a wide range of practices and disciplines. Urban planning involves the work of designing, developing, and regulating public spaces, from environmental development to infrastructure. It relates to disciplines such as engineering, architecture, management science, and sociology, among others. As a means of narrowing the discussion, this dissertation focuses on playful design strategies and games for engaging the public that have long been used by practitioners in architecture and urban planning, highlighting charrettes and shared vision planning.

Urban planning shares common ground with both technical communication and game studies. In regard to the former, planners must devise ways to inform the public about projects while involving them in the design phase. It's a communication challenge that is reminiscent of much technical (and risk) communication scholarship: that is, how can one ethically and effectively inform and engage an audience? In regard to its relationship with game studies, planners have employed modeling and simulation, games, gamification, and play to solve their communication challenges since the 60s and 70s (Gordon & Shirra, 2011). Modeling and simulation is a staple of contemporary participatory methods in urban planning, but at times, their complexity has been considered a barrier for lay audiences (Poplin, 2012). Seeking to better engage the public, practitioners have turned to games and gamification (Poplin, 2012), with a wide range of techniques across urban planning and architecture (Kasprisin, 2016).

The charrette is one such model of public participation in architecture and urban design. Dating back to 19th Century France (Lennertz, et al., 2014), when architecture students completed an intense design sprint, submitting their work to a cart that would travel the campus, collecting their final drafts, contemporary charrettes engage people in a similarly intense, collaborative brainstorming session (Roggema, 2013). Those involved in a charrette come together to work a problem, often engaging in paper prototyping in ways that are reminiscent of playful public participation.

In the field of Integrated Water Resources Management (IWRM), they call these collaborative design sessions shared vision planning (SVP). IWRM focuses on maintaining sustainable water and land resources, while factoring in economic and social impacts (Kirshen & Caldwell, 2008). One characteristic difference between charrettes and SVP is that SVP tends to rely on computer modeling, as opposed to the paper prototyping tools commonly seen in

charrettes, and the literature suggests that experts have yet to frame SVP as a space for play, outside of the MHT; otherwise, the two are quite similar in regard to their purpose, strategies, and overall execution.

Playful Public Participation as a Manifestation of Gamification in Urban Planning. One manifestation of gamification in urban planning contexts is known as gamified participation. It is sometimes referred to as "e-government, e-democracy, [or] the provision of forums for online debate (...). A critical issue in all of these cases is one of encouraging engagement across a broad spectrum of potentially interested parties and stakeholders" (Tolmie, et al., 2014), more specifically, encouraging engagement via play or gamified participation. This branch of gamification is defined accordingly: "Integrating game elements into applications that aim to foster public participation is what we refer to as gamified participation. While research on gamification has seen a great increase, gamified participation remains an underexplored discipline" (Thiel, 2016).

Simulations and games have been designed for city planning meetings as a means of fostering and enhancing deliberation since the 60s and 70s (Gordon & Shirra, 2011). According to Josh Lerner (2013), games and gamification have been leveraged to enhance participation in Latin America since the 1960s:

> Planners and organizers in Latin America and elsewhere have increasingly mixed games and game techniques into participatory processes. Games have become a key tool for campaigns, meetings, workshops, and actions, usually through physical icebreaker and team-building games, mapping simulations, and contests (Al-Kodmany, 2001; Arias, 1996; Romero et al., 2004). Planners are also making participatory processes more *gamelike*—as in Brazil's participatory budgeting and Venezuela's communal councils

(Lerner, 2011). Without necessarily using games themselves, they are applying common

game elements, structures, and processes (p. 187-188).

While this area of research may be underexplored, the uses of games or gamification for such

contexts has ebbed and flowed internationally for decades. One example of an early city

planning game is not unlike the CC games designed for stakeholder workshops in this

dissertation: "Trade-Off (1967) asked participants to develop improvements for a simulated city,

and, through a series of trade-offs, learn first-hand about the complicated decision-making that

must take place to balance necessary improvements with budget constraint" (Gordon & Shirra,

2011).

However, the use of serious games in urban planning contexts lost popularity for a time

(Gordon & Shirra, 2011). More often, contemporary "participatory methods involve public

participation geographic information systems (PPGIS) and urban simulation models that help the

lay public visualize and make sense of the increasing amount of urban data available" (Gordon &

Shirra, 2011). In the mid-90s to early 2000s, new GIS tools were developed and integrated into

community planning but could not "encourage higher public participation in planning" (qtd. in

Poplin, 2012, p. 196). The problem was that some of these tools were considered too complex for

lay audiences (Poplin, 2012). While the Web 2.0 era helped, with more user-friendly tools like

Google Maps and Google Earth, practitioners still felt the need to "bring playfulness and

pleasure to the serious processes of urban planning decisions with public participation" (Poplin,

2012, p. 195-196) through games and gamification. Playful public participation (PPP) has been

one such response, integrating audiences through incentives, "online storytelling, walking,

moving, sketching, drawing, and games" (Poplin, 2012, p. 196), indicating a wide range of

approaches to games and play in these contexts.

Charrettes as a Manifestation of Playful Design and Planning. Playful public participation (PPP) can be traced to long-standing traditions of play as an element of design work, involving fields such as architecture and urban planning. Ronald Kasprisin (2016), an experienced practitioner and scholar in architecture and urban planning catalogs a variety of play-activities commonly used by notable architects and artists, such as the following: free play with prototyping tools, sketch-play, process models, drawing as play-tool, Lego blocks, or a creative playroom. These techniques are reminiscent of those listed above for PPP. In fact, these approaches to play are often infused in design intensives or charrettes.

A charrette is defined as "a gathering of people for an intense period of brainstorming and design. Faced with a problem or challenge the participants pool their talents to produce plans to achieve a goal" (Roggema, 2013, p. 15). A common workshop model in urban planning, the charrette takes many forms (Roggema, 2013) and has been classified as a "metagenre," involving "both a design approach and documentation genre" (Mara, 2006, p. 217): the intense, collaborative approach to design and the final product it results in. This final product is one element that distinguishes the charrette from workshops or brainstorming formats (Kasprisin, 2016). The other distinguishing factor is time commitment: a workshop is shorter, whereas design intensives usually occur over three to five days (Kasprisin, 2016), though others contend that charrettes can be either single- or multiple-day sessions (Lennertz, et al., 2014). Overall, they're regarded as "highly creative, energetic, and interactive community events: a combination of a barn raising and a New England town meeting" (Lennertz, et al., 2014).

The word "charrette" is French for "cart," and was connected to these events as a reference to "the final, intense work effort expended by art and architecture students to meet a project deadline" (Lennertz, et al., 2014, p. 15) at the École des Beaux-Arts in Paris during the

19th century. Projects ended "en charrette when proctors circulated a cart, or charrette, to collect final drawings for jury critiques while students frantically put finishing touches on their work" (Lennertz, et al., 2014, p. 15). Contemporary charrettes "combine this creative, intense time compression, and peer critiques or 'pin-ups' still common in art and architecture schools today, with stakeholder workshops and open houses" (Lennertz, et al., 2014, p. 15). There has been difficulty tracing the origins of the modern charrette, however: "Its roots may be found in a variety of projects and processes, some related to land use and some not" (p. 15).

Design charrettes are regarded as most effective when they succeed in gathering as varied an audience as possible, and when that audience has equal access to the work of designing (Roggema, 2013; Lennertz, et al., 2014). Charrettes operate according to a "democratic process in which all voices and viewpoints are aired and considered [and involve] all disciplines from the start in an orchestrated series of 'feedback loops'" (Lennertz, et al., 2014, p. 3): "multidisciplinary teams of architects, planners, engineers, economists, market experts, public agency staff, and others work concurrently to build a feasible solution to community development problems from the onset of the charrette" (Lennertz, et al., 2014, p. 9). The heterogeneous, multi-stakeholder nature of the events indicate that design charrettes operate as boundary objects: they foster cooperation among groups with different backgrounds. The design charrette centers around an issue, such as flooding, where boundary lines are drawn on the basis of a participant's stake in the discussion. As Wilson and Herndl (2007), Star (2010), and Star and Griesemer (1989) point out, boundaries are both dividing lines as well as shared discursive spaces, and like a good boundary object, charrettes are designed to work against a demarcation exigence and work toward an integrative exigence. One way charrettes move toward an integrative exigence is that they "work in a 'bottom-up' way and take local knowledge and

perceptions into account in designing and decision-making; collaborate across disciplines, organizations, and levels of government" (Roggema, 2013, p. 20). To achieve this bottom-up dynamic, the designer "swaps from a prima donna role to a (...) serving and/or facilitating role" (Roggema, 2013, p. 20).

To better engage public participation, charrettes tend to feature a "hands-on crafted approach to problem solving as opposed to digital graphics" (Kasprisin, 2016, p. 150). The physical manipulation of crafts are considered faster, easier to produce in a limited time frame, and encourage members of the community to interact with designers in the development of ideas (Kasprisin, 2016). Some even "incorporate picnics, tours, and interactive exercises," (Lennertz, et al., 2014) as well as walking audits and role playing. For example, a "police officer pretends to be eight years old, while the fire chief pretends to be 80 years old. At stops [along the walking audit], role players explain what works or does not work for them" (Lennertz, et al., 2014, p. 58). Such methods support the notion that "play is essential in design intensives when working with the community, providing a stimulating and personal approach to community involvement" (Kasprisin, 2016, p. 151).

The Game of Floods is partly based on charrettes, as indicated by one of the game's designers: "When I was in grad school, (...) we did a charrette for the Sacramento Delta Region and that actually influenced some of the rules of the game, like different participants and how you kind of go around, one person at a time, and propose a different idea" (Participant E, personal communication, June 29, 2018). Creators of the *Game of Floods* and MHT drew on influences from popular games, but their most fascinating influence are charrette frameworks that they've integrated into their designs. While speculative, it's possible that the charrette

tradition, with its playful nature and game-like qualities, influenced the design of many climate change games, as it has the *Game of Floods*.

   Shared Vision Planning as a Manifestation of Playful Design and Planning. While the *Game of Floods* was heavily influenced by charrettes, the MHT was identified by one of its designers as a product of shared vision planning (SVP): The MHT would "fit under a variety of frameworks," but it's considered either a "stakeholder workshop" (Participant B, personal communication, June 16, 2018) or "shared vision planning (...) under the auspices of the USACE" (Participant A, personal communication, June 7, 2018). Shared vision planning is typically employed in planning processes associated with Integrated Water Resources Management (IWRM). IWRM works toward sustainable uses of water and land resources, while balancing economic and social factors (Kirshen & Caldwell, 2008). The literature on IWRM, and planning communities more broadly, suggests that stakeholder involvement is vital, yet practitioners have long grappled with the challenge of fostering public participation (Kirshen & Caldwell, 2008). Since the 80s and 90s, practitioners have pointed out the "flaws in commonly used public involvement methods (especially public meetings/hearings)" (Palmer, et al., 2013, p. 616) and have worked toward "more collaborative decision-making techniques for involving stakeholders and the public at large," (Palmer, et al., 2013, p. 616). These collaborative approaches are more common today (Palmer, et al., 2013), and SVP is regarded as one such technique.

   SVP is a collaborative approach to problem-solving with three main pillars. According to the "Shared Vision Planning Primer (Palmer et al, 2008): Shared Vision Planning (SVP) is a disciplined planning approach that incorporates traditional water resources planning methodologies, structured public participation, and the use of collaborative modeling in the

creation of an integrated decision support tool" (qtd. in Kirshen & Cardwell, 2008, p. 2). This modeling component, and its attention to problem-solving, make SVP yet another manifestation of modeling and simulation. The decision support tool is designed with the participation of stakeholders, and it presents causal information about relationships in a given water resource system (Kirshen & Cardwell, 2008): "Throughout development, the model becomes a common avenue for stakeholders to develop a shared understanding (...) and to debate alternatives" (Kirshen & Cardwell, 2008, p. 3). The process of designing it, and its use in the planning process, foster the cogeneration of knowledge (Palmer, et al., 2013) and facilitate dialogue across stakeholder groups as they determine "mutually acceptable solutions" (Kirshen & Cardwell, 2008, p. 2). The collaborative development of a model is a planning technique called "joint fact finding, in which 'stakeholders with differing viewpoints and interests work together to develop data and information, analyze facts and forecasts, develop common assumptions and informed opinion, and, finally, use the information they have developed to reach decisions together'" (qtd. in Kirshen & Cardwell, 2008, p. 3). The goal is to bring about "a common understanding of a natural resource system and [provide] a consensus-based forum for stakeholders to identify tradeoffs and new management options" (US Army Corps of Engineers, 2020), and a primary feature of this communication format is the involvement of stakeholders in an iterative process that focuses on the development of tools "that are later used to evaluate (...) alternatives, and generate alternatives themselves" (Global Water Partnership Organisation, 2018). The use of models to support planning efforts is quite common, and these practices extend beyond IWRM: they relate to a number of fields and endeavors, such as systems dynamics and adaptive management (Palmer, et al., 2013).

SVP operates as a boundary object, inviting stakeholders from different sectors to pool their knowledge, develop a shared language, and collaboratively produce further boundary objects: modeling tools that can be used to work at the center of these stakeholders' interests. SVP is recommended for "multi-stakeholder, multi-issue situations [where] it is highly useful to bring sectors together. It is also useful where there is no common database and data sharing is difficult, and where there is little shared knowledge of the resources" (Global Water Partnership Organisation, 2018). According to the creator of the MHT, SVP (and the MHT therein) are appropriate for situations that meet the following conditions: "as long as there's a concept of a risk, exposure to that risk, resilience, adaptation, constrained budgets, competing interests, and good will, it seems to work well" (Participant A, personal communication, June 7, 2018). These conditions are broad and applicable to a wide range of wicked problems and contexts (Rittel & Webber, 1973), and the creator believes the MHT could be adapted to any natural hazard, but it can even relate to "market hazards, organizational dysfunction," and issues beyond environmental risk (Participant A, personal communication, June 7, 2018).

SVP is similar to the charrette model in that they operate as boundary objects, inviting collaboration across a group of heterogeneous stakeholders in a short, intense period of active design. The literature around SVP doesn't overtly highlight play as an element of these workshops, but their collaborative, low-stakes nature certainly creates a space for the playful manipulation of elements within the decision support tool (both in the development of the tool and its application). One way charrettes and SVP differ is in regard to this tool: whereas a charrette traditionally features physical objects for manipulation, SVP features computer modeling.

Situating Charrettes and Shared Vision Planning in Conversations about Play and Games. An argument could be made for charrettes and SVP as gamified stakeholder workshops ("integrating game design elements in non-game contexts" (Deterding, et al., 2011, p.1). They could also be framed as playful design and planning or playful public participation (design work and/or public "participation encouraged or enhanced by play and joy" (Krek, 2008). Charrettes and SVP could also be viewed as games themselves. Definitions of games vary, in part due to the wide variety of developers, players, purposes, and contexts. In *The Study of Games*, Elliot Morton Avedon and Brian Sutton-Smith (1971/2015) capture the challenge of defining games accordingly:

> Each person defines games in his own way—the anthropologists and folklorists in terms of historical origins; the military men, businessmen, and educators in terms of usages; the social scientists in terms of psychological and social functions. There is overwhelming evidence in all this that the meaning of games is, in part, a function of the ideas of those who think about them (p. 438).

It can be difficult to navigate the many varying definitions of games and related concepts, like play and interaction, as each definition carries remnants of related fields. In their influential book *Rules of Play: Game Design Fundamentals*, Katie Salen and Eric Zimmerman (2003) compile a set of definitions of games, among other related concepts, from key scholars and works in game studies, and distil them into their own definitions with a focus on viewing games from the distinct field of game design. They offer 8 definitions, highlighting the drawbacks and affordances of each, from David Parlett, a game historian; Clark C. Abt, who coined the term "serious games"; Johann Huizinga, notable Dutch anthropologist; Roger Caillois, French sociologist who expanded Huizinga's work; Bernard Suits, a philosopher; Chris Crawford, a

game designer; Greg Costikyan, a game designer and writer; and Elliot Morton Avedon and Brian Sutton-Smith, who are highly regarded in the field of game studies. From this wide range of voices, they extract the following elements of a game definition: "proceeds according to rules that limit players; conflict or contest; goal-oriented/outcome-oriented; activity, process, or event; involves decision-making; not serious and absorbing; never associated with material gain; artificial/safe/outside ordinary life; creates special social groups; voluntary; uncertain; make-believe/representational; inefficient; system of parts/resources and tokens; a form of art" (Salen & Zimmerman, 2003, p. 79). They distil this set into the following definition: "a game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (Salen & Zimmerman, 2003, p. 80).

If we apply Salen and Zimmerman's (2003) definition of games to SVP and charrettes, we see stakeholders invited to participate in a system that engages them in conflict, albeit non-artificial conflict to the extent that they're grappling with issues that affect their residence. Conflict emerges within negotiations across stakeholders as well as the challenges of responding to the problems presented as the subject of the charrette or SVP session. As carefully orchestrated events with rounds of feedback, charrettes are defined by rules, and they result in a quantifiable outcome: a project proposal with varying degrees of feasibility. Likewise, SVP tends to follow a specific framework, with a round developing a decision support tool and a round employing it toward decision-making. A winner may not necessarily be declared, but the event closes with a tangible outcome, as a project plan or tool is adopted. Whether they're classified as playful design and planning, gamification, or games, charrettes and SVP belong in conversations about play and games.

Connections to the Field of Modeling and Simulation

Modeling and simulation (M&S) is a discipline that focuses on developing a representation of an event, whether that event is real or contrived (Banks, 2009). Models approximate a system, and simulations enable users to observe and analyze that system in action. It is a "problem-based discipline that allows for repeated testing of a hypothesis" (Banks, 2009, p. 3). As a result, it's inherently multidisciplinary, as its theories and research methodologies are employed to solve problems across a range of fields. This dissertation focuses on branches of M&S related to games employed in training contexts, such as military and business games, tracing the roots of CC games and their main features to these traditions of M&S. These games have much in common with their counterparts (military and business games) in M&S: they offer a model of a region and simulate a system (in this case adaptation planning); they are designed to hone strategic planning skills where players consider various scenarios; and the MHT in particular features a Decision Support Tool, which is common in M&S. As with the previous disciplines discussed in this chapter, there is more to the field of M&S, but I adhere to historical information as well as characteristics that relate to these games.

Climate Change Games as a Manifestation of Modeling and Simulation. M&S is a discipline with a set of theories and methodologies that revolve around the "notion that models are approximations for the real-world" (Banks, 2009, p. 3). Those that operate in M&S begin with "a model approximating an event. The model is then followed by a simulation, which allows for the repeated observation of the model," (Banks, 2009, p.3). A model is defined as "a representation of an event and/or things that [are] real (a case study) or contrived (a use-case). It can be a representation of an actual system. It can be something used in lieu of the real thing to better understand a certain aspect about that thing. To produce a model you must abstract from

reality a description of a vibrant system" (Banks, 2009, p. 5). The definition of simulation is harder to pin down:

> Definitions of simulation range from:
>
> - a method for implementing a model over time
>
> - a technique for testing, analysis, or training in which real-world systems are used, or where real-world and conceptual systems are reproduced by a model
>
> - an unobtrusive scientific method of inquiry involving experiments with a model rather than with the portion of reality that the model represents
>
> - a methodology for extracting information from a model by observing the behavior of the model as it is executed
>
> - a nontechnical term meaning not real, imitation (the correct word here is the adjective simulated)
>
> Simulation is used when the real system cannot be engaged. The real system may not be engaged because 1) it may not be accessible, 2) it may be dangerous to engage the system, 3) it may be unacceptable to engage the system, or 4) the system may simply not exist (Banks, 2009, p. 6).

Based on the above definitions, climate change games offer a representation of a system related to climate change. In the case of the *Game of Floods* and the MHT, they offer a representation of a region (fictional in the case of the *Game of Floods* and actual in the case of the MHT) in the form of inundation maps, marked with affected assets. Game rules and rounds of gameplay generate a simulation of decision-making processes as a technique for training players. They're used as simulations because the systems they represent may not be accessible: they often represent large spans of time that project well into the future as a means of testing risk

management decisions. Simulating this complexity enables groups to test ideas in a condensed time frame.

The history of M&S is inextricably linked to the history of war games, which is as old as war itself: "the military has been using games for training, tactics analysis, mission preparation, and systems analysis for centuries" (Smith, 2010, p. 6). Their use dates "as far back as 3000 B.C., [when] the game of Wei Hai employed colored stones to represent opposing forces" (Hill & Tolk, 2017, p. 279). Chess was used "as early as 500 B.C." to foster "strategic planning skills" (Hill & Tolk, 2017, p. 279). Tabletop games evolved to facilitate "group deliberations on plans or actions. Early Vikings and Celtics are credited with explicitly considering various scenarios using these tabletop games (e.g., imagine a map laid out on a table with various pieces placed to represent forces)" (Hill & Tolk, 2017, p. 279). The modern era of simulation, however, "is usually associated with the advent of flight simulation in the early 20th century. Computer-based simulation began in the 1950s and, of course, is now commonplace" (Loftin, 2009, p. 248). From sand tables to maps with icons, gridded terrain boards and pawns that represent warriors and leaders, to computer-based military simulations, games have been a valuable means for visualizing tactics and working through problems in a low-risk environment (Smith, 2010), much like CC games in stakeholder workshop contexts. They allow players to work through scenarios that may be too dangerous, too inaccessible, or in regard to climate change, too complex and expansive. Scenarios related to climate change take decades to transpire; a simulation enables users to accelerate the timeline to better examine the potential impact of certain decisions.

M&S branches into a number of tracks, including analysis methodology, modeling methodology, simulation optimization, agent-based simulation, hybrid simulation methods, social and behavioral simulation, healthcare applications, manufacturing applications, military,

homeland security, and emergency response applications (Tolk, et al., 2017). Within the latter

branches, decision support tools are often designed to "provide critical decision support for

operational and strategic planning and decision-making" (Tolk, et al., 2017, p. 12). Such tools

enable users to input data and analyze the results, determining an appropriate plan of action to

respond to a scenario. These tools are the root of many computer-based CC games, and the MHT

features a "Decision Support Tool," based in Microsoft Excel, which allows players to weigh

factors such as budgetary concerns and public opinion while determining an adaptation plan for

an affected region. As with many CC games, the MHT is a playful manifestation of key elements

of M&S.

Another branch of M&S and serious games ventures into business education. Business

games have long been used to reproduce "parts of specific economic, political, or social systems

and [offer] a simplified access to the complex correlations in these systems" (Nohr, 2011, p. 1).

CC games work toward the same goals: capture the complexities of climate change and the

economic, political, and social systems involved in a distilled version for players. In the world of

business, games have ultimately become viewed as a "'medium of reflection' in the 20th Century

(Nohr, 2011, p. 2), and their popularity in these professional contexts have likely inspired other

fields, such as those involved in communicating environmental risk, to develop and implement

games for their own purposes.

As games designed to model aspects of climate change and simulate processes associated

with mitigation and adaptation, the CC game genre can be viewed as a form of modeling and

simulation, bringing M&S into the shared space created by games like the MHT and the *Game of

Floods*—space that is shared with technical communication, game studies, urban planning,

which are all, themselves, wide-ranging fields spanning (or influenced by) multiple disciplines.

Models and simulations are familiar problem-solving tools for actors from a number of disciplines, and they're able to represent complex actor relations within their models. M&S itself is interdisciplinary, an applied methodology employed as a means of understanding subjects of study from a range of disciplines, making it a natural fit for boundary objects.

Conclusion

In mapping the boundaries of the MHT and the *Game of Floods*, we venture across the fields of technical communication, more specifically risk communication, game studies, urban planning, and modeling and simulation, with a specific branch of research on the emergent CC game genre. Throughout the literature in these fields, we can see a narrative forming: one that explains why these games came to be. First, there is a tradition of research on problematic power differentials in communication models related to environmental risk, particularly in the field of rhetoric and technical communication. Despite long-standing criticism, educational and professional training contexts tend to gravitate toward an ever-dominant deficit model, framing audience members as having an attitudinal or knowledge deficit in need of correction. Civic meetings and urban planning events have historically been organized in ways that limit audience involvement in decision-making, and contemporary practitioners have been working to change this dynamic. Scholars in the field of rhetoric and beyond have highlighted the problems with deficit models of communication and called for greater levels of inclusion. Practitioners involved in modeling and simulation and urban planning have likewise held democratic, participatory approaches to communication in high regard, aiming for strategies that foster dialogue and public engagement. These practitioners have turned to games, gamification, play, and prototyping methods, as well as modeling and simulation tools to enhance engagement. As an extension of these efforts, CC games have been developed to respond to the problems posed by the deficit

concept in both educational contexts as well as stakeholder engagement workshops, such as the ones involved in this study. The MHT and the *Game of Floods* were, therefore, designed to respond to a rhetorical exigence rooted in environmental risk communication: namely, how to foster inclusive, dialogic models of communication and move past the deficit model. In responding to this exigence, designers of the MHT and the *Game of Floods* drew their inspiration from contemporary charrettes and shared vision planning models, and they were influenced by common notions of modeling and simulation (as tools approximating an event for the purpose of inviting observation), as well as notions of play, games, and gamification (as uniquely motivating and engaging). The MHT and the *Game of Floods*, therefore, present a fascinating amalgam of influences at the intersection of a number of fields: two boundary objects merging traditions from urban planning, modeling and simulation, game studies, and technical communication.

Much of the research relating specifically to the CC game genre is focused on the educational power of these games. Like broader conversations about games and education, research on CC games tends to be optimistic, arguing that these games move beyond the deficit concept because they are uniquely participatory; however, participation is undertheorized in this niche area of research. In the field of game studies, scholars agree that games are extraordinarily complex and varied, and more caution is needed when considering their influence on players. Game studies scholars debate over the participatory nature of games, particularly in regard to procedurality. Proceduralists argue that rules may be the primary way games frame participation, creating opportunities for players to make choices and act within the game; as a result, designers can infuse meaning into carefully constructed game rules, shaping the choices and behaviors available to players and influencing the way they participate in the game. Arguments against

procedurality point to opportunities for players to appropriate game rules and make choices beyond the designers' intentions. The literature points to gaps in our understanding of participation in games, particularly as it pertains to the CC game genre in training contexts.

