The serious potential of fun games: a new model for public engagement

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THE SERIOUS POTENTIAL OF FUN GAMES: A NEW MODEL FOR PUBLIC ENGAGEMENT

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“We’re only just beginning.
Generations before us have given their lives for the freedoms we enjoy today.
And, it is our responsibility and duty
To continue that struggle.
To be in the arena.”
~ Rob Young

Dedicated to those in the arena.

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LIST OF SYMBOLS AND ABBREVIATIONS

ICT	Internet Communication Technology
ULI	Urban Land Institute
CLUG	Cornell Land Use Game
AI	Artificial Intelligence

SUMMARY

This dissertation examines the relationship between game playing and social learning in public participation activities and whether and to what extent participants demonstrate enhanced collaborative decision making (collective intelligence) as a result. This research highlights the potential of Internet Communication Technology (ICT) to advance public engagement activities and demonstrates how planners might practically and intentionally design small group activities to promote collaborative processes.

A review of theoretical literature and empirical research, as well as practical involvement in public participation, indicates that problems in public participation can be summarized along three categories: (1) scale and representativeness, (2) commitment, and (3) capacity. It is difficult for planners to scale these activities in large numbers and to create a representative sample of the population; participants find it difficult to remain committed to involvement in these activities over the length of a planning process; and many participants and stakeholders do not demonstrate capacity to work collaboratively.

Given these challenges to public participation in practice, literature from a variety of fields was examined to understand how these challenges have been overcome in other environments where complex problems require collaborative decision making and input from diverse stakeholders. These fields include management, gaming, organizational behavior and social psychology. Literature from collaborative planning theory, organizational behavior and game theory is used to explain the importance of social learning, to identify the potential for games to be used as a team building intervention, to determine how interventions can be employed online in practice, and to demonstrate the

ability of games to change team behaviors in measurable ways that lead to enhanced collaborative deliberations and decision making.

By using an experimental research design to test public participation methods, this research provides new perspectives on public participation and civic engagement. The impacts of this research are important not only for planners, but for all institutions that rely on collaborative decision making and need to understand group processes.

CHAPTER 1. INTRODUCTION

Innovations in communication, technology, and civic engagement are redefining how people interact professionally, civically, and personally (Kleinhans, Van Ham, & Evans-Cowley, 2015; Qualman, 2010). Across the world, there is evidence that changes in politics, social structures, and innovation are generated from the bottom up (Bugs, Granell, Fonts, Huerta, & Painho, 2010; Oser, Hooghe, & Marien, 2013; Trapenberg Frick, Weinzimmer, & Waddell, 2015). Civic activism takes place online, and events such as the Global Climate Strikes, Arab Spring, Egyptian revolution, Occupy Wallstreet, and Tea Party movement have demonstrated the power of community action when combined with the power of internet communication technologies (ICT). New online and mobile platforms such as Kickstarter, NextDoor, Facebook, and Twitter, demonstrate the collective power of citizens with aligned interests. These popular examples are manifestations of changes in communication patterns, but more importantly they demonstrate that despite widespread claims that new developments and cultural changes are creating communities devoid of social capital (Paxton, 1999; Putnam, 2000; Rupasingha, Goetz, & Freshwater, 2006), the drive to interact among citizens remains strong, especially as a form of resistance.

These global trends are also redefining the ways in which persons responsible for representing the public interest seek to effectively understand, represent, and implement policies to promote that interest. Public engagement activities, always critical to planning, have become more frenetic as agencies strive to engage across popular social media platforms and to harness the power that many citizens have demonstrated through these platforms (Afzalan & Evans-Cowley, 2015; Fredericks & Foth, 2013; Kleinhans et al., 2015). The goals of public participation, often varied, and methods of public participation, also varied, require that planners pick from among a suite of traditional and emerging tools to do one of four things: amplify their message, gather input, conduct group visioning, and implement plans. The temporal and geographic scale of planning efforts also dictates the type of method planners use to complete these tasks. What a small neighborhood master plan requires in terms of engagement is quite different than what a regional visioning process requires. This dissertation examines public participation activities that are episodic and occur throughout a planning process with a pre-determined duration.

Generational changes also guide how citizens want to interact and what their expectations for these interactions are. Millennials have now eclipsed the Baby Boomers as the largest generation in the United States. Socioeconomic and cultural changes have required planners to revisit how they engage the public and to what ends. Millennials are more comfortable interacting online, and largely do not view online interactions as barriers to authentic conversation, but as substitutes for traditional face-to-face interactions (G. Bull, 2010). The opportunities and challenges of public engagement in city and regional planning have increased and morphed as part of the technology changes described here. Although methods of public engagement can be contested in practice, the role of engagement remains fundamental to the planning discipline.

Communicative planning theories hold public participation in high regard—it is the process of knowledge creation and can work as a collaborative governance structure (Healey, 1998). The name that planners use to describe this work, “public participation” has morphed and been redefined as “citizen engagement”, reflecting this perspective that planners must move beyond traditional participation strategies, such as conducting public hearings and town meetings in order to work most effectively and share power with citizens. Effective engagement in the communicative model requires planners to facilitate opportunities for citizens and stakeholders to interact. Frequently referred to as interactive, or authentic, these opportunities for dialog can be carefully designed to achieve process outcomes that are fundamental to the enhancement of a community's social and institutional capital. These types of exercises can also provide methods for participants to engage in creative discourse on complex and intractable planning issues. One of the intermediary goals for public engagement identified by collaborative and communicative planning theorists is the occurrence of social learning—this type of learning is also called mutual learning and occurs when diverse participants learn from one another enough to reframe their perspectives related to complex problems (R. Bull, Petts, & Evans, 2008; Forester, 1999; Thomas Webler, Kastenholz, & Renn, 1995). Social learning is critical to consensus building, can generate support for implementation of planning policies, and is a component of building social and institutional capital. Despite the benefits of social learning and the widespread consensus that public engagement is critical for planning to succeed, public engagement suffers from a series of challenges that planning has yet to fully address as a profession.

These challenges include (1) scale and representativeness, (2) commitment, and (3) capacity. Embedded within these challenges, unequal power relations, limited time and facilities to conduct extensive participation exercises, and mistrust among participants and conveners or decision makers can also contribute to engagement failures (Laurian & Shaw, 2008). Planners have attempted to address these challenges, in part, using emerging technologies such as those broadly characterized as ICT (Evans-Cowley & Hollander, 2010). Planners have also begun to rely on ICT to create online platforms. These platforms can include message boards, forums, interactive maps, and live webinars. Some of these technologies even ask participants to play community wide games as a method of interacting in groups. Most commonly, planners are using ICT to solicit input on planning processes by asking participants to contribute to spatial datasets through crowdsourcing (Brabham, 2009; Geertman, 2002; Kleinhans et al., 2015). Leveraging ICT to conduct public engagement exercises is one way in which planners are attempting to address issues with scale and representativeness.

Planners design public engagement exercises to satisfy legal requirements, speed implementation of agreed upon policies and plans, educate community members, establish partnerships between government agencies and communities, solicit feedback and commentary, and identify community goals for the future (Creighton, 2005). Collaborative planning helps agencies achieve these goals but also establishes a process by which citizens and stakeholders can generate long-term partnerships with agencies. The basis of these experiences is facilitated groups (Judith E. Innes & Booher, 2004).

In other fields, small groups are used to achieve similar outcomes. Small groups are not unique to the planning process, although they certainly permeate the way planners work. Across disciplines and practices, the small group has become the *de facto* work organization (Kozlowski & Bell, 2001; Kozlowski & Ilgen, 2006; Shalinsky & Norris, 1981). What individuals cannot achieve, small groups can (Kozlowski & Bell, 2001; Woolley, Chabris, Pentland, Hashmi, & Malone, 2010). Within the planning profession, this type of work organization also occurs, and was explicitly identified in the literature as early as the 1980s (Shalinsky & Norris, 1981). As planners we work in small, interdisciplinary groups, to complete the tasks most commonly associated with our field: preparation of plans, community meetings, negotiation, goal formation, and review of documents (Shalinsky & Norris, 1981). We also frequently ask citizens to engage with small groups through focus groups and advisory boards. The popular and regional scale goal setting approach espoused by the Urban Land Institute, Reality Check, brings hundreds of invited stakeholders together and asks them to play a board game in small groups of 5-7 ("Reality Check - Urban Land Institute," n.d.) . This game has been developed to educate stakeholders on the tradeoffs inherent in regional development challenges, and although each table of participants has a facilitator to manage game play, there are no rules for how participants should interact. In other examples, we ask citizens to develop ideas in groups, review models in groups, and develop visioning maps in groups (Desouza & Bhagwatwar, 2014; Frewer & Rowe, 2005; Kleinhans et al., 2015; Zellner et al., 2012). The appeal of games for planners is a reaction to the challenges we face in engagement. Asking participants to engage over a game is an attempt to introduce dynamic tradeoffs as well as fun and play into the planning process.

The management field has decades of research dedicated to understanding the function of the small group in a work environment. The communicative focus on interactions between participants lends itself to an organizational behavioral approach to developing methods and processes to elicit the highest level of coordination and collaboration between individuals. Organizational behavior examines measures of high performing teams as well predictors of team performance (Kozlowski & Bell, 2003; Salas, Rozell, Mullen, & Driskell, 1999). The team-building literature uses empirical data from this research work to suggest interventions that will enhance preexisting and new teams.

Predictors of group performance can be measured in several ways, but most recently collective intelligence has been suggested as the strongest predictor of a group's ability to perform well at complex cognitive and social tasks (Woolley, Malone, Woolley, & Aggarwal, 2015). Collective intelligence is defined by the group's average social empathy score and turn taking. Social empathy is how well group members perceive the nonverbal emotional responses of other group members. Turn-taking represents the proportion of time that each group member spends speaking—a more even distribution of turns conveys a shared respect of one another's views and demonstrates empathy. These measures, together, are collective intelligence and groups with a high average social empathy score that also have near equal distributed time spent speaking among members tend to perform at a higher level when addressing a complex challenge than groups that do not possess these attributes and qualities (Woolley et al., 2010; Woolley, Malone, et al., 2015).

Improving group performance and functioning is as critical to small group activities in planning as it is for other organizations. Team-building interventions have been examined as one method for improving the interactions and performance of small groups (Ellis, Luther, Bessiere, & Kellogg, 2008; Salas et al., 1999). Of the team building interventions suggested, game playing has been adopted within the planning field as a suitable method for public engagement and education.

Literature on game design suggests that of the myriad of games available for play, those that are semi-cooperative in nature have the greatest potential for creating opportunities for learning (Gordon & Baldwin-Philippi, 2014). Furthermore, role-playing and simulation games allow participants to practice interacting according to rules of play (Cecchini & Rizzi, 2001; Ellis et al., 2008; Gordon & Baldwin-Philippi, 2014; Poplin, 2012; Schirra, 2013). This practice interaction and practice inhabiting and communicating perceptions and roles that are in conflict can train participants to interact more productively (Susskind, Mnookin, Rozdeiczer, & Fuller, 2005). Role-playing games have been used in a wide variety of contexts where negotiation between parties with perspectives that are at odds is required (Cecchini & Rizzi, 2001; Desouza & Bhagwatwar, 2014; Guhathakurta, 2002; Susskind et al., 2005).

Although not explicitly named in research on semi-cooperative games for planning, the gaming environment can also create opportunities for participants to engage in social learning—a critical intermediary part of the process of collaborative planning. The availability and proliferation of ICT tools and the use of these tools by planners to engage the public requires additional research and evaluation to understand how these might be more effectively deployed to create opportunities for social learning and to leverage this social learning to enhance the capacity of participants to engage and deliberate on complex tasks. Collectively, these impacts of game playing can help planners design more collaborative processes.

Examining the potential of games to create opportunities for social learning in public engagement activities is of critical importance to the planning field. The potential of games to address three critical challenges to effective public engagement is discussed in Chapter Two. These challenges are identified as: (1) scale and representativeness, (2) commitment, and (3) capacity.

1.1 Research Questions

Our challenge as planners to generate widespread and representative interest and commitment to public planning is particularly problematic when evaluated through collaborative planning theory, which not only emphasizes the importance of participation, but espouses an interactive approach to planning that reinforces the importance of social learning and social capital (J. E. Innes & D. E. Booher, 1999, 2004; J. E. Innes & D. E. Booher, 2010). This dissertation examines the potential of games to create opportunities for participants to interact and experience social learning. If this relationship can be demonstrated, it will lend support to the arguments made by collaborative planning theorists that interactive methods of public participation can support institutional change and development of social capital (Conroy & Evans-Cowley, n.d.; Garmendia & Stagl, 2010; Healey, 2003). Results will also provide valuable insights into better design of team-building interventions to improve planning public participation processes and garner more public support for these activities.

The research questions of this work are twofold: 1) do online games create opportunities for social learning among teams in an urban planning public participation process? and, if so, 2) do groups that demonstrate social learning also demonstrate enhanced collaborative decision making (collective intelligence)?

To answer these questions, we have designed a two-phase experiment that asks participants to play a role-playing game online, and participate in subsequent simulated planning decision-making exercise. Games will be scored, allowing us to examine how high vs. low scoring groups work together in the simulated planning decision-making exercise. Pre and post surveys will also be administered to participants to measure whether and to what extent the game playing created opportunities for social learning. The research design draws on group formation and task effectiveness research conducted by Salas, Rozell, Mullen, and Driskell (1999) and Tannenbaum, Beard and Salas (1992) and parallels prior public participation research by Deyle and Shively (2009) and Goodspeed (2013). This design involved undergraduate students at our university. Simulations can be problematic because they do not allow researchers to understand how vested interests and power relations can confound participatory exercises. However, in this research design, our simulated planning decision making exercise required students to deliberate on changes to the Georgia Tech bus system, which directly affects each of our students on a daily basis. Experimental design is quite rare in city planning public participation research, bringing an unusual degree of internal validity to this research. External validity challenges are expected with this experimental approach, however, as shown in Table 2-2, the research method is significant because it represents the only social learning in planning work done that goes beyond the case study.