Altogether, the narrative we see takes on a problem/solution framework: deficit concepts of communication are broadly considered problematic; therefore, tools and models that promote dialogic communication are preferable. The MHT and the *Game of Floods*, for example, operate as rhetorical boundary objects when used in the context of stakeholder engagement workshops. Rather than arranging a model where a speaker communicates a message from a podium, these games bring participants from disparate disciplinary and jurisdictional backgrounds together to address a simulated problem; as a result, they aspire toward a democratic rhetoric that provides equal access to meaning making.

While these games may not achieve a fully democratic communication model, their nature as boundary objects certainly helps. As boundary objects themselves, they merge various traditions, achieving something new that doesn't necessarily promote one discipline over another; as a result, different ways of seeing are infused into these games, giving voice to disciplines that might otherwise be absent from these contexts. By operating as boundary objects in stakeholder engagement workshops, they invite multiple perspectives without necessarily promoting one perspective over another; instead, they create a space for people to assume new roles, negotiate their professional knowledge within the constraints of the game, while pooling resources to collaboratively develop solutions. These games work toward an inclusive, dialogic model by focusing on an integrative exigence rather than one of demarcation (Wilson & Herndl, 2007).

CHAPTER III

MULTIDISCIPLINARY METHODS AND METHODOLOGY FOR GRAPPLING WITH

THE COMPLEXITY OF CLIMATE CHANGE GAMES

When research sites cross multiple disciplines, span decades, or involve various groups and people, it's important to acknowledge the complexity of the situation and the position of the researcher. As an answer to the challenges of communicating complex information, CC games have emerged as an amalgam of various long-standing traditions from urban planning, such as charrettes and shared vision planning, serious games and gamification, as well as modeling and simulation. No one field can adequately respond to this unique genre of games. Games like the MHT and the *Game of Floods* require a flexible, multidisciplinary approach, one that enables the researcher to adapt as the subject of study comes into focus. Navigating the complexity of these artifacts involves careful listening, humbling inquiries into unfamiliar territory, and the need to flexibly adapt to the topic as it unfolds (while somehow avoiding mission creep). I would like to acknowledge that my background in English studies influences the research questions I ask and the way I tell this story. There are certainly other ways to tell this story, and further research from different perspectives is needed.

This chapter explains the rationale behind the methodology and methods used to answer my research questions. I begin with a discussion of storytelling as a methodology, making an argument for its value in this particular project. I then transition to a discussion of my methods: semi-structured observational field notes, survey research in the form of interviews and questionnaires, followed by thematic analysis of interview data. I close by addressing the limitations of my design and the way I mitigate those limitations. While storytelling

methodologies have been employed in science and technology studies (STS), organizational studies, design, feminist studies, and more recently technical communication (Legg & Sullivan, 2018), the methods I employ are based on practices in the social sciences, educational research, usability studies, and games user research. This multidisciplinary approach was designed to enable me to listen to the stakeholders involved and observe them during gameplay, attending to their unique situation. It also enabled me to develop a multidisciplinary analytical framework, a heuristic born from these interviews and observations and rooted in theories from rhetoric, technical communication, and game studies.

Storytelling as Methodology

In an example of storytelling as a methodology, Julie Staggers and W. Michele Simmons (2018), "offer a heuristic of lenses," (p. 51) to interrogate the complex network of actors involved in the "bomb towns" (p. 47) of Oak Ridge and Hanford, and they relay their analysis "through a series of stories" (p. 47). This dissertation follows their example, telling a series of stories about these games. By way of a review of literature, chapter 2 tells an origin story, showing why these games came to be and tracing their influences. Chapter 4 gives voice to the designers and practitioners behind the games, relaying their stories about their communication needs, the work involved in producing these games, and perceptions of their use. Chapter 5 includes a series of stories about gameplay, informed by observational field notes. Altogether these stories illustrate where these games came from, how they're being used, and why as a means of coming to terms with their complexity.

In chapter 1, I include a story about my research trajectory over time and the way I stumbled through it. Employing a storytelling methodology herself, Sarah Read (2018) calls her own research an "an attempt to write a unified account of the elephant experienced by the blind

man who can only feel one small piece of the animal at a time" (p. 142). This dissertation is the elephant, and I've been blindly working my way through it one piece at a time (one field of research, one workshop, one game, one interview, and so on to completion). Like Read (2018) and Staggers and Simmons (2018), I include storytelling because I believe it provides the best way to capture the slippery nature of climate change games as a genre. These games emerge and disappear; they pop up in specific regions for specific uses; their content changes, as does their rhetorical purpose, audience, and context. The CC game market is unpredictable. As a result, I needed a methodology that allowed me to move flexibly, along with the changing shape of my topic.

According to Emily Legg and Patricia Sullivan (2018), while storytelling as a methodology "can include questions and approaches that resemble *a priori* reliances on testing hypothesis, questions are more likely to emerge as the researcher becomes a part of the experience and relates to the agents within that experience" (p. 40). This methodology makes room for the messiness of complex research sites, such as the ones I found myself in. After I interviewed practitioners and observed gameplay, some of my previous research questions became irrelevant, and new questions emerged. Of particular importance to this dissertation, storytelling practices require the researcher to:

- "listen to (instead of just seeing and sorting)" (Legg & Sullivan, 2018, p. 41)
- pay "attention to the mediums used to fashion stories; alert to affordances; suspicious that their agencies will interact with stories in ways that render them differently than other mediums would" (Legg & Sullivan, 2018, p. 42)
- Draw "porous boundaries for places, events, participant groups" (Legg & Sullivan, 2018, p. 42).

In regard to the first bullet point, losing trace of certain games and, over time, discovering new ones within my own local region involved major shifts in my thinking: theories I once thought helpful were no longer directly applicable; hypotheses I once thought appropriate were no longer relevant. The more I learned about the games, the designers' process and intentions behind these games, and the contexts they were being used in, (ironically but perhaps unsurprisingly) the less I seemed to understand. I realized I had carried too much with me to the field: I had formed my hypothesis, organized my methods, nearly arriving at my conclusions already. I expected to see and sort (Legg & Sullivan, 2018, p. 41), but I discovered that the research site, the designers and practitioners, and the game itself, had unexpected stories to tell, and I needed to listen.

In regard to the second bullet point, storytelling requires researchers to pay "attention to the mediums used to fashion stories; alert to affordances; suspicious that their agencies will interact with stories in ways that render them differently than other mediums would" (Legg & Sullivan, 2018, p. 42). I have been suspicious of CC games, particularly because of the amount of enthusiasm I saw in the research. I believed games potentially created an illusion of participation, recreating problematic deficit models of communication by constraining gameplay and limiting access to meaning-making. When it comes to a given climate change game, players have little influence over the way risk is constructed or defined within the scenarios offered to them; anything they do exists within the designed boundaries of the game (its rules), of which they rarely have designerly input. The kind of inclusive, negotiated approaches scholars are calling for frame risk communication as a social process, encouraging a view of risk embedded in cultural contexts as opposed to being separated from it (Staggers, 2006). The goal is to create spaces where risk itself can be collectively defined, and some CC games come packaged with the designers' ideological notions of risk already infused into the game. I originally believed that this

results in an illusion of participation. I learned that the MHT and the *Game of Floods* have certain affordances as boundary objects that build toward inclusive, dialogic communication, and I chose to pursue the notion of boundary objects further.

In regard to the third bullet point above, storytelling requires researchers to draw "porous boundaries for places, events, participant groups" (Legg & Sullivan, 2018, p. 42). When I defended my prospectus, I was interested in observing one very specific dynamic: the dynamic between the expert and the non-expert. I hypothesized that, if games were being used to raise public awareness, then the games were ultimately serving as a means of translating technical and scientific information from experts to non-experts, creating a communication event that might recreate deficit models of communication. When I attended the events for the MHT and the *Game of Floods*, however, I learned that the events were considered train-the-trainer workshops rather than public outreach events. The dynamic I observed didn't fit the typical expert/non-expert framework. While those in attendance may not call themselves experts (they preferred the term key stakeholder), they certainly had a rich, professional background in the subject. I had a vision of the participants that did not match reality, and subsequent interviews revealed that the participants involved in the production of these games, as well as their dissemination and consumption, are more varied than I imagined: these games have been adapted for various purposes and contexts in every state of the nation, as well as abroad. I was required to draw porous boundaries for these events and participant groups, making this particular study a good fit for storytelling as a methodology.

Research Questions

After listening to these designers and practitioners and considering what they had to say, my research questions shifted away from questions about agency to questions about the origin of

these games and their current applications. Throughout these interviews, I could hear them circling around this need to bring disparate communities and perspectives together through the games, that the games offered an opportunity to model this complex issue and view it comprehensively, while transcending boundaries that normally constrain the way they approach problem-solving. Without using the terminology directly, these practitioners were framing these games as boundary objects. As a result, my questions shifted to the following:

- What is the origin of the climate change game genre?

- Why are key stakeholders in coastal resilience using climate change games?

- How do these games operate for these key stakeholders?

To answer these questions, I engaged in ethnographic research, using mixed methods, including survey research, which involved interview and questionnaire, as well as observation of gameplay, taking semi-structured observational field notes. Inductive thematic analysis of survey data led to the development of a heuristic, combining theories from my review of literature with themes from the interview data. This heuristic was then applied to the analysis of the game and my observation of gameplay.

Methods for Data Collection

Interview

Interviews of game designers and local workshop organizers (n=6) were conducted, inquiring after their perceptions of game/workshop goals, the gap, need, or set of challenges this mode of intervention is designed to address, as well as their approach to design and implementation. As listed in Table 3 (p. 93), interviews were conducted with 2 practitioners involved in the MHT (1 game designer and 1 workshop organizer). Interviews were conducted with 3 practitioners involved in the *Game of Floods* (2 game designers, 1 workshop organizer). I

also conducted an interview with 1 participant who played both the MHT and the *Game of Floods*. Game designers and workshop organizers were identified by online public record of their involvement with these efforts. I contacted interviewees via email, which was also public record, and approached others at the workshops themselves. Because these games have been adapted and adopted in different contexts across the nation, I had difficulty identifying who the original designers of the games were and the degree of involvement workshop organizers had in designing, or at least revising, the games. Until I conducted the interviews, I wasn't sure who was a "game designer" and who was a "workshop organizer" (and in the case of the MHT, which prioritizes iterative design, the workshop organizers participated in the design of the game, reworking aspects for their particular event). Within interviews with workshop organizers, I was able to learn who the original designers of the games were, and I reached out to them via email to request additional interviews. As a result, I have a set of interviews with the people who originally designed these games (n=3) and the people who adopted and adapted the games for use in Hampton Roads, Virginia (n=2). Interview subjects represented the following agencies at the time of their involvement with the design and implementation of the games: FEMA, USACE, the Hampton Roads Planning District Commission, and the Marin County Community Development Agency (see Table 3 below).

	Game Designers Interviewed	Workshop Organizers Interviewed	Player/Participant Interviewed
Involved in the MHT	Participant A	Participant B	Participant C
Involved in the *Game of Floods*	Participant E and F	Participant D	

Table 3: Distribution of interview participants, their role, and their involvement with each game

Each interview consisted of the same set of 25 questions, and sessions lasted between fifteen

minutes and an hour (See Appendix A). Some interviews were conducted in person, while others

took place online using Cisco Webex as an online Web conferencing application. All interviews

were recorded, either by phone or with the recording tool in Webex. Interview recordings were

transcribed, and all files were saved in a password-protected environment.

Interview is a common method employed in technical communication (Hughes &

Hayhoe, 2008), as well as games user research (Drachen, et al., 2018), and as an outsider, it was

necessary for me to engage in interviews to gain a clear understanding of the purpose, history,

and uses of *The Game of Floods* as well as the MHT.

Semi-Structured Observational Field Notes

As I coordinated interviews with those I had identified as workshop organizers, I also

requested an opportunity to observe gameplay. While on site at the workshops hosting the

games, notes were taken by hand in a notebook to enable freedom of movement around the

room. During note-taking, I focused on observing the player experience overall, while attending

particularly to time-on-task, facilitator interactions with players, "in-game events, spontaneous

player comments, players' body language, facial expression, and posture, the play space, [and]

the set-up" (Drachen, et al., 2018, p. 182-183). Such notes allowed me to gain a sense of players'

reactions to the games, how the games operated within, or supported, the larger workshops, and

how workshop organizers interacted with players during gameplay. It helped me better

understand the games by seeing them in action.

Questionnaire

While corresponding with organizers of the MHT via email about the opportunity to

observe and conduct interviews, they indicated they were interested in conducting a post-test

questionnaire to gauge players' reactions to the game and asked for my help in carrying it out. I offered to conduct the questionnaire and requested permission to use the data in my dissertation. They granted permission and gave me a set of questions they had designed, and I formatted them into a Google Forms survey (See Appendix B). With their permission, I adjusted the wording of one question and added a follow-up question of my own (See Appendix B). After rounds of edits conducted via email with the workshop organizers, the final draft of the questionnaire included 17 questions with a blend of closed- and open-ended questions (See Appendix B).

Most of the questions focus on efficacy: did the MHT offer an experience that was clear, informative, and useful (See Appendix B)? Organizers were interested in whether the game was having the effect they hoped it would. I edited one question to ask whether players experienced a balance in education and engagement during gameplay and, in a follow-up question, to explain their definition of engagement (See Appendix B). At the time, I was interested in players' experiences of engagement, but as stated above, my interests shifted to the designers and organizers and the rhetorical work they were trying to achieve with these games. Eleven respondents participated in the MHT survey (n=11).

The organizers behind *The Game of Floods* conducted a questionnaire of their own, again focusing on efficacy. While I wasn't involved in any aspect of its design, I was given permission to access the results and use their data in my dissertation as an unpublished source. Both questionnaires were used as source material to elaborate on the goals of designers and organizers and summarize broad reactions among players. Nine respondents participated in the *Game of Floods* survey (n=9).

Methods for Data Analysis

Thematic Analysis

I used inductive and deductive thematic analysis to examine the interview data. Thematic analysis is a "process for encoding qualitative information. The encoding requires an explicit 'code.' This may be a list of themes; a complex model with themes, indicators, and qualifications that are causally related; or something in between these two forms" (Boyatzis, 1998, p. 4). Thematic analysis is regarded as an effective means of "exploring complex, multidisciplinary phenomena," (Boyatzis, 1998, p. viii) as well as a way of "analyzing qualitative information" and of "systematically observing a person, an interaction, a group, a situation, an organization," (Boyatzis, 1998, p. 4-5) etc. It is "regularly used by scholars and researchers in literature, psychology, sociology, cultural anthropology," (Boyatzis, 1998, p. 6) and many other disciplines. While some researchers employ thematic analysis at an early stage in their research, such as a pilot study, it is considered an effective means of analyzing qualitative information at any stage (Boyatzis, 1998).

Interview transcripts were coded for themes and analyzed according to the process of inductive thematic analysis. I first reduced the raw information by reading the transcript and paraphrasing or summarizing it, abstracting the information in the form of an outline (Boyatzis, 1998, p. 45). Each interview was treated as a discrete subsample. Summaries from one subsample were compared to summaries of the others in order to determine potential patterns or themes. Those patterns were then extracted and listed on an initial codesheet (below).

Round 1 Codes:

Purpose and Goals

Purpose: support mitigation planning

Goal: multiple perspective (silo)

Goal: Problem-solving

Goal: multi-faceted solutions

Goal: education/raise awareness

Goal: get feedback/be graded

Goal: empowerment

Goal: broker a conversation

Goal: work from common ground

Goal: local deployment, have more meetings

Goal: not for planning/decision-making

Goal: Gauge community leanings

Outcome: low-stakes

Outcome: focus (relates to game as tech comm/boil down)

Outcome: influenced decision-making

Need: clear objective

Describing the Game

Game as Tech Comm (distilled, boiled down, adapting language)

Game as "Tool"

Rare

Interactive/collaborative

Engagement, also "game as energizing"

Alternative communication method/ "better than PowerPoint"

Situated Learning: Tangible and understandable

Realism

Value of existing roles/role-playing (subject positions)

You don't lose the GoF

Need knowledgeable facilitator

Scalable/Adaptable

What makes game work: five factors

Relationship to Shared Vision Planning

Miscellaneous

Comparison GoF v Tournament (level of realism/specificity/technicality)

Design process

Preaching to the choir: people already in it/interested in it

Charrette

There are no answers (related to you don't lose GoF?)

Learn from building game

As a result of this initial stage of coding, I discovered that the notion of boundary objects was applicable to this work. The prominence of codes like "broker a conversation" and "work from common ground," was reminiscent of the notion of boundary objects and their uses in technical communication. This connection led to a second stage of deductive or theory-driven thematic analysis, applying boundary objects and scholarship related to technical communication to the interview transcripts. The following codesheet was developed for the second round of theory-driven thematic analysis:

Final themes and codes:

Games reflect goals of technical communication and game design (48)

Distilled/boiled down (14)

Alternative communication method; better than PowerPoint; engaging (34)

Games operate as boundary objects (101)

Based in action; game as tool (game is something actors act toward and with) (17)

Integrative exigence (a good communicative device; a thing that highlights

lines/demarcation and fosters shared social and discursive space): (37)

brokers a conversation (11)

multiple perspectives (20)

Value of roles/role-playing (6)

Interpretive flexibility (different outcomes, uses; scalability) (47)

Scalable/adaptable (references to its adaptability to new

contexts/audiences or multiple interpretations) (6)

Education/awareness/problem-solving (as one scalable/flexible use) (32)

Low-stakes (fosters collaboration without need for consensus; no victory

condition/no right answer) (9)

To produce the codesheet listed above, codes were developed to have the following elements:

"1) A label (i.e. a name); 2) [When necessary,] a definition of what the theme concerns (i.e. the

characteristic or issue constituting the theme); 3) [When necessary,] a description of how to

know when the theme occurs (i.e., indicators on how to 'flag' the theme) (Boyatzis, 1998, p. 31).

I add the phrase "when necessary" to the quotation above to indicate that I did not always

include a definition or description of a code when I thought the label itself was self-explanatory,

particularly since I wasn't coordinating with a second coder. For example, one code was labeled

"distilled/boiled down," for moments when the interviewees talked about the way the game

simplified or distilled the complexities of the issue. The label felt self-explanatory.

Boundary Objects as a Theoretical Lens

As a result of thematic analysis of interview transcripts with designers and workshop organizers, it became apparent to me that the games created a shared space where key stakeholders from disparate professional backgrounds could think broadly about the issue and solve multifaceted resilience-related problems. As I listened, I realized these game designers and workshop organizers viewed the games as boundary objects (without directly using the term), fostering cooperation among people from different professional discourses.

The notion of boundary objects fits well with storytelling as a methodology. Legg and Sullivan (2018) cite Star and Griesemer's (1989) work, stating that "boundary objects can assist in building stories that position actor, actants, and objects into various configurations of meaning; in doing so, they emphasize how these shared objects contribute to the construction of multiply meaningful stories" (p. 26). In this regard, I can attend to the ways in which games, as boundary objects, foster the collaborative construction of meaning. Boundary objects correspond to theories of rhetoric that highlight demarcation and integration (Wilson & Herndl, 2007), such as Burke's (1969/2001) notions of division and identification. Applying Star and Griesemer's (1989) boundary objects to these games allows me to view these artifacts according to a lens of division and identification, marking moments where the games foster identification while highlighting areas of division among participants.

The Development of a Heuristic

Analysis is driven by two resources: the theories presented in the review of literature in chapter 2 and data from interviews and observations. I combine theories with data to produce a heuristic for analyzing how these games operate as unique and effective forms of communication

for these audiences and within these contexts. The heuristic I designed represents a blend of influences from theories about boundary objects, rhetoric and technical communication, urban planning, and game studies, and distils them into a series of characteristics. In my final chapter, I then offer this heuristic as a means for future practitioners to assess and adjust CC games as they work toward their goals: using games as rhetorical boundary objects to develop a shared language, probe complex, multi-stakeholder issues such as coastal resilience, and foster collaboration across disciplinary and professional boundaries.

Heuristics are common in technical communication scholarship. They "are used to connect abstract theories to individual, concrete practices" (Johnson-Eilola & Selber, 2013, p. 5), and as such, they represent a way to invite praxis into the design and implementation of CC games. Heuristics serve as "rough frameworks for approaching specific types of situations [and] help technical communicators solve problems not by providing straightforward answers but by providing tentatively structured procedures for understanding and acting in complex situations" (Johnson-Eilola & Selber, 2013, p. 4). Heuristics provide a framework for analysis or a general mode of operation; they indicate a way forward but do not represent a "definitive solution" to complex problems (Johnson-Eilola & Selber, 2013, p. 5). As a result, further work is needed to assess the validity, usability, and usefulness of the heuristic I offer, particularly as the boundary work this community engages in varies significantly between audiences and contexts.

Limitations

Human subjects research has limitations. As self-report methods, survey methods like interview and questionnaires introduce subjective bias (Drachen, et al., 2018, p. 176). My data reflects personal views, and it's important to note that all personal views are shaped by participants' backgrounds, their ideological stances, their roles and relationships. Observational

field notes are prone to researcher biases, as well, such as the "interpretation bias, observer-expectancy bias, and confirmation bias" (Drachen, et al., 2018, p. 176). My observations are likewise shaped by my own personal and professional background, as well as my expectations about the study.

In regard to the interview transcripts, there is only one researcher coding the data, and thematic analysis can be prone to limitations, such as projection and sampling (Boyatzis, 1998, p. 12). In regard to projection, "the stronger a researcher's ideology or theory, the more he or she will be tempted to project his or her values or conceptualization of the events onto the people from whom the raw information has been collected," (Boyatzis, 1998, p. 13). One can have too much familiarity with the phenomenon being studied and inadvertently impose "their own typical response to the situation" (Boyatzis, 1998, p. 13). As someone who is not a practitioner in the field of coastal resilience, I certainly lack familiarity with the subject matter. My limitation is on the other end of the spectrum: for a researcher who has little to no prior experience with a phenomenon, "the novelty of the situation can be overwhelming" (Boyatzis, 1998, p. 13). To mitigate the effects of these limitations, I worked toward "developing an explicit code," and adhered "close to the raw information in the development of the themes and code" (Boyatzis, 1998, p. 13). In regard to the second limitation of thematic analysis, the sample in this study is small. I analyze two games and interview six people. My findings are not generalizable; instead, my project is regionally specific and represents a case study of two events occurring in Hampton Roads, Virginia, in 2018—a case study that has broader implications for future rhetorical work with games employed for the purpose of communicating risk.

Conclusion

As a project that spans multiple disciplines and grapples with a slippery genre of games,

one that's difficult to track down in local settings and one that shifts between audiences and contexts, I needed to adopt a methodological framework that would allow me to move flexibly and operate as an observer/listener. I adopted storytelling as a methodology to enable me to adapt to the changing shape of my selected artifacts and the network of stakeholders that surround them, while telling their story as honestly and accurately as possible. My methods (survey research and semi-structured observational field notes) afford me the opportunity to observe these artifacts in action and listen to the voices of the actors within this system. My analytical methods (inductive and deductive thematic analysis and the development of a heuristic) limit the possibility of imposing my view on the data, creating a space for themes to emerge from the data itself. Overall, I believe the methodology and methods presented here allow me to best tell these stories.

CHAPTER IV

A HEURISTIC FOR ASSESSING THE RHETORICAL BOUNDARY WORK OF

CLIMATE CHANGE GAMES

As a means of telling the practitioners' and designers' stories, I present the results of thematic analysis of interview data and demonstrate how they relate to scholarship in game studies, technical communication, and boundary objects. I close the chapter by combining these elements into a heuristic for further analysis and game development. Interviews were conducted with workshop organizers, game designers, and one participant who played both games at both events. To clarify, I interviewed three people who designed the MHT and *Game of Floods* (1 person who designed the MHT and 2 people who designed *The Game of Floods*), and I interviewed two people who operated as workshop organizers, adopting and implementing the games into these local contexts (1 organizer for each game/event). I also interviewed one person who attended each event in 2018 and played each game. At the time they were involved in designing and implementing these games, interview subjects represented the following agencies: FEMA, USACE, the Hampton Roads Planning District Commission, and the Marin County Community Development Agency. See Table 3 (p. 93) for a list of interview participants and their roles as they relate to each game. My goal in interviewing these practitioners was to learn more about why and how these stakeholders were using games, while gaining a better understanding of how these games operated for these stakeholders. As I listened to their stories of use and design, I found that these designers and organizers were not only operating as game designers; they were also operating according to practices recognized in the field of technical

communication, designing games that replace more common media in technical communication (such as slide presentations) as a means of achieving rhetorical boundary work.