Answering these questions has the potential to demonstrate how team building interventions can be used to the planner's benefit, but also how they may serve small groups of community members by making them more effective collaborators. Asking these questions addresses many of the areas identified for future research in the literature reviewed for this study. Most critically, these questions exist to serve as a link between social learning and other important facets of collaborative planning and decision making. These questions also make social learning an explicit goal of an urban planning game, rather than a beneficial byproduct. Additionally, empirical evidence that online games can enhance capacity of participants to benefit can help define a new method of planning engagement that expands the scale of planning through online games while also ensuring greater levels of commitment by making the process fun, and training participants to work collaboratively.

This dissertation uses team building, social learning, and communicative planning theories to propose a process of engagement that enhances the collaborative and dialogical skills of participants and stakeholders while achieving process goals important to planners. Most importantly, the results of this research will provide an empirical test of the claims of communicative and collaborative planning theorists. The theoretical arguments proposed here suggest that the organization behavior field has much to offer planners interested in designing engagement tools, but the use of a specific tool as a team building intervention gives practicing planners an implementable and applicable method of enhancing their public engagement processes. It is our hope that this research contributes theoretically to the field of communicative planning, and that its applied nature lends itself to implementation in on-going engagement efforts.

Specifically, this research addresses whether and to what extent we can design team-building interventions that improve collective intelligence of small groups; how to create opportunities for social learning in a public planning process; the correlation between social learning and collective intelligence; and the ability of team building interventions to support these goals in temporarily convened groups; and the ability of online tools to increase the potential scale of these efforts.

Earlier work on gaming for civic engagement demonstrates that although there are measurable benefits associated with gaming for participants, it is difficult for groups to “transcend the magic circle”(Gordon & Schirra, 2011), i.e., despite the structured and facilitated nature of games providing productive opportunities for engagement, the behaviors and interaction that participants exhibit and experience during the game do not carry forward through to their subsequent real life interactions (Gordon & Schirra, 2011). Other research on social learning and planning engagement has found that long term changes in individual’s instrumental and communicative knowledge are difficult to measure, but possible (R. Bull et al., 2008). This research design will measure the extent to which participants can transcend the magic circle because data will be collected both during and after the game. This research will also contribute to empirical data on how individuals develop instrumental and communicative knowledge in a facilitated role-playing simulation and the extent to which they maintain and practice this knowledge in unfacilitated deliberative work in the near future.

This research provides high internal validity; uses a consistent measurement tool for group learning; demonstrates the importance of group learning by linking it to other desirable outcomes; tests the effectiveness of team building on temporary teams; and characterizes and measures attributes of the planning process.

1.2 Dissertation Structure

This dissertation is organized in five chapters. Chapter 2 outlines a theoretical argument for why specific serious games could be effective tools to create social learning opportunities and how these opportunities might be catalyzed into more effective group deliberations. This chapter presents literature from communicative planning, social learning, organizational behavior, and game design to make the argument. Chapter 3 describes the research design and methodology, including experimental protocols, data collection, and analysis tools used to test hypotheses presented. Chapter 4 discusses collected data, analysis, and results. Chapter 5 discusses the conclusions and implications of this research for planners and scholars.

CHAPTER 2. LITERATURE REVIEW

The theoretical basis for this research references prior work in public participation, collaborative planning, organizational behavior, and game design. We use theoretical arguments from organization behavior to challenge the dichotomy between process and outcome that characterizes much of the debate within the planning field in both theory and practice. We reframe questions of public participation as they relate to their communicative nature and the role of social learning within these interactive experiences. Finally, we examine the potential of games to serve as effective team building interventions to accomplish process outcomes such as social learning within the planning context.

Across these bodies of literature, a central question emerges: how do people work together in small groups to address complex problems and how can we design experiences to allow participants to learn from one another? This literature review identifies how this problem has been studied before, its importance to the planning profession, and the contributions that organization behavior and game design fields can make to the planning practice.

2.1 Public Participation

Types of public participation vary widely by planning project—activities undertaken by planning departments to conduct public visioning as part of a comprehensive plan update are not necessarily the same as those used to gather feedback on large capital investment projects or in regularly occurring community meetings used to represent neighborhoods in large cities. However, when examined within the collaborative planning framework, there are three distinct phases of collaborative planning (Gray, 1989). These include problem-setting, direction-setting, and implementation. The types of public participation activities examined in this dissertation can be characterized as problem or direction setting—whereby participants join a planning process through a formalized meeting or activity, as convened by the planning agency, and through episodic intervals remain involved in follow-up activities that ask them to both provide feedback and interactively help determine, in a consensus seeking fashion, the way forward. Many planning departments conducting long range plans design their engagement processes in this way—setting up a series of meetings, smaller group activities, and final presentations to seek approval from participants and stakeholders, but they fail to create truly collaborative processes because they do not train their stakeholders and participants how to engage.

Public participation has long been a hotly contested part of planning practice and research. When legally mandated or professionally required, it can contribute to development of a civil society, enable planners to anticipate public concerns and attitudes, maintain credibility of planning agencies, avoid worst case confrontations, increase ease of implementation of policies, build consensus, minimize cost and delay of project delivery and improve the quality of decisions (Creighton, 2005). Planners facilitate public participation to learn community preferences, gather and use local knowledge, increase the fairness of planning, and to garner legitimacy and support for decisions and implementations, and because it is legally required in some instances. Yet, despite these potentially beneficial outcomes, participation can "… [cause] delays, and if citizens are listened to, it may result in bad decisions" (Judith E. Innes & Booher, 2004). Additionally, "Planners and administrators can be out of touch with communities and local knowledge, but citizens can be out of touch with political and economic realities and long-term considerations for a community or resource" (Innes & Booher, 2004).

The potential benefits and disadvantages of public participation are also implicated in debates related to how to measure planning success—frequently these debates position planning outcomes against planning processes. A 2009 survey conducted by the National League of Cities (NLC) on public engagement found that, among the respondents, across three categories of potential benefits of public engagement (community building, citizen-government relations, and problem-solving), a majority picked "build[ing] a stronger sense of community" as their top answer to the question "What is the greatest benefit of public engagement?" (NLC, 2009). This response indicates that there is a strong desire to use process to generate outcomes considered important to planning successes.

The communicative turn in planning represents a theoretical shift from focusing on the rational planning model to focusing on the interactive nature of stakeholder collaboration (Habermas, Habermas, & McCarthy, 1985). There is a long tradition of applying the rational planning model in practice. This model of planning relies on a positivist scientific method for recognizing and analyzing knowledge, and while it predominates in practice, there is evidence to suggest that this model does not account for the relationships between stakeholders and the power politics that plague planning policy creation and implementation (Baum, 1996; Coleman, 1993). Habermas defined communicative rationality as a theory that addressed both the rational process of knowledge creation and analysis and the interactive part of planning. Habermas defines three kinds of knowledge interests: 1) technical & instrumental, 2) practical & interpretive, and 3) critical & emancipatory (Habermas, 1978). Collaborative planning can help bring critical & emancipatory knowledge to the fore, but it can also provide a vehicle for interpretive knowledge as well as serve as a venue for technical knowledge to be shared (Daniels & Walker, 1996; Healey, 1998). Participants in planning processes crave all three and require methods that allow them to understand all three (Forester, 1999; Judith E Innes & Booher, 2014).

Collaborative planning theorists describe successful engagement activities as those that create opportunities for authentic dialog (Forester, 1999; Yankelovich, 2001). These types of activities are characterized as interactive, two-way conversations, among diverse participants, engaged in collaborative problem solving. In these types of experiences, planners move from one-way communication to two-way communication, that is not top down or bottom-up, but both ways. Many scholars would agree that these type of activities are designed as ways moving engagement activities to the partnership rung on Arnstein's "Ladder of Participation" (Arnstein, 1969).

When considering public engagement, we must identify those mechanisms of participation typically deployed in the United States context. Of the traditional variety, public hearings, comment periods, meetings, and media notices do not demonstrate evidence of satisfying the goals of public engagement in planning. These mechanisms of participation do not establish the basis for long-term development of social capital because they are not characterized as participatory, reflective, or collaborative. Innes and Booher claim that true attempts at collaborative planning can lead to collaborative rationality and social learning. Forester's notion of "transformative dialog" can characterize these events: citizens adopt other points of view, refine their own views, reflect on their perspectives, and individually learn while reaching mutually agreeable solutions (Burton, 2009; Forester, 1999). In an age where opportunities for spontaneous social learning are limited, using a collaborative approach to planning projects can serve other community goals beyond the planning process (Putnam, 2000).

Emerging technologies have changed the way planners work. Most critically, the internet has changed the way planners communicate with stakeholders and how those stakeholders communicate independent of planning processes. Planners use ICT to engage in a variety of communication methods—those methods that employ one-way communication tactics have been effectively and efficiently completed via ICT. A more difficult task has been employing ICT to facilitate two-way engagement. These platforms are part of a larger phenomenon called digital democracy, defined by Hacker and van Dijk as "a collection of attempts to practice democracy without the limits of time, space and other physical conditions, using ICT or [computer mediated communication] CMC instead, as an addition, not as a replacement for traditional 'analogue' political practices" (K. L. Hacker & van Dijk, 2000) p2. These methods are designed to supplement traditional face-to-face participation and engagement methods. Van Dijk has categorized efforts of digital democracy into four categories: "allocution (e.g. interactive broadcasting), consultation (e.g. information retrieval), registration (e.g. telepolling or televoting) and conversation (e.g. electronic mail and discussion)" (K. L. Hacker & van Dijk, 2000) p6. This dissertation looks at those digital democracy tools and methods that focus on consultation, registration, and conversation. It is these characteristics that are most used by planners and have the most potential for aligning with collaborative planning efforts. Social media platforms such as Twitter and Facebook have not performed well as interactive engagement tools for planning agencies (Evans-Cowley & Griffin, 2012; Gordon, Baldwin-Philippi, & Balestra, 2013; Schweitzer, 2014). The dialog on these platforms is less useful to planners than the dialog shared over in-person meetings. Companies have begun to develop platforms to explicitly engage citizens on issues of public importance. These platforms, broadly characterized as Online Citizen Engagement Tools, cater to civic debates and dialog by creating private communities for jurisdictions, allowing citizens to give feedback to one another through voting and other tools, and syncing with spatial technology so that citizens can provide input to the planning process through maps and visuals. Organized by patterns identified by Van Dijk, these platforms are shown in Table 2-1.

Table 2-1: Engagement Platform Characteristics

Category	Platform	Location Based	Moderated	Notes
	MetroQuest	Yes	Yes	Dashboards that educate and solicit input
	Open Town Hall	Yes		Location based
	PlaceSpeak	Yes		Location based
	MindMixer	Yes	Yes	Topical questions & response
	Crowdbrite			Can host synchronous online meetings/ charrettes
Consultation	CitizenSpace			Run surveys and manage paperwork
	EngagingPlans			Share documents, advertise events, collect input through discussion, surveys and draft document review
	IdeaScale			Share & collaborate and allow teams to prioritize ideas
Registration	Poll Everywhere			Polling activities through cell phones as clickers
	Textizen	Yes		Text/SMS based survey
	Community planit			Visioning game
	@Stake	No		Role playing simulation game
	Cityzen			Targeted messaging and feedback through location and demographic targeting
Conversation	Bang the Table	No		Solicit feedback, and maintain communication through blogs and newsletters
	coUrbanize			Real Estate development platform that allows developers and planers to solicit input on plans and projects
	Dialogue App			Moderated discussion boards
	Neighborland	Yes		Moderated/location based question and response forum
	Civic Commons			Topical discussions started by citizens

Nextdoor	Yes	No	Topical and location based discussions started by citizens
WeJit			Amplifies topical discussions by integration with social media tools
Budget Simulator	No		Solicits feedback on city budget
Citizen Budget	No		Budgeting exercise that educates and allows citizens to provide input on budget
Neighborly	Yes		Crowd sourced funding for projects through municipal bond support

Platforms designed to facilitate, consult, or solicit input by stakeholders allow users to respond to surveys and polls, mark items on maps, and provide feedback on potential projects, visions, and community goals. Deliberative or conversational platforms are designed to facilitate conversation between stakeholders on a number of different topics. Of these consultation and conversation platforms, several are solely dedicated to soliciting money for projects as a way of demonstrating priorities and/or to help in constructing participatory budgets based on priorities. There are also platforms designed primarily to help planning agencies make announcements and popularize planning initiatives while also soliciting feedback. The vast majority of these platforms use a moderated or facilitated asynchronous discussion to encourage feedback and gather insights from citizens. These platforms are contracted by municipal or regional planning agencies, and the topical discussion is driven through questions or policies posed by these agencies. Few of these platforms are completely citizen driven, and those that are lack facilitation and moderation. Anonymity of users and location-based selection of participants are also included as design elements in these platforms.

These engagement platforms, despite demonstrating design limitations, are successful in creating opportunities for interaction and dialogical exchange, but the possibility of double loop learning occurring on these platforms is unknown (Cecchini & Rizzi, 2001; Garmendia & Stagl, 2010; Poplin, 2012; Simpson, 2001; Zellner et al., 2012). The promise of ICT—that it will engage a larger, more representative group of citizens more efficiently – is lofty and remains unproved in practice and research (K. L. Hacker & van Dijk, 2000; Oser et al., 2013; Vicente & Novo, 2014). The Hacker & van Dijk definition of digital democracy is useful for considering the role of these platforms in planning practice— they suggest research questions that frame the questions proposed in this dissertation: does increasing access lead to increased citizen empowerment? Does it do this representatively or merely enhance the socio-political power that certain stakeholders and participants already possess? This research is designed to assess the extent to which some types of digital democratic platforms can enhance collaborative planning by creating opportunities for social learning.