In what follows, I discuss the results of inductive thematic analysis of interview data, demonstrating the ways in which interviewees' goals and processes align with understandings of technical communication and game studies. Throughout the chapter, I will be discussing the following:

Final themes and codes:

Games reflect goals of technical communication and game design (48)

Distilled/boiled down (14)

Alternative communication method; better than PowerPoint; engaging (34)

Games operate as boundary objects (101)

Based in action; game as tool (game is something actors act toward and with) (17)

Integrative exigence (a good communicative device; a thing that highlights lines/demarcation and fosters shared social and discursive space): (37)

brokers a conversation (11)

multiple perspectives (20)

Value of roles/role-playing (6)

Interpretive flexibility (different outcomes, uses; scalability) (47)

Scalable/adaptable (references to its adaptability to new contexts/audiences or multiple interpretations) (6)

Education/awareness/problem-solving (as one scalable/flexible use) (32)

Low-stakes (fosters collaboration without need for consensus; no victory condition/no right answer) (9)

As listed above, two notable themes emerged in the interviews with game designers, workshop facilitators, and the player involved in both: 1) games reflect common goals of the fields of technical communication and game design, and 2) these games operate as boundary objects. To clarify, I'm not arguing that these practitioners are purposefully framing these games according to concepts in technical communication and game design, nor do I believe that they overtly view these games as boundary objects. Across these interviews, they never refer to technical communication, game studies, or boundary objects directly; however, as I explored the interview transcripts, it was clear to me, from my position in English studies, that the way practitioners regarded these games reflected common goals of the fields of technical communication and game design when interviewees spoke of the way these games 1) distilled complex notions of coastal resilience (discussed 14 times across 6 interviews), and 2) provided an alternative communication method to traditional genres of technical communication (discussed 34 times across 6 interviews). While they never used the term "boundary object," I also noted when interviewees articulated features of boundary objects while describing the games: the games' integrative exigence (discussed 37 times across 6 interviews), their interpretive flexibility (discussed 47 times across 6 interviews), and the active nature of the games (discussed 17 times across 6 interviews). In describing the features, uses, and goals of these games, practitioners unintentionally used concepts that relate to technical communication, game studies, and boundary objects, and I believe it's important to highlight these unintentional connections. By highlighting them, I offer practitioners a new set of traditions to inform their ongoing use of games. In their current approach to building these games, designers draw on traditions in urban planning, such as the charrette and SVP, but this dissertation points toward additional traditions (such as technical communication, game studies, and boundary objects) that can support them as

they carefully design these games and make arguments promoting their use. By highlighting these unintentional connections, I also bring a unique subject of study to the fields of technical communication and game studies, inviting the fields to pay attention to this genre of games and their uses in these specialized contexts. As idiosyncratic examples of environmental risk communication, these games have implications for other efforts to communicate technical and scientific information in playful ways.

Climate Change Games Reflect Common Goals of Technical Communication and Game Design

To unpack the themes I saw within these interviews, I will first discuss the moments when participants articulated views relating to the goals of game design and technical communication. I organized these themes within the codesheet accordingly:

Games reflect goals of technical communication and game design (48)

Distilled/boiled down (14)

Alternative communication method; better than PowerPoint; engaging (34)

During interviews, practitioners indicated that they intentionally used these games as replacements for other forms of communication, such as slide presentations, and they circled back to this point often, suggesting that this replacement was significant for them. In the effort to experiment with more inclusive models of communication, they turned to games to achieve something they believed the slide presentation could not. They note the games' ability to encourage greater levels of participation through dialogue, suggesting that they see conversation as a meaningful activity, one worth designing into games and one worth fostering in the contexts they're working with.

They also point to the games' ability to distil complex notions of coastal resilience, which is reminiscent of common goals in technical communication as well as game design. Representing complex information is fundamental to the work of technical communication: scientific and technical processes must be communicated clearly to ensure the safety, health, and efficiency of the stakeholders involved, whether the subject is coastal resilience or COVID-19. Games operate as models of larger existing processes, and game designers generate a simplified, distilled version of those processes to enable play and experimentation. These practitioners show an interest in these games' ability to distil information, and this interest reveals an important point of convergence between the fields of technical communication and game studies.

Games Distil Complex Notions of Coastal Resilience

Like most issues related to environmental risk, coastal resilience is a "wicked problem" (Rittel & Webber, 1973). It's a worldwide issue, involving current trends that project well into the future, and it requires the consideration of scientific, social, and economic factors that significantly affect a wide range of stakeholders. In order to even begin to engage in the topic and design an experience of it, an author must distil quite a bit. The practitioners involved in these games are well aware of this enormous task and felt these games could simulate an experience of adaptation and mitigation planning, making it more accessible for audiences within a limited time frame. During interviews, accessibility came up 14 times and focused on the approach to game design as well as the overall goal of the games. The examples I highlight below revolve around accessibility as it relates to 1) language, 2) player options, and 3) the design choices regarding the maps used in each game.

Less Technical Language to Enhance Accessibility. One game design choice highlighted in the interviews related to language. When talking about *The Game of Floods,* one

interviewee stated, "the language in the game has been purposefully kept very simple. There is some technical terminology, but (...) there are additional materials explaining what mitigation actions were available and how much they would cost" (Participant D, personal communication, June 26, 2018). While the interviewee did not cite specific examples, the participant workbook for the *Game of Floods* offers a definition of concepts like adaptation and the lifespan of functional working life of assets, suggesting simplified writing for a broader potential audience: "Adaptation is the practice of planning for anticipated climate change and developing strategies to address potential impacts" (p. 3). This choice is likely due to the understanding that their audience may have varying levels of familiarity with the issue of coastal resilience, and the game must provide common ground. Stakeholders at the event featuring the *Game of Floods* represented a range of organizations, such as the Hampton Roads Planning District Commission, Virginia Department of Emergency Management, Virginia Department of Conservation and Recreation, USACE, City of Hampton, City of Newport News, Institute of Marine Science, and Old Dominion University. While these parties have a stake in the discussions, they don't necessarily deal with adaptation and mitigation directly as a part of their jobs; as a result, the language used to communicate these ideas must be accessible to those attending.

Limited Player Options to Enhance Accessibility. Another design choice in the *Game of Floods* related to the selection of adaptation strategies. According to one game designer, "there is a whole suite of adaptation strategies out there; I mean, there's just dozens and dozens that we could have included, so I think it was just thinking about which ones would realistically be implemented in [this region], so we had to put some serious thought into that" (Participant E, personal communication, June 29, 2018). As pictured in Figure 3 (p. 110), the 2018 iteration of

the *Game of Floods* offered only a small cross-section of possible adaptive solutions to communicate the message and fit the game within a smaller window of time.

Relocating and Raising Assets		
Unit	Cost/Unit - Relocating	Cost/Unit - Raising
Estates or Townhomes	$ 100 k/home	$ 50 k/home
School	$ 2.5 M	$ 1 M
Hospital	$ 6 M	$ 6 M
Senior Living Center	$3 M	$1.5 M
Downtown village	$ 500 M	$ 350 M
Power plant	$ 25 M	$15 M
Park	$ 100 k	n/a
Pump station	$ 1 M	$ 200 k
Substation	$2 M	$300 k
Bridge	n/a	$ 10 M
Road - 10,000 linear feet	$ 200 k	$ 1 M
Bike path – 10,000 linear feet	$ 50 k	$25 k
Historic Courthouse	n/a	n/a

Asset Protection		
	Protective circular flood wall to 1' SLR	Protective circular flood wall to 3' SLR
Power Plant	$ 400 k	$ 700 k
Substation	$200 k	$ 300 k
Wastewater Treatment Plant	$ 500 k	$ 750 k
Stormwater Filtration Plant	$ 200 k	$ 350 k
Water Treatment Plant	$600 k	$800 k
Pump station	$100 k	$ 150 k
Transportation Hub	$200 k	$400 k

Shoreline Protection		
	Unit	Cost/Unit
Traditional levee – 1 feet of SLR	10,000 linear feet	$ 2 M
Traditional levee – 3 feet of SLR	10,000 linear feet	$ 5 M
Living levee – 1 feet of SLR	10,000 linear feet	$ 3 M
Living levee – 3 feet of SLR	10,000 linear feet	$ 8 M
Seawall – 1 feet of SLR	10,000 linear feet	$ 1.5 M
Seawall – 3 feet of SLR	10,000 linear feet	$ 4 M
Flood gates / Tidal barrier	Sized to close off harbor to 1 feet of SLR	$ 10 M
Flood gates / Tidal barrier	Sized to close off harbor to 3 feet of SLR	$ 15 M
Mangrove Restoration	10,000 linear feet	$5 M

Figure 3: A list of adaptive solutions from the Game of Floods *Participant Workbook developed by the Urban Sustainability Directors Network*

Urban Sustainability Directors Network – Climate Preparedness Training Toolkit

	Unit	Cost/Unit
Building Code Update to require new structures to be elevated above future flood elevations	Study and Implementation	$150 k
Solar and Wind Feasibility Study	Study	$250 k
King Tides Public Awareness Campaign and Warning Program	Study and Implementation	$200 k
Cost of Inaction Study to justify taking action to adapt to climate change	Study	$200 k
Track and monitor storm events and damage to identify vulnerable areas	Monitoring	$250 k
Update Hazard Mitigation Plan and identify potential flood mitigation projects	Study	$250 k
Develop guidance to consider sea level rise in Capital Improvement Planning process	Study	$100 k
Citywide Sustainability Plan	Study	$250 k

Figure 4: A list of non-structural solutions from the Game of Floods *Participant Workbook developed by the Urban Sustainability Directors Network*

The strategies available to players (as pictured in Figure 3 on p. 110 and Figure 4 above), offer non-structural and structural measures, such as relocation, raising, and protection. This set of options encourages the player to focus on fewer strategies while still offering a range that is representative of larger adaptive measures.

Similar design choices needed to be made about the selection of assets in the *Game of Floods*. Assets refer to infrastructure or facilities represented on the game board (see Figure 5, p. 112). Participants were tasked with evaluating and prioritizing key assets, generating an adaptation strategy that would protect them. There are, of course, an immensely wide range of assets to consider in any given region: "we had all these maps of (...) power supplies (...) and where septic systems could possibly be and public water systems (...). There's a lot of things

going on, so the less the better, right? So I only implemented what they would actually deal with in that geography" (B. Van Belleghem, personal communication, July 6, 2018).

Figure 5: The game board for the 2018 Game of Floods *developed by the Urban Sustainability Directors Network*

The 2018 iteration of the *Game of Floods* above depicts 24 assets, which is significantly pared down when considering the number of assets existing in a region like Hampton Roads, VA. Because the asset inventory round requires participants to read about each of the 24 assets, evaluate, and prioritize them, it's arguable that 24 is still too many to process given the time constraints of the game. Processing 24 assets takes time. However, they offer a wide range of

representative assets from tourist revenue sources, to the homes of vulnerable populations, to affected modes of transportation, and such a range is important for understanding the breadth of the issue.

   Abstract Map Design to Enhance Accessibility. While the MHT used maps of actual regions in Hampton Roads (see Figure 6, p. 114), the *Game of Floods* used a more simplified, abstract map of a hypothetical region (see Figure 5, p. 112). In the first iteration of the game, "the actual design of the game board (...) is loosely based off of some communities in West Marin," California (Participant E, personal communication, June 29, 2018). They made this design choice because they thought it would influence game play in positive and productive ways and help to avoid property battles. This design choice was utilitarian, as well: "If we had done it like actual land area, we would have had a poster like 50 feet long because the coast is so long" (B. Van Belleghem, personal communication, July 6, 2018). Because they had to make cuts anyway, they were required to think strategically about the impact it would make on the message and the way the *Game of Floods* would be played, and they chose to create an abstract likeness of the region to promote gameplay.

Figure 6: Satellite images of regions in Coastal Virginia used in the Hampton Multi-hazard Tournament *in 2018*

As satellite images of regions in Hampton Roads, the maps used in the MHT may be less accessible for audiences who are less familiar with inundation maps and the way they communicate. They require a certain level of literacy that the audience I observed in 2018 appeared to have, and the MHT was designed with this specific audience in mind; however, the use of satellite images limits the scalability of the game when considering broader audiences with less familiarity navigating inundation maps like these.

Games Themselves Enhance Accessibility. Interviewees identified that they selected a game as opposed to another form of communication because they felt it would more effectively capture the breadth of the issue. Van Belleghem indicated that the *Game of Floods* offered an "effective [way] to communicate complex issues and have people think about them comprehensively and simultaneously" (B. Van Belleghem, personal communication, July 6, 2018). Essentially, designers of both games are taking a very complex issue and distilling it into

something digestible, something players can grapple with in a limited time frame while still

providing a meaningful experience. The result is a game that enhances accessibility to content

with the goal of complicating players' understanding of that content, encouraging them to see

multiple facets simultaneously. Another game designer explained that the MHT was intended to

perform the following:

> Translate the hard work that these communities have already done, both technically in
>
> terms of qualitative risk identification and risk mitigation options available, within a
>
> framework that would help them see what the implications would be beyond what they
>
> would normally consider because of their own individual mandates, [while considering]
>
> what the costs would be relative to the benefits of their current budgets and strategies,
>
> versus taking the risk of releasing the tax burden but also making a significant difference
>
> in the reduction of social vulnerability, financial costs, health, etc. (Participant A,
>
> personal communication, June 7, 2018).

It's notable that the word translation is used here in reference to the work of communicating

these professional dynamics. In their seminal piece, "The Technical Communicator as Author:

Meaning, Power, Authority," Slack, Miller, and Doak (1993) discuss three ways that technical

communicators have been described and how these descriptions influence their relationship with

their texts and their audiences: transmission, translation, and articulation. Translation "can be

understood in terms of a primary concern with the constitution of meaning in the interpretation

and reinterpretation of messages," (Slack, et al., 1993, p. 14), which positions the communicator

as the "mediator of meanings" (Slack, et al., 1993, p. 14). At this moment in the interview, the

designer positions himself and his collaborators as mediators, gathering meanings that have been

dispersed across stakeholders and agencies and reinterpreting them into a single, comprehensive (and comprehensible) message about a large and complex network.

Games can be designed to communicate such complex messages because they represent systems and invite players to experiment therein. According to Jesse Schell (2008), in his influential book *The Art of Game Design: A Book of Lenses*, "games give us practice digesting and experimenting with simpler models, so we can work our way up to ones as complex as the real world, and be competent at dealing with them when we are ready" (p. 117). Game designers should, therefore, attend to the ways in which games "with their simple rules [operate as] pre-digested models that we can easily absorb and manipulate" (Schell, 2008, p. 117). One goal of game design is to design an experience that makes real-world processes simpler, so the participant can relax and play (Schell, 2008).

The designers of the *Game of Floods* and the MHT have constructed a simpler model out of the dispersed work patterns in coastal resilience and translated that model into the design of their game. Doing so affords players an opportunity to more easily consider the complexities of this reality and manipulate it as they work through problem-solving activities. By the time this model reaches the players, much of the "complexity has been stripped away" (Schell, 2008, p. 117), leaving a simpler framework that encourages the freedom to experiment and engage in creative problem solving.

Achieving this level of comprehensiveness required designers to distil quite a bit: "We're trying to use [the MHT] as a vehicle to integrate an awful lot of information that's already been done—[information] that's excellent but isolated" (Participant A, personal communication, June 7, 2018). Designing these games required them to research the work of various roles and draw information from multiple jurisdictions about their approach to the problem, while integrating

the latest policies. Van Belleghem, one of the designers of the *Game of Floods*, discussed her design process at length, demonstrating the sheer depth of research required to produce the game's version of coastal resilience:

> I went on all these tours of the different flood districts with public works staff, so I think we did one district a month, and they had a lot of new staff themselves, so they were taking everybody around and also having all the zone engineers see things happening in the other zones that they weren't necessarily in charge of, and I got to tag along and learn with them, and we had to call the different firms that we knew about to get information on the cost impacts of the engineering tools, so that was definitely the biggest learning benefit for me, personally, and then like I said, you learn a lot about the cultures of engineering versus planning and maybe the different conflicts that could arise, (...) so there's this multiple aspect of learning actual engineering material and then sort of the bureaucratic culture of the different departments that are working together but are not necessarily approaching things the same way all the time (B. Van Belleghem, personal communication, July 6, 2018).

This designer had to conduct field work to achieve a comprehensive view of the issue, exploring the engineering and the bureaucracy across various jurisdictions so that she could capture it all in an activity that would take 2 hours. Her process, and the product it resulted in, represent an impressive act of technical communication—focusing the vast complexity of this issue into something usable and comprehensible. The following was said of the *Game of Floods*, but it applies to both: "Once it was played, it became very clear that this is exactly how you build a hazard mitigation plan; this is exactly how you analyze what your threat hazards are and you prioritize how you're going to mitigate them and (...) boil into three hours what typically a

community will spend 15-18 months doing" (Participant D, personal communication, June 26, 2018). Overall, the game designers had to consider as many facets of the issue as possible and find a way to communicate the breadth of coastal resilience into something that would be useful to an audience within a brief timeframe.

This work is reminiscent of technical communication, as the work of communicating complex information is central to the identity of the field: "the field of technical communication is concerned with how professionals communicate complex information with specialist and nonspecialist users in order to solve practical problems" (Henze, 2016). Technical communicators "work to ensure that information resources meet users' needs" (Hart-Davidson, 2013, p. 50), which involves evaluating "information products for usability and usefulness, and based on findings (...) recommend and help guide improvements. (...) Technical communicators are distinctively skilled in assuring that such artifacts succeed rhetorically with audiences" (Mirel, 2013, p. 285). While these definitions are broad enough to capture a wide range of skills and goals, communicating complexity is integral to all of them. Technical communicators help make sense of complexity, and that's quite clearly a chief consideration of these game designers and facilitators.

Games Provide an Alternative, Improved Communication Method

As unique manifestations of technical communication and game studies, these games don't just distil complex notions of coastal resilience. They offer an alternative communication method that interview subjects see as an improvement upon more common genres of technical communication (discussed 34 times across 6 interviews). Much of their excitement about these games appeared to come from the fact that these games weren't PowerPoint presentations. This connection demonstrates that they were intentionally adopting games as a replacement for more

traditional forms of technical communication. Instead of inviting a speaker to relay information from a podium, they wanted to encourage more audience participation, and they felt the games offered an opportunity to do just that. As practitioners who attend meetings often, games offered a refreshing alternative.

Games as Refreshing, New, and Improved Forms of Communication. What kept emerging across interviews was the perception that a game is better than presentational speaking, which is the typical format these practitioners use. Table 4 (p. 120) lists a collection of statements from every interview subject, where they compare the games with presentational speaking, and the way each subject frames their comparison is strikingly similar:

"The uniqueness of this was (...) its structure—I got the impression that most people had never done anything like this" (Participant A, personal communication, June 7, 2018).
"We attend a lot of meetings, and so we were trying not to make this another meeting but to get them engaged—actively engaged—in developing strategies. (...) We go to so many different meetings that having the fun element would make it different and engaging and really motivate them, working together, and in one aspect I think it did. I think it made it interesting, but as we saw from the feedback, I think it was distracting, so I think it could play as a strength and a weakness" (Participant B, personal communication, June 16, 2018).
"I would say the overall workshop of having people come in and do [a] mix of Q&A and presentations (...)—that's fairly typical. The Game of Floods component (...), as far as I know, has not been done, and we usually don't do games like that" (Participant C, personal communication, June 15, 2018).
"First of all, people are sitting around a table, looking at each other, collaborating. That does not happen in the typical meeting setting where we have rows of chairs, and a speaker in front, and what is typically a deadly PowerPoint. (...) So I think the fact that it was a different physical format, it was colorful, it was something different. I think everybody responded to the fact that it wasn't another PowerPoint, and the level of engagement was much stronger right from the beginning" (Participant D, personal communication, June 26, 2018).
"It's a little more engaging than just sitting there and watching a PowerPoint or listening to someone just talk about it. They can actually be involved in it. (...) Just listening to PowerPoints can be kind of boring to some people, and we thought a game would sort of resonate with people more in the long term, and if they're actually playing, then it's a little more, I mean they have to obviously process these concepts and apply them; whereas, if they're just sitting there listening to a PowerPoint, they could leave and not have to synthesize it in any way" (Participant E, personal communication, June 29, 2018).
"Traditionally, you'd have presentation after presentation after presentation, and then you'd be like, well ok what do you think? So I think this gives a way to do that, and it also gets people to engage with each other and the community about it instead of it being: we're the government officials, we have this to say, and you listen, so I think it gives that as well" (B. Van Belleghem, personal communication, July 6, 2018).

Table 4: Interviewees' comparisons between the Multi-hazard Tournament *and/or the* Game of Floods *and presentational speaking*

These statements demonstrate that the interviewed designers and facilitators see the games directly replacing more common forms of technical communication that they would otherwise engage in to perform their work, namely presentational speaking. The two elements that appear to distinguish games from presentations, according to the perceptions of these designers and facilitators, are that 1) they're more engaging, and 2) they're more engaging because they encourage greater participation on the part of the audience.

      Framing Participation and Engagement According to Conversation. Engagement is often highlighted in discussions about serious games (Aleksandra, et al., 2016; Gee, 2003; McGonigal, 2011; Morganti, et al, 2017; Nussbaum, et al., 2015), and these interviews were no exception. Interviewees framed engagement according to the core dynamic of the game: conversation. If players are talking through the problem, they're actively engaged: "getting them engaged and actively participating, we felt that that was a better opportunity; they were actually busy working on a project" (Participant B, personal communication, June 16, 2018). Engagement is slippery and immeasurable, but these codes indicate that designers and facilitators are very interested in experimenting with modes of communication that change speaker-audience dynamics. Overall, they hope these games move people to act—both within and beyond gameplay itself.

      Interviews suggest that game designers and workshop facilitators involved in the MHT and the *Game of Floods* have reflected on what they believe sets their game apart from other forms of communication (and there are distinct similarities in the qualities they highlight); however, they don't necessarily define the meaning of terms like "engagement" or "participation." Schell (2008) argues that this is common in game design: "as with many fields of design, game designers follow their gut instincts and feelings about what makes a good or a bad

game, and sometimes have difficulty articulating what exactly it is about a certain design that is good or bad—they just know it when they see it" (p. 25). Terms like "engaging," "fun," and even "participation," are difficult to pin down. As Schell puts it, "Some of the ideas we will have to deal with are necessarily murky. Terms like 'experience,' 'play,' and 'game' are defined differently by different people, and considering that the ideas these terms represent do not have clear definitions even after the thousands of years we've been thinking and talking about them, it is unlikely they will be rigidly defined any time soon" (Schell, 2008, p. 25). While these practitioners are not formal game designers, I see them operating in a similar way, drawing from their training in urban planning traditions and their experience in designing and carrying out workshops. Their professional experience drives their sense of what is more or less engaging and participatory within their community, as well as what is more or less fun.

Based on my observations and my understanding of the interview data, I suspect the interviewees would consider "engagement" and "participation" according to audience conversation. When they see the audience engaging in a conversation about coastal resilience as a means of responding to the rules and challenges of the game, they see that behavior as more active than the behavior they see audiences perform during a slide presentation. Interview data suggests they believe dialogue is more active and participatory, and thus more effective, than sitting and listening to one person speak.

This interest in promoting active dialogue is likely driven by the growing concern, developing in the 80s and 90s, over public involvement methods and the push toward more inclusive models in the field of IWRM and urban planning (Palmer, et al., 2013). As practitioners with a background in these fields, they're likely influenced by such literature and

turn to CC games as a means of fostering collaborative approaches that are more common in their line of work today (Palmer, et al., 2013).

These goals resonate with scholarship in related fields, such as technical communication and education, as well. Rhetorical models in the field of technical communication caution against frameworks that limit audience participation and magnify a single speaker (Gottschalk-Druschke & McGreavy, 2016; Grabill and Simmons, 1998; Simmons, 2007; Slack, et al., 1993; Staggers, 2006). Educational theories regarding constructionism and enactivism hold that learners are best guided through powerful educative conversations with one another as opposed to listening to a lecture, and games have long been employed to assist in these efforts (Li, 2013). Kurt Squire (2011) writes about the role games can play in shaping a player's experience, particularly an educative experience: "within game contexts, at least two qualities are important: (1) the learning cycle of a player developing goals, reading the game space for information, taking action in the game world, and then reading games for feedback; and (2) the social experience of participating in particular game communities" (Squire, 2011, p. 30). For Squire, meaning-making is both productive and social. James Paul Gee (2003), another prominent figure in discussions about edutainment, also believes learning is active and social. According to Gee (2003), "games are potentially particularly good places where people can learn to situate meanings through embodied experiences," (p. 26) and games often involve players in social groups (which he calls "affinity groups"). As social groups, they collectively shape one another's goals and values to align with members of that domain.

There is another layer to this notion of conversation in games. Scholarship in game design points to an ongoing conversation between the game creator and the player. Anna Anthropy and Naomi Clark (2014) describe this level of conversation in the following way:

conversation is happening between the creators of the game and the player. It's a tricky

kind of conversation to have. As the creator, you have to hope that what you're saying in

the conversation—through the rules and shaping of the experience as well as the words,

images, or sounds you've added to the mix—gets across and finds a player, somewhere

out there, who responds with choices, thoughts, and maybe even interesting strategies and

emotional engagement (n.p.).

The way the designer structures the game limits the way players can respond (Anthropy & Clark,

2014). Viewing the game in this way (as a conversation between the game designer and the

player) affects the interpretation of "participation." The game designer makes meaning through

design choices (selecting visuals, themes, mechanics); the game player makes meaning by

playing the game according to the creator's design (or perhaps by appropriating game rules).

However, players may be "controlled by the design of the game to act in specific ways" (Li,

2013, p. 28); player participation is limited when they don't have access to design. Participation

can, arguably, be greatly enhanced by inviting players to contribute to the design of the game

through approaches such as transformative play, "where inventing and transforming the rules are

part of the game's design" (Salen & Zimmerman, 2003, p. 305), or learning by game building

(Li, 2013), where participants are invited to engage in meta-analysis or to build a game as a

means of exploring a concept.

Games Operate as Boundary Objects

When I was categorizing the themes present in the interview data, I debated whether to

file participants' references to the features of boundary objects as a sub-theme or code supporting

the theme discussed above, as further evidence that participants frame these games according to

the goals of technical communication. I considered this because the notion of boundary objects

has been employed in the field of technical communication for over a decade: Wilson and

Herndl's (2007) influential article "Boundary Objects as Rhetorical Exigence: Knowledge

Mapping and Interdisciplinary Cooperation at the Los Alamos National Laboratory" makes a

case for the rhetorical significance of Star and Griesemer's (1989) notion of boundary objects.

As Star (2010) explains, boundary objects are intended to help us understand work patterns as

they pertain to situations that involve the collaboration of disparate groups. It's arguable that all

artifacts of technical communication operate as boundary objects, whether they're intentionally

designed to do so by their creators or not. Instead of representing this data as a sub-theme,

however, I chose to distinguish it as a major theme because the notion of boundary objects

doesn't originate in the field of technical communication (rather, it comes from science and

technology studies) (Wilson & Herndl, 2007), and I wanted to highlight the unique rhetorical

work these practitioners were hoping to achieve. In this section, I discuss how game designers

and workshop facilitators unintentionally frame these games as boundary objects during

interviews, sharing further results of thematic analysis, and I organize this section according to

the structure of the codesheet below.

    Games operate as boundary objects (101)

        Based in action; game as tool (game is something actors act toward and with) (17)

    Integrative exigence (a good communicative device; a thing that highlights

    lines/demarcation and fosters shared social and discursive space): (37)

        brokers a conversation (11)

        multiple perspectives (20)

        Value of roles/role-playing (6)

Interpretive flexibility (different outcomes, uses; scalability) (47)

> Scalable/adaptable (references to its adaptability to new contexts/audiences or
> multiple interpretations) (6)
>
> Education/awareness/problem-solving (as one scalable/flexible use) (32)
>
> Low-stakes (fosters collaboration without need for consensus; no victory
> condition/no right answer) (9)

Games are Based in Action

I label the first sub-theme relating to boundary objects "based in action" (discussed 17 times) according to Star's (2010) explanation that a boundary "object is something people (...) act toward and with. Its materiality derives from action, not from a sense of prefabricated stuff or 'thing'-ness" (p. 603). This sub-theme focuses on references to the game as a tool, referring to moments when the interviewee specifically used the term "tool" when talking about the game. This word choice demonstrates the interviewees' emphasis on action: that players must act toward or do something with the game (operate it as a tool), and this action is embedded in group conversation.

Games are Viewed as Tools. Every interviewee used the term "tool" when referring to a given game: a "valuable tool" (B. Van Belleghem, personal communication, July 6, 2018), a "useful tool" (Participant C, personal communication, June 15, 2018), a "wonderful tool" (Participant E, personal communication, June 29, 2018), a "collaborative and communications tool" (Participant D, personal communication, June 26, 2018), a "training tool, (...) a teaching tool" (Participant A, personal communication, June 7, 2018), and an "educational tool" (Participant B). This range of modifiers for the word "tool" suggests a high level of interpretive flexibility; the games certainly mean different things to different people. Overall, using the word

tool to describe the game is notable, and its prominence across the six interviews was striking. It could be that "tool" is common parlance in coastal resilience communities when referring to communication artifacts, but it does suggest that the game is regarded as a passive object that cannot act on its own. Someone must act with it. It must be played; it must be contextualized. The game is "something people (...) act toward and with" (Star, 2010, p. 603), and that action is what unlocks the power and meaning of the game.

The view of games as active is common in game studies. According to Alexander Galloway (2006), games are actions. While he was speaking of computer games in particular, this view of games can be applied to board games, as well: "if photographs are images, and films are moving images, then video games are actions. (...) Without action, games remain only in the pages of an abstract rule book. (...) They exist when enacted." (Galloway, 2006, p. 2). A game's rule book is an invitation to action, and rules shape the choices players can make during play (Anthropy & Clark, 2014; Salen & Zimmerman, 2004). For Sicart (2011), "the meaning of a game, its essence, is not determined by the rules, but by the way players engage with those rules, by the way players *play*." The game cannot act on its own. It's a tool, and it's what players do with that tool that makes it a meaningful boundary object. The primary action I observed in the games played at the 2018 events was conversation. Other actions supporting conversation involved listening, reading (the playbook or guide), and writing (in the guide or inputting data in the DST).These games required participants to speak to one another to complete rounds of gameplay: they needed to read, discuss, advocate for specific assets, ask questions, debate, and agree upon a plan to protect the assets in front of them. While the *Game of Floods* required hand-written recording of these conversations to indicate each group's final plans, the MHT required additional action with the Decision Support Tool. A facilitator was positioned at each table with

a computer, tasked with inputting the group's choices into the Excel program to help them determine the best plan of action. The primary and most significant action across the two games, however, was the act of conversing.

Games Encourage an Integrative Exigence

As boundary objects, these games work toward an "integrative exigence," and participants reflected on this fact 37 times across the six interviews. This phrase comes from Wilson and Herndl's (2007) argument that "a boundary object can also function as a rhetorical construct that encourages an integrative rather than a demarcation exigence" (p. 132). These games ultimately work toward an integrative exigence by fostering dialogue among stakeholders from different disciplinary and jurisdictional backgrounds. I noted any instances in the transcripts where interviewees highlight dividing lines as well as the way these games create a shared space: moments where they refer to the desire to process multiple perspectives within and through the game, moments where they articulate the desire to achieve common ground and foster conversation, as well as moments where they underscore the significance of their professional roles or role-playing within the game. While there was a longer list of codes for this sub-theme in early rounds of coding, I organized these moments into three categories: brokers a conversation (which was discussed 11 times), multiple perspectives (discussed 20 times), and value of roles/role-playing (discussed 6 times).

Each interviewee discussed the inherent communication and collaboration challenge faced by key stakeholders of coastal resilience, and one workshop organizer affiliated with the *Game of Floods* described it accordingly:

There's a real discrepancy among the communities that are part of this PDC. We have

both very small communities with very few staff, who wear a lot of hats, and in that case,

they're not so siloed; however, they have such a burden in terms of the multiple roles that

they play that they don't necessarily get an opportunity to take advantage of meeting with

their colleagues and sharing ideas, and then there's the larger communities (...) where

everybody has a very narrow lane, and the silos are much greater, although perhaps they

have less of a workload and so could share and facilitate a little more than they do, but

it's part of the community culture that they don't necessarily (Participant D, personal

communication, June 26, 2018).

These communities have an interest in communicating and collaborating across jurisdictional

boundaries, but there are barriers that they're working against.

Another interviewee associated with the MHT also points to a level of separation that

they're trying to work against: "we attend these meetings, and we see different ways that

communities are addressing flood risk, and we hear about different programs separately. I think

[this game] brings people together and say now how do you implement it" (Participant B,

personal communication, June 16, 2018). What they describe aligns with the kinds of situations

Star and Griesemer (Star, 2010) were interested in examining: "extremely diverse groups of

actors [such as] researchers from different disciplines" (Star & Griesemer, 1989). Wilson and

Herndl (2007) likewise examine "a technical community butting up against a problem they

cannot solve, not solely because the problem is large and complex but also in part because of the

obstacles imposed by different disciplinary and organizational perspectives on the problem"

(Wilson & Herndl, 2007, p. 130).

Across the six interviews, participants underscore a desire to foster collaboration to

combat this silo effect. Workshop facilitators worked toward "cross-pollination" (Participant B,

personal communication, June 16, 2018) by "putting people on teams and deliberately mixing

them from different backgrounds" (Participant A, personal communication, June 7, 2018). They

underscore how the game is intended to get players "to be thinking about 'how do you

communicate about mitigation? How do you collaborate? How do you see other people's points

of view, and ultimately how do we all come together to make these hard choices?' (...) I saw [the

Game of Floods] as being a simple enough way of getting to that conversation" (Participant D,

personal communication, June 26, 2018). Teamwork among mixed groups of stakeholders and

competition between teams were game dynamics that were highlighted as a contributing factor

for establishing common ground: "we found a common ground for people regardless of their

cultural or educational background [because] sports is something everyone gets, and so it was a

natural way to break the ice and psychologically have a willingness to work together"

(Participant A, personal communication, June 7, 2018). Overall, it was clear that interview

subjects wished to work against a demarcation exigence and use the game to create a shared

social and discursive space, serving an integrative exigence.

Games Afford Interpretive Flexibility

Another prominent sub-theme was "interpretive flexibility," which was discussed 47

times across the six interviews. I collapsed a long list of codes into three main codes for this sub-

theme: "scalable/adaptable" (discussed 6 times) for moments when interviewees referred to the

ability to adapt this game to new contexts or audiences and its openness to multiple

interpretations, "education/awareness/problem-solving" (discussed 32 times) for moments when

they highlighted education or awareness as one specific use or application, and "low-stakes"

(discussed 9 times) for moments when they noted that the game had no right answer, no

significant contribution to policy-making, and thus no need for consensus.

Games are Scalable and Adaptable. For Star and Griesemer (1989), "boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star & Griesemer, 1989, p. 393). Interviewees reflected on the flexibility of their games, their widespread appeal, and their usefulness in different contexts: they framed the games as scalable/adaptable (discussed 6 times across 6 interviews). Of the MHT, one interviewee said the following:

> They could use [the game] as a tool to even use alongside developing their next hazard mitigation plan or they could use it prior to a hurricane landfall maybe at the beginning before a season begins and assess 'what is our risk for the community,' and the data that's developed during hazard mitigation plans are really well suited for that type of analysis, and they could use that as kind of a tournament maybe not necessarily competition-wise but just to determine what their risk is and where their centers of damage would be, so we really feel like they could use it in many situations (Participant B, personal communication, June 16, 2018).

The wide spectrum of potential uses and applications of these unique boundary objects likely explains why they have been adapted and employed in every state in the nation as well as nations abroad.

Games can be Adapted for Education or Awareness. One way practitioners framed these games as adaptable is in their discussions of different educational uses (discussed 32 times). The MHT was primarily designed to teach participants about the notion of tradeoffs when developing mitigation plans and adopting adaptation strategies. As I recorded in my observational field notes, one element that was repeated often throughout the rounds of the MHT

was that the organizers and facilitators wanted participants to understand that every approach to enhancing resilience had "tradeoffs." According to the Tournament "playbook," which was distributed to participants via email prior to the event and printed for their use at team tables, the Tournament was designed to "tell the participants where potential future projects would be useful for mitigation when opportunities arise; how much they may gain in CRS points [a Community Rating System by FEMA related to flood insurance premiums] for particular investments; what projects (management measures) are most appropriate for different kinds of coastal flooding events; where you can get funding for these options," (Playbook) and offer a deeper understanding of cost/benefit ratios. The USACE also had the following goals for the tournament: "provide information useful for feasibility studies; introduce the NACCS Coastal Storm Risk Management Framework to show how this resource and associated data can best be used; illuminate connections between NACCS and options for local governments to invest in hazard mitigation strategies" (Playbook). The NACCS identifies hazards from Maine to Virginia, as well as mitigation measures that would be appropriate for these regions, so organizers "tried to employ those to take the NACCS another step" (Participant B, personal communication, June 16, 2018). That, coupled with recently acquired data about Salter's and New Market Creek from the Continuing Authorities Program Project, fueled the data that shaped the DST. The MHT was tailored to communicate very specific learning objectives.

The learning objectives for the *Game of Floods* revolved around the goals of the day-and-a-half workshop that served as the context for the game. Within the context of the larger workshop, the game was being leveraged to start a conversation and support mitigation plans:

We were looking for a way to engage the Hampton Roads PDC in an ongoing

conversation over the next year, looking at how to integrate better planning in all of their

planning mechanisms, so having their hazard mitigation plan talk to their comprehensive

plan talk to their transportation plan, making sure their economic development was

sympathetic with their hazard mitigation plan goals, to also increase flood insurance

premiums in the area (Participant D, personal communication, June 26, 2018).

As a result, both the *Game of Floods* and the MHT had been adapted to achieve specific

educational goals, while raising awareness about aspects of coastal resilience. These learning

outcomes are unique to the Hampton Roads contexts, though; they don't apply to every

application of the games, which speaks to their interpretive flexibility as a boundary object.

They've been adapted to fit the needs of this very specific context.

      Games Offer Low Stakes Exploration and Interpretation. Not only do these games

flexibly adapt to different contexts (different communities and planning districts, as well as

different training foci). They also invite multiple interpretations from their players. Interviewees

suggested that players interpret the problems presented by the games in different ways, and this

freedom of interpretation is due, in part, to the low-stakes nature of the games (discussed 9 times

across 6 interviews). For example, the MHT integrated a scoring mechanic, where a rating

system derived a score that would determine a winning team at the end. This mechanic resulted

in a competition dynamic. Despite this fact, the facilitator announced "you're all winners" at the

conclusion of the MHT, and the designer of the *Tournament* underscored the importance of

creating a "safe and mature way to share knowledge" (Participant A, personal communication,

June 7, 2018). While competition could work against this goal, the facilitators and designers

emphasized the low-stakes nature of their game. The *Game of Floods*, on the other hand, had no

victory condition of any kind. Groups shared their adaptation strategies in a final reflective

discussion, but no winner was declared: "you really don't win or lose the game of floods because

it's all about tradeoffs, and there's not a right or a wrong way to do these things" (Participant E, personal communication, June 29, 2018). Competition and victory condition aside, the open-ended nature of the games' conclusion lowers the stakes and allows for greater interpretive flexibility which is, again, a characteristic of boundary objects (Star & Griesemer, 1989; Star, 2010). Each team works the problem in their own unique way, resulting in a wide array of potential solutions. It may be that an underlying belief was woven into the design of the games here: "We don't necessarily have the answers. And then when there are answers, there isn't a lot of money, so there is a lot that needs to be considered" (B. Van Belleghem, personal communication, July 6, 2018). The games are designed to foster these many considerations and allow for multiple interpretations.

There are many moments across game studies literature where scholars note the significance of low stakes play. There is the belief that games offer "better hope of success" (McGonigal, 2011) because they tend to be scaffolded in such a way as to fit players' capabilities and enable them to advance. They provide "just-in-time and on-demand information situated in the sorts of contexts in which it makes sense and can be used" (Gee, 2013, p. 132). They train players by having them work through a subdomain that builds toward fruitful generalizations along a path of timely instruction. As a "designed experience," (Squire, 2006) there is intentionality behind the content and pacing of a game, opening opportunities for game players to adopt and assume identities while enacting problem-solving techniques that enable them to analyze a system and effectively act within it. Games "allow us to play with representations (…) and to test the rule systems of those representations" (Squire, 2011, p. 30). In his influential book, *Man, Play, and Games*, Roger Caillois (1961) presents an argument for the role of games in human culture and their impact on social behavior. As he discusses the role of games in

culture, he compares the low stakes nature of games to the high stakes realities they simulate. Games like the MHT and the *Game of Floods* invite players to engage in a representation of a reality, and because it is a representation, players have more room to interpret it in various ways and experiment with problem-solving strategies that they might not have the means or the opportunity to attempt in other spaces.

What's fascinating about these multiple interpretations from the perspective of boundary objects is expressed by Star and Griesemer (1989):

> When participants in the intersecting worlds create representations together, their different commitments and perceptions are resolved into representations (...). This resolution does not mean consensus. Rather, representations, or inscriptions, contain at every stage the traces of multiple viewpoints, translations and incomplete battles (p. 413).

These games bring stakeholders from different backgrounds together toward the goal of developing a shared vision for adaptation, and this shared vision ultimately captures the varied positions and "incomplete battles" inherent in coastal resilience. Additionally, each team's vision may differ wildly from one another's. These boundary objects, therefore, may produce more variation than they do consensus, but consensus isn't necessary for boundary objects to operate; variation is more important, particularly when the goal is to "have people think (...) comprehensively and simultaneously" about this multifaceted issue (B. Van Belleghem, personal communication, July 6, 2018).

A Heuristic for Assessing the Rhetorical Boundary Work of Climate Change Games

CC games such as the *Game of Floods* and the MHT are so multifaceted that neither technical communication nor game studies alone can fully explain them; however, when used in conversation with voices from the practitioners who design and employ these games, this subject

of study can begin to come into focus. To work toward a clearer view of CC games employed in stakeholder engagement contexts, I combine scholarship presented in chapter 2 with my results of thematic analysis of interview data presented in this chapter to generate a heuristic. This heuristic is borne from interview and observation, rooted in notions of boundary objects, charrettes, and game design, and can be used as both an analytical framework to unpack these games and a tool for designing future stakeholder engagement games. As a "rough framework" (Johnson-Eilola & Selber, 2013, p. 4), heuristics do not offer a "definitive solution" (Johnson-Eilola & Selber, 2013, p. 5); further work is needed to test the validity and usefulness of this heuristic and foster flexible and effective approaches to CC game design.

Overall, my findings suggest that CC games designed for stakeholder engagement workshops should foster boundary work for a varied audience within an intense design period using charrette and game design strategies. As a result of my analysis of theories, interviews, and observations, I present the following heuristic (Figure 7, p. 137), arranged according to rhetorical notions of purpose, audience, context, and strategies:

Foster **boundary work** for a **varied audience** within an **intense design period** using **charrette and game design strategies.**

Purpose	Audience	Context	Strategies
• work toward inclusive and dialogic cooperation that should not necessarily pursue consensus; • enhance accessibility to the issue by presenting clearly articulated problems/challenges (preferably artificial conflict) for the audience to address; • be easily adaptable and scalable, able to serve varying audiences, purposes, and contexts.	• involve a heterogeneous audience of stakeholders, made up of different disciplinary and professional backgrounds.	• take place within an intense design period, within a single- or multi-day workshop.	• articulate clear rules to govern rounds of audience participation and production; • provide adequate feedback to achieve discernibility and integration; • feature physical design tools (such as prototyping materials) as opposed to digital programs; • result in a quantifiable outcome, concluding with plans to address the articulated problems/challenges.

Figure 7: The Rhetorical Boundary Work Heuristic

The Rhetorical Boundary Work Heuristic (Figure 7, p. 137) links interview and observational

data to theory on boundary objects, technical communication, charrettes, and game design.

Together, they produce a metric for assessing existing CC games used in stakeholder workshop

contexts, while offering a guide for producing future iterations.

First, scholarship and interview data suggests that CC games should work toward

dialogic cooperation and collaboration and should not necessarily pursue consensus. This notion

is largely influenced by scholarship on boundary objects but includes elements from rhetoric and

the charrette tradition, as well. In order to broaden individual perspectives through dialogue,

dialogue must be free and equal. Each participant must have the same access to meaning making

with no one voice prioritized over another. Equal access is supported by Porter's (1998) "rhetoric

of democratization," where an audience collaboratively constructs knowledge, and charrettes

have been known to operate in this way, as well. In a charrette, the designer "swaps from a prima

donna role to a (...) serving and/or facilitating role" (Roggema, 2013, p. 20). In addition to a

flattened hierarchy for equal access to meaning making, it's important that CC games remain low

stakes to invite open communication. Working toward collaboration without consensus helps to

ensure that the exercise is low risk, with few implications for the participants' stake or

jurisdiction.

CC games should enhance accessibility to the issue by presenting clearly articulated

problems/challenges—preferably artificial conflict—for the audience to address. This

recommendation represents a blend of game design theory and the charrette tradition, as well as

technical communication, and it reflects the interests of the participants I interviewed. Charrettes

are structured so that, "faced with a problem or challenge the participants pool their talents to

produce plans to achieve a goal" (Roggema, 2013, p. 15). While a charrette may generally

present a problem tied to the region where the event is held, it's best if CC games present a hypothetical situation as a means of producing "artificial conflict." Artificial conflict is identified as a defining feature of game design, according to Salen & Zimmerman (2004), and it would continue to foster a low-stakes environment for creative design work and the free sharing of ideas. I add the notion of enhancing accessibility to the issue as a result of interview data, but it also reflects game studies scholarship: specifically, business games project "parts of specific economic, political, or social systems and [offer] a simplified access to the complex correlations in these systems" (Nohr, 2011, p. 1). Interview data indicates that the goals for the MHT and the *Game of Floods* is partly to provide a comprehensive view of coastal resilience, distilling the complexity of such a broad issue into a limited, workable exercise. This notion of distilling complexity and communicating it in a clearer, more usable and useful form captures common views of technical communication, as well.

CC games should be easily adaptable and scalable, able to serve varying audiences, purposes, and contexts. Adaptability is a feature of boundary objects. According to Star & Griesemer, 1989), "boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star & Griesemer, 1989, p. 393). Interviews indicate that scalability and adaptability are important to this community, as stakeholder workshops emerge in different regions and contexts, and their purposes and audiences vary. As a result, CC games used for stakeholder engagement must be flexible to be of any use.

Scholarship and interview data suggests that CC games should involve a heterogeneous audience of stakeholders, made up of different disciplinary and professional backgrounds). This call for heterogeneity comes from theories about boundary objects as well as applications within

the charrette tradition. Boundary objects "explain the activity in just these sorts of interactions in which people from many different communities participate on a common project" (Wilson & Herndl, 2007, p. 134). Charrettes have historically been structured to involve "all disciplines from the start" (Lennertz, et al., 2014, p. 3). For these games to successfully achieve their goals, they should be played by as varied an audience as possible, broadening individual perspectives through dialogue among participants with different backgrounds.

CC games should take place within an intense design period, within a single- or multi-day workshop. This suggestion is drawn from the charrette tradition and was observed in the 2018 events I attended. A charrette is "an intense period of brainstorming and design," (Roggema, 2013, p. 15) so gameplay should feel intense. Participants should have enough time within a round to produce a valid response while feeling pressured to move quickly. Short bursts of activity promote focus and foster a low-stakes environment. It's preferable if gameplay can invite participants to not only brainstorm but to design, as well. Design might take the form of generating a hypothetical adaptation plan, or designing elements of the game during gameplay, or inviting participants to design a CC game themselves.

CC games should articulate clear rules to govern rounds of audience participation and production. This suggestion is an extension of the previous one regarding enhancing accessibility, and it comes from game design. Most definitions of games refer to rules and the important way they communicate messages and shape the players' experience. Salen and Zimmerman's (2004) definition is no different: games are "defined by rules" (2004, p. 80). Rules should guide a player's actions, prompting them to make choices that relate to the topic of the game, thereby communicating messages about the possibilities and limitations of agency as it relates to climate change.

CC games should provide adequate feedback to achieve discernibility and integration. This suggestion is drawn from game design and uses terminology from Salen and Zimmerman (2004). According to Salen and Zimmerman (2004), "discernable means that the result of the game action is communicated to the player in a perceivable way" (p. 34). Proper feedback helps the player understand what effect their choices or actions might be having, allowing them to adjust accordingly to succeed in the game; otherwise, their actions may feel random and disconnected. An additional consideration is that, "whereas discernibility of game events tells players what happened (I hit the monster), integration lets players know how it will affect the rest of the game (If I keep on hitting the monster I will kill it. If I kill enough monsters, I'll gain a level.)" (Salen & Zimmerman, 2004, p. 35). The two elements combine to foster meaningful gameplay.

CC games should feature physical design tools, such as prototyping materials, as opposed to digital programs. This recommendation narrows the focus to tabletop workshop games within the broader CC game genre. There are a number of computer games within the CC game genre, and even several tabletop workshop games that feature a digital component, such as a calculator or modeling program. As a result, this recommendation may require adjustment and may not be necessary, but I include it as a result of my observations of gameplay and as a means of aligning CC games with charrette models. Charrettes often employ a "hands-on crafted approach to problem solving as opposed to digital graphics" (Kasprisin, 2016, p. 150). This approach is not only faster and easier to implement in workshop settings; it helps to foster democratic engagement across all members. A digital program may require some level of training or expertise that not all members have, which creates an imbalance. If there is only one electronic device per table, only one person is manning the digital program, creating an imbalance. Physical

tools help limit these effects.

Finally, CC games should result in a quantifiable outcome, concluding with plans to address the articulated problems/challenges. This suggestion reflects my observation of these games and combines aspects of game design with common approaches to charrettes. Salen and Zimmerman (2004) indicate that a game should result "in a quantifiable outcome" (p. 80), such as a score or a winner. I pair this with approaches to charrettes, where "participants pool their talents to produce plans to achieve a goal" (Roggema, 2013, p. 15). As suggested earlier, rounds could result in the development of a hypothetical adaptation plan or even a game design plan, where participants propose adjustments to an existing game or propose the design of their own CC game.

Conclusion

While I listened to my interview recordings, I could hear more than the voices of my subjects. I could also hear the voices of scholarship in technical communication, game design, and boundary objects, pointing toward inclusive, dialogic communication that involves diverse audiences in an intense, active, and playful experience. While these practitioners are directly influenced by fields like modeling and simulation and urban planning, their use of games as a response to the communication challenges they face draws in values and approaches that they may not have intended. Bringing these values and approaches to light helps connect their work to additional fields of study for further professional and academic pursuits.

After listening to interviewees' stories about their design process, intended purposes, and uses for these two games, I could see notions of technical communicators and game design rising to the surface. Two major themes emerged in the data: first, these two games reflect common goals in the fields of technical communication and game design, and second, they operate as

boundary objects. In regard to the former, these games were designed to communicate complex notions of coastal resilience while offering an alternative to more common, presentational methods of communication. In regard to the latter, interviewees demonstrated a desire for these games to foster an integrative exigence with interpretive flexibility, and they valued the way these games engaged players in action. I combine these themes with literature on technical communication, game design, and urban planning (as discussed in chapter 2) to produce a heuristic that is grounded in practice and theory, and I organize it according to the rhetorical concepts of purpose, audience, context, and strategies as a means of facilitating analysis. In the following chapter, I use this heuristic as an analytical framework for assessing the MHT and the *Game of Floods*, determining how they work toward these goals.

CHAPTER V

APPLYING THE RHETORICAL BOUNDARY WORK HEURISTIC TO THE *MULTI-*

HAZARD TOURNAMENT* AND THE *GAME OF FLOODS

Interviews and observations, as well as theories of game design and boundary objects, point toward the following goals for cooperative tabletop CC games designed for stakeholder engagement workshops (see Figure 7, p. 137). Such games should foster boundary work for a varied audience within an intense design period using charrette and game design strategies by achieving the following goals:

- work toward inclusive and dialogic cooperation that should not necessarily pursue consensus;

- enhance accessibility to the issue by presenting clearly articulated problems/challenges (preferably artificial conflict) for the audience to address;

- be easily adaptable and scalable, able to serve varying audiences, purposes, and contexts;

- involve a heterogeneous audience of stakeholders, made up of different disciplinary and professional backgrounds;

- take place within an intense design period, within a single- or multi-day workshop;

- articulate clear rules to govern rounds of audience participation and production;

- provide adequate feedback to achieve discernibility and integration;

- feature physical design tools (such as prototyping materials) as opposed to digital programs;

- result in a quantifiable outcome, concluding with plans to address the articulated problems/challenges.