When collaborative and communicative planners speak of transformative, authentic, or interactive dialog, they are describing a process whereby social learning occurs. It is the occurrence of social learning that marks a participatory approach as dialogical in the sense that it is transformative, authentic, or interactive. Social learning, also known as "mutual learning", "double loop learning", or "group learning" (Argyris, 1976; Deyle & Schively, 2009; Goodspeed, 2013; Judith Eleanor Innes & Booher, 2010; Klosterman, 1985) has been defined, within the planning context, as an experience where participants in a process generate a new understanding of a problem based on shared information. Social learning allows participants to learn from one another. This process of double loop learning allows participants to iteratively frame problems, design new solutions, and generate new perspectives on old problems (Goodspeed, 2013). Planners suggest that without social learning, diverse participants are unlikely to be successful at generating constructive and creative ways to address problems, and that social learning is a prerequisite to understanding the tradeoffs inherent in planning challenges (Webler et al., 1995). The nature of social learning means that it cannot happen at the individual level, while elements of social learning include improvement of an individual's cognition, the measurement of social learning is inherently at the group level. To engage in social learning requires an individual to participate in a small group. These dimensions of social learning have been categorized as instrumental and communicative (R. Bull et al., 2008).

Citizens have diverse needs and different perspectives on public participation, and these perspectives and needs can also change over time (T Webler, Tuler, & Krueger, 2001; Thomas Webler & Tuler, 2006). Methods of participation that give participants the opportunity to make decisions and engage in groups help create a process that allows participants to actively interact with complex planning topics. Social learning can be understood from both a psychological and sociological perspective (T. Webler, H. Kastenholz, & O. Renn, 1995). Webler describes how group processes influence an individual participant's development and knowledge acquisition (instrumental learning). By joining these two disciplinary understandings of social learning, Webler suggests that social learning occurs when a group of individuals with a variety of interests can come together to solve a shared problem "in a manner that is responsible to both factual correctness and normative consent (meaning legal as well as other kinds of social responsibilities" (1995, 445). Solving this problem requires the individual to develop instrumental knowledge and communicative knowledge.

2.1.1 Social Learning

Social learning is broadly defined as a process whereby citizens determine "mutually acceptable solution[s]" to challenges within their community. Two dimensions of social learning are identified: instrumental and communicative (R. Bull et al., 2008). Social learning can happen within a distinct public participation event and process, but also occurs external to the overall planning process. The nature of social learning is that information is transferred and mutually acceptable solutions are developed in contexts where social capital has been developed—reinforcing social learning structures. As such, it is foundational to successful public participation and successful planning.

Social learning is an intermediate goal of engagement processes that facilitate authentic dialog through interactive mechanisms (Argyris, 1976; Schusler, Decker, & Pfeffer, 2003). Social learning extends the process of learning beyond individual cognitive enhancement and serves as a measure of the extent to which individuals in a group reframed their individual perspectives based on interaction with others. Webler describes how group processes influence an individual participant's development and knowledge acquisition. By joining these two disciplinary understandings of social learning, Webler suggests that social learning occurs when a group of individuals with a variety of interests can come together to solve a shared problem "in a manner that is responsible to both factual correctness and normative consent (meaning legal as well as other kinds of social responsibilities" (1995, 445).

Webler's definition of social learning also relies on the individual's "cognitive enhancement" (T. Webler, H. Kastenholz, & O. Renn, 1995). Burton also suggests that understanding social learning from both the individual and group perspective is informative: "In short, greater participation stimulates community development. . . but of course this relies on participation taking a social form" (P. Burton, 2009). They key to the social component of these learning activities is the interaction and dialog fostered by such. Burton cites other empirical research that shows how citizens reach mutually agreeable solutions, but also how they learn individually in the process (P. Burton, 2009; J. Forester, 1999; D. Yankelovich, 2001). Collaborative processes create opportunities for social learning, where individuals increase their knowledge, come to mutually agreeable solutions, create and build social networks and social capital and create institutional capital. Such achievements respond to direct desired outcomes from most planning processes (P. Burton, 2009; J. E. Innes & D. E. Booher, 2010)

Collaborative planning calls for participation among a wide variety of stakeholders, identification of mutually acceptable goals, and interactive problem solving (Judith Eleanor Innes & Booher, 2010). Potapchuk also sites these collaborative approaches as part of an argument for sustainable politics and describes the importance of social, intellectual and political capital in garnering support for policy decisions and creating communities where implementation of these decisions can succeed (Potapchuk, 1996). Successful planning requires professional planners, decision makers, stakeholders and the greater public to cooperate and understand the tradeoffs inherent in seeking self-interest over the public good. Planning in a community where social capital already exists increases the potential that the planning project will succeed, despite other challenges.

Social learning research within collaborative planning is limited. Goodspeed's summary of previous research on the topic identifies the predominant contexts for research, including the regional processes discussed by Innes and Booher and Friedmann's societal level. Most recently Goodspeed and Deyle and Schively advanced the notion of observing shifts in social learning over time (Deyle & Schively, 2009; Goodspeed, 2013). Goodspeed tested social learning in observable meetings, while Deyle and Schively tested social learning over the length of a planning process. All of the research done on social learning within a planning context has been conducted through observation and case study analysis, as shown in Table 2-2.

Table 2-2: Previous research on social learning

Title	Author	Year	Method	Findings	Limitations
How planners and stakeholders lean with visualization tools: using learning sciences methods to examine planning processes	Radinsky, et al.	2017	Case Study	Using video to observe and code "conversational moves" in planning meetings across 3 case studies, researchers were able to analyze the extent to which group learning was occurring based on conversation analysis, interaction analysis, and visualization of discourse codes	
Planning support systems for spatial planning through social learning	Goodspeed	2013	Case Study	Survey evidence participants in workshops using planning support systems reported high learning	Relies on self-reported learning and satisfaction with process may be a "result of purposeful selection of innovative workshops . . .[that] were likely better organized, staffed, and managed.." (184-5)
Learning from your Neighbor: The Value of Public Participation Evaluation for Public Policy Dispute Resolution	Stephens & Berner	2011	Literature Review	Public participation and public policy dispute resolution (PPDR) share common goals and draw on common methods; the focus on social processes in public participation can be used to design and inform PPDR	Meta analysis on procedural methods and evaluation measures
Modeling, Learning, and Planning Together: An application of participatory	Zellner et al	2010	Participatory design and case study	Researchers reframed how to measure learning using participatory modeling literature and asked participants to questions that assessed how they	Meeting attendance was uneven, drop in attendees between

agent based modeling to Environmental Planning				changed their internal metal models; "collective learning produced a solidarity that allowed for new planning strategies to emerge" (89)	meetings; relies on self-reported survey data; required expert facilitation
Group Learning in Participatory Planning Processes: An exploratory quasiexperimental analysis of local mitigation Planning in Florida	Deyle & Slotterback	2009	Case study, pre-test/post-test quasiexperiment	No evidence that group learning was "facilitated by specific attributes of the planning process" (34); "evidence of changes and convergence of perceptions of participants that are indicative of increased mutual understand of the problem"	Non-equivalent control groups; participant turn over;
Social learning from public engagement: dreaming the impossible?	Bull, Petts & Evans	2008	Case study follow-up	"Social learning is not confined to within process…public participation can play [a role] in engendering …citizenship" (714)	Revisited participants from a case that was 10 years old and relied on self report of behavioral change
Social Learning for Collaborative Natural Resource Management	Schusler, Decker & Pfeffer	2003	Case study; observation and interview	"Eight process characteristics fostered social learning in this case: open communication, diverse participation, unrestrained thinking, constructive conflict, democratic structure, multiple sources of knowledge, extended engagement, and facilitation" (324)	Examined social learning at one "deliberative planning event" involving 32 participants; no evidence that social learning contributed to long term collaborative management
Collaborative learning: Improving public deliberation in ecosystem-based management	Daniels & Walker	1996	Applied use of collaborative framework to one case		One case; participant observer

Public participation in impact assessment: a social learning perspective	Webler et al	1995	Case Study	"Achieving criteria for social learning…[with]…criteria for fairness and competence will result in public participation exercises that are widely viewed as successful" (461)	Single case; only validates that social learning framework can be used in evaluation of participation

Critiques of the communicative turn in planning frequently say that its focus on planning process is at the expensive of planning outcomes. Framing the debate between process and outcomes creates a false dichotomy. These frames of planning theory suggest that types of governance/ interaction processes can demonstrate more potential than can less inclusive, more top down processes in developing planning policy responses to challenges. Planning has poorly, if at all, demonstrated this relationship using empirical data. The collaborative planning framework appeals to the planning community because of our overwhelming proclivity to care about space and people. There is an inherent bias towards inclusivity amongst practitioners and researchers—despite the theoretical lenses with which we associate our work and ideas. Organizational behavior, however, is largely concerned with demonstrating this relationship between processes of interaction and substantive changes in outcome. Within the field of organization behavior, research is regularly conducted to study small group processes to understand under what conditions these groups perform best and how to intervene to make groups more capable and successful. These interventions are frequently referred to as "team building"(Klein et al., 2009; Salas et al., 1999). Designing and implementing effective team building interventions requires an understanding of how to measure team performance, how to test what predicts team success, and how teams form.

2.2 Organizational Behavior Approach to Small Groups

Should planners want to create opportunities for social learning to occur they must create a framework for individuals to participate as members of a small group, and, increasingly, planners have been designing public engagement activities around small groups (Gordon & Baldwin-Philippi, 2014; Landis, 1995; "Reality Check - Urban Land Institute," n.d.). In designing these experiences, planners are following contemporary global trends that have refocused concepts of productivity, creativity, and innovation at the group level (Salas et al., 1999). Well-known and well-respected companies tout their group processes as part of their success, and in higher education, universities are now including learning objectives related to working in diverse interdisciplinary teams. As more of our professional world transitions to small group work, we have devoted time to understanding how to measure a group's success. Operationalizing success requires identification of several measures of success. There are widespread metrics for measuring group success, one such measure is the concept of collective intelligence (Straus, 1999; Woolley et al., 2010; Woolley, Malone, et al., 2015). Collective intelligence is based on social empathy scores and conversational turn-taking. Organizational behaviorists are also researching how to intervene in teams to enhance performance. These interventions, referred to as "team building" interventions have typically been deployed in work place settings to optimize the performance of long-standing professional small groups with common purpose. The result of current research on team building interventions inconclusive (Klein et al., 2009).

2.2.1 Team Formation and Team Building Interventions

Efforts to improve or change the way teams function are referred to team building interventions. These interventions are geared towards moving teams through group development stages. Team building interventions try to make this process more efficient. Organizations have experimented with how to cultivate these processes and stimulate productivity among teams using various forms of team building interventions (J. I. Porras & P. O. Berg, 1978; E. Salas, D. Rozell, B. Mullen, & J. E. Driskell, 1999). Team building activities are designed to establish better communication among members, increase the creativity and problem-solving ability of the team, allow for productive and constructive feedback among members, and increase objective performance measures. Team building interventions are designed according to a four-part framework that includes solving problems, establishing interpersonal relationships, clarifying roles, and setting goals. Typical team building interventions have included: physical challenges such as ropes courses, role playing, games, ice breakers, and other activities that remove team members from their typical professional roles. Most the studies on these interventions have examined how they are used in a workplace setting with teams that work together over a long period of time (3 months plus), and that can dissolve or reformulate at the successful completion of their team task. Teams have become a popular organizing unit for many organizations—there is substantial evidence that the collective abilities of teams surpass the limitations of individuals (Kozlowski & Bell, 2003). As teams become more important in professional culture, substantial theoretical and empirical evidence has been developed to understand how teams function, and how to improve their functioning.

Teams, or small groups, progress through several social processes to become more productive (M. A. Amos, J. Hu, & C. A. Herrick, 2005; D. R. Ilgen, J. R. Hollenbeck, M. Johnson, & D. Jundt, 2005). The four stages of group development include: (1) forming, (2) storming and norming, (3) performing, and (4) adjourning (M. A. Amos, J. Hu, & C. A. Herrick, 2005; S. W. Kozlowski & B. S. Bell, 2003; S. W. Kozlowski & D. R. Ilgen, 2006; J. A. LePine, R. F. Piccolo, C. L. Jackson, J. E. Mathieu, & J. R. Saul, 2008). It is commonly understood that teams that reach the performing stages work well together, and the group processes established for their interaction contribute to their success. The stages of team formation, however, are not linear: teams can progress forward and move backwards. Furthermore, these stages of group development have been studied mostly on teams that meet two conditions: one, they are professional teams organized around productivity and two, they exist for 3 months plus.

The Tuckman model of group development, originally proposed in 1965, and revised in 1977 to include a new fifth stage (adjourning) still stands as the de facto conceptual model for small group development. Team building interventions are typically designed to move the group towards the performing stage, where "the group becomes a 'problem-solving' instrument as members adapt and play roles that will enhance the task activities. Structure is supportive of task performance. Roles become flexible and functional and group energy is channeled into the task" (https://organisationalbehaviour aspects. wikispaces.com/Group+Dynamics).

Group structure, including patterns of roles, norms, and relationship between group members, can have an overwhelming effect on the interactive qualities of group members. Many of these team building activities use games, challenges, and other playful mechanisms to engineer experiences that enable to teams to experience these components (E. Salas, D. Rozell, B. Mullen, & J. E. Driskell, 1999). Although team building is one of the most established organizational methods for engineering successful teams—the empirical evidence on its relation to improved performance is inconclusive (E. Salas, D. Rozell, B. Mullen, & J. E. Driskell, 1999; S. I. Tannenbaum, R. L. Beard, & E. Salas, 1992). However, despite the lack of consistent, conclusive, empirical data on team building's effect on performance, the meta-analysis conducted by Salas does conclude that smaller teams, with defined roles, operating over a shorter time frame, tend to have a more significant role in defining performance (E. Salas, D. Rozell, B. Mullen, & J. E. Driskell, 1999). This conclusion on team size is in direct contrast to the conclusion generated in Klein et. al's 2009 meta-analysis piece on team building which demonstrates that team building efficacy is more significant for teams of larger sizes. Tannenbaum suggests that although evidence is weak for team building's effect on behavior outcomes, it does contribute to positive perceptions and attitudes (S. I. Tannenbaum, R. L. Beard, & E. Salas, 1992).