In this chapter, I apply this heuristic to both the MHT and the *Game of Floods* to analyze the way they foster boundary work. I indicate where the games meet the criteria in the heuristic, as well as where they fall short, suggesting how they might adjust based on the values infused into this heuristic. To support my claims, I highlight questions and responses to post-test questionnaires along with my observational field notes and interview data. The questionnaire for the MHT was adapted from a previous event in San Antonio and was revised to gather feedback about the 2018 event in Hampton. This questionnaire was designed by the USACE. I assisted in formatting, disseminating, and collecting responses to existing questions and was given permission to include questions of my own. I had no involvement in the questionnaire for the *Game of Floods*, but I was given permission to use its data in this dissertation.

As an assessment of these games according to the goals of the heuristic, this chapter is organized around these goals. To clarify the structure of this chapter, I've arranged headings and subheadings (with some minor change in language) into a comparative chart (see Table 5 below):

Heuristic Goals	*Game of Floods*	MHT
Work toward inclusive and dialogic cooperation that should not necessarily pursue consensus	The *Game of Floods* works toward inclusive and dialogic cooperation through a fictitious scenario and flexible game mechanics	The MHT works toward inclusive and dialogic cooperation by engaging in large-scale, localized conversation
	As low-stakes exercises, both games do not necessarily pursue consensus	
Enhance accessibility to the issue by presenting clearly articulated problems/challenges (preferably artificial conflict) for the audience to address	The *Game of Floods* enhances accessibility to the issue by presenting an abstraction	The MHT enhances accessibility to the issue by approximating reality

Be easily adaptable and scalable, able to serve varying audiences, purposes, and contexts	The *Game of Floods* achieves adaptability through abstraction	The MHT achieves adaptability through iterative design
Involve a heterogeneous audience of stakeholders, made up of different disciplinary and professional backgrounds	The Audience for the *Game of Floods* could have been more varied; employs role-playing	The MHT could have been more varied; forgoes role-playing
Take place within an intense design period, within a single- or multi-day workshop	Participants of each game reported a need for more time; instead of adjusting the time frame, adjust the mechanics	
	The *Game of Floods* could integrate funding options while reducing mitigation options	The MHT could omit the second round and focus on one region; omit either the peer score or the DST
Articulate clear rules to govern rounds of audience participation and production	Role-playing rules were unclear in the *Game of Floods*	The DST was unclear in the MHT
Provide adequate feedback to achieve discernibility and integration	The *Game of Floods* achieves discernibility through facilitation and reflection	The MHT achieves discernibility through facilitation and reflection, as well as the use of referees
Feature physical design tools (such as prototyping materials) as opposed to digital programs	The *Game of Floods* features physical tools	The MHT features a digital DST
Result in a quantifiable outcome, concluding with plans to address the articulated problems/challenges	The outcome in the *Game of Floods* is non-quantifiable	The outcome in the MHT is quantifiable

Table 5: The Rhetorical Boundary Work Heuristic as a comparative chart for assessing the Multi-hazard Tournament *and the* Game of Floods

Table 5 reorganizes the heuristic, presenting it in the form of a comparative chart for quicker

reference. Upon applying it to these games, it's apparent that both the MHT and the *Game of*

Floods work toward all of the goals listed, but there are areas where more is needed to better foster this boundary work while designing charrette-style games that articulate clear messages about coastal resilience.

Foster Boundary Work

As audiences and contexts for stakeholder engagement games vary, purposes shift as well. These games might integrate more specific learning outcomes, but interview, observation, and scholarship suggest that they are primarily designed and implemented to serve the following purposes as listed in the first panel of the heuristic (see Figure 8, p. 148): foster inclusive dialogue and cooperation, enhance accessibility to the issue, and offer a tool that is easily adaptable and scalable. Working toward these outcomes ultimately involves boundary work, as complex, multifaceted issues are adapted to encourage collaboration among stakeholders. In what follows, I analyze the way these games carry out these purposes, using interview and questionnaire data, as well as observational field notes as supporting evidence.
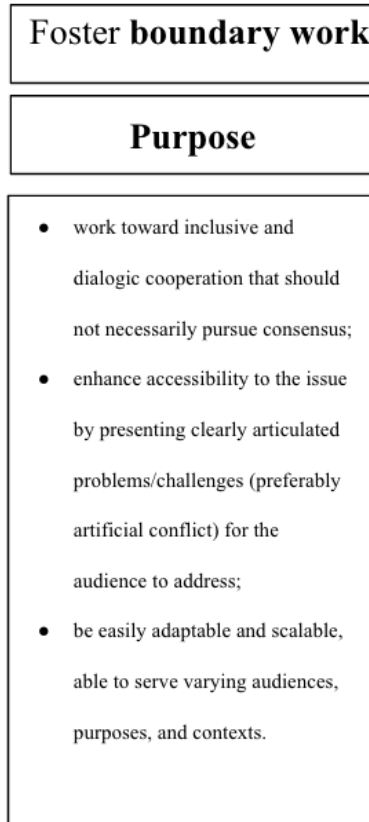
Figure 8: The purpose of CC games designed for stakeholder engagement contexts

Foster Boundary Work by Achieving Inclusive and Dialogic Cooperation, Not Necessarily Consensus

First, as stated in the heuristic, cooperative tabletop CC games designed for stakeholder engagement workshops should foster boundary work by pursuing inclusive and dialogic cooperation, not necessarily consensus. Scholarship on boundary objects, and related works in rhetoric and the charrette tradition, advocate for workshop models that promote two-way dialogue over one-way communication. Such models create equal access to meaning making among participants, leading to a cross-pollination of ideas and the collaborative construction of knowledge. Boundary objects promote cooperation among stakeholders without pursuing consensus, ensuring a low stakes environment for open communication and experimentation. In

this section, I first discuss the *Game of Floods* as it fosters dialogue and invites participants to push against the boundaries of the game, either through direct additions or by integrating flexible game mechanics. I then transition to the way the MHT works toward these goals. Like the *Game of Floods*, the MHT doesn't require participants to arrive at consensus, other than inviting them to collaboratively produce a final plan. This plan and the nature of the game itself is low stakes, generating an inclusive, playful atmosphere.

The *Game of Floods* Works Toward Inclusive and Dialogic Cooperation through a Fictitious Scenario and Flexible Game Mechanics. The *Game of Floods* was developed for its original context in Marin County, CA because of a perceived gap in "having effective ways to communicate complex issues and have people talk about them comprehensively and simultaneously" in a way that "gets people to engage with each other and the community about it instead of it being 'we're the government officials, we have this to say, and you listen'" (B. Van Belleghem, personal communication, July 6, 2018). The goal for this original context, then, was to foster a communication model that moved away from one-way communication (from experts to non-experts) to inclusive cooperation among a heterogeneous audience, a key feature of both charrettes and boundary objects. By inviting community members (residents, as well as city officials and researchers), designers felt the game could not only serve an educational role, but workshop organizers could gather more or better ideas: "we don't have all the answers (...) maybe somebody out there (...) has a better idea" (B. Van Belleghem, personal communication, July 6, 2018). Additionally, it enabled workshop facilitators to reach a better understanding of public opinions about adaptation: "for us, it was mostly to gauge where the community was in terms of whether they would want to retreat or protect or do nothing, so if the community seemed [enthusiastic] about engineering, then that would become apparent in the gameplay

itself," (B. Van Belleghem, personal communication, July 6, 2018), and this can inform approaches to planning, as well as the way they might sell their plan to the public. As is the case with boundary objects, the game has interpretive flexibility even in regard to its intended purpose: it fosters communication and engagement, supports efforts in education and awareness, problem solving or idea gathering, while operating as a feedback mechanism.

For the context I observed in Chesapeake, VA in 2018, the *Game of Floods* was used to kick start a one-and-a-half-day workshop "with the Hampton Roads PDC (Planning District Commission), which supports (...) between 14 and 17 communities" (Participant D, personal communication, June 26, 2018). The goal of the workshop overall was to "support hazard mitigation planning and to support mitigation activities, (...) following through with their identified mitigation actions and their hazard mitigation plans" (Participant D, personal communication, June 26, 2018). The game thus served as a distilled version of themes that would emerge in discussions later in the workshop. This game was viewed as an "opportunity to get people to think outside of their own (...) silo, in terms of their day-to-day job, whether they're an emergency management coordinator, or a planner, or a zoning/floodplain administrator" (Participant D, personal communication, June 26, 2018). Like the MHT, then, the *Game of Floods* is an opportunity to broaden perspectives and foster collaboration across departmental boundaries, thereby meeting heuristic criteria and operating as a boundary object in that it intersects with, and fosters collaboration across, different social worlds (Star & Griesemer, 1989; van Pelt, et al., 2015). To use Star and Griesemer's (1989) language about boundary objects, the chief end of these games is to "maximize both the autonomy and communication between worlds" (p. 404).

Certain design choices, such as the design of the map, were made to enhance communication between worlds. The *Game of Floods* designers thought a game would "enable [them] to broach (...) topics without igniting a property battle" (B. Van Belleghem, personal communication, July 6, 2018): "we didn't want it to be a map of an actual community because we were concerned that people would start arguing about the fate of their private properties, and that would skew the objective" (Participant E, personal communication, June 29, 2018). Wilson and Herndl (2007) "argue that a boundary object can also function as a rhetorical construct that encourages an integrative rather than a demarcation exigence" (p. 132). Choosing a fictitious map to avoid self-serving interests of stakeholders suggests that these designers have intentionally designed the game's visuals to avoid demarcation and foster integrative thinking, working toward inclusive cooperation, as it removes a sense of personal property.

Flexibility of game rules further enhances communication between worlds by fostering dialogic cooperation. During the 2018 event, it was observed that players appropriated certain game mechanics, finding spaces to adjust the game to their own goals. For example, one group adjusted the point at which they would receive the budget because of the impact it would have on their planning process. I observed that most groups accepted their budgets at the point when the facilitator was handing them out. They were eager to see their funds so they could more accurately and definitively begin planning adaptation strategies. One member, however, urged his team to finish their asset inventory (see Figure 9, p. 152) and vulnerability score before looking at their budget.

Game of Floods – Resilience Harbor

Asset Inventory

Step 1. Facilitators will provide each team with a brief history of the town, the sea level rise and precipitation scenario your group will be using for the Game of Floods, the amount of funding your team has available for adaptation projects, and each team member's role for the game. Record your climate change scenario and funding limit:

Climate Change Scenario: _____

Funding Limit: _____

Step 2. Review your game board and the assets. Select a subset of the infrastructure and community assets for further evaluation in the game. The team should assemble a list of assets that will be considered in the development of a climate change adaptation plan for the town. Each team member should consider their assigned role when selecting assets – make the case for your assets! Facilitators will provide the team with Asset Cards describing the assets shown on the game board. Complete the Asset Inventory Table below using information from the Game Board and the Asset Cards.

Asset Inventory Table

	Asset	Year Built	Condition (Poor, Moderate, Good)	Prior Damage History (Y/N)	Sea Level Rise Inundation Zone (12", 24", or 36")	Riverine Flooding Zone (Y/N)
1						
2						
3						
4						
5						
6						
7						
8						
9						

Figure 9: The Asset Inventory page from the Game of Floods *Participant Workbook developed by the Urban Sustainability Directors Network*

The facilitator asked, "Do you want your budget?" The group paused, and a member said, "It'd help us to decide." Another player responded, "I'd like us to get through this exercise without it." The facilitator returned later for a second attempt, and the same player who pushed back before said, "We have two more. You can set it down." The facilitator placed the card down on the table, budget side down (see Figure 10, p. 153).

Figure 10: An example of a budget card from the Game of Floods *developed by the Urban Sustainability Directors Network*

Once the group finished the round they were working on, they later flipped it over. While it isn't a profound adjustment to the game, it is a moment where the players didn't necessarily follow the rules. They perceived a moment in the game that was flexible, and they pushed. Sicart (2011) might call it "an act of appropriation of the game by players." They waited to examine the budget because they wanted to speak more broadly about the value of assets—about what made them valuable and vulnerable—to enable them to have a broad discussion about their philosophy before being influenced by their budgetary constraints. This group perceived a level of flexibility in the overall approach to the game and exercised some control over pacing to ensure they could play the game the way they wanted. As a result, the flexibility of the rules actually fosters inclusive and dialogic cooperation, giving players some access to design by adjusting the rules as they go.

Inclusive cooperation in the game appears later in round 3, as well, in a round that is noted as optional in the facilitator materials: in it, groups are tasked with performing a

vulnerability assessment (see Figure 11, p. 154), generating a vulnerability score for each of the

9 assets they prioritized in the previous round.

Figure 11: The Vulnerability Assessment page from the Game of Floods *Participant Workbook developed by the Urban Sustainability Directors Network*

This score is meant to help with later planning as players determine which assets to focus on

protecting with their limited funds. What's interesting is that groups are invited to develop their

own metric for assessing vulnerability. The facilitator can assist groups by offering the following

example that they can adopt or adapt: "Example Exposure Definition: High (3): Already floods

OR floods at 12 inches, Med (2): Floods at 24 inches, Low (1): Floods at 36 inches; Example

Sensitivity Definition: High (3): Poor Condition (or old), Med (2): Good Condition, Low (1): Excellent Condition" (Facilitator Guide, 2016). The example offered by the facilitator reflects a definition of vulnerability that examines the relationship between exposure and sensitivity. Groups are invited to consider their own definitions and translate them into a decision matrix that can generate a score.

Inviting players to develop their own definition of vulnerability is an interesting choice—a unique moment where players can design their own game mechanic (what they articulate in this round affects decision-making in following rounds) while collaboratively constructing meaning. It's a moment reminiscent of scholarship on games and learning, notably Gee's (2003) argument that games promote designerly thinking. It's also reminiscent of a movement known as "learning by game building," which focuses on "providing students the opportunities to construct their own games and new relationships with knowledge in the process" (Li, 2013, p. 19). Students engage in anything from paper prototyping to the use of game-building software, such as Scratch, Gamestar Mechanic, or Game Maker, among others (Li, 2013). During the growth of the computer game industry in the 1980s, "learning by game design and building began to gain researchers' attention" (Li, 2013, p. 34), resulting in a number of studies (Li, 2013; diSessa, 2000; Kafai, 1995; Wilensky & Reisman, 2006). These studies indicate that game building fosters a greater understanding of the central content of a given game, and the act promotes "creativity, communication, critical thinking, logic, and problem solving," which are "constantly practiced during the process of game design and building" (Li, 2013, p. 49). In the *Game of Floods*, groups are only designing a single game mechanic; otherwise, they're working with fully developed game mechanics (for example, there is no opportunity to revise or write in additional adaptation strategies in the final round of gameplay). Although it's short-lived, this moment

where players can write in their definition of vulnerability in the *Game of Floods* is valuable. It opens a space to leverage notions of access and meaning-making in the field of technical communication: namely that risk is "socially constructed" and "conceptualizing risk as socially constructed is important because (1) it locates knowledge-making within communication processes, and (2) it considers how power is differentially exercised in such processes" (Grabill & Simmons, 1998, p. 423). In this moment, players collaboratively construct a definition, an exercise in knowledge-making through the act of communication, and while the facilitator may hand down a definition if needed, a definition is not imposed on players by the designers of the game.

The MHT Works Toward Inclusive and Dialogic Cooperation by Engaging in Large-Scale, Localized Conversation. Within the USACE Institute for Water Resources, there is a national Silver Jackets program, with inter-agency teams at the federal, state, and local level, and all focus on flood risk reduction ("About the Silver Jackets Program," 2018). As a part of the floodplain management program, the Tournament was designed with a specific learning objective in mind: help "improve [Hampton's] community rating score, reduce the maximum number of insurance premiums per household so general homes would have lower premium costs, [as well as] to support the city of Hampton" (Participant A, personal communication, June 7, 2018). The Tournament was, therefore, a training exercise, but collaboration was one of the primary goals of the MHT.

The goal of collaboration is evident in the nature of the questions posed in the post-test questionnaire. It asks whether, "as a result of the tournament did you meet a person you didn't know before who could be a beneficial contact in the future, (...) discuss potential projects or collaborations, (...) identify potential opportunities to coordinate efforts, (...) identify potential

projects that could be implemented, (...) [and] pursue new projects or collaborations with someone you have [or have not] worked with before?" Responses to these questions were positive. All participants reported yes to meeting someone who could be a beneficial contact, and in the remaining questions, either 7 or 8 responded yes out of a total of 11 survey participants. Additionally, the questionnaire asked for feedback like "based on your experience, (...) would you recommend the use of a tournament exercise [for] increasing levels of trust among stakeholders, (...) improving communication among stakeholders, (...) [and] creating new collaborations to address common problems." Respondents were most positive about the goal of "improving communication among stakeholders," with 10 stating yes, they would recommend the tournament and 1 indicating maybe out of 11 responses. These responses are supported further in open-ended reflective statements on the survey. One participant "had an opportunity for great conversations with other participants [and] was able to hear a lot from different organizations and representatives," while another indicated that "it was helpful to hear different perspectives (engineering vs. policy) and discuss trade-offs between mitigation approaches." For the majority of survey respondents, the MHT appears to have succeeded in offering a valuable networking opportunity that promoted engaging conversations while opening opportunities to build toward collaborative projects in the future.

In addition to the goal of collaboration, interviewees indicated that the MHT works toward the related goal of broadening perspectives. For heterogeneous audiences to collaborate, they must be able to understand the perspectives of their colleagues. Designers and workshop facilitators hoped the game would offer "something interesting and engaging, [to get the audience] actively participating," (Participant B, personal communication, June 16, 2018) while serving as a means of breaking "down silos" (Participant A, personal communication, June 7,

2018). They pointed out that participants have plenty of meetings but lack spaces where they can more actively share ideas and collaborate (Participant A, personal communication, June 7, 2018; Participant B, personal communication, June 16, 2018). As recorded in field notes, at the end of the event, facilitators led a reflective discussion about major takeaways. Table 6 below lists a few themes from this discussion:

Collaboration across jurisdictions	"If we collaborate across jurisdictional boundaries, hopefully we can cross boundaries for solutions that work."
	"We need to get together once a year to see what's new (...) and discuss new ideas. We know funding is better for multi-jurisdictional projects."
Broadening perspectives	"Has you think about many hazards at once and have different people in the room to discuss, meet new people, generate new ideas; you might learn a new management method, discover new funding opportunities."
	"I don't do mitigation in my job, so it's helpful to hear how people come to make these decisions."

Table 6: Key quotations from final reflective discussions in the Multi-hazard Tournament

In addition to the comments listed above, one person reflected on the importance of having large-scale community-wide conversations, examining "what we want our community to look like and determining how to use opportunities to get to our overall goal. We're too siloed." The facilitator responded, "We hoped you'd walk away with that—new perspectives and the goal of collaborating." The above feedback indicates that the MHT works toward inclusive and dialogic cooperation: audience members found it notable enough to reflect on their level of cooperation in the final discussion and had favorable comments about their experience.

As Low-Stakes Exercises, Both Games Do Not Necessarily Pursue Consensus. One key difference between these games and charrettes is the outcome, of course: "charrettes are

supposed to work toward consensus in an otherwise divisive situation" (Mara, 2006, p. 222).

While the MHT and the *Game of Floods* engage a variety of stakeholders in an "otherwise

divisive situation," (Mara, 2006, p. 222), it doesn't necessarily have a goal of arriving at

consensus: the goal is to foster learning objectives via problem-solving and collaboration, with

the additional goals of fostering networking and communication across groups. Each group must

conclude gameplay by agreeing on an appropriate and feasible adaptation strategy and develop a

proposal. In the *Game of Floods*, proposals are presented to the room for reflective discussion. In

the MHT, proposals are presented to the room, judged and scored, and a winner is declared. The

proposals themselves represent some degree of consensus (players were required to agree on the

elements of their proposal); however, consensus here is flexible and playful—it's only a means

to the victory condition, the end of the game. As recorded in field notes, the competition was

taken lightly, and there were signs of playfulness and enjoyment across participants in both

games. In the MHT, the workshop organizer, wearing a referee uniform, kick-started the day by

blowing a whistle; another threw a penalty flag as one would in an American football game,

which was met with laughter; participants playfully heckled and joked ("Oh yes, I'm

competitive," and "that's ok; we're smart.") and although the winning team was awarded medals

for their achievement, the workshop closed with the organizer's statement "you're all winners."

The competition served to underscore the fact that this was to be regarded as only a game, where

the final consensus didn't matter as much as the process of arriving at it. While the players' final

products may be used as feedback to assist in further refining the game (Participant A, personal

communication, June 7, 2018; Participant B, personal communication, June 16, 2018),

adaptation plans remain hypothetical with no intention of directly incorporating them into current

policy. By remaining hypothetical, the game can operate as a low-stakes exercise "without the

need for consensus," (van Pelt, et al., 2015, p. 42) a chief characteristic of boundary objects and an important element of play. One primary aspect of play, according to Caillois (1961) is that it is "a free and voluntary activity, a source of joy and amusement. A game which one would be forced to play would at once cease being play. It would become constraint, drudgery from which one would strive to be freed" (p. 6). Lowering the stakes enhances the feeling of play.

Enhance Accessibility to the Issue By Presenting Clearly Articulated Problems

As stated in the heuristic, cooperative tabletop CC games designed for stakeholder engagement workshops should foster boundary work by enhancing accessibility to the issue and presenting clearly articulated problems/challenges (preferably artificial conflict) for the audience to address. This recommendation is influenced by game design as well as approaches to charrettes, where "participants pool their talents to produce plans to" respond to a problem (Roggema, 2013, p. 15). Charrettes generally invite stakeholders to explore issues related to their region, but I recommend artificial conflict as an aspect of game design, according to Salen & Zimmerman (2004), and as a means of fostering low-stakes play. Enhancing accessibility to the issue is a reflection of interview data, game studies scholarship, and technical communication, as well. Both games distil the complexity of coastal resilience into a short exercise, but they make different choices as they do so: the *Game of Floods* is less detailed and more abstract than the technically complex MHT, and observational field notes, interview, and questionnaire data indicate that abstraction may be preferable.

The *Game of Floods* Enhances Accessibility to the Issue by Presenting an Abstraction. As opposed to the MHT, which uses inundation maps of Salter's Creek and New Market Creek, real locations in Hampton Roads, with a detailed DST guiding decision-making, the *Game of Floods* was purposefully designed to distil the issue into a more abstract version,

working toward the heuristic feature of enhancing accessibility to the issue by presenting artificial conflict. Rather than a satellite map of a local community, the map represents a fictitious one (Resilience Harbor in the June 2018 iteration) with similar features to the local region.

Players noted the abstract nature of the game in the final reflective discussion after gameplay. I recorded in my field notes that one player wanted "more details about what each asset contributes to the economy to make more of a benefit-cost analysis. On the other hand, the more data, the more complicated the game becomes. We were able to come up with our assumptions. Each player and group could tailor their own views." Relative to the MHT, the *Game of Floods* is less technically detailed, in part because of its abstract map and less detailed assets. My observations suggest that this lack of realism poses only minor frustration for players and may enable broader philosophical discussions of the issue rather than more specific strategies governed by budgets and politics. The reflective statement made by the player also points to the fact that the game creates opportunities to have players reflect on the assumptions they make during gameplay, the organizational structures they operate in, and the way those organizational structures influence their thinking.

The MHT Enhances Accessibility by Approximating Reality. Both games are working to enhance accessibility to the issue by presenting clearly articulated problems/challenges, but the way the MHT frames the problem differs from the *Game of Floods*. One person who attended and played both the MHT in Hampton and the *Game of Floods* in Chesapeake in 2018 said (in an interview that took place prior to the *Game of Floods* event), "the corps *Tournament* was much more technically sophisticated and much more targeted toward coming up with optimal solutions with existing funding sources, and I think the *Game of Floods* is supposed to

be a little more qualitative, less quantitative" (Participant C, personal communication, June 15, 2018). The MHT is highly detailed, and was, therefore, a more complex simulation. Balancing the level of complexity for audiences has long been a challenge in the field of modeling and simulation (Poplin, 2012). While simulations can be helpful tools for engaging participants, their complexity can create a barrier (Poplin, 2012), and observational field notes, as well as questionnaire data, suggest that the MHT's complexity posed somewhat of a barrier for participants.

A few respondents reflected on the MHT's level of detail in the post-test questionnaire, saying it "was quite a bit of information to digest" and a "technical writer" was needed to help simplify it. Others appeared to want more detail, however: "It does not capture change in support over time, change in budget positions over time, change in risk perceptions over time (etc. change in any number of other drivers of the dynamics)." Similarly, another respondent wanted the game to offer more information and detail that would better represent the realities of the situation:

> Statistics on vulnerability of households (various types), adaptive capacity of households, traditionally underserved areas and communities, etc. It is artificial to ask planners to plan in absent of these things. These are real world things that are in fact central to nearly all discussion of programs and projects—e.g., who has the need and who will this serve? The current scenarios treat households and individuals as abstract agents, each endowed with the same bland, nondescript characteristics. That simply is not the way it is.

The MHT cannot possibly capture all facets of this complex issue while fitting within a reasonable amount of time (the 2018 Hampton MHT was a 5-hour event, which is a significant time commitment). Important elements must surely be left out, but participants demonstrated that

they were aware of the omissions. It appears the closer the game maps to reality, the more its

players demand of it, particularly as an audience of knowledgeable key stakeholders. According

to game studies scholars Judd Ruggill, Ken McAllister, and David Menchaca (2004), "most

games that simulate labor (...) do so poorly. Ask any farmer how 'real' SimFarm is" (p. 306).

The interviewed participant who attended both events reflected on the problem of realism in the

following way:

> Well, you know they say 'all models are wrong; some of them are useful,' right? So one
>
> of the weaknesses of these sorts of workshops is that they're not realistic enough, then the
>
> benefits don't really make themselves apparent (...). And I saw this a little bit with the
>
> *Tournament*. The DST was very sophisticated, but it had a few questionable assumptions
>
> built into it that I saw, and that I think some others saw. And so, when that happens, I
>
> think it's easy to get derailed on the one hand, but (...) if you're trying to make something
>
> extremely precise and accurate, but you don't make it 100% accurate, then it's going to
>
> actually discourage people from working through it. (...) I have a hunch that this *Game of*
>
> *Floods* is going to be less emphasis on the number crunching, and I think that might be
>
> good because it gets you to think about the options that are out there but not to focus on
>
> the specifics so much. (...) It's a thought exercise (Participant C, personal
>
> communication, June 15, 2018).

If players' professional patterns of data acquisition and problem-solving do not align with the

mechanics and dynamics of the game, they're more likely to focus on the game's gaps and

constraints. As indicated above, a more abstract, simplified version of the game that can be

treated as a broader thought experiment may limit this effect. The fact is, however, an audience

of experts will always perceive gaps and oversights. Game designers and workshop organizers

can leverage this fact when employing such games in train-the-trainer events. Integrating opportunities to reflect on gaps during gameplay—or allowing space for game mechanics to be "written in" or added extemporaneously by players—may become a valuable exercise with useful learning outcomes and opportunities for reflection, particularly because doing so would engage players in the game's ongoing development and design.

Be Easily Adaptable and Scalable

In order to foster boundary work, cooperative tabletop CC games designed for stakeholder engagement workshops should also be easily adaptable and scalable, able to serve varying audiences, purposes, and contexts. By adaptable, I mean that revisions should not be too work-intensive. The game should be designed in such a way that facilitators may be able to quickly and easily revise game elements to fit their needs. By scalable, I mean that the game should be able to scale to a wide variety of audiences and contexts, from train-the-trainer events to educational contexts, or from 5-hour time frames to 2-hour time frames. According to Star & Griesemer, 1989), "boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star & Griesemer, 1989, p. 393). For these games to be good boundary objects, they need to be flexible, and interviews demonstrate that this is an important trait for workshop facilitators. While the MHT requires intense "scoping" to adapt to different settings, this careful, iterative process has made it a valuable feature in workshops across the US and abroad. The *Game of Floods* requires less preparation, and its abstract nature makes it broad enough to apply to a number of audiences and contexts. Both games work toward this goal, but the *Game of Floods* is more easily adapted.

The *Game of Floods* Achieves Adaptability through Abstraction. Like the MHT, the

Game of Floods has been adapted for a variety of audiences and contexts. Since its inception, the game has been used in stakeholder workshops in West Marin, in schools throughout Marin County as part of a sea level rise curriculum, engaging approximately 300 youths, (Participant E, personal communication, June 29, 2018). The game has been played "in at least 50 different states, everywhere from Hawaii to Maine," and creators have received requests for copies of the game from people across the nation (Participant E, personal communication, June 29, 2018). The Eastern Shore Land Conservancy in Maryland was awarded a grant in 2018 to adapt the *Game of Floods* for planning in the city of Baltimore ("CRF 2018 Grants," 2018), and this particular adaptation was featured in the Hampton Roads 2018 Plan Implementation and Grants Development Workshop, hosted by FEMA and the Hampton Roads Planning District Commission, in Chesapeake, Virginia in June of 2018. Ongoing interest in the game encouraged Marin County to design and release a board game version in 2019.

The extent of the game's reach and its variation across contexts suggests that the game is, indeed, adaptable and scalable. Workshop organizers are able to scale the game to match their needs and interests. What makes the game so adaptable is its abstract nature. Designed with hypothetical regions, such as Resilience Harbor in the 2018 iteration, an abstract inundation map, and a set of roles and assets that reflect nearly every seaside community, this game can be used by stakeholders with very little need for revision. It sets the scene with enough information, framing a problem, a setting for the problem, and a set of solutions, and invites the audience to fill in the gaps with their own expertise and backgrounds. Abstraction enables adaptation in the case of the *Game of Floods*.

The MHT Achieves Adaptability through Iterative Design. The MHT achieves adaptability through extensive iterative design work. This cyclic design process involves what is

described as "scoping" (Participant A, personal communication, June 7, 2018). Participants in the 2018 iteration were asked to take part in a dress rehearsal approximately one month prior to the event, and organizers determined whether they've designed the event to cover all of the most relevant topics, gathered feedback on the mechanics, and ensured that the tournament would meet their needs and expectations (Participant A, personal communication, June 7, 2018). A few of the participants who took part in the event also took part in the scoping exercise the month before (Participant A, personal communication, June 7, 2018). According to field notes, during the introduction on the day of the event, a facilitator said, "We want to do future events, so give us your expertise." The iterative design process and their openness to feedback suggests that the MHT is "plastic enough to adapt to local needs and the constraints of the several parties employing them," (p. 393) which is a feature Star and Griesemer (1989) highlight about boundary objects, but it also aligns with the work of technical communication in general, employing "iterative design (...) and user testing," (DeAnda & Kocurek, 2016, p. 206) as key elements of their work.

The MHT has gone through several adaptations, with iterative design processes employed to adapt them to each unique, local context. It dates back to 2011 in Canada and has been adapted to institutions, risks, and contexts across the globe. The first iteration of this event took the form of a Drought Tournament, focusing on drought-related systems thinking for a variety of audiences and took place in Calgary in Alberta, Canada, in February of 2011 (Participant A, personal communication, June 7, 2018). Since then, variations of the Tournament have been conducted around the world ("List of … Tournaments," n.d.).

In the case of the 2018 event, organizers wanted to offer a "platform that could be easily implementable anywhere [for] developing their next hazard mitigation plan or (...) prior to a

hurricane landfall," (Participant B, personal communication, June 16, 2018), and they hoped participants would adapt the game to their own educational outreach efforts as they communicate with citizens or local leaders. One of the key features of boundary objects is their interpretive flexibility (Star & Griesemer, 1989; Star, 2010); as Star (2010) explains, one map, for example, can mean different things to different people. Interpretive flexibility also suggests that boundary objects can be adapted for different settings, as well (van Pelt, et al., 2015). The MHT has been strategically adjusted to communicate different messages for different audiences and contexts with the hope that participants will continue to adapt it further.

Whether one can see the MHT as "easily" adaptable is debatable, however. Scoping and dress rehearsals are both time- and work-intensive, but they appear to be necessary for honing the Decision Support Tool in particular. Because the game uses satellite inundation maps of problematic regions, careful planning must go into their selection. The robust nature of the DST also requires adjustment as organizers consider which factors to include in its calculations, factors that reflect their changing training goals. The DST for the 2018 iteration, for example, included elements related to the North Atlantic Coast Comprehensive Study (NACCS). This report "looked at the hazards in the area, and it identified mitigation measures that would be appropriate for certain areas, and it also looked at what those benefits would be and what the costs were" (Participant B, personal communication, June 16, 2018). In designing the DST, therefore, designers integrated information from the NACCS report in order to "take the NACCS another step" (Participant B, personal communication, June 16, 2018).

Both games demonstrate that they can be scaled to meet the needs and interests of a wide variety of audiences and contexts, as they've been adopted across the United States and abroad, but the ease in which they're able to do so varies. The *Game of Floods* appears to more easily

adapt to different audiences, as it presents an abstract view of the issue in ways that are representative of most coastal regions while the MHT presents a realistic view that requires careful, advanced tuning.

Foster Boundary Work for a Varied Audience

The next item on the heuristic points to considerations of audience (see Figure 12, p. 169): cooperative tabletop CC games designed for stakeholder engagement workshops should involve a heterogeneous audience of stakeholders, made up of different disciplinary and professional backgrounds. Both charrette and boundary object scholarship underscore the importance of a broad audience. Wide ranging perspectives, shared in a space that invites inclusive and dialogic cooperation, work toward a meaningful, educative experience for all parties. When dealing with issues as complex as coastal resilience and the broader topic of climate change, it's important that discussions reflect the immense spectrum of voices involved. In the case of the *Game of Floods* and the MHT, both events brought together an audience with a similar range of disciplinary backgrounds. In fact, some members from the MHT event also attended the event that featured the *Game of Floods*. Despite the range of professionals present, the audience could have been more varied, and in the case of the *Game of Floods*, a role-playing dynamic is used to capture a variety of perspectives regardless of audience demographics. While role-playing may offer a more complete view of the spectrum of stakeholders involved, it may also limit players' ability to leverage their own expertise and learn from one another. Forgoing role-play and fostering greater audience diversity is ideal.

varied audience
Audience

- involve a heterogeneous audience of stakeholders, made up of different disciplinary and professional backgrounds.
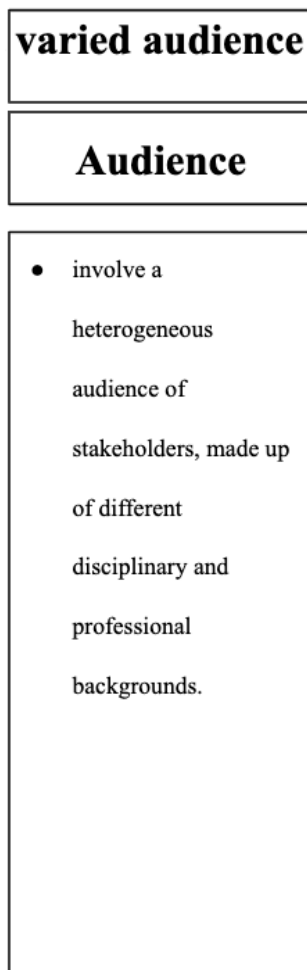
Figure 12: The audience of CC games designed for stakeholder engagement contexts

The Audiences for Both Games Could Have Been More Varied

The audience for the 2018 event featuring the *Game of Floods* included officials from VDEM, DCR, Army Corps of Engineers, FEMA, local municipalities, ODU, the William and Mary College of Environmental Law, and the Hampton Roads PDC (Participant D, personal communication, June 26, 2018). They were floodplain managers, land use planners, NFIP coordinators, state hazard mitigation officers, communications specialists, environmental planners, and engineers. Overall, this group was made up of stakeholders who had "at least a

starting knowledge about mitigation and resilience" (Participant D, personal communication, June 26, 2018), but their experience with this issue varied.

The audience for the 2018 MHT was made up of a wide range of stakeholders, similar to the *Game of Floods* event. Participants represented the Hampton Roads Planning District Commission, the city of Hampton and Newport News, the Institute of Marine Science, corps districts from the federal side, state representation from the Virginia Department of Emergency Management (VDEM), and the Virginia Department of Conservation and Recreation (VDCR); however, greater diversity could have been achieved. In their post-test questionnaire, when asked which stakeholders should have been included, game participants indicated that "community grouops [sic], health folks, non-profits, disability advocacy folks," representatives from "Public Works/Drainage," "representation from building or other industries," and an "Elected official (would be interesting to get their take on raising taxes in scenarios) or Planning Commissioner" would have been valuable inclusions.

Filling the Gaps in Audience Demographics with Role-playing

Each game differs in their approach to role-playing. While the *Game of Floods* requires participants to assume a role outside the player's personal and professional expertise, the MHT does not integrate a role-playing rule, instead inviting participants to play according to their own stake in the issue. Each approach has its advantages and disadvantages. While role-playing may constrain gameplay and create a false sense of the range of stakeholders and their perspectives, it may also help fill in the gaps when voices are missing from a given event.

In the first round of the *Game of Floods*, players were required to choose a role from a stack of role cards and play the game according to that role (see Figure 13, p. 171).

Community Representative

Role: Community Advocate

You represent the underserved residents of the Pelican Townhomes community. The neighborhood has historically felt that their needs have been neglected by the town's government and tourism industry and you provide a trusted voice for their concerns.
Every citizen deserves a voice!

Figure 13: An example of a role card from the Game of Floods *developed by the Urban Sustainability Directors Network*

Roles included deputy mayor (elected official), transportation planner (transportation representative), water/wastewater enterprise general manager (water representative), power plant enterprise general manager (power representative), city planner and sustainability director (city planning and sustainability), director of public works (city engineering/public works), homeowner association president (community representative), community advocate (community representative), and mangrove association president (community representative). Each role card included the title and a brief summary as a means of guiding role-play.

Limiting the roles one can play enhances accessibility to the issue by narrowing its scope, but imposing a role-playing rule and reducing the list of options presents a constraint. It limits the way players might engage in play and limits the notion of who is a stakeholder. One

favorable outcome of this design choice is that it may encourage people to adopt a new perspective and operate from a viewpoint that differs from their own, which promotes a broader, more empathetic understanding of the issue, particularly if the audience is less varied than desired; however, if players are not familiar with a given role, their performance of it won't be as educative.

In contrast, the MHT invites audiences to operate according to their current role and title rather than play a role. I observed group members sharing their personal and professional experience as they engaged in problem-solving throughout rounds of gameplay, sharing that could be limited by playing a role outside their personal and professional background. One of the Tournament designers explained the rationale for this design choice:

> One of the great wastes we have in our culture is that we spend all this money getting everybody educated and then we throw them in these institutional arrangements where we rarely extract their knowledge base and keep honing it; [the *Tournament*] is an opportunity to allow them to think as they were trained; they get to use their ecosystem talents or their engineering talents, and so they get a voice in it in a way that maybe they don't get to use normally and so hopefully [the *Tournament*] will capture a better integration of knowledge without all the practical constraints they've had to deal with (Participant A, personal communication, June 7, 2018).

The Tournament gathers people across agencies and institutional backgrounds and gives them a scenario to which they can apply their expertise. As they collaborate with others outside the organizational structures they typically operate in, they achieve a better understanding of their role in a larger network. The MHT invites participants to "translate the hard work these communities have already done within a framework that would help them see what the

implications would be beyond what they would normally consider due to their own mandates, budgets, and strategies" (Participant A, personal communication, June 7, 2018). Understanding the network potentially lays groundwork for further cross-jurisdictional collaboration and utilizes the diversity of voices in the room.

Charrettes operate in a similar way: audience members from a varied background are invited to leverage their expertise as they collaborate. One interviewee who was a participant in both the MHT and the *Game of Floods* likened both games to design charrettes: "we usually don't do games like that. We've done charrettes before (...) [which are] an intense design exercise where you bring in a bunch of people, like stakeholders and experts, and you give them a problem, and they just work it for hours, days, whatever" (Participant C, personal communication, June 15, 2018). While the *Game of Floods* invites players to play a role, the MHT does not, ultimately conforming more to the nature of charrettes. If the audience is, indeed, varied, and represents a wide range of disciplinary backgrounds, jurisdictions, and community viewpoints, then forgoing role-playing can be effective; however, if there are groups who are under-represented or missing, the experience will be limited. Role-playing may help to resolve this problem, and the decision to integrate role-playing may be made once facilitators have an understanding of the audience demographics for the upcoming workshop.

Foster Boundary Work for a Varied Audience within an Intense Design Period

The next item in the heuristic points to considerations of context: cooperative tabletop CC games designed for stakeholder engagement workshops should take place within an intense design period, within a single- or multi-day workshop (see Figure 14, p. 174). This recommendation refers to the charrette tradition, as a charrette is "an intense period of brainstorming and design," (Roggema, 2013, p. 15). As playful versions of charrettes

themselves, these games were designed to take place in a shortened time frame, pressuring audience members to focus and move through tasks quickly. Doing so is not only practical (professional audiences are busy); it supports the larger goals of the game. Limiting the players' time promotes a low stakes environment, and condensing such a complex issue into a shortened time frame enables audiences to better understand it comprehensively and approach problem-solving holistically. While both games are designed to fit within a limited time frame, further adjustments could be made to their scope to allow them to fit more comfortably.
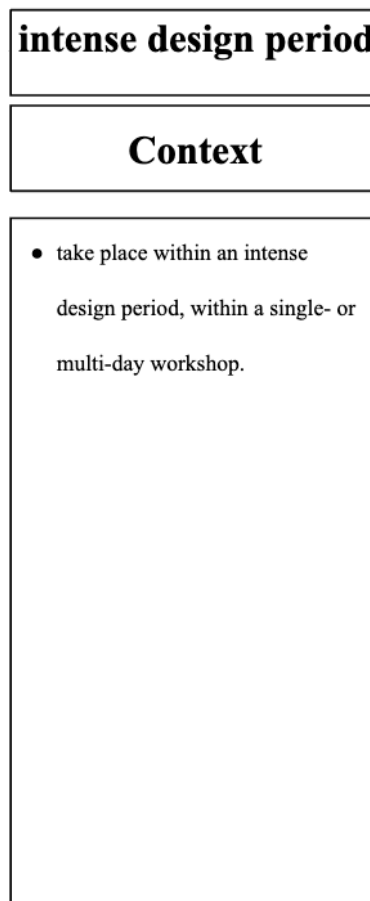

Figure 14: The context for CC games designed for stakeholder engagement contexts

Participants of Both Games Reported a Need for More Time

Observation, interview, and questionnaire data suggest that the *Game of Floods*, which took 2 hours to complete, was a short enough time span to hold its audience members' attention but was perhaps too intense as players reported that they were pressed for time. Interviewees indicated that the game has been well-received overall (Participant E, personal communication, June 29, 2018; B. Van Belleghem, personal communication, July 6, 2018). Additionally, in the post-test questionnaire seeking feedback from participants in the June 2018 iteration in Chesapeake, VA, 5 out of 8 respondents specifically identified the *Game of Floods* as the most useful or most informative aspect of the 2-day workshop, saying it was "an excellent exercise," that "it made for a different training experience," and one "really enjoyed the Game of Floods." When asked to identify the least useful or least informative part of the 2-day workshop, only one participant identified the game: for one person, the game was "interesting but not especially useful." And when asked what could have improved the event, 2 out of 9 respondents focused on the game, saying they were "a little rushed for time" and that they required "a little more hand holding when it came to the start of the game with the initial city audit of properties. People jumped right into steps 2 and 3 without finishing step 1 for all the properties." These responses were reflected in the final discussion at the end of the game. One participant called for additional time: "An additional 30 minutes. Takes a while to get fired up, and that would have helped." The *Game of Floods* certainly meets the heuristic requirement of taking place within an intense design period. Although it was set in the context of a 2-day workshop, the *Game of Floods* took approximately 2 hours to complete, making rounds of gameplay tight. Overall, the 2018 questionnaire indicates that, among the players who responded to the questionnaire, the game

was considered unique, valuable, and enjoyable, and they would have benefitted from more time with the game and more direction within the game early on.

As opposed to the *Game of Floods*, the MHT was a 5-hour event, and the entire workshop was devoted to the game (once the game was complete, there were no further presentations or events). A five-hour game is extensive, but the requirements of each round kept players on task and busy, rushing to complete their designs by the end of the round. I observed players exhibiting signs of playful distress, such as groaning when facilitators would announce that a round was coming to a close. Table 7 below contains a few statements I heard relating to the intensity of the design period:

"We have two minutes left, and we don't have a plan!"
"You're expecting a lot for an hour discussion."
"This is a whole lot of work!"
"It took time figuring out all the buttons."

Table 7: Expressions of playful distress among players of the Multi-hazard Tournament

A number of players sounded distressed near the end of a given round, as evidenced in Table 7, and that pressure contributed to the intensity of the design period. Because both the *Game of Floods* and the MHT "boil into three hours what typically a community will spend 15-18 months doing," (Participant D, personal communication, June 26, 2018) participants are simply going to want more time.

Even though the audience is requesting more time, the amount of time allotted shouldn't necessarily be extended. It's important to maintain an intense design period, one that presses audiences to move quickly in a way that is pleasantly uncomfortable. According to Gee (2005)

good games should be "pleasantly frustrating" (p. 36). He states, "good games stay within, but at the outer edge of the player's 'regime of competence'" (Gee, 2005, p. 36). They keep players at the edge of their abilities, neither challenging them too much nor too little. A pleasantly uncomfortable design period challenges players enough to keep them engaged and underscores the message that this exercise is low stakes. If participants understand that all members are working under the same time constraints, they may feel less pressure to produce something polished, opening up a space for debate, play, and experimentation that may not be afforded in a situation where audiences sense the need to produce a well-crafted proposal.

Instead of Adjusting the Timeframe, Adjust Game Mechanics

While the length of time may not need to be adjusted, game mechanics should further clarify the problem and the way players are asked to respond to it. As indicated by observations and questionnaire data, the games are still requiring audiences to process too much to comfortably fit within the time frames allotted. In the analysis that follows, I include recommendations that might address the pressure audiences feel without necessarily adjusting the timeframe.

The *Game of Floods* Could Integrate Funding Options While Reducing Mitigation Options. After the audience understands the hazards' influence on the region, the *Game of Floods* offers a list of mitigation strategies, as well as a single, non-negotiable budget, and invites groups to discuss their options and develop a plan (see Figure 3 and Figure 4, p. 110-111). As pictured in Figure 3 (p. 110) and Figure 4 (p. 111), the *Game of Floods* lists a wide range of mitigation strategies and includes information about their size and costs so that groups can consider how much they wish to purchase with their budget. Even though this list is limited, it is still quite a lot to process. The MHT provides a narrower list by contrast (see Figure 15, p.

178, and Figure 16 p. 179); however, these options are further complicated as groups are invited

to consider funding options, including local, USACE, FEMA, and Natural Resources

Conservation Service (NRCS) funds. Reducing funding options certainly streamlines gameplay;

however, one of the goals of each game was to encourage participants to consider creative

sources of funding. It may be necessary to maintain a complex funding framework in the MHT

and design it into the *Game of Floods* to support this learning outcome.

Figure 15: Structural measures listed in the Playbook for the Hampton Multi-hazard Tournament *in 2018*

Non-Structural Management Measures

Vents & Elevating Utilities

Acquisition (with recreational & wetland options)

Elevation

Figure 16: Non-structural measures listed in the Playbook for the Hampton Multi-hazard Tournament *in 2018*

The MHT Could Focus on One Region and Omit the Second Round. In both the MHT and the *Game of Floods*, scenarios are introduced, and groups take time to understand hazard conditions and their impact on a given region. For the *Game of Floods*, participants are asked to focus on one hypothetical region. In the MHT, participants are asked to focus on two regions in Hampton Roads, VA. While it better represents the complexity of the issue to consider more than one unique region, focusing on a single region for the game may further streamline the exercise and their process as they work through subsequent rounds.

While the *Game of Floods* moves participants through the proposal stage just one time to complete the game, the MHT requires participants to complete two proposals, repeating gameplay a second time. The main difference between the first round and the second round is the hazard scenario they were presented with. In round 1, the teams are asked to develop a plan for addressing repetitive loss in the regions where no disaster has occurred, meaning there is no access to disaster relief funds. In round 2, teams respond to a scenario where Hurricane Isabel recently swept through the regions, and disaster relief funds are available. Asking participants to develop a plan with and without certain funds supports learning objectives related to funding;

however, it asks a lot of participants to complete such an extensive exercise twice. The game

could be simplified by moving the audience through each round only once, requiring them to

develop a proposal in response to only one hazard scenario.

       The MHT Could Omit Either the Peer Score or the DST. Unlike the *Game of Floods*,

which doesn't include a rating system or a victory condition, the MHT determines a winner by

combining a peer score with a technical score. The MHT begins by asking participants to

develop a metric for rating their peers' final proposals. The data they input into the DST then

generates a technical score. A rating system has advantages: it provides valuable feedback to

help players understand their actions within the game, and by inviting audience members to

develop the peer score themselves, it creates an opportunity for inclusive participation. The

process of developing a metric for the peer score takes valuable time away from other more

important rounds of play, however, and could either be streamlined by preparing a metric in

advance or omitting it from the game.

       In the MHT, groups use the DST to weigh and select management measures, involving

both structural and non-structural measures (see Figure 17, p. 181), and a technical score is then

generated for the teams between rounds. Because the *Game of Floods* operates without a DST

and because most charrettes favor physical prototyping tools, it may be possible and

advantageous to proceed without one. Players may not get as much guidance or feedback about

their choices, but omitting the DST could streamline their experience and reduce the intensity of

the design period to something more comfortable for audiences. Because the victory condition is

based on a score, designers should not omit both the DST and the peer score. Based on other

elements of the heuristic, I recommend omitting the DST (in favor of simplicity and physical

design tools) while keeping only the peer score, allowing teams to develop their own metric (in favor of inclusive approaches to communication).

Figure 17: The Decision Support Tool, an Excel program used in the Hampton Multi-hazard Tournament *in 2018*

Overall, questionnaire data and observations suggest that players struggled with the intensity of these games, expressing the need for more time in order to complete the requirements. Because timeframe may be difficult to adjust (workshop constraints may limit the amount of time facilitators can allocate to gameplay, and professional audiences can only give so much of their own time), game mechanics can be revised to arrive at a more comfortable (while still being, perhaps, pleasantly uncomfortable) (Gee, 2005) level of intensity for players.

Foster Boundary Work for a Varied Audience within an Intense Period Using Charrette and Game Design Strategies

The final item in the heuristic points to design strategies that combine approaches from the charrette tradition along with tactics from game design (see Figure 18, p. 182). The recommendations listed in this section of the heuristic are intentionally broad as the CC game

genre encompasses a wide variety of media and content. I choose to focus on rules, feedback, and victory condition as they are aspects of most games. The recommendation to feature physical design tools, however, is more specific as it relates to charrette-style workshop settings that favor tabletop gaming.

charrette and game design strategies.

Strategies

- articulate clear rules to govern rounds of audience participation and production;
- provide adequate feedback to achieve discernibility and integration;
- feature physical design tools (such as prototyping materials) as opposed to digital programs;
- result in a quantifiable outcome, concluding with plans to address the articulated problems/challenges.

Figure 18: The strategies for CC games designed for stakeholder engagement contexts

Articulate Clear Rules to Govern Participation

First, cooperative tabletop CC games designed for stakeholder engagement workshops should articulate clear rules to govern rounds of audience participation and production. Rules are fundamental to gameplay as games are "defined by rules" (Salen & Zimmerman, 2004, p. 80), and they communicate the central message of the game, pointing to the assumptions made by the designers (Anthropy & Clark, 2014). Rather than analyze all game rules in the *Game of Floods* and the MHT, in what follows, I focus on the mechanics that were either reported or observed to

be the most problematic.