The results on team building interventions are largely inconclusive, and rarely are team building interventions deployed on teams that are temporarily created and exist for short periods of time. One reason why results from team building interventions may be inconclusive is because measuring team performance is not an agreed upon science. In many notable studies, team performance was analogous to completion of complex tasks, while in other studies, team performance was more ambiguous, sometimes measured as changes in the way teams interacted or perceptions of team members about their collective purpose or one another (). When measuring a team's performance on complex tasks, many researchers design tasks according to the McGrathTask Circumplex (McGrath, 1984). The highest order of tasks requires participants to negotiate over limited resources and make collective moral judgements. Using this taxonomy of tasks to measure the extent to which teams or small groups can complete a complex task has been applied widely in the management literature, but the extent to which this method has been used to test pre/post team building intervention changes on teams is limited, having only been used in a handful of studies.

Empirical evidence for the success of team building interventions is limited, and no evidence exists yet to suggest how team building intervention efficacy differs by type of team; if the reason for team formation affects team building efficacy; how the size of teams changes the efficacy of team building interventions; whether or not there is an interactive relationship between team type and team size and team performance; and how team building interventions change the performance and behavior of teams over the course of a longer period of study (Klein et al, 2009).

2.2.2 Measuring and Predicting Team Performance

Measuring how teams perform has been conducted using diverse metrics. Most commonly, completion of complex tasks is used to determine how successful a team has been during its time together. But, other performance measures exist that track progress over time (summative vs. formative measures). Objective and subjective measures can confound researchers attempting to operationalize team performance. Of these measures, some have been operationalized in a way that makes data collection more objective. However, others require non-participant observation and structured interviews with team members to ascertain the extent to which the team achieved them. These teams not only seem to enjoy the process of working with one another, but they produce results, in many forms, at a high and consistent level (Duhigg, 2016). A combination of objective and more subjective measures represents state of the art on measuring team performance. Across the studies relying on the measures listed in Table 4, one conclusion is that however team performance is measured, it must capture an element of that team's purpose or the organization's purpose. Perhaps one of the reasons why team building interventions are structured around goal setting and clarifying of purpose is that because without a clear objective, teams struggle to perform, and it is more difficult for team members and organizations to judge or measure the team's performance. This is perhaps most evident in city planning participation exercises where teams are convened and given a loosely defined purpose. In almost all cases, the feedback loop to our citizen participants is non-existent, they do not know how well they performed, nor do they fully understand what is expected of them (Charnley & Engelbert, 2005; Irvin & Stansbury, n.d.; Verba, Schlozman, Brady, & Nie, 2012).

Team building interventions are designed to move teams through the stages of group formation so that they may perform at a high level. Despite a wealth of research on team building interventions, measurement of team performance and collection of data pre/post Treatment have combined to make the results of this work inconclusive—another approach to understanding high performing teams is to reverse engineer the process.

Researchers in organizational behaviour have attempted to define and operationalize predictors of team performance in order to better understand why certain teams perform at a higher level than others (Salas et al., 1999; Woolley et al., 2010).

The ability to predict team performance based on certain measures would allow for more intentional team building interventions. Traditionally, researchers have relied on group measures such as average IQ scores of individual team members to determine how successful a group might be at completing a complex task (Woolley et al., 2010). This has been a historically unreliable measure with which to predict team performance. More recently, researchers have demonstrated the predictive potential of a new measure: collective intelligence (Wooley et al., 2010). This new measure is comprised of two components: the average social empathy scores of the group members and the "conversational turn-taking behaviour" of group members (Wooley). Additional testing of this group measure revealed that it is effective at predicting performance in online-mediated group work and with members from different cultures (Engel et al., 2015). This notion of collective intelligence is more accurate at predicting a group's performance than previous measures developed in organizational behaviour, including average IQ, and diversity quotient, etc.

The wide variety of predictor variables tested against team performance indicate that although this phenomenon is well studied, very few of the tested variables remain significant. In addition, these studies do not consistently test predictors against the same performance measures. Even more problematic for drawing conclusions from this meta-analysis is that the method of analysis for these studies differs based on the levels of data collected and the context in which each study took place. Of the studies reviewed, the most recent work completed by Wooley et. al shows the strongest relationship between tested predictors and team performance. Their new measure, "collective intelligence" shows promise for small groups completing complex tasks. These tasks closely resemble tasks frequently associated with small group work in public participation (visioning, trade-offs, and decision making) (Arciniegas & Janssen, 2012; Straus, 1999; Zeleny & Cochrane, 1982).

Collective intelligence is the single most critical variable in predicting a group's performance. This variable has proven true across several scenarios. Turn-taking is operationalized by the percentage of time in a group meeting that each group member speaks—groups that experience a more equal distribution of talking among members rank as a 1 on turn-taking, while groups that demonstrate a less equal distribution of speaking, rank closer to 0. The second component of collective intelligence, social empathy, is more difficult to measure, but is an individual measurement of each group member's ability to react appropriately to the group and the individuals within it (Woolley, Aggarwal, & Malone, 2015; Woolley et al., 2010). When these two variables are combined, a group's collective intelligence score can be determined. Effectively, those groups with higher collective intelligence, controlling for group composition, size, and average IQ, were more effective at solving complex problems (Woolley, Aggarwal, et al., 2015). The experimental protocols used to test these relationships were not specific to the planning domain, but the complex tasks that groups were asked to complete mimic many of the challenges of planning deliberations— and are aligned with the problem setting and direction setting phases of collaborative planning.

In studies that test collective intelligence, group performance on complex tasks has been used as a measurement for group performance. In a more popular application of the collective intelligence research, researchers followed several teams at Google Inc for months at a time. Their conclusions were particularly novel in the organizational behaviour field. What they found was both counterintuitive to what was previously assumed about the predictors of team performance, and lends more support to the notion that social empathy and conversational turn- taking are better predictors for performance than measures related to IQ and background knowledge (Duhigg, 2016). This recent research demonstrates that teams that perform well do so because of the way the members of the team interact with one another, and that these interactions are measurable in ways that allow us to test their strength as it relates to team performance. Predicting group performance per metrics that are measured by the interaction patterns of group members suggests that team building interventions could be successful in modifying group behaviours in such a way to make groups perform better.

While the social empathy of group members may be a fixed trait, the conversational turn-taking of a group is a behaviour that develops over time (Sacks, Schegloff, & Jefferson, 1974; Woolley et al., 2010). In fact, in research on teams, the development of a team's norms typically occurs after several other stages of group development that can take place over a much longer period of time (Tuckman & Jensen, 1977). The way team members interact is critical the group's ability to successfully perform complex tasks. In public participation exercises, most of the tasks planners ask community members to perform fall into the complex task taxonomy of the McGrath circumplex, but they also require that participants engage in ideation and creativity (Brandt & Eva, 2006; Evans-

Cowley & Hollander, 2010; J. F. Hacker, Krykewycz, & Meconi, 2009). Additional research in organizational behaviour suggests that other group characteristics help predict how successful a group might be at demonstrating these types of behaviours.

Successful small group work in a public participation process in planning will be characterized by those experiences where social learning occurs, where groups complete complex tasks, and where participants develop creative solutions, however, based on the team building literature, there is little evidence to suggest that infrequent, randomly convened groups of planning participants will be able to achieve the deliberative patterns of conversation that make teams successful in addressing complex problems.

2.3 Games

Planners have been attempting to overcome the challenges to successful engagement for quite some time. One such mechanism that has been deployed in planning practice is the use of games to both educate and solicit feedback from participants. Games have potential to contribute positively to achieving both process and outcome goals related to public participation (Baba & Ieee, 2006). Games can be used as team-building activities that help establish productive teams, and they also provide opportunities for social learning and interactive education of participants within a public planning process (Brandt & Eva, 2006; Ellis et al., 2008; Gordon & Schirra, 2011; Schirra, 2013; Voinov et al., 2016). The evaluation of gaming within public participation frameworks is important because the use of games continues to increase as planning relies more on new technology, online platforms, and more diffused participation events. Gaming activities allow for both interaction and team-building. Games have been used as team-building interventions, as tools to increase civic engagement, and as educational devices. As using games to educate and gather input from participants in planning processes becomes more ubiquitous, it will be more critical for us to evaluate their use within the planning framework, especially as it relates to social learning and collaborative planning.

Traditionally, games are popular methods to entertain players. We think of games as tools to engage with children, practice the art of play, and entertain ourselves. However, games serve purposes beyond entertainment and their development and design exists within a much larger theoretical and academic framework. The potential of games to educate and motivate players has recently emerged in the trend to "gameify" difficult tasks and incentivize challenging changes in human behavior. Popular mobile applications like "DuoLingo" and others have emerged as single player games for players to develop certain skills, such as language acquisition or memory and recall. Classroom technologies such as "Kahoots" have been globally adopted by educators attempting to engage their students in new and exciting ways that harness the excitement of competition to motivate students to learn and retain knowledge. Older games have been redeployed through social media platforms to create opportunities for asynchronous multi-player digital play, and digital games previously used for purely entertainment purposes have been brought into the educational realm as ways to teach students (Terzano & Morckel, 2015). SimCity is one popular example of this phenomenon—its popularity peaked among a wide range of age groups in the 1990s, and it has recently resurfaced as a subject of interest for its pedagogical application in planning classrooms as well as a research tool to investigate how participants understand tradeoffs in planning (Gaber, 2007; Terzano & Morckel, 2015). Planners, too, have deployed games to educate participants in the planning process, and also to entertain and provide opportunities for asynchronous engagement through online platforms (Gaber, 2007; Poplin, 2012). Games not only serve as one tool with which to scale a planning exercise, but also to address the commitment issue—making participation in the planning process more fun encourages more people to participate throughout the duration of a planning project. The popular fascination with gaming technology to incentivize behavior, motivate learning, and connect through ICT, has widespread implications for planning applications especially in public engagement.

2.3.1 Types of Games

Games can be characterized by their digital (or non-digital nature) or to what extent play can be asynchronous. We are evaluating use of games for team-building and planning that are semi-cooperative and broadly defined as "serious." Serious games share objectives related to education and double-loop learning, while semi-cooperative games rely on interaction between participants to yield double-loop learning outcomes. Semi-cooperative games, while generally based in some real-world problem, tend to be less realistic than games categorized as serious, but both types of games are attempting to use play as a motivation tool for engaging with topics generally characterized as difficult or controversial (Guy, Bidwell, & Musumeci, 2005; Michael & Chen, 2005; Peleg & Sudhölter, 2007). In each case, these games allow participants to explore differences in perspectives without having to engage in combative zero-sum negotiations. The rules of these games are also designed to reward both strategic and cooperative behaviour. There are outcomes in these games that are win-win, and win-lose, but players must interact with others. Those players that seek to maximize their individual performance at all costs fail in the game. In some of these games, the semi-cooperative nature of the structure is not revealed to participants at first, and this emergent framework makes these games less useful as one-time team building interventions.

"The term 'serious games' refers to games designed to do more than just entertain (Michael & Chen, 2005). Zyda provides the following definition: serious games are a 'mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives' (Zyda, 2005) Serious games are often designed as virtual environments explicitly intended to educate or train (Breuer & Bente, 2010; Michael & Chen, 2005; Susi, Johannesson, & Backlund, 2007). Air Force flight simulators are considered the ultimate serious training game— used to simulate real world situations that can very much be life or death for the flight student (cite). Two key features of serious games are their educative and immersive qualities" (Poplin, 198)

Within this category of games, the structure of the rules is designed to encourage and reward certain intrapersonal behaviours among participants. For example, in the game Pandemic, players must interact to solve a health crisis, and while they can accrue points for individual behaviours, the game cannot be won without interactive and cooperative behaviour. Similarly, the game Settlers of Catan requires individuals to assess strategy, but can reward those participants that cooperate with others to work against other players. These types of games can also be educational, but their primary objective is to encourage players to interact in certain ways to "beat" the game.

Games used to advance planning objectives fall into two categories: those used to pursue learning objectives in the classroom, and those used in civic engagement exercises.

Four main categories of civic engagement games exist: community problem solving and cohesion; humanitarian work; civic action taking; skill and network building (https://elabhome.blob.core.windows.net/resources/engagement-game-guidebook.pdf).

The Cornell Land Use Game (CLUG), developed by Allan Feldt in the 1960s, is one of the first examples of a game used in a planning classroom to achieve learning objectives related to training planners. CLUG, later renamed the Community Land Use Game, allowed up to five (5) players to attempt to optimize land purchasing and development constrained by a fixed sum of money (Feldt, 2014). The players or teams had to work with other teams to develop relationships to accomplish the game objectives. The game persisted long enough to be tested on desktop computers, but with less desirable results as cooperation within teams declined as number of team players increased (Feldt, 2014). CLUG's design was based on the semi-cooperative game model popularized by other games that preceded it. Feldt's interest in designing CLUG was not in developing a tool to study learning behavior, but in creating a "teaching machine" (Feldt, 1962).

He hypothesized that a game developed according to the systematic challenges inherent in real life and requiring cooperation among teams could replace more traditional pedagogical methods used by the planning faculty. While CLUG did not replace the planning master's curriculum, Feldt made a convincing case for how games could be used as teaching machines (Feldt, 1962).

Since then, a variety of games with planning related objectives have been developed, deployed, tested, redesigned, and shelved. Although the use of games in planning classrooms showed promise, rigorous research measuring how learning objectives were met through games did not exist. Through observation and anecdote, it appeared that students retained more information than they had otherwise (Feldt, 2014). CLUG has been reimagined by several planners and deployed in a variety of instances to this day. Feldt's original game represents a seminal contribution to planning because he was the first to introduce games as a useful component of planning pedagogy. The descendants of CLUG relied on a similar game structure: participants operating within constraints to optimize objectives and relying on other teams to do so. These games share the characteristics of other semi-cooperative games discussed earlier. In 1977 French and Godschalk developed the Land Classification Game to train local elected and appointed officials how to use land classification planning system mandated by the N.C Coastal Area Management Act (Personal communication, French, 2017). Now, almost 60 years later, there is more widespread acceptance of this approach to education (Breuer & Bente, 2010; Cecchini & Rizzi, 2001; Gaber, 2007; Terzano & Morckel, 2015). Commercialization of games and distribution of games through ICT platforms pervades a variety of disciplinary fields in higher education. The ability of well-designed and thoughtfully employed games to aide in the achievement of learning objectives has been demonstrated (Breuer & Bente, 2010; Gaber, 2007; Gordon & Baldwin-Philippi, 2014; "Making Blocks & Lots: A Window into Learning and Creativity," n.d.).