Rules for Role-playing were Unclear in the *Game of Floods*. According to my observations of the 2018 event, *Game of Floods* players read their role cards and discussed their roles during the round that required them to, but I didn't see them engage in much role-playing beyond that. According to my field notes, when one group selected their roles, a member said in jest, "I'm the mayor, so I guess I just get to ignore everyone." As they proceeded with the asset inventory round, another member said, "oh so we're probably supposed to fuss at each other over what we regard as our top assets," and another responded, "I think we're supposed to be fighting with the mayor," and they laughed. Role play set a playful tone early in the game, which helped to lower the stakes and serve as an ice breaker, but I didn't see revelatory connections made about stakeholders and the relationships among them. Ultimately, participants didn't continuously perform their role, and by the end of the game, this rule appeared to be forgotten. It may need to be better explained or supported, perhaps by integrating more information on role cards or by modeling how players should role-play, and facilitators may need to keep reminding audience members to do it.

The DST Was Unclear in the MHT. Players were required to input their selections into the DST throughout gameplay. Their input would then generate a technical score that, combined with the peer score the audience developed at the beginning of the game, would produce an overall score and determine a winner. One problem is that, as a decision support tool, it's designed with certain assumptions. I return to a portion of an interview quotation used above: "The DST was very sophisticated, but it had a few questionable assumptions built into it that I saw, and that I think some others saw" (Participant C, personal communication, June 15, 2018). One respondent on the questionnaire wrote, "we had a lot of experts at the table that knew their

programs really well, what we had a hard time understanding was how to succeed in the game."

Another indicated that their group felt they "were more successful in the game when [they]

focused on the DST than [when they] focused on what was best for the community," indicating

that the DST may have constrained gameplay and interfered with some of the goals of the game,

which is in part to inspire broader approaches to problem-solving that better serve the

community. The DST, therefore, succeeds in offering clear feedback to play and win the game,

but that feedback may guide players to follow the values infused into the DST rather than their

own values as a team. If the DST requires participants to focus more on its mechanics than on

"what was best for the community," then the DST and game rules are at odds, muddying the

clarity of the Tournament's central message.

Provide Adequate Feedback to Achieve Discernibility and Integration

Cooperative tabletop CC games designed for stakeholder engagement workshops should

provide adequate feedback to achieve discernibility and integration, according to game designers

Salen and Zimmerman (2004). They indicate that discernibility "means that the result of the

game action is communicated to the player in a perceivable way," (p. 34) and "integration lets

players know how [their actions] will affect the rest of the game" (p. 35). Players must

understand how their actions change the game. Both games achieve discernibility and integration

through the facilitator's role and end-of-session reflective discussion, but the use of referees in

the MHT works against an inclusive dynamic, and the lack of feedback in the *Game of Floods*

diminishes scalability.

The MHT Achieves Discernibility and Integration through the Use of Referees. One

significant way feedback is designed into the MHT is with the use of referees. Workshop

facilitators dressed in referee uniforms walked the room during the 2018 Tournament, answering

questions, listening in, and prompting new ideas and directions. At the end of the game, referees listened to proposals and provided overall feedback on each team's design. The referee dynamic provided a valuable feedback mechanism, but one respondent on the questionnaire pointed out some of the drawbacks in its execution:

> Coordinators were quite busy during the event, and often were trying to provide feedback to our group when we didn't really want/need it at the moment. I.e., we are trying to count how many houses we can fund under a certain program, and a referee comes over and starts telling us to focus on aspects they are experts in. With such limited time we felt a little overwhelmed.

A referee feedback system imposes a kind of hierarchy that works against the goal of fostering inclusive engagement. It communicates the message that some people in the room may have more knowledge or a broader perspective as they are placed in the role of filling gaps in players' knowledge and redirecting them as needed. Additionally, as indicated in the quote above, their feedback was not always timely or welcome. Adjustments to the approach can better leverage this dynamic.

Both Games Achieve Discernibility and Integration through Facilitation and Reflection. The *Game of Floods* doesn't have as many mechanisms for giving feedback as the Tournament. There is no scoring system, no victory condition, and there are no referees, but the two games operate similarly in the way they leverage the role of the workshop facilitator and end-of-session reflection. The facilitator in both games operated much like the referees in the MHT (in the MHT, the workshop facilitator was one of the referees): walking the room, listening in, redirecting, pointing out next steps.

In each game, the facilitator provided the main source of feedback, but each team was also invited to provide feedback to the other teams in the room at the end of the session. In reflective discussions at the end of gameplay, teams could comment on one another's proposal. In fact, in the MHT, teams were asked to score the other teams using the peer score metric they developed at the beginning of the session. This dynamic articulates the message that there is a right way to do things, and the community determines what's right through consensus. With no formal feedback mechanism and no victory condition in the *Game of Floods*, this game communicates a slightly different message: "there's not a right or a wrong way to do these things," (Participant E, personal communication, June 29, 2018). This open-ended conclusion invites multiple interpretations and fosters inclusive participation, but it works against other features in the heuristic: it doesn't provide adequate feedback to achieve discernibility and integration, it doesn't result in a quantifiable outcome, and I argue that it limits its ability to be easily adaptable and scalable for varying audiences. An audience of key stakeholders may be able to self-monitor their actions in the game, determining the feasibility of their planning decisions, but a less experienced audience, such as students, might not. They may be more likely to end up guessing with no formal feedback mechanism to help them adjust.

Feature Physical Design Tools as Opposed to Digital Programs

Cooperative tabletop CC games designed for stakeholder engagement workshops should feature physical design tools (such as prototyping materials) as opposed to digital programs. Because the CC game genre is an amalgam of various influences, such as modeling and simulation and charrettes, the nature of the tools involved runs the gamut from physical prototyping tools to digital programs like decision support tools. This recommendation encourages designers to move toward the charrette tradition to better achieve boundary work.

Physical tools foster inclusive cooperation among participants, they enhance accessibility to the issue, and enhance adaptability. While a digital program is a central feature of the MHT, the *Game of Floods* is entirely paper based.

      The *Game of Floods* Features Physical Tools whereas the MHT Features a Digital DST. There are no digital tools used by players of the *Game of Floods*. The only digital tool is a PowerPoint presentation that the facilitator projects to introduce the game and govern rounds of gameplay. For participants, each table is equipped with printed participant workbooks, role cards, a map, and worksheets for each round. The game doesn't feature prototyping materials beyond the space for writing provided on the worksheets and workbook; I observed participants improvising with a lanyard and a pen to measure distances on the map as a means of determining how many feet of sea wall they needed. Tools for measurement may be needed, but the game materials appear to cover the needs of the audience based on my observations and the lack of responses related to prototyping tools in the questionnaire.

      Responses to the questionnaire indicated that MHT players identified two primary aspects they would have liked to have seen improved. When asked about what changes players would make, 8 out of 9 respondents focused on the DST, calling for "more info on the DST" and the need for "a manual for the DST!" Questionnaire data and observations indicated that the DST posed some usability issues, whereas the physical tools available on the table (printouts of inundation maps, for example), were not reported as problematic. During interviews, I learned that the person seated at the computer station at each table had received training on the DST during a dry run that took place before the event. The tool, therefore, required some additional training. Not all members at the table received that training, which creates an imbalance that works against the goal of inclusive participation. Additionally, the one trained person seated at

the computer station was the only one who operated the DST. Others had to stand and lean in to get a better view of it, asking the operator to make specific changes so they could see what effect it had. While the DST works toward discernibility, offering feedback on the team's plans so that the team can weigh decisions and develop their adaptation plans accordingly, it works against some of these other heuristic features, making it a problematic game mechanic and one that may not be necessary given trends in the charrette tradition.

Result in a Quantifiable Outcome

As a response to both game design and approaches to charrettes, cooperative tabletop CC games designed for stakeholder engagement workshops should result in a quantifiable outcome, concluding with plans to address the articulated problems/challenges. According to Salen and Zimmerman (2004), a game concludes with "a quantifiable outcome," (p. 80) such as a victory condition, and charrettes work toward the development of a plan (Roggema, 2013). A quantifiable outcome also supports the previous recommendation regarding clear feedback.

Unlike The Game of Floods, the MHT has a Quantifiable Outcome. There is no victory condition for the *Game of Floods*, so there is no quantifiable outcome. The game does, however, conclude with plans to address the challenges articulated in the game. At the end, teams share their adaptation proposal with the group, and the session concludes with a reflective discussion. Discussion provides a form of feedback, as the facilitator and audience members raise points about which aspects of their proposals seem feasible, but the outcome is non-quantifiable. As indicated by a designer of the *Game of Floods*, "you really don't win or lose the game of floods because it's all about tradeoffs, and there's not a right or a wrong way to do these things" (Participant E, personal communication, June 29, 2018). The lack of victory condition conveys this message, and as mentioned before, this lack of feedback may not have a negative

effect on knowledgeable audiences (who can monitor their choices based on professional experience); however, less experienced audiences may struggle to understand the major takeaways of the game.

Like the *Game of Floods,* the MHT is designed to address the problems articulated by the game by inviting players to develop a proposal addressing resilience in specific regions according to a given scenario. Unlike the *Game of Floods*, the Tournament results in a quantifiable outcome because of a scoring mechanic and a victory condition. After proposals are shared with the group, teams score one another to produce a peer score. The DST also generates a score based on the team's entries into the program. The peer score and technical score are combined to produce an overall score for each team. At the end of the game, a winning team is declared, as well as a most improved team (based on the score increase between round 1 and round 2), and all of the winners received medals. Scores offer additional feedback throughout the game and provide a sense of conclusion at the end of it, but like the other forms of feedback in the MHT, it may also obscure the central message of the game as players focus on their score over more important concepts related to coastal resilience.

Conclusion

Both the *Game of Floods* and the MHT present unique responses to the communication challenges that these designers and facilitators face. They leverage game design and the charrette tradition to communicate complex messages about the issue of coastal resilience and the network of stakeholders involved while fostering an inclusive atmosphere for dialogue and collaboration. These games work toward all recommendations on the heuristic; however, there are aspects that could be enhanced to better achieve these aims. Each game is most successful in the boundary work they set out to achieve, but there are areas for improvement in regard to audience, context,

and strategies, all understandable areas of concern given the difficulty of attracting broad participation and the fact that the designers of these games do not have a background in game design. Overall, the *Game of Floods* accomplishes certain goals better than the MHT and vice versa, but both games require further revision, and as games that are constantly undergoing revision, I trust that they'll continue on their current trajectory toward effective boundary work.

Chapter 6 offers further support for practitioners as they continue on this trajectory. At the end of my interviews with game designers and workshop facilitators, I asked what they needed to make this work more successful. They pointed toward a need for clearly articulated outcomes for these games, more research, a collection of existing examples, and a greater understanding of the conditions that foster collaboration and decision-making. To respond to these needs, I offer a series of takeaways—pieces that can be used for further research, design, development, and assessment.

CHAPTER VI

KEY TAKEAWAYS FOR PRACTITIONERS WHO USE CLIMATE CHANGE GAMES

As a means of concluding this dissertation, this chapter shares what practitioners have identified as their needs, as it pertains to the use of CC games for stakeholder engagement workshops, and offers a response. As stated in chapter 2, storytelling as a methodology requires scholars to "listen to (instead of just seeing and sorting)" (Legg & Sullivan, 2018, p. 41). In keeping with this methodology, this chapter further relays the stories I listened to: in interviews, observations, and ongoing correspondence with my subjects of study. At the end of my interviews, I closed by asking them what they needed to make events like this more successful. While observing participants play the games, I recorded moments where players articulated how these games benefitted them, and how these games can do better. In ongoing correspondence with practitioners throughout my work on this dissertation, I received requests for research. Together, these voices pointed toward the following needs:

- A Statement of Purpose

    - Objectives need to be articulated clearly to make a case for their use and (once approved and planned) attract audiences.

- A Review of Literature

    - Sources are also needed to make a case for their use, while influencing further design and development.

- A List of Existing Games

    - A collection of games would help practitioners efficiently select appropriate tools for their needs, while influencing further design and development.

- A Greater Understanding of the Conditions that Foster Collaboration and Decision-making

  o The rhetorical boundary work heuristic can drive design and assessment in ways that enhance the boundary work these games aim to achieve.

This chapter responds by offering key takeaways: this statement, review, list, and my heuristic. My hope is that practitioners will borrow them for proposals or marketing materials; they might use these to explore examples of similar games, or they might add another tool to their existing design processes. These takeaways are by no means comprehensive, but I invite practitioners to use and build upon them as needed.

A Statement of Purpose

Two interview subjects pointed to a need for a clear sense of purpose. For one, that purpose could be achieved by "having a facilitator bring us all together to identify the goals, [articulating] what is going to be the benefit for the state" (Participant B, personal communication, June 16, 2018). The other was thinking about marketing these events: "we try to drive 'this is what we're doing, and this is why,' and give people a lot of lead time. So having that opportunity—why you're coming, what you're going to get out of it—is really important" (Participant C, personal communication, June 15, 2018). This participant noted that these professionals "have to have a good justification for it" (Participant C, personal communication, June 15, 2018): while the game might serve more of an educational purpose for public audiences, professional audiences may need a clearer objective. In the segment below, I draft a brief statement of purpose that practitioners may adjust to promote the use of CC games for stakeholder engagement. This statement certainly cannot apply to all CC games, contexts, or audiences, but it can be revised to fit the needs of a given situation.

This stakeholder engagement workshop features a game that has been designed for the following purposes:

- Offer a valuable networking opportunity:
  - Funding is more successful for cross-jurisdictional projects. This game invites you to work a problem with colleagues from different disciplinary and professional backgrounds, creating connections that may lead to collaboration across jurisdictional boundaries. Transcend boundaries for solutions that work.

- Create a low-stakes environment for creative problem-solving:
  - Gameplay generates a brainstorming session that can influence the design of hazard mitigation plans for the region, plans that require updates and revisions. The voices at these tables can offer creative ideas that ultimately shape policy.
  - This brainstorming session can hone skills in marketing a given hazard mitigation plan within your community. Listening to the voices at these tables will help you tune in to your community.

- Introduce a new tool for future training/educational events:
  - This game can be adapted to different audiences and contexts, making it a valuable tool—for educating stakeholders, for creating better plans for more resilient communities, and ultimately reducing the damage we see in our communities.

This statement of purpose infuses material from scholarship, as well as data from interviews and observations. The first bullet point ("offer a valuable networking opportunity") articulates the goals of a boundary object (Wilson & Herndl, 2007) in language that may appeal to professional audiences who are familiar with the value of networking, and the support I offer

("funding is more successful for cross-jurisdictional projects") is a direct quote that I recorded in observational field notes during gameplay as a player reflected on the value of the MHT. "Work a problem" is a quote from an interview, as the speaker was describing charrettes (Participant C, personal communication, June 15, 2018). Using language that a practitioner might use to describe charrettes may help make games more familiar, as charrettes are more familiar to urban planning communities.

The second bullet point ("create a low-stakes environment for creative problem-solving") is largely influenced by game studies as scholars note the significance of low-stakes play (Caillois, 1961). An interviewee indicated that the *Game of Floods* would "influence the design of hazard mitigation plans for the region, plans that require updates and revisions" (Participant D, personal communication, June 26, 2018), and I recorded the workshop facilitator stating that the game would help players consider how they might market their hazard mitigation plan within their community.

The third bullet point ("introduce a new tool for future training/educational events") is inspired by interviews. Multiple participants indicated that these games were valuable tools that players could turn around and use for their own purposes, whether for education, training, or planning (Participant A, personal communication, June 7, 2018; Participant B, personal communication, June 16, 2018; Participant C, personal communication, June 15, 2018; Participant D, personal communication, June 26, 2018; Participant E, personal communication, June 29, 2018). I employ their language and their values to help articulate one of the games' key purposes. Overall, the language I use for this purpose statement can be used to promote a variety of tabletop CC games for stakeholder engagement contexts.

An Abridged Review of Literature

       Practitioners indicated an interest in gathering more sources related to their efforts. While drafting this dissertation, I received emails from those I interacted with, requesting sources and any review of literature I might be able to offer, and during an interview, one participant stated, "I'm always interested in more research" (Participant D, personal communication, June 26, 2018). While chapter 2 offers a more extensive review of literature, I include an abridged version in Appendix G that practitioners might find useful for their purposes, whether they may need a small passage to develop a pitch, a proposal, or other argument for the use of games in stakeholder engagement workshops. This summary may also point practitioners to other disciplines where they can continue their inquiries. As a means of condensing the review of literature presented in chapter 2, this abridged version leaves out literature from urban planning, as well as broader sources about modeling and simulation (M&S). This choice is reflective of my understanding of audience: as practitioners in the resilience community, they are likely familiar enough with urban planning and M&S to omit for this version (see Appendix G).

A List of Existing Climate Change Games

       Interviewees indicated an interest in developing a "collective knowledge base" (Participant E, personal communication, June 29, 2018) associated with games like the *Game of Floods* and the MHT, including a list of existing games that might serve as examples for further design and development or a cache of resources to adopt and implement in future workshops. I highlight interview moments where they express this interest in Table 8 (p. 196):

"Having the game tools developed, you know that's something we don't have the capacity to do is develop those kinds of tools, like the Decision Support Tool or the Game of Floods. To have those things available is certainly helpful" (Participant C, personal communication, June 15, 2018).
"I can't come up with these types of creative tools on my own. I don't have enough time; I don't have enough bandwidth, but I sure recognize them when I see them, and my job is to help get word out to these communities and to these community leaders that these things exist and that they will help" (Participant D, personal communication, June 26, 2018).
"Sort of a list of existing games or some kind of way for us to identify what other similar types of games are out there so that we can pull from that, and maybe people could use the game for their own purposes but understand what different games are out there and how they've been used and some of the lessons learned from those things" (Participant E, personal communication, June 29, 2018).

Table 8: Key quotations expressing an interest in a collective knowledge base

In what follows, I offer two lists of examples of the CC game genre that are available in the English language (at the time of writing this dissertation), organized according to format and presented in alphabetical order (see Table 9, p. 197, and Table 10, p. 198). While these lists are not comprehensive, they share options that practitioners may find useful.

Computer Games
2050 Energy Calculator is a browser game that operates more like a robust energy calculator. The goal is to reduce carbon emissions in the UK by 2050, and the user adjusts dynamic sliders associated with different economic sectors to lower emissions while examining graphs that articulate the impact such decisions have on the economy (Department of Energy and Climate Change, n.d.).
BBC's *Climate Challenge* is a free, single-player browser game, where the player operates as the president of European Nations, tasked with reducing carbon emissions to combat climate change. As president, the player must keep voters happy to remain in office (BBC, 2014).
Before We Leave is a city building game spanning multiple planets. Set at a point when inhabitants can re-emerge after a disaster, the player weighs decisions about development against their environmental impact (Carpenter, 2020).
Climate Quest is a free, downloadable game where the player selects from a set of practitioners (such as an urban planner or climate scientist) and sends one to a given region to help it prepare for upcoming climate disasters (Earthgames, n.d.b).
Enercities is a free, single-player, city building browser game that invites the player to design a sustainable city, managing pollution and making choices to enhance renewable energy (Paladin Studios, n.d.).
Flood Fighter: Nevada was designed by the Nevada Silver Jackets to educate youth audiences about emergency management as it pertains to flooding. In this free, downloadable game, players must respond to different flood scenarios (Nevada Floods Awareness Committee, 2014).
The Other World is an augmented reality scavenger hunt with a theme of climate justice, designed to be played on the campus of the University of Washington in Seattle (Earthgames, n.d.c).
Rizk is a free, single-player, browser game where players must mine for resources to encourage their plant to grow. As they mine, they awaken threats: spores that attack the plant. The player can respond by budgeting for and implementing defenders (Kongregate, n.d.).
WaterSim is a computer model that is accessible online or on site at Arizona State University's Decision Theater. It combines water supply and demand, as well as climate and political data and communicates it in the form of dynamic charts and graphs (Arizona State University, n.d.).

Table 9: A list of current computer games in the climate change game genre

Tabletop Games[†]
Adaptnation is a role-playing game where individual players operate as city leaders, coordinating with one another to form a nation and respond to worsening conditions related to climate change (Earthgames, n.d.a).
Before the Storm is a role-playing game where participants respond to forecasted weather-related disaster scenarios. Designed by the Red Cross Red Crescent Climate Centre, this game is intended for donors, members of the community, as well as practitioners associated with the Red Cross (Climate Centre, 2020a).
Broken Cities invites players to compete in city building, aiming to gain the most wealth while making decisions about profit or environmentalism (University of Helsinki, 2018).
California Water Crisis balances water demand with resources in one of the three main regions in California: Northern CA, Southern CA, and the Central Valley (California Rail Map, n.d.).
Climate Diplomat Negotiations is a role-playing game, where players adopt the perspective of multiple stakeholders engaged in negotiations to "extend or replace the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC)" (Hart, 2009).
Cool It! Is a 90-minute workshop designed for elementary school aged children. The event includes games, videos, quizzes, and dialogue to educate students and raise awareness about climate change. It concludes with a 4-week Cool It! Challenge, where students work toward reducing their carbon footprint at home and compete for prizes and public recognition (British Columbia Sustainable Energy Association, 2015).
Decisions for the Decade is a tabletop educational game, inviting players to engage in cooperative decision making, navigating the challenges of a changing climate and working to manage risks (Climate Centre, 2020b).
Early Warning, Early Action is a card game designed to generate discussion among climate scientists, Red Cross volunteers, and community members. Players review or generate action cards to respond to a forecast scenario (PetLab, n.d.).
Extreme Event is a role-playing game, where players respond to a disaster simulation related to an earthquake, hurricane, or flooding event. Game materials can be downloaded for free, and there is a Digital Game Portal that requires computer access during the workshop (National Academy of Sciences, 2020).
Flood Resilience Game is a role-playing game that invites players to assume the role of an affected stakeholder, such as a farmer or government official, and explore strategies and policies for enhancing resilience and dealing with flooding in a river valley region (Centre for Systems Solutions – CRS, 2018).

[†] Tabletop games may include a digital element, such as a computer program designed as feedback or as a decision support tool.

International Climate Conference is a game designed to simulate an international climate conference, negotiating goals for CO2 emissions (Planpolitik, n.d.).
Keep Cool is a board game designed in English and German, inviting players to role play as global leaders, determining whether to protect the environment or protect their "own interests" (Petschel-Held & Eisenack, n.d.).
Sustainable Delta is a serious game where participants work in teams to develop a plan to respond to flooding and/or drought in three fictional delta regions (Deltares, n.d.).
Thirst for Power is a resource management game where players must balance transportation and energy needs with their water resources, while considering their environmental impact. A card game designed for 2-5 players, each player assumes the role of governor in a given region (Board Game Geek, n.d.a).
The *UVA Bay Game* is a role-playing game, inviting audiences that range from students to practitioners to operate as key stakeholders to address concerns related to the Chesapeake Bay Watershed (Center for Leadership Simulation & Gaming, n.d.).
UVA Louisiana Coastal Resilience Game is a role-playing game, inviting student audiences to operate as key stakeholders to address Louisiana's changing shoreline (United States Business Council for Sustainable Development, 2020).
Wargame: Clout and Climate Change invites practitioners to generate strategies for national security in light of climate change (Center for a New American Security, n.d.).
Winds of Change is a board game where players build cities while limiting CO2 emissions (Board Game Geek, n.d.b).
World Climate is a role-playing simulation, using a computer program to model the results of negotiations (Climate Interactive, 2020).

Table 10: A list of current tabletop games in the climate change game genre

A Greater Understanding of the Conditions that Foster Collaboration and Decision-making

Interview subjects pointed to an interest in understanding "the conditions that foster the integration of this process effectively into ongoing work that would help improve or foster decision making" (Participant A, personal communication, June 7, 2018). They pointed to an interest in "more collaboration" (Participant B, personal communication, June 16, 2018) and a

way to bring "us all together, the different stakeholders, to develop this plan that would be implementable in different areas" (Participant B, personal communication, June 16, 2018). These interests indicate a desire to produce boundary objects that work toward inclusive and dialogic cooperation among a heterogeneous audience. The rhetorical boundary work heuristic I offer will help practitioners assess existing games for their ability to fulfill their goals, for their intended audience, within their unique contexts, while attending to important strategies in game design. It can be used as a rubric for determining whether a given game operates according to these standards, or it can drive the development of questions for post-test questionnaires if practitioners are assessing the efficacy of their games in use. It will also help in further development of current or future games for stakeholder engagement, as designers can use these features as standards to work toward.

Cooperative tabletop CC games designed for stakeholder engagement workshops should…

- work toward inclusive and dialogic cooperation that should not necessarily pursue consensus;

- enhance accessibility to the issue by presenting clearly articulated problems/challenges (preferably artificial conflict) for the audience to address;

- be easily adaptable and scalable, able to serve varying audiences, purposes, and contexts;

- involve a heterogeneous audience of stakeholders, made up of different disciplinary and professional backgrounds;

- take place within an intense design period, within a single- or multi-day workshop;

- articulate clear rules to govern rounds of audience participation and production;

- provide adequate feedback to achieve discernibility and integration;

- feature physical design tools (such as prototyping materials) as opposed to digital

programs; result in a quantifiable outcome, concluding with plans to address the

articulated problems/challenges.

The Rhetorical Boundary Work Heuristic blends data from interviews and observations with

theory regarding boundary objects, rhetoric, technical communication, urban planning, and game

studies to produce a standard for CC game design. The purposes listed above are intended to

foster boundary work, and they come from scholarship on boundary objects; however, they

infuse calls for inclusive, dialogic communication from rhetoric, technical communication, and

urban planning, as well. Scholars and practitioners across these fields share an interest in

promoting interdisciplinary collaboration. Likewise, the statement about involving a

heterogeneous audience is not only driven by boundary objects but rhetoric, technical

communication, and urban planning. The context, an intense design period, harkens to charrettes

and their power to inspire active engagement in urban planning. The strategies section listed

above largely comes from game studies, but they serve the overarching purposes of these games.

For example, clear rules governing rounds of gameplay contributes to the goal of enhancing

accessibility. Utilizing physical tools is a nod to charrettes as a staple of urban planning, and it

promotes inclusive dialogue as they are easier for audience members with varying expertise to

manipulate. Like the games it frames, this heuristic is an amalgam of different influences, and

it's designed to help practitioners better achieve this important boundary work.

Assumptions and Limitations

This project surprised me. I knew I wanted to study climate change games, but by the

time I heard that the *Game of Floods* and the MHT would be featured in workshops in my

region, I had very little time to prepare and even less information about them. I assumed I would

see these games being used as educational tools for public engagement, and this assumption was

based on the perception that, outside of entertainment, games are used for education and training. It was also based on the emphasis on public engagement I had been seeing in technical communication scholarship about environmental risk. When I arrived and began interviews and observations, I discovered that these were stakeholder engagement workshops, or "train-the-trainer" events, and these games were being played by experts to develop expertise. While training was certainly involved, these weren't just educational games being used to educate; there was something else at work here, and it took time for me to place it.

I also had limited access to these games. Practitioners shared the 2018 game materials with me (such as the participant workbooks and facilitator guides, as well as the DST), but I did not have access to previous iterations, and game materials are somewhat static when they aren't being played. Observational field notes allowed me to see the games in action, but field notes have their limitations: my notes are likely shaped by my knowledge and background, as well as the assumptions I carried with me to the research site. Having little prior knowledge about the games and these events before they took place, I had to rely on semi-structured methods of note-taking, which are less focused than structured approaches. Additionally, the act of note-taking itself is limited: having to tune in to the work of one team meant missing out on moments of interaction going on between players at another table. Without audio- or video-recording, I could only capture so much of the gameplay in writing.

I also had limited access to the professional communities employing these games. As tabletop games designed for stakeholder engagement workshops, they only appeared once in this region during the time of writing this dissertation; as a result, I didn't have an opportunity to pilot my methods. I was granted opportunities to interview a small sample of practitioners, but as an outsider to this community, I lacked the personal and professional experience to fully

understand the nuances behind their work and appreciate the challenges they faced. Survey

research is inherently biased: questionnaires offer self-reported opinions of players, and

interviews reflect personal views, while my own biases shape the nature of the questions I ask.

Thematic analysis is also limited as there is no second coder for this project.

Overall, my findings are not generalizable. I offer a regionally specific case study of two

climate change games and their use in stakeholder engagement contexts in Coastal Virginia. I do

believe, however, that this case study has far-reaching implications for games that do this kind of

rhetorical boundary work, particularly in challenging communication contexts among diverse

audiences of stakeholders.

Conclusion

As I reviewed observational field notes and began coding the interviews, the notion of

boundary objects came to the fore. When I paired my data with scholarship, I found support for

the idea that these games are boundary objects, and they are being used (perhaps unintentionally)

to do boundary work. As boundary objects themselves, they are the manifestation of a wide

variety of influences from game studies, technical communication, modeling and simulation, and

urban planning. While some of these influences are intentional (designers drew on their

background in urban planning, infusing elements of charrettes and shared vision planning into

their games) others were not (the exigence these designers are responding to is inherently

grounded in technical communication, and choosing games as a medium involves the many

disciplinary influences that come packaged with games). In tracing the origin of these games,

this dissertation attempts to come to terms with the emergent genre of CC games, calling

attention to this genre for future researchers and pointing practitioners to scholarly traditions that

may be less familiar to them. As boundary objects with myriad influences, this origin story is

surely incomplete, and further research is needed from different disciplinary perspectives to fill the gaps. Such work is important: by understanding its roots, we can better understand this multifaceted genre and leverage it for the greater good.

These games are boundary objects, and they operate as boundary objects when deployed. While more could be done to enhance their boundary work, they're being used to work toward inclusive and dialogic cooperation without necessarily pursuing consensus. They're attempting to communicate the extraordinary complexity of resilience through artificial conflict that invites experimentation. They're scaled to different scenarios and adapted to a wide variety of diverse audiences for different purposes across the United States and beyond. During interviews, these designers and workshop organizers never used the term "boundary object" to describe their work, but these games certainly exhibit the features of boundary objects, and as urban planning communities continue to work against problematic communication models like the deficit concept, the notion of boundary objects can be a valuable metaphor. This dissertation highlights the nature of these games as boundary objects and proposes a heuristic that practitioners can use to continue the important boundary work they're already doing.

And it is important work. Scholars and practitioners across disciplines have been calling for dialogic communication for decades, and these games represent an innovative attempt at moving the resilience community forward. We need good tools that foster holistic problem-solving strategies while promoting interdisciplinary, cross-jurisdictional collaboration. We need effective boundary objects that lead to better plans for more resilient communities. We need good games that invite diverse audiences to play.

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APPENDIX A

INTERVIEW SCRIPT

Introduction:

Is it ok for me to record this conversation?

I have started the recording. If you decide to participate in this study, then you will take part in an audio-recorded interview about your process of and your goals for designing game elements for this public outreach effort. It will also involve research of typewritten observational field notes recorded by the investigator during the event you designed. If you say YES, then you are agreeing to voluntarily participate in a 30-minute interview. You may refuse to answer any of the questions at any point during the interview. Observational field notes will be conducted during the duration of the public outreach event, recording the behavior of event attendees). Identifying information about you and event participants will not be recorded. Do you agree to my attending the event and taking observational field notes? And may we proceed with the interview?

<div align="center">25 questions</div>

About the event:

1. Please describe this event.
2. Aside from "the Tournament" what terminology do you use to describe this event (a stakeholder workshop? A public meeting?)? Is it non-traditional? What distinguishes it from other types of intervention?
3. Why adopt this particular method of intervention with your audience as opposed to another; what are its strengths? What are its weaknesses?
4. Have you organized events like this in the past? If so, can you describe them and their similarity to this one?

About the audience:

1. How many are attending, and who is attending this event (their age, residency, title, stake in the discussion)?
2. Why do you think this audience needs this intervention?
3. What are they expecting to get out of this event?
4. What is their motivation for attending?

About the purpose:

1. What need, gap, or set of challenges does this event respond to?
2. What are you hoping to achieve/what are the desired outcomes?
3. Are there plans to use feedback (or other outcomes) produced by participants during gameplay in any way? If so, how will it be used?

About your strategies:

1. How did you design the workshop to achieve each desired outcome and respond to the needs/challenges you described?

2. Why did you adopt a game for this context?

3. What limitations do you see in the strategies you employ?

4. What are the strengths of these strategies?

About your process:

1. How did you prepare to employ the strategies you just described?

2. What was your process for designing this event?

3. What was your process for designing the game within the event?

4. Do you seek feedback from would-be audience members while designing/preparing? If so, can you describe your methods?

5. Do you seek feedback from audience members after they have attended the event? If so, can you describe your methods?

6. If you responded yes to question 3 or 4 above, can you describe how you use this data?

Other:

1. What do you need to make events like this more successful? (What do you need from research?)

2. Can you describe any similar efforts in Hampton Roads that have occurred recently or will be occurring in the near future?

3. Are there any other comments you'd like to make about this work that I may not have covered with my questions?

4. Do you have any questions for me?

APPENDIX B

MULTI-HAZARD TOURNAMENT QUESTIONNAIRE

Hampton Multi-Hazard Tournament Post-Evaluation 2018
DESCRIPTION OF RESEARCH STUDY

Several studies have been conducted looking into the subject of the process and efficacy of designing games for, as well as gamification elements of, public outreach and stakeholder workshops, but further research is needed on the dynamics at work in this unique and complex communication context.

If you decide to participate in this survey, then you will be sharing anonymous feedback and join a study involving research of a survey about your reactions to the game. Participation is voluntary. If you agree to participate, then your participation in the survey will last for approximately 15 minutes. Approximately 30 game participants will take part in this study. Responses are anonymous; identifying information of participants will not be recorded. You may refuse to answer any of the questions at any point during the survey.

RISKS AND BENEFITS

RISKS: No identifying information will be collected, so there little to no risk of a loss of anonymity; however, as with any research, there is some possibility that you may be subject to risks that have not yet been identified.

BENEFITS: There are little to no benefits. Potentially, the main benefit to you for participating in this study is that participation invites potentially valuable reflection on your experience as a game participant, which may influence the way you use this experience.

COSTS AND PAYMENTS

This research is not supported by funding. The researcher is unable to give you any payment for participating in this study.

CONFIDENTIALITY

The researcher is not collecting identifying information and will store survey responses in a password-protected file folder. The results of this study may be used in reports, presentations, and publications; but the researcher will not identify you. Of course, your records may be subpoenaed by court order or inspected by government bodies with oversight authority.

WITHDRAWAL PRIVILEGE

It is OK for you to refuse to participate. Participation is voluntary, and you may refuse to answer any question by skipping it. Your decision will not affect your relationship with Old Dominion University, or otherwise cause a loss of benefits to which you might otherwise be entitled. The researchers reserve the right to withdraw your participation in this study, at any time, if they observe potential problems with your continued participation.

VOLUNTARY CONSENT

By completing this survey, you are saying several things. You are saying that you have read this form or have had it read to you, that you are satisfied that you understand this form, the research study, and its risks and benefits. The researchers should have answered any questions you may have had about the research. If you have any questions later on, then the researchers should be able to answer them:

Megan McKittrick, M.A. – Investigator (757) 683-5818

Daniel Richards, Ph.D. – Responsible Project Investigator (RPI) (757) 683-4629

If at any time you feel pressured to participate, or if you have any questions about your rights or this form, then you should call Dr. Tancy Vandecar-Burdin, the current IRB chair, at 7576833802, or the Old Dominion University Office of Research, at 7576833460.

Q1: Please indicate your level of agreement with the following statements about the information you received, including the invitation, decision support tool, and playbook:

#	Question	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
1	The tournament met my expectations.					
2	I received information that I did not need to use for the tournament. (please describe)					
3	I would have liked to receive more or different information before the tournament.					
4	The playbook was useful during the tournament.					
5	The tournament organizers/facilitators provided clear goals for what the tournament would accomplish.					
6	The Decision Support Tool was useful during the tournament.					

Q2: Please explain your response to this statement: "I received information that I did not need to use for the tournament."

Q3: Please explain your response to this statement: "I would have liked to have received more or different information before the tournament."

Q4: What additional information do you wish you had during game play?

Q5: Is there anything we should change about the information that we provide, including the invitation, Decision Support Tool tutorial, and playbook? Please describe.

Q6: Please indicate whether, after the tournament, you feel less, more, or no change in familiarity/comfort with each of the following than you did prior to participating in the tournament:

#	Question	Less familiar/com fortable	No change	Slightly more familiar/comfort able	Much more familiar/comfortable
1	The NAACS Report				
2	CRS Points				
3	Using models to make decisions and plan for the future				
4	Available Funding Sources				
5	How other groups of stakeholders (other than my own) deal with flood hazards and water quality issues				

Q7: Please indicate the degree to which you agree or disagree with the following statements about your experience with the tournament:

	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
The hazard scenarios provided a realistic context for decision making.					
The length of the tournament was appropriate.					

The pace of the tournament was appropriate.					
The tournament was the right mix of information and engagement					
I learned information during this tournament that will inform my future decisions related to water quality and flood control.					
The relevant stakeholders and interests were represented at the tournament.					
The tournament fostered meaningful dialogue between me and event coordinators.					
The tournament fostered meaningful dialogue between me and fellow participants.					

Q8: Please explain your response to the statement above "the tournament was the right mix of information and engagement."

Q9: Please define what engagement means to you.

Q10: Please explain your response to the statements above regarding "meaningful dialogue" between you and event coordinators and fellow participants.

Q11: If you disagreed with the statement above, that "relevant stakeholders and interests were represented at the tournament," please explain who should be included.

Q12: As a result of the tournament, did you:

#	Question	No	Yes
1	Meet a person you didn't know before who could be a beneficial contact in the future?		
2	Discuss potential projects or collaborations?		
3	Learn about another person's interests with regard to funding that will be useful to you professionally?		
4	Identify potential opportunities to coordinate efforts?		
5	Identify potential projects that could be implemented?		

Q13: As a result of the tournament, how likely are you to:

#	Question	Not likely	Somewhat likely	Very Likely	Not applicable	I don't know
1	Pursue new projects or collaborations with someone you have worked with before?					
2	Pursue new projects or collaborations with someone you have NOT worked with before?					
3	Follow up to learn more about another aspect of funding?					
4	Consider a different approach to problem solving, decision making and/or planning related to water quality, flooding, or drought?					
5	Consider a different approach to problem solving, decision making and/or planning related to water quality or flooding?					

| 6 | Look into the NAACS Report or CRS Points. | | | | | |

Q14: Based on your experience, for what purposes would you recommend the use of a tournament exercise like this one?

#	Question	No	Maybe	Yes
1	Networking among stakeholders			
2	Increasing levels of trust among stakeholders			
3	Learning about flooding hazards and water quality			
4	Improving communication among stakeholders			
5	Creating new collaborations to address common problems			
6	Identifying strengths and weaknesses in various strategies for solving problems			
7	Identifying the costs and trade-offs among various strategies for solving problems			
8	Evaluating the financial investments needed to solve problems			
9	Developing hazard mitigation/response plan(s) focusing on water quality or flooding hazards			

Q15: What did you learn today that you didn't know before that would be helpful in decision making or investing in flood or water quality mitigation moving forward? How might you use this information in future projects or initiatives?
Q16: What additional information will you be seeking after you leave today?
Q17: Additional comments:

APPENDIX C

PERMISSION TO USE IMAGES FROM THE USDN ITERATION OF THE *GAME OF*

***FLOODS*‡**

Re: Request for Permission to use Images of Game of Floods

[redacted]

Tue 8/13/2019 5:51 PM

To: Mckittrick, Megan L. [redacted]

Hi Megan,
I would love to hear more about your project and what you're writing about the USDN Game of Floods.
Obviously we would want you to credit the Urban Sustainability Directors Network and also have some information about how USDN developed the tools and how FEMA is utilizing them with local governments with USDN support.
I personally have facilitated the USDN Game of Floods over 160 times and would be happy to send you additional photos if you're interested.
If you have a chance, we'd love to hear more about your dissertation.
Best,

[redacted]

[redacted]
Urban Sustainability Directors Network
[redacted]

www.usdn.org / Twitter: @theUSDN

On Tue, Aug 13, 2019 at 11:00 AM Mckittrick, Megan L. [redacted] wrote:

Hello, [redacted]

I hope this message finds you well. I am writing to request permission to publish images of the *Game of Floods* in my dissertation. My dissertation examines the use of games in stakeholder engagement meetings in Hampton Roads in 2018.

The images I use will likely include a screenshot of the game board, game cards, and player handbook used at the June 2018 event in Chesapeake, Virginia. I did not take any photographs at the event itself, so images will only consist of screenshots of the game materials shared by [redacted]

Please let me know whether I need to seek permission from any other parties involved in the design of the game materials beyond you and whether you consent to have these images published for academic purposes.

Thank you so much for your time. I look forward to hearing from you.

Megan McKittrick
Lecturer
Ph.D. Candidate

---

‡ Identifying information redacted

APPENDIX D

PERMISSION TO USE POST-TEST QUESTIONNAIRE FOR THE *GAME OF FLOODS*§

Re: Game of Floods: Request for access to survey results

Tue 6/26/2018 12:10 PM

Dissertation

Cc:Mckittrick, Megan L.

Will do, ▮ You will be receiving those results this week.

resilienceaction
partners | A JOINT VENTURE OF OGILVY PUBLIC RELATIONS & MICHAEL BAKER INTERNATIONAL

From:
Date: Tuesday, June 26, 2018 at 12:02 PM
To:
Cc: "Mckittrick, Megan L."
Subject: RE: Game of Floods: Request for access to survey results

All –
I promised Megan that we would share the results of our workshop survey with her for inclusion in her dissertation project. Please send her a copy when you send the results to me, ▮ We will review before sharing with our state partners.

Thanks for everyone's help.

"The devastation of the next storm will not be decided in the weeks in which it rakes across the ocean or the days in which it pounds our shores. The impact of the next hurricane is being decided right now— in the days, weeks and months of preparation that are required to make communities resistant to disaster."
Anonymous

---

§ Identifying information redacted

APPENDIX E

PERMISSION TO USE IMAGES OF THE *MULTI-HAZARD TOURNAMENT*[**]

From: █████████████████████████████████
Sent: Monday, August 17, 2020 8:04 AM
To: ████████████████████████████████
Cc: Mckittrick, Megan L.
Subject: RE: [EXTERNAL] FW: Requesting Permission to use images of MHT in Dissertation

Thank you, █████████████

Respectfully,

███████████████████████████████

U.S. Army Corps of Engineers, Norfolk District

████████████████████████

Let your past inform your present steps towards a better future!

From: ███████████████████████████
Sent: Monday, August 17, 2020 8:02 AM
To: ██
Cc: Mckittrick, Megan L.
Subject: [Non-DoD Source] RE: [EXTERNAL] FW: Requesting Permission to use images of MHT in Dissertation

███████████

I have no issues.

Thanks,

█████████

-------- Original message --------
From: █████████████████████████████
Date: 8/17/20 7:59 AM (GMT-05:00)
To: ████████████████████████████████████
Cc: "Mckittrick, Megan L."
Subject: [EXTERNAL] FW: Requesting Permission to use images of MHT in Dissertation

Good morning Megan,

Thank you for the ask. I have no concerns about the first four images.

███████████████

Do you have any concerns about publishing the map that we used for the multi-hazard tournament?

Respectfully,

████████████████████████

U.S. Army Corps of Engineers, Norfolk District

████████████████████

[**] Identifying information redacted

APPENDIX F

PERMISSION TO USE POST-TEST QUESTIONNAIRE FOR THE *MULTI-HAZARD*

***TOURNAMENT*††**

From: [redacted]
Sent: Tuesday, August 13, 2019 11:23:26 AM
To: Mckittrick, Megan L. [redacted]
Subject: RE: Permission to use Survey Results in Dissertation

Hi Megan,

Of course. Would you mind sharing your results again with me and also, they results will be anonymous, correct?

Thanks!

Respectfully,

[redacted]

[redacted]

[redacted]

U.S. Army Corps of Engineers, Norfolk District

[redacted]

[redacted]

---

†† Identifying information redacted

From: Mckittrick, Megan L. ███████████████████
Sent: Monday, August 12, 2019 9:45 PM
To: ███████████████████████████████
Subject: [Non-DoD Source] Permission to use Survey Results in Dissertation

Hello, ████████████

I am writing to request permission to use the results of the following survey as a reference in my dissertation:
██

Hampton Multi-Hazard Tournament Post-Evaluation 2018

████████████████

Thank you so much for your time.

Megan McKittrick
Lecturer

Ph.D. Candidate
Department of English
Old Dominion University

APPENDIX G

AN ABRIDGED REVIEW OF LITERATURE

As communication artifacts that respond to different disciplinary pressures and are influenced by a number of related traditions, climate change (CC) games designed for stakeholder engagement contexts exist on the boundaries of various fields of study: rhetoric, technical communication, risk communication, urban planning, game studies, and modeling and simulation, with more specific research on the CC game genre.

Scholarship in the fields of rhetoric, technical communication, risk communication, and urban planning reveal the exigence behind these unique artifacts. Researchers in rhetoric, who investigate artifacts related to risk and technical communication, have identified problematic power differentials in spaces like civic meetings: risk communication has a history of being framed in such a way that limits audience involvement in decision-making, and these scholars have called for more inclusive, dialogic participation between speakers and audiences (Grabill & Simmons, 1998; Simmons, 2007; Staggers, 2006). Researchers in modeling and simulation and urban planning have likewise called for strategies that foster dialogue and public engagement (Kirshen & Caldwell, 2008; Palmer, et al., 2013). Such widespread interdisciplinary interest in dialogic communication has motivated practitioners to experiment with modeling and simulation tools, as well as games, gamification, play, and prototyping methods (Gordon & Shirra, 2011; Katsaliaki and Mustafee, 2015; Lerner 2013; Poplin, 2012; Sadler, et al., 2013; Sadowski, et al. 2013).

Research focusing on the emergent genre of CC games pays particular attention to their uses and efficacy in educational contexts, their power to raise awareness, and to spur

communities to engage in problem-solving strategies and eco-friendly behaviors (Froehlich, 2014; Waddington, 2015). They argue that games enhance participation, moving toward more inclusive models of communication. Driven by risk communication research, CC game scholars acknowledge problematic communication models (Aleksandra, et al., 2016; Lee, et al., 2013; Nussbaum, et al., 2015) and call for localizing game content to better include the public's experiences (Chowdury, et al., 2012), while appealing to the values (Etkin & Ho, 2007) of a targeted, regional audience (Duan & Fortner, 2005).

Enthusiasm over the power of CC games is reminiscent of enthusiasm over educational games in general. Games and simulations have long been recognized by scholars for their worth as an educational tool (Mäyrä, 2008). Games have been used for learning and teaching for 4-5,000 years (Tobias & Fletcher, 2011, p. 6). Game studies reviews of literature demonstrate that there are several key themes in ongoing discussions of learning games: that games engage/motivate (Mitchell, et al., 2004; Dodlinger, 2007), that games offer unique learning benefits (Mitchell, et al., 2004; Dodlinger, 2007), and that there are opportunities with new and emerging technologies (Mitchell, et al., 2004).

Motivation is one of the primary subjects of study in educational games, showing a general consensus that games have the potential to motivate players in ways that are valuable to educators (Dodlinger, 2007). However, there is disagreement over what it is that makes games uniquely motivating (Dodlinger, 2007): some believe narrative context in games are particularly motivating (Dickey, 2005; Fisch, 2005; Waraich, 2004; Dodlinger, 2007); goals and reward systems motivate players (Amory, et.al., 1999; Jennings, 2001; Waraich, 2004; Zagal, et al., 2000; Dodlinger, 2007); and games enable players to achieve a "flow" state (Csikszentmihalyi, 1990; Prensky, 2001).

There are also a number of ways scholars believe games educate: they encourage engagement in passive learners (Tanner & Jones, 2000; Annetta, 2007), reaching "learners who may lack interest or confidence" (Mitchell, et al., 2004) or those who struggle with traditional learning styles (Dede, 2004; Annetta, 2007); they offer repetitive scenarios for "drill and practice" (Mitchell, et al., 2004) that often increase in complexity and difficulty in safer and more practical ways through low-cost simulation games (Mitchell, et al., 2004); they allow the "manipulation of objects" (Mitchell, et al., 2004) in a risk-reduced setting (Mitchell, et al., 2004); they foster collaboration and reflective discussion (Mitchell, et al., 2004); Gee (2003) and Squire (2006) argue that, as designed experiences, games instruct "through a grammar of *doing* and *being*" (Squire, 2006, p. 19), and change the way a player relates to an issue, as well as the way they understand different perspectives (Mitchell, et al., 2004); and they are especially effective when they are designed to focus on a specific issue or learning outcome (Mitchell, et al., 2004). Overall, research indicates that there are benefits to using games in educational contexts.

Researchers in climate change simulation and gaming (cc s/g), as well as researchers in learning games, often point to engagement as a unique feature of the medium, focusing on the player's level of participation. In the field of game studies, there is a distinct conversation about participation as it pertains to procedurality. Proceduralists argue that rules may be the primary way games frame participation, creating opportunities for players to make choices and act within the game (Bogost, 2007; Salen and Zimmerman, 2004); as a result, designers can infuse meaning into carefully constructed game rules, shaping the choices and behaviors available to players and influencing the way they participate in the game (Anthropy & Clark, 2014). Arguments against procedurality point to opportunities for players to appropriate game rules and make choices

beyond the designers' intentions (Sicart, 2011). Attention to rules, feedback systems, and the outcome of the game are important to consider when designing the players' experience. CC games have been identified as boundary objects, underscoring their ability to promote a shared language among players with different backgrounds and experience (van Pelt, et al., 2015). The notion of boundary objects was developed to describe collaborative projects, where contributors must negotiate experiences and agendas from different disciplinary backgrounds (Star and Griesemer, 1989; Wilson & Herndl, 2007), and these games invite players to engage in such collaborative negotiations. Boundary objects operate in different disciplinary spaces and can flexibly adapt to varied contexts and uses; as such, they're valuable tools for facilitating dialogue among members of a heterogeneous audience (Star & Griesemer, 1989; Star, 2010; Wilson & Herndl, 2007). As boundary objects themselves, CC games merge various traditions, achieving something new that doesn't necessarily promote one discipline over another; as a result, different ways of seeing are infused into these games, giving voice to disciplines that might otherwise be absent from these contexts. By operating as boundary objects in stakeholder engagement workshops, they invite multiple perspectives without necessarily promoting one perspective over another; instead, they create a space for people to assume new roles or negotiate their professional knowledge within the constraints of the game, pooling resources to collaboratively develop solutions. These games work toward an inclusive model by focusing on an integrative exigence rather than one of demarcation, which is important in civic engagement contexts where cooperation and communication across heterogeneous groups is vital (Wilson & Herndl, 2007).

VITA

Megan L. McKittrick
Department of English
Old Dominion University
5000 Batten Arts and Letters, Norfolk, VA 23529

Biography

Megan McKittrick is a Lecturer and PhD candidate in the Department of English at Old Dominion University, conducting research at the nexus of game studies and technical communication, while teaching composition, digital writing, as well as technical and scientific writing.

Education

M.A. English (Rhetoric and Composition) – Graduated with Distinction, 2008
    Old Dominion University, Norfolk, VA
B.A. English – Summa Cum Laude, 2005
    California State University, Fresno, CA

Publications

Jovanovic, V., Tombolato-Terzic, D., Richards, D., Pazos, P., McKittrick, M., Romberger, J., Popescu, O. (2017). Developing a Faculty Learning Community to Support Writing across Different STEM Disciplines. *Proceedings of 124th ASEE Annual Conference & Exposition*. Columbus, OH.

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