Planners use semi-cooperative games in a variety of contexts. Games have been used as educational tools (Terzano & Morckel, 2015), and games have been used as tools to engage the public. The Department of Housing and Urban Development (HUD) created a "Model Cities" program that used a game to educate participants on the trade-offs inherent in planning. Various games have been developed to be used in classrooms to illustrate the challenges planners must face. Games deployed as part of public participation efforts ask participants to play in small groups and frequently are designed to reflect local experiences and planning challenges—these games are both purposeful and entertaining, but they are also structured to be educational.

Game playing has been identified as a method of developing enhanced visuals, greater opportunity for collaboration or identification of mutual goals, and high levels of interactive opportunities and entertainment (A. Poplin, 2012). Introducing participants to a game simplifies complexity, and can remove participants from combative or aggressive situations. Participation in a game may require less mental capacity, but gives back to the participant a greater sense of empowerment and knowledge of the issues at play. Games can be structured so that participants must work collectively in a smaller scale version of world that they have only grappled with mentally. The similarities between the structure of games and the qualities needed to create social learning make evaluating game playing within a social learning and collaborative planning context a logical step in making the argument that employing games within the planning process can lead to creating social and institutional capacity in the long term. However, research has not yet been done to test the effectiveness of games on changing the way players interact in subsequent group meetings. There is limited evidence to suggest that game playing can modify participants behaviour to make them more collaborative and productive (Gordon & Schirra, 2011).

These benefits have made game playing a critical part of an increasing number of planning processes' public participation design—it serves to educate participants while soliciting their input. Initiatives such as Urban Land Institute's (ULI) "Reality Check" ask participants to come together and play a game where they place blocks and infrastructure investment on a map of their region, while being limited by realistic constraints such as public funds and land availability ("Reality Check - Urban Land Institute," n.d.). Many Metropolitan Planning Organizations use similar versions of transportation games to ask participants where new transit and road infrastructure should be placed (J. F. Hacker et al., 2009). Other planning agencies ask participants to role play when deciding how to invest limited funds, and an increasing number of regional planning agencies are developing online and digital tools that ask participants to act as planners themselves, designing the future of their region and realizing the trade-offs inherent in their plans. Gaming in city planning is now interactive more than it is purely unidirectional. Literature examines how these types of games can bridge the gap between technical experts and stakeholders (B. Guy, N. J. Bidwell, & P. Musumeci, 2005). Inviting participants to play these games can also generate additional public enthusiasm for participating in planning projects. The literature examines the proliferation of games such as SimCity, Second Life, and other urban planning games that have captivated the public's imagination. These games continue to increase in popularity (D. G. Lobo, 2007). Additionally, the educational potential of serious game playing can be leveraged to help educate stakeholders in planning issues (J. B. Hollander & D. Thomas, 2009). The interactive nature of games leads to a stronger learning effect on participants (M. Prensky, 2003). Games also force our participants to situate themselves within a broader social context and system—this process is akin to the process first described by Wenger in 1998 as a "mode of belonging" (E. Wenger, 1998).

The three components of modes of belonging are engagement, imagination, and alignment. Engagement refers to working together, interacting with others, and participating in dialog. Imagination refers to situating ourselves within a world that we cannot fully grasp. Alignment refers to a two-way process that ensures our expectations are realistic and that we are abiding by a joint moral code (E. Wenger, 1998). These components, central to fostering social learning, are also central to public participation in planning—we want our participants to work together, to appreciate other perspectives and think about the future collectively within the bounds of regulations and legal frameworks.

By addressing how game playing can educate participants and help bolster institutional capacity that is needed to pursue collaborative planning, it can be used as a component of designing more effective planning processes. Based on the literature examined, games help participants understand the interactions between each other's decisions and identify mutual goals rather than self-interested objectives (N. Baba & Ieee, 2006; A. M. Evans & J. I. Krueger, 2011; J. F. Hacker, G. R. Krykewycz, & J. M. Meconi, 2009; A. Poplin, 2012). The ability of gaming to fulfil this role cannot be overstated when planning problems continue to increase in complexity. Successful long range planning now requires professional planners, decision makers, stakeholders, and the greater public to cooperate and understand the trade-offs inherent in seeking self-interest over the public good. Creating opportunities to educate participants in a planning process through gaming will serve the planning process well. The Delaware Valley Regional Planning Commission summarized their experience with "Dots and Dashes", a transit planning game: "It condenses (at least conceptually) much of the transportation planning process so that it becomes possible for a lay audience in about an hour to engage in planners' decision making. Because of Dots & Dashes, planners are informed of participant's priorities for investments, and participants leave more informed of the difficult trade-offs that govern decision making … this unique method of public outreach also introduced DVRPC's profile and mission to a new audience" (J. F. Hacker, G. R. Krykewycz, & J. M. Meconi, 2009). Given the overwhelming success of this low-tech gaming approach in the complicated field of transportation planning, it follows that games have serious potential in overcoming traditional participation challenges and addressing the requirements of successful collaborative planning theory.

While a variety of gaming approaches have been used with the public, there is limited scholarly research that measures the extent to which game participants in a public planning process engage in social learning. Additionally, there is a lack of research on the extent to which, controlling for other variables, the introduction of a game to the planning process leads to different planning outcomes. Furthermore, despite the theoretical framework of collaborative planning, which suggests that social learning can lead to other goals such as the development of social and institutional capital, it has not been tested to show how the social learning experience might enhance a small group's ability to deal with complex situations. Previously, games studied within the planning process, have examined the game's ability to educate participants and generate positive associations with planning—but these examinations have been conducted at the individual level. While enhancing an individual's cognition is important, semi-cooperative games that are designed to guide participants into a series of interactive behaviours to pursue common goals, need to be assessed at a group level to determine how successful they can be as an intervention in small groups.

2.3.2 Games and ICT

Historically, games were in-person events. It is hard to imagine how players might have confronted the challenges of space and time to play games without the internet. Today, we estimate that a large majority of game playing occurs through digitally mediated experiences (Takahashi, 2013). These experiences can be asynchronous or synchronous, and can take place via the internet or through computer games.

The digitally mediated nature of game playing has changed the way players interact with games, and one another. The ability for multi-player games to happen asynchronously has expanded the reach of games, but has limited the interaction and feedback typically associated with multiplayer games (). The advent of gaming through ICT has distinct advantages for deploying games for educational and engagement purposes. Large, regional, multi-player games used in city planning projects, as discussed earlier, are not feasible without the technological innovations in ICT. In-person games can be constrained by number of participants, size, and time (). Games used in planning processes, whereby outputs of game play were used as inputs to the planning process also meant that without the help of certain technological advancements, data collection and processing proved problematic at large scales.

2.3.3 Games as team-building interventions

Given that games are designed to achieve social learning objectives in a wide variety of contexts, their ability to generate intermediate outcomes relevant to collaborative planning is evident, and this type of learning is also critical to team formation. Team norming relies on an element of social learning, where team members learn not only about new information from one another, but also how to interact. The extent to which this is possible depends on the backgrounds of each participant. The ability of a team to move through the stages of group formation to group performance is also dependent on the background knowledge of each member . The social learning objective of games has long been touted as an important characteristic of why they can be used in team building interventions. Along the four dimensions of team building interventions, games are most closely linked with team norming. Furthermore, the rules of games can be used to test rules of group interaction and move groups through the norming stage more quickly. Now that predictors of group performance have been identified as those that describe how members interact (collective intelligence), games may have even more potential to be effective team building interventions.

Games are used as a vehicle to promote interpersonal relationships among team members. These types of team-building interventions typically employ a playful method of interaction for which games are uniquely well suited. In this context, games demonstrate potential to effectively improve processes by which team members interact because the institute behavioural rules that govern play. The ability of games to allow for risk-free interaction or low stakes interaction also gives games the potential to create opportunities where team members can develop trust amongst each other (Ellis et al., 2008; Gordon & Baldwin-Philippi, 2014; Michael & Chen, 2005).

The educational nature of games can also be leveraged in team-building applications to expose team members to information they may not have been previously considering. The main goal of games when used as part of team-building interventions is predominantly to structure the process of communication between group members as a basis for enhancing relationships (Ellis et al., 2008). High performing teams frequently demonstrate well – developed interpersonal relationships (Duhigg, 2016). The ability of games to leverage this function of team-building makes them especially well-suited to study as a mechanism for enhancing a group's collective intelligence. If conversational turn-taking can be taught through a structured process of interaction, typically seen in game playing rules, then games have potential to be tested as a team building intervention in a more deliberate way with greater empirical clarity.

2.4 Conclusion and questions

The literature outside of the planning discipline indicates how and why designing small group activities can serve the goals of public engagement in a way that overcomes the divide between planning process and planning outcomes. If process outcomes, such as social learning, are of critical importance for communicative and collaborative planning, these process outcomes can be leveraged to achieve outcomes that other fields have suggested are important precursors to the development of creative and innovative ideas. From a social constructivist and relational perspective, we suggest that planners have a normative requirement to increase the capacity of community members and stakeholders in public engagement processes to engage, negotiate, ideate, and critically reflect.

A review of the relevant literature across these three fields indicates that although various disciplines desire to know how to bring small groups of people together to solve complex problems, and how to create opportunities for participants in those groups to engage in social learning, a variety of challenges to generating this knowledge exist. Within the planning realm, typical research methods used to study public participation and small groups have led to many studies that rely on non-participant observation and single-case study design, limiting the validity of conclusions associated with that work. Moreover, previous work in organizational behavior, has attempted to operationalize team performance and identify predictors of success, but has been unable to conclusively demonstrate that team building interventions have a positive effect on team performance.

Of the techniques and tools studied as part of the literature on public engagement and social learning, none are classified as gaming tools, and many, if not all, of those studies have examined to what extent learning occurs among participants, but not necessarily if group/social learning occurred. The lack of study on social learning can be partially attributed to measurement difficulties. It is hard to judge how individuals have modified their perspectives based on their interactions with others, and much of social learning happens beyond process, as participants reflect back on their experiences (R. Bull et al., 2008). In this regard, recent work has advanced the measurement of social learning by attempting to operationalize it among several variables collected through surveys, but this work is still limited in its ability to associate social learning with other goals related to planning objectives.

While the gaps in this literature cannot be conclusively addressed in a single study, this research uses an experimental design to test how game playing can improve deliberative processes for small groups engaged in city planning activities. The selection of a role-playing semi-cooperative game (@Stake) as a treatment activity in this experiment is based on the design of the game, prior evidence that demonstrates that games can effectively create social learning opportunities and generate enthusiasm for the planning process, and the specific set of rules that govern the game. The game itself, @Stake, takes on the role of the facilitator in a deliberation among community members as the rules of the game govern turn-taking and equal participation among the players. However, while @Stake has been chosen because it embodies game design principles that support social-learning and capacity building of participants engaged in deliberative discourse, this game was not previously designed to be played online. The choice to use this game as an intervention in an online format is a direct response to the ubiquity of online planning engagement activities. By operationalizing social learning and group performance in an experimental setting, this research advances the public engagement literature as well as research within the learning and team building domains. These contributions are achieved through the research design detailed in the following chapter.

CHAPTER 3. RESEARCH DESIGN

This chapter details the research design of this study, variable operationalization, the game, the survey instrument, and data collection protocols. The research questions of this work are: 1) do online games create opportunities for social learning among teams in an urban planning public participation process? and, 2) do groups that demonstrate social learning also demonstrate enhanced collective intelligence (turn-taking) and enhanced collaborative decision making? These questions are based on the literature reviewed; the conceptual framework for this research is shown below.

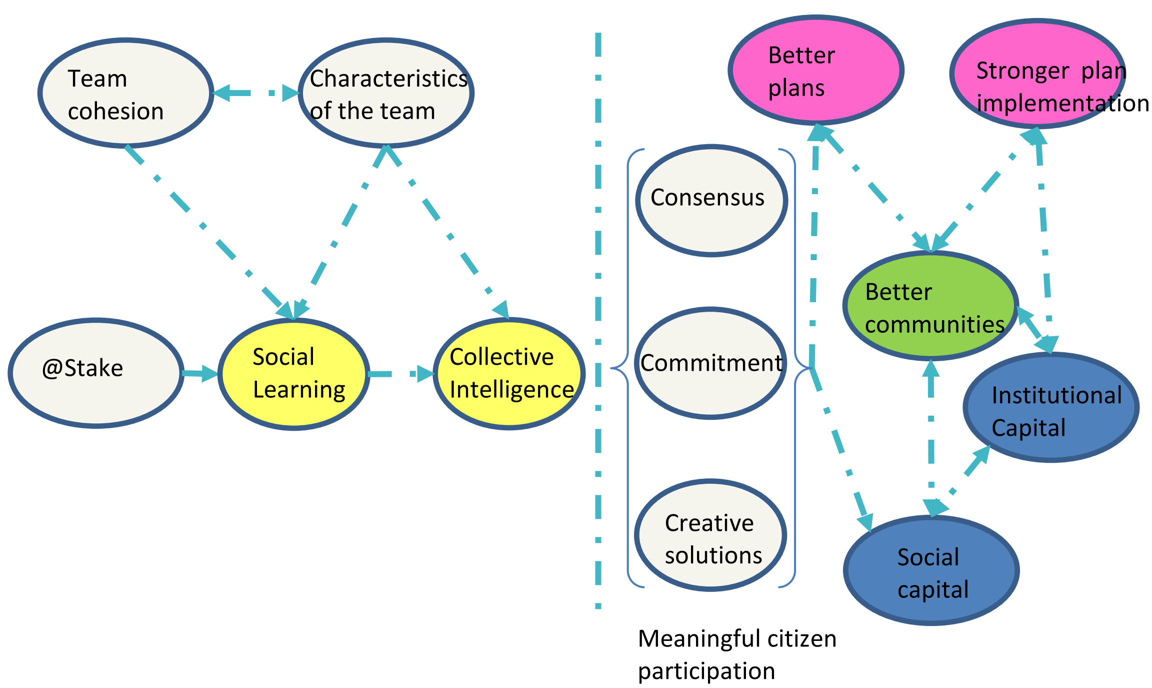


Figure 3-1: Conceptual Framework

The hypotheses are shown in Table 3-1.

Table 3-1: Hypotheses

Number	Hypothesis
1	Treatment groups will experience social learning
2	Treatment groups will demonstrate more equal distribution of turn-taking than control groups
3	Higher self-reported social learning among Treatment groups will correlate with more equal distribution of turn-taking
4	There will be a statistically significant difference in the mean rank of creativity of decision between Treatment and control groups
5	There will be a statistically significant difference in the mean rank of perception of consensus between Treatment and control groups
6	There will be a statistically significant difference in the mean rank of commitment between Treatment and control groups

3.1 Research Design

This experiment has been designed to answer the research questions presented above and test the hypotheses shown in Table 3-1. The experimental protocol involved college undergraduates enrolled in courses taught in the School of City and Regional Planning at Georgia Tech. None of these students were majoring in City and Regional Planning. Each participant completed a pre-Treatment survey (Appendix A) to establish pre-existing background knowledge on the subject, as well as to collect socio-demographic data, including that of students' major. This survey was used to collect data listed in Table 3-2. Participants were randomly assigned to groups and groups were organized into Treatment and control.

Table 3-2: Pre-Treatment survey information

Data	Method of Measurement
Age	Years
Year (1^{st}, 2^{nd}, 3^{rd}, 4^{th}, +)	Year of undergraduate
GPA	Grade Point Average
Major Field	Name of major
Sex	Male/Female/Non-binary/Self-describe
Ethnicity	White/Hispanic or Latinx/Black or African American/Native American or American Indian/ Asian/ Pacific Islander/other
Social Empathy Score	Score on “Reading the Mind’s Eye” test
Background knowledge score	Correct answer on “What are transit headways?”
Previous experience in planning	Yes/No

Student participants were randomly assigned to either the control group (no game) or the Treatment group (online game). Each student group had either 3 or 4 participants.

3.1.1 Treatment Protocol

Treatment groups were asked to play an online version of @Stake while communicating over a Slack channel. @Stake was designed as capacity-building role-playing game with civic prompts. The content and rule structure of the game make it appropriate as a tool for understanding both how social learning can occur during game-play and how participants might adopt the deliberative structure of the game into a non-game mediated follow-up meeting. The game was deployed online to understand how benefits known already to be by-products of game play might translate beyond face-to-face communication. Given that the game was not intended to be played online, the results of this work can only be interpreted in comparison to the variables measured and are not a commentary on the game design itself. The Treatment group was then asked to complete a post-Treatment survey (Appendix B) that required them to respond to questions using a Likert scale of 1-7. The prompts have been categorized into instrumental and communicative learning. The responses of each participant were combined to create average group scores. Groups were ranked according to their social learning scores.

Following Phase One of the experiment, the Treatment groups engaged in Phase Two. Both control and Treatment groups participated in Phase Two. In Phase Two, the Treatment groups were required to propose updates to the Georgia Tech Bus and Trolley system. This simulated planning challenge was designed to allow groups to pursue optimization of ridership, efficiency, and cost. The outcomes of this case study were scored to objectively measure those groups who performed the best on the case study, as summarized by three variables: creativity in proposed decision, perceived consensus among team members, and commitment to the planning process. In addition, the group deliberation on their case study was recorded to collect data on time spent speaking to determine the turn-taking distribution among group members (collective intelligence). The experimental notation for the Treatment group is shown below.

R	X_1	O_1	X_2	O_2
R			X_2	O_2

Figure 3-2: Experimental Notation
Figure

Where
R = random assignment to control or Treatment group
X_1 = Treatment (@stake game)
O_1= post Treatment survey measuring social learning
X_2= Simulated transit re-design challenge
O_2= post Treatment survey & observation measuring turn-taking distribution, consensus, creativity of proposed solution, and commitment

3.1.2 Control Protocol

After being randomly assigned to their groups, members of the control groups did not meet prior to X_2. They were asked to come together only to participate in the simulated planning challenge. The outcomes of this case study were scored to objectively measure those groups who performed the best on the case study, as summarized by three variables: creativity in proposed decision, perceived consensus among team members, and commitment to the planning process. In addition, the group deliberation on their case study was recorded to collect data on time spent speaking to determine the turn-taking distribution among group members (collective intelligence). The experimental notation for the control group is shown below.

R	X_1	O_1	X_2	O_2
R			X_2	O_2

Figure 3-4: Control Group Experimental Notation

Where
R = random assignment to control or Treatment group
X_1 = Treatment (@stake game)
O_1= post Treatment survey measuring social learning
X_2= Simulated transit re-design challenge
O_2= post Treatment survey & observation measuring turn-taking distribution, consensus, creativity of proposed solution, and commitment

One of the anticipated benefits of this methodological approach is that it accepts the challenges put forth in recent related research to generate potential insights into "the revealed behavior by users, rather than just their perception of their behaviors afterwards"

(Peltzer, 2014, p 159). Additionally, this research measures the extent to which social learning leads to beyond-process outcomes, such as improved deliberations (R. Bull et al., 2008). This two-phase approach demonstrates whether or not games can create opportunities for social learning, as well as the extent to which differences in social learning impact deliberative processes in an unfacilitated setting. Furthermore, this research design allows us to test if there is a difference in deliberative processes and quality of decisions between groups who have played the game and groups who have not.

3.1.3 @Stake

@Stake is a role-playing simulation game developed for the purposes of conducting community planning exercises. Developed by the Engagement Lab at Emerson University, it has been deployed in several contexts. It is a serious game with the goal of facilitating simulated role play to educate participants on trade-offs and challenges to achieving specific planning or community objectives. To advance the game, or win points, participants must pitch their agenda items to a person assigned as the decider. Points are awarded when the players successfully pitch their ideas. The game uses "…role-play, competition, and collaboration [to] encourage creative ideas, empathy and learning about local issues through a playful approach, framed by the 'safe' space of a game with rules" (https://medium. com/engagement-lab-emerson-college/stake-a-series-of-field-notes-in-gamedevelopment-570078fe2e74#.ofo3iyqak). Each role has hidden agenda items, and when these are satisfied, players receive bonus points, regardless of whether their idea was selected as the best one by the decider. At the end of three rounds, the winner is named based on the number of points accumulated.

This game satisfies several other characteristics required to study social learning in micro-group processes. The game requires participants to

- communicate & collaborate
- operate within rules, guidelines, and a time limit
- keep score
- pursue compromise to advance, and
- learn about new things (Gordon & Baldwin-Philippi, 2014).

This game was also chosen because it can be modified to ask participants to grapple with challenges unique to their community. Replicas of the game pieces and relevant background information are contained in Appendix D. Each participant in the game is assigned a role, and each role has individual goals that, once met, allow the player to progress through the game. This game format requires each participant to learn about the others, as well as collaborate to move forward (G. Haas & R. Woo, 2011). By requiring such collaboration, the game forces interaction.

One of the reasons @Stake was chosen as the game playing intervention for use in this study is because it is a flexible game—it has already been applied in several contexts, in terms of both cultures and content. The variety of applications for which @Stake has been used supports the idea that games are particularly effective means of establishing an interactive framework that supports critical reflexivity across a variety of contexts and among diverse groups. The other reason @Stake was chosen is because it is a fast-paced game that requires participants to show up, but not necessarily to over prepare. What it sacrifices in fidelity of the roles, it gains in fun. It is these types of applications that have the most potential to overcome the commitment issue faced by planning engagement processes. @Stake has been designed to be self-facilitated and in the rules of the game, it requires participants to take turns speaking. The rules of the @Stake game align with collective intelligence. Using a game that trains participants to deliberate in a more effective way is a logical extension of testing how communicative knowledge in social learning can lead to better decision making and collective intelligence in groups.

@Stake was designed as capacity-building role-playing game with civic prompts. The content and rule structure of the game make it appropriate as a tool for understanding both how social learning can occur during game-play and how participants might adopt the deliberative structure of the game into a non-game mediated follow-up meeting. The game was deployed online to understand how benefits known already to be by-products of game play might translate beyond face-to-face communication. Given that the game was not intended to be played online, the results of this work can only be interpreted in comparison to the variables measured and are not a commentary on the game design itself. Because the game was deployed online, interpretation of results are complicated by the dual-nature of this intervention. No comparison is provided between an online and face-to-face deployment of @Stake. This choice was made as direct response to the needs of professional planners; the benefits of these games have been demonstrated effectively in a face-to-face game play setting, but it is unknown how the positive game-play outcomes can be realized in an online setting.

3.2 Variables and Survey Instruments

This methodological approach is adapted from Goodspeed's method of operationalizing the social learning framework first developed by Wenger (imagination, alignment, engagement) (R. R. C. Goodspeed, 2013). This approach differs from many post-participation evaluative surveys because it expands the foci beyond the individual's acquisition of knowledge or interpretation of the planning process. The goals of this survey are to situate the individual's response within the group context. The survey is designed to understand how games can facilitate social learning. These questions are developed from earlier empirical work done to test the success of team building interventions and from previous work done to test the ability of planning support systems to provide opportunities for social learning (Goodspeed, 2013) M. A. Amos, J. Hu, & C. A. Herrick, 2005; A. A. Bubshait & G. Farooq, 1999; D. R. Ilgen, J. R. Hollenbeck, M. Johnson, & D. Jundt, 2005). The first two surveys were administered online for all participants in the Treatment and control groups. The final survey was administered as a paper copy at the conclusion of the face-to-face deliberations.

This experiment was conducted with 102 individuals randomly organized into 30 groups of 3 or 4, resulting in an n of 30 with 15 control groups and 15 Treatment groups. The results from the survey questions were summed by participant and averaged for each group. In this way, we compared if differences existed between the Treatment groups (game) and control groups. To test the hypotheses presented in this chapter, there are four dependent variables in Phase Two: **turn-taking of participants during deliberations, creativity, perceived sense of consensus, and commitment to planning process.** We used this information to test the strength of the interaction between social learning and **collaborative decision making**.

In the Phase One analysis, we assessed the extent to which social learning occurred in the Treatment group by administering a survey to all participants. Questions on this survey asked them to self-report on their experiences of social learning. The questions were organized according to the instrumental and communicative categories. The intent of this analysis is to demonstrate the extent of social learning experienced by participants in the Treatment group. The question used to demonstrate acquisition of instrumental knowledge are shown below.

Table 3-3: Instrumental Knowledge Survey Question

Survey Question #	Question	Answer
9	I learned a great deal	1(strongly disagree)- 7 (strongly agree)

Questions used to demonstrate acquisition of communicative knowledge are shown below.

Table 3-4: Communicative Knowledge Survey Questions

Survey Question #	Question	Answer
4	I was able to imagine new solutions to problems	1(strongly disagree)- 7 (strongly agree)
5	I thought about the problems in a new way	1(strongly disagree)- 7 (strongly agree)
6	I understood the perspectives of my group members	1(strongly disagree)- 7 (strongly agree)
7	At the end of the game, I shared views with more than one other participant	1(strongly disagree)- 7 (strongly agree)
8	We had more points of agreement than disagreement at the end	1(strongly disagree)- 7 (strongly agree)

The individual results of these questions were averaged to create an individual level of reported social learning. For each group, a mean social learning score was assigned based on the individual responses to both instrumental and collective knowledge.

3.2.1 Hypothesis 1

H_1 Treatment groups will experience social learning

To test this hypothesis, teams that play games were administered a post-Treatment survey that asked them to self-report their experiences of Instrumental and Communicative learning during the game playing process. Measuring instrumental knowledge was defined as the individual's response to the question "I learned a great deal", while measurement of Communicative learning was reflected by the mean of the individual's responses to a suite of questions assessing alignment with group perspectives. A total social learning score was computed for each participant by summing the mean of the communicative scores and the score on instrumental knowledge acquisition. Descriptive statistics were prepared at the group level to demonstrate the range of social learning scores across the 15 Treatment groups. The reported means of social learning from Phase One will be compared, using a paired samples *t*-test, to reported means of social learning from Phase Two to determine if there is significant difference in mean reported scores for the Treatment groups during online vs. face to face interactions.

3.2.2 Hypothesis 2

H_2 Treatment groups will demonstrate more equal distribution of turn-taking than control groups

In the Phase Two analysis, we test how **turn-taking, one element of collective intelligence,** is influenced by that the group's participation in the Treatment (online game) when compared to groups that did not participate in the Treatment (control). Turn-taking is measured by observation of the video-taped discussion between group members during the phase two. The audio/video footage was transcribed. This broad transcription will allow us to generate a 0-1 measure of uneven distribution of speaking (values closer to 1) and even distribution of speaking (values closer to 0) on a continuous scale.

Our hypothesis is that **social learning**, along with average social empathy, will be significantly correlated to the group's **conversational turn-taking**, and that these variables will be significantly different between the control and Treatment groups. If these relationships are demonstrated at the significant level, we will have advanced the notion of collective intelligence and demonstrated the ability of games to act as a team building intervention to provide opportunities for social learning and enhance the team's ability to complete a complex task by improving their deliberative processes.

To test this hypothesis, an independent samples *t*-test will be used to compare the reported means of turn-taking between control and Treatment groups.

The Table below identifies the variable used in this analysis.

Table 3-5: Independent Samples *t*-Test Variables of Interest

Variable	Type	Method of measurement
Degree of turn-taking	Continuous (0-1)	Observed speaking patterns
Treatment/Control	Dummy (Categorical)	T or C, as assigned

3.2.3 Hypothesis 3

H_3 Higher self-reported social learning among Treatment groups will correlate with more equal distribution of turn-taking

A second independent samples *t*-test will be used to compare the reported social learning during Phase Two of the experiment between control and Treatment groups to determine if there is a significant difference.

Table 3-6: Independent Samples *t*-test variables of interest

Variable	Type
Social Learning (Phase Two)	Continuous
Treatment or Control	Groups/Factor

3.2.4 Hypotheses 4, 5, and 6

While turn-taking is considered part of a group's collective intelligence, and is a critical component of predict group performance, collaborative planning and public participation also evaluate the success to which planning engagement exercises lead to effective planning. To translate the potential communicative gains from game playing to unfacilitated consensus driven discussion in the planning process, additional statistical measures will be used to determine if a relationship exists between the presence of the Treatment and the quality of decision, consensus perspective and commitment to the process. By testing these relationships, we will be to analyze several questions suggested by previous research:

1) Are there beyond process gains after the game? (R. Bull et al., 2008)

2) Can the game train participants to self-facilitate, manage conflict, and set goals? (Judith E Innes & Booher, 1999) and therefore generate successful consensus driven conversation without facilitation?

The following hypotheses will be tested using independent samples *t*-tests or Mann-Whitney U statistical tests, as guided by the distribution of the data, to determine if a significant difference exists between Control and Treatment groups.

H_4 There will be a statistically significant difference in the mean rank of creativity of decision between Treatment and control groups
H_5 There will be a statistically significant difference in the mean rank of perception of consensus between Treatment and control groups
H_6 There will be a statistically significant difference in the mean rank of commitment with the process between Treatment and control groups

Demonstrating if differences in the group's mean scores on quality of group decision, consensus perspective, and commitment during Phase Two, are related to the Treatment will be computed by a set of Mann-Whitney U tests. Mann-Whitney U tests are typically used in psychology to determine differences between interventions. If the data is similarly distributed across Treatment and control groups (assessed through a visual inspection of a population pyramid) Mann Whitney tests can demonstrate if there are significant median differences between the Treatment and control group for each of the three dependent variables shown in the following Table.

Table 3-7: Dependent Variables

Variable	Type	Collection method
Creativity	Ordinal	Survey & Observation
Perceived sense of consensus	Ordinal	Survey
Commitment	Ordinal	Survey

These variables are operationalized through a set of questions in the post Treatment survey. Each of these questions asks respondents to answer using a Likert scale of one (1) – strongly disagree—to seven (7)—strongly agree.

Table 3-8: Survey questions for Mann-Whitney U test comparisons

Survey Question #	Question	Construct
1	I believe our group achieved consensus in our vision for the GT Bus and Trolley system changes	Perceived consensus
2	I could imagine new solutions to problems	Creativity
3	I thought about problems in a new way	Creativity
4		
5	My group discussed all issues	Perceived consensus
6	When conflict arose, we discussed it	Perceived consensus
7	At the end of session, I shared views with more than one other participant	Perceived consensus
8	We had more points of agreement than disagreement at the end	Perceived consensus
9	I felt a sense of loyalty to my group's creation	Commitment
11	I was satisfied with the process as a way of working with Georgia Tech on providing my input to changes to this service	Commitment
12	I would willingly participate in another event like this in the future (without compensation of any kind)	Commitment

The results of the responses for all questions for each construct will be averaged for each participant and aggregated to form a score for each group for each dependent variable (creativity, consensus, commitment). The creativity of each group's proposed changes to the transit system will also be observed through number of factors each group considered in their final design. The independent variable for each Mann-Whitney U test is the categorical variable that denotes if the group received the Treatment. The Mann- Whitney U test is expressed, as shown below.

$$U_1 = R_1 - \frac{n_1(n_1 + 1)}{2} \tag{1}$$

Where U=min (U_1, U_2) and $n_1 =$ size of sample 1 and R_1 = adjusted rank sum for sample 1 for each dependent variable in question (as shown in Table 3.9).

$$U_2 = R_2 - \frac{n_2(n_2 + 1)}{2} \tag{2}$$

Where U=min (U_1, U_2) and $n_2 =$ size of sample 2 and R_2 = adjusted rank sum for sample 2 for each dependent variable in question (as shown in Table 3.9).

The Mann-Whitney U test is a non-parametric test that presumes no directional relationship between variables. It is frequently used as an initial statistical test to demonstrate if the two samples are significantly different. It is also used when the data are not normally distributed, but similar enough in shape.

3.2.5 Endogenous and Exogenous Variables

Social empathy is an endogenous variable that is highly correlated with gender. We are organizing teams to control for gender mix. An accepted test for measuring an individual's social empathy score is the "Reading in the Mind's Eye" test (RME). The RME test asks participants to look at several photos of people and characterize their emotional state (Declerck & Bogaert, 2008; Woolley et al., 2010). Typically, women perform better on the RME than men, explaining why gender can sometimes explain groups that perform well on complex tasks. Those groups with more women typically perform at higher rates because their average group social empathy scores are higher than those groups with less women.

Table 3-9: Independent and dependent variables for all analyses

Independent Variables (Individual level)	Independent Variables (Group level)	Dependent Variables/ Outcomes (Individual level)	Dependent Variables/ Outcomes (Group level)
Age	Age Range	Social Learning (instrumental)	Mean of instrumental social learning
Year (1st, 2nd, 3rd, 4th, +)		Social Learning, communicative dimension	Mean of communicative social learning
GPA	Average GPA	Sum of communicative and instrumental means	Mean of Sum of communicative and instrumental social learning
Major Field	Diversity of majors		Turn-taking
Gender	Gender composition		Creativity of group decision-making
Ethnicity	Diversity		Mean of participant Consensus perspective
Social Empathy Score	Average social empathy score		Mean of participant commitment to process
Background knowledge score	Average background knowledge		

This research will show if games create opportunities for social learning, and the extent to which the social learning experience of the group relates to that group's ability to productively deliberate on a complex related planning tasks. If hypotheses 1-3 are demonstrated, this research will contribute to design of public engagement activities that have potential to create opportunities for social learning and to use those activities as fruitful methods of training participants in productive engagement. If Hypotheses 4-6 are demonstrated, this research suggests that social learning can contribute to patterns of deliberation that are identified as not only collective intelligence, but consensus-seeking.

CHAPTER 4. RESULTS

The research questions of this work are twofold: 1) do online games create opportunities for social learning among teams in an urban planning public participation process? and, if so, 2) do groups that demonstrate social learning also demonstrate enhanced collaborative decision making (collective intelligence)? @Stake was chosen as a Treatment game because it was designed to build empathy and suggests turn-taking as an effective way to generate creative ideas and stimulate productive discourse. The experiment was designed to evaluate the extent to which participants, without facilitation or instruction, could carry forward these deliberative structures of the game to an unfacilitated deliberative exercise.

To answer these questions, we proposed a two-phase experimental protocol, explained in Chapter Three. This chapter details the data, analysis, results, and findings of each phase of the experimental protocol.

Six hypotheses were tested under the two broad research questions. The listed hypotheses are shown below.

Table 4-1: Research Hypotheses

H_1 Treatment groups will experience social learning
H_2 Treatment groups will demonstrate more equal distribution of turn-taking than control groups
H_3 Higher self-reported social learning among Treatment groups will correlate with more equal distribution of turn-taking
H_4 There will be a statistically significant difference in the mean rank of creativity of decision between Treatment and control groups
H_5 There will be a statistically significant difference in the mean rank of perception of consensus between Treatment and control groups
H_6 There will be a statistically significant difference in the mean rank of commitment with the process between Treatment and control groups

4.1 Participants and Experimental Design

We recruited students enrolled in courses offered by the School of City & Regional Planning at the Georgia Institute of Technology. Students who volunteered to participate received extra credit in their courses and were entered into a drawing for Amazon gift cards. Students who did not complete the entire study did not receive extra credit. Once students consented to participate in the study, each participant completed a pre-experiment survey, which collected demographic data, emotional intelligence scores, and information on their background knowledge of city planning concepts related to the work they would be asked to perform in the experiment.

A total of 102 participants completed the experiment, ranging in age from 19- 24 years old. 62 percent of the participants self-identified as White, 19 percent as Asian, 7 percent as Hispanic/Latinx, and 5 percent as Black or African American. The remaining 7 percent included White/Asian mix, Pacific Islander, Native American or American Indian, Bi-Racial and Middle Eastern. 45 percent of the participants were female, 47 percent were male, and others identified as non-binary. 86 percent of the participants were taking or had previously enrolled in a City Planning course at Georgia Tech, but only 19 percent had previously been involved in a city planning activity (described as a meeting, presentation, workshop, or research). Given the research study's use of the Georgia Tech Bus & Trolley system as a way to explore deliberative processes, we asked the students how often they used this service. 52 percent of the participants said they used this system "Very Rarely—once a week or less" and 8 percent of students said they had never used it. 40 percent of the students used it a few times a week or more.

Participants were assigned a random number using Microsoft Excel's random number generator. Students were grouped into three or four person groups based on the ascending order of their random numbers and controlling for gender mix (i.e. there were no single gender teams created). Teams were randomly assigned to the Control or Treatment Groups. Treatment groups participated in both Phase One and Phase Two of the experiment, while Control groups participated only in Phase Two. There were 15 control groups and 15 Treatment groups.

Each team was sent an email to sign up for a time to schedule their online game (Treatment group) or face-to-face meeting (control group). Once scheduled, each team received a reminder email 24 hours prior to the scheduled activity. Treatment groups participated in an online version of the @Stake Game, using a specially created Slack channel to communicate as if they were in a chat room. Participants followed the game's prompts on their own devices and used the Slack channel to communicate, as directed by the game. At the conclusion of the game, participants completed an online survey about the experience. After completing the survey, the Treatment teams were sent a follow-up email to schedule their face-to-face meetings. Face-to-face meetings were conducted between one week to five weeks after the initial online @Stake game to mimic the typical timeline of planning engagement activities during a municipal planning project.

Control groups, who did not participate in the @Stake game, received an email to schedule their face-to-face meeting. Once scheduled, each team received a reminder email 24 hours prior to the scheduled face-to-face activity. Each group met in small meeting room in the College of Design building. Groups were briefed by the author on the goal of the activity, the tools available for their use, the approximate time they were expected to deliberate, and the post-meeting survey. An outline of the briefing provided by the author is included in Appendix C. Participants completed a hard-copy paper survey about the experience. After completing the survey, survey results were manually entered into an Excel sheet. The audio and video footage of the face-to-face meeting was stored on a secure drive on the College of Design's Research Drive. The audio footage was transcribed by an artificial intelligence (AI) based transcription service, Trint, and edited by the researcher for accuracy and completeness. The data collected during Phase One and Phase Two of the experiment included the results of pre-experiment survey, Phase One survey, and post-Phase Two survey. Additionally, Phase Two of the experiment yielded audio/video recordings, map products, and summary sheets used to characterize the qualities of plans each group made related to the Georgia Tech Bus & Trolley system. Collectively, this data was categorized and analyzed through several nonparametric statistical tests to ascertain the extent to which differences existed between the control and Treatment groups. The results and analysis for the research questions are explained in the following sections of this Chapter.

The data was analyzed to understand the extent to which online games create opportunities for social learning to occur and the cumulative effect that social learning has on deliberative processes. The results are discussed in sequential order and the statistical measures of significance are organized according to hypothesis.

4.2 Social Learning among teams

Social learning, a cornerstone of collaborative planning theory and a fundamental concept within the field of learning science, has been described as the process by which individuals in a group generate knowledge that impacts their future behaviors through interaction with one another. Social learning has typically been measured through survey questions that ask participants to assess their experience as it relates to the other members of their group, team, or community while engaged in a certain activity. Using conventional survey questions on communicative and instrumental knowledge, we asked Treatment and Control groups a series of questions related to these concepts. Participants responded to each question on a scale of 1-7, where 1 was strongly disagree and 7 was strongly agree. The answers were averaged for each individual to generate a social learning score and then averaged for each group to generate the group's social learning score. For Treatment groups there were two social learning scores generated following their participation in Phase One and Phase Two of the experiment. Control groups had one social learning score after their participation in Phase Two of the experiment.

There were two important findings generated from a comparison of the social learning scores between Phase One and Phase Two for the Treatment groups and between social learning scores of Treatment and Control groups for Phase Two. The reported mean of social learning for Treatment groups after participating in the online game (Phase One) was moderately high on the 1-7 scale, indicating that social learning can happen during an online game. In addition, these groups demonstrated a higher level of social learning in Phase Two. This increase in social learning was identified as significant in a paired samples *t*-test and could indicate one of two relationships. Firstly, this suggests that there might be a cumulative effect of participating in both Phase One (online game play) and Phase Two (simulated planning challenge). This effect would be consistent with research on social learning, team development and learning science which suggest that the process of social learning occurs over a longer period of time than one meeting and that groups that spend more time together generally express more alignment. This effect, while unproven in this study's design, is also supported by an additional finding. The Treatment groups demonstrated more equal distribution of turn-taking than control groups. While this difference was not significant at the *p .10* level, a future research design could help resolve the question of whether social learning has a cumulative effect on group participants and the extent to which the turn-taking of participants is a result of the game playing experience and/or social learning.

Distinguishing the effect of repeated interactions on reported social learning is impossible to do given the research design of this work. When comparing the reported social learning of Treatment and Control groups after Phase Two of the experiment, there was no significant difference in the reported social learning. Furthermore, the mean of reported social learning after Phase Two was higher for Control groups than for Treatment groups.

4.3 Planning Outcomes

A reported weakness in prior research in this area suggests that little is known about how the positive associations and reported outcomes from game playing translate into changed behaviors in future collaborative or deliberative processes among groups. This research design attempted to address this gap in knowledge by comparing the experience of the Treatment group to that of the control group. The control group did not interact via an online game prior to participating in a simulated planning challenge. We generally labeled all measures, other than social learning and turn-taking/collective intelligence, as planning outcomes. These outcomes include measures of commitment, creativity, and consensus and were operationalized as a way to understand how participants viewed the planning activity (commitment), their perceptions of their group's ability to achieve a unified vision (consensus), and the quality of their plan (creativity). As discussed in Chapter Two, these three measures are critical barriers to successful community engagement. These measures were generated through survey responses from Phase Two of the experiment and an evaluation of the plan making artifacts generated by the teams during their simulated planning challenge of redesigning the GT Bus & Trolley system.

On the whole, while comparisons of these measures did not reveal significant differences between Treatment and Control groups, several findings are important to note. Given the small n of this study, a variety of measures are used to assess and determine the findings. The analysis and findings presented below rely both on statistical measures as well as descriptive assessment of findings. This analysis is consistent with ongoing debates in the social sciences that support using additional measures to understand findings in research studies with small ns (Wasserstein & Lazar, 2016) There were significant one-tailed correlations reported between a group's mean of social learning and commitment, creativity, and consensus, indicating that designing activities around social learning can have positive effects on planning outcomes.

These findings suggest that social learning can occur for participants engaged in an online game and that there may be some evidence to suggest that social learning is cumulative for participants engaged in multiple activities within an urban planning process. While there were no statistically significant differences demonstrated between Treatment and Control groups, the Treatment groups did report a more even distribution of turn-taking than Control groups. The strength of the correlations and the directionality of the findings confirm the theoretical foundation and research design of this work as basis for continued exploration among these variables Furthermore, correlations are present between social learning and commitment and creativity, supporting prior theoretical and empirical work that social learning can be an important cornerstone of collaborative planning. A larger sample size could lend itself to a more rigorous understanding of the relationship between social learning, game playing, and turn-taking, which remains unresolved in this study.

The statistical measures and associated caveats regarding data irregularity are described in detail, by hypotheses, in the following sections of this chapter.

4.4 Do online games create opportunities for social learning among teams?

The first research question: do teams that play online games experience social learning? was evaluated by examining the results of the post-Treatment survey (Appendix B). The hypothesis is that Treatment groups will experience social learning. As discussed in Chapter 3, these questions were asked of those students in the Treatment Groups:

Table 4-2: Social Learning Survey Questions

Survey Question #	Question	Answer
4	I was able to imagine new solutions to problems	1(strongly disagree)- 7 (strongly agree)
5	I thought about the problems in a new way	1(strongly disagree)- 7 (strongly agree)
6	I understood the perspectives of my group members	1(strongly disagree)- 7 (strongly agree)
7	At the end of the game, I shared views with more than one other participant	1(strongly disagree)- 7 (strongly agree)
8	We had more points of agreement than disagreement at the end	1(strongly disagree)- 7 (strongly agree)

The answers to each of the 5 survey questions were tabulated for each individual—giving that individual a mean communicative learning score. This score was added to the individual's response on the instrumental knowledge acquisition question ("I learned a great deal"). Results were then aggregated at the group level to generate a mean social learning score for each group. These results indicated that groups experienced high levels of social learning. The descriptive statistics on these results are shown below.

Table 4-3: Social Learning

Item Statistics: Social Learning, O1

Questions	Mean	Std. Deviation	N
I thought about the problems in a new way	4.88	1.350	50
I understood the perspective of my group members	5.54	1.092	50
At the end of the game, I shared views with more than one other participant	5.38	1.338	50
I was able to imagine new solutions to problems	5.02	1.378	50
We had more points of agreement than disagreement at the end	5.30	1.359	50

Cronbach's *alpha* was computed to measure the reliability of these questions. This result indicates that these questions are reliably loading on to the construct of social learning, i.e., removing one of these questions from the scoring of the construct would lessen the reliability of the measure. Results of this analysis indicated that the survey did a decent job of estimating social learning.

Table 4-4: Survey Question Reliability Results

	Cronbach's *alpha* based on Cronbach's Standardized	
Cronbach's *alpha*	Items	N of Items
.807	.801	5

Results indicated that participants in the Treatment groups experienced social learning in an online setting. This result is consistent with the game design and game parameters, which encourage participants to think creatively about solutions to civic challenges and deliberate to come up with solutions that may satisfy more than on participant's goals, based on their assigned roles. @Stake was originally designed to build empathy and provide educational opportunities for participants who played the game in a face-to-face synchronous setting. The treatment used in this work represents a departure from the original game design and thus these results represent how the dual nature of this variable (the deployment of a game and the deployment of said game online) influenced participant experiences. While the dual nature of this variable makes interpretation of these results more difficult, it also presents the opportunity for future study to clarify how social learning experiences might differ among groups of participants engaged in online vs. face-to-face game play as part of a public participation process.

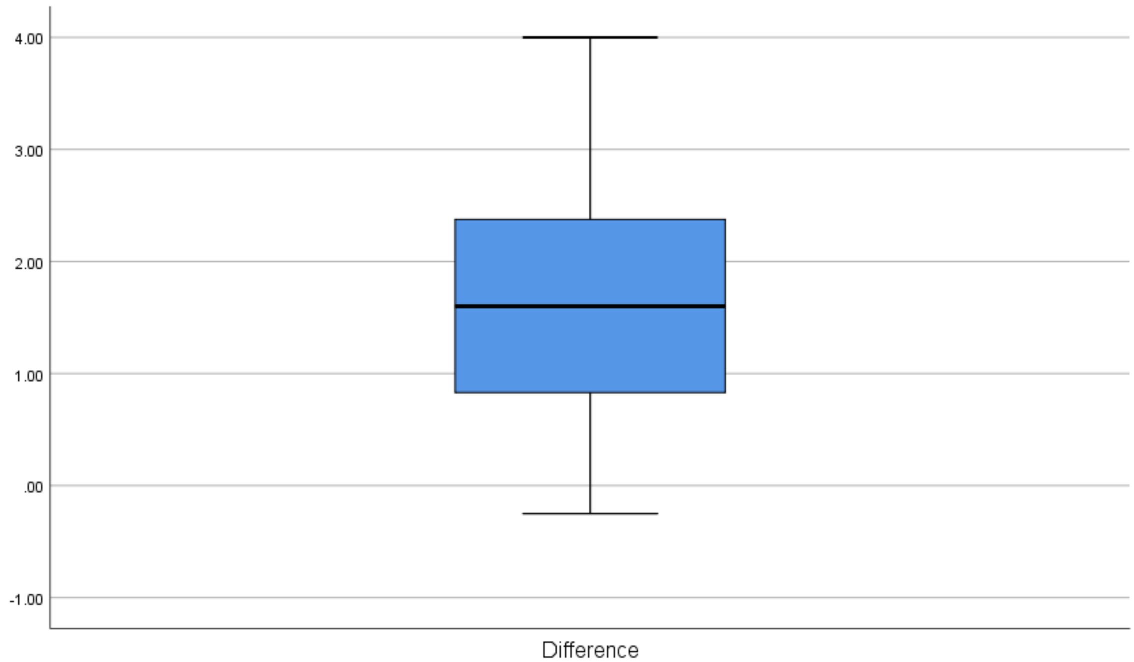
Given the scale provided in the survey, we can claim that participants experienced some social learning, however, we cannot compare how their experience differs or not from participants who played the same game in person because this experimental design did not include that experience as a point of comparison.

The reported social learning of participants during Phase One for the Treatment Group was compared to their reported social learning during Phase Two to determine if there was a significant difference between the online environment and the face to face environment in creating an opportunity for social learning to occur. Although the activities that occurred during these two phases (playing a rule-based game and unfacilitated deliberation) were different, the survey questions used to measure social learning were the same.

A paired-samples *t*-test was used to determine whether there was a statistically significant mean difference between the reported social learning in Phase One and Phase Two of this experiment. Data are mean +/- standard deviation, unless otherwise stated. The paired samples *t*-test requires data to have a continuous dependent variable (mean of reported social learning from survey results) and an independent categorical variable (Phase One results vs Phase Two results on the same population). In addition, the paired-samples *t*-test requires that the data be normally distributed and that there be no significant outliers in the differences between the two groups (Phase One and Phase Two results).

No outliers were detected that were more than 1.5 box-lengths from the edge of the box in a boxplot (Figure 4.1). The assumption of normality was not violated, as assessed by Shapiro-Wilk's test ($p=.613$). Participants reported higher levels of social learning during Phase Two than during Phase One.

Figure 4-1: Box plot showing the mean of the difference between Soclal Learning O1 and Social Learning O2 for Treatment Groups



Participants in the Treatment group reported a higher level of social learning (11.321 +/- 1.321) during Phase Two than they did during Phase One (9.589 +/- .983). The reported social learning during Phase Two was 1.73 higher +/- .342 [mean +/- standard error] than the reported social learning during Phase One. Treatment groups reported a statistically significant increase in social learning during Phase Two when compared to reported social learning for Phase One, $p < .05$, $d=1.307$. The measured effect size, $d = \frac{M}{SD}$ where M is the mean difference between the samples and SD is the standard deviation, is equal to 1.307. While the measured effect size, d, is large, the variations in d are largely field specific and there are no interpretation guidelines offered related to the difference in social learning within an urban planning process (Cohen, 1988).

These results are shown below in Table 4-5.

Table 4-5: Paired Samples Test for Treatment Group Social Learning

Mean	Std. Deviation	Std. Error Mean	95percent CI of the Difference		t	df	Sig. (2-tailed)
			Lower	Upper			
-1.73200	1.32476	.34205	-2.46563	-.998369	-5.064	14	.000

The results suggest that there was a statistically significant difference between reported social learning means of the Treatment groups during Phase One (online game) and Phase Two (face to face deliberations) ($P < .05$). This suggests that there may be reason to believe that social learning happens at a higher level in face to face deliberations than during online deliberations or that reported social learning is increasing as participants spend more time together.

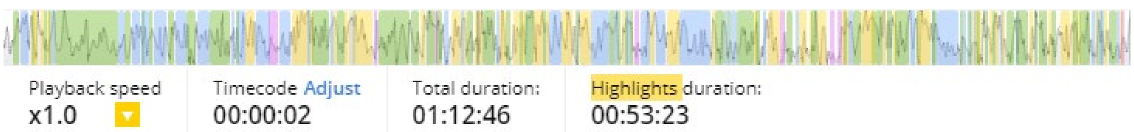
The results of this survey indicate that the online format of @Stake gave participants the opportunity to experience social learning. The participants responded positively to the experience and indicated that they learned a great deal. What these results do not tell us is the extent to which these experiences carry forward beyond the scope of the game. This phenomenon, referred to as the "magic circle" suggests that positive outcomes associated with game playing are not easy replicated within the same group of individuals outside the confines of the game experience (Gordon, Haas, & Michelson, 2017). The challenges asserted by planners conducting public engagement suggest that the positive experiences participants report after engagement activities do not always correlate with long-term commitment to planning processes.

Our paired samples *t*-test demonstrates that there was significant difference between reported social learning during Phase One and Phase Two, which indicates that online environments may not be as supportive of creating social-learning as face-to-face deliberations, however, these results demonstrate the need to determine whether or not the demonstrated significant increase in social learning between activities is additive. Among Treatment groups, is the higher level of social learning reported in the face-to-face deliberations due to their previous meeting online? To further assess the ability of online games to aid in social learning and their impact on other planning outcomes we collected additional data during Phase Two and compared this data among and between Treatment and Control groups.

4.5 Turn-Taking and Social Learning

Hypotheses 2 and 3 described how turn-taking would relate to social learning and the difference between turn-taking for control and Treatment groups. To assess the extent to which social learning and turn-taking were related, reported social learning for Treatment and control groups was collected and collective intelligence, defined as a combination of turn-taking and social empathy scores was computed for each group. Social empathy scores were averaged for each group by recording the self-reported score for each individual generated through the "Reading in the Minds Eye" test taken as part of the pre-experiment survey. This method of assessing social empathy is consistent with prior research in this domain (Woolley, Malone, et al., 2015). Turn – taking was measured through transcription and timing of the team's deliberation during Phase Two of the experiment. Transcriptions were created from audio/ video footage using an AI powered transcription tool—Trint. Once transcribed, each transcription was reviewed against original audio/video footage to correct errors and ensure that each team member's spoken word was attributed and timed correctly. The time each team member spent speaking was compared against the total time of the transcription (less the time used by the researcher to give instructions) to estimate how equal the distribution of speaking was for each of the 30 groups. The Trint software was used to highlight each speaker, and the Trint highlights tabulated time each speaker spent speaking (see Figure 4-3 for an illustrative example of this method).

Figure 4-2: Example of Time Stamping



The time spent speaking was divided by the total time the group spent deliberating to estimate the percentage of time that each person was speaking. The difference between the maximum percentage and the minimum percentage was tabulated and scaled to 0-1 range. Scaling turn-taking on a 0-1 range is consistent with prior research in this domain (Woolley, Malone, et al., 2015). Scores that were closer to 0 represented a more even distribution of speaking, or, described another way, a smaller magnitude of difference between the percentage of time dominated by one speaker in the group when compared to the least active speaker. The deliberations ranged in total duration from 44 minutes to 92 minutes. Teams were given the same guidelines, that the exercise was expected to take an hour and a half, and that the researcher would check in on their progress at the hour mark. The reported scaled distribution of turn-taking for each group is reported in the following Table.

Table 4-6: Turn-Taking by Team

Treatment (T) or Control (C)	Team Number	Length of deliberation (mins)	Turn Taking (0-1)	RME* (Team Mean)	Number of members
C	1	58	1	29.33	3
T	2	92	.74	26.33	3
T	3	64	.29	29.00	4
T	4	88	.38	28.25	4
T	5	80	.08	28.33	3
T	6	88	.61	25.33	3
T	8	44	.09	29.00	3
T	9	81	.26	29.00	3
C	10	87	.79	26.00	4
C	11	84	.32	28.33	3
C	12	87	.40	28.5	4
C	13	66	.41	31.00	4
C	14	73	.28	28.50	4
C	15	88	.26	26.67	3
C	16	89	.35	25.33	3
C	17	77	.73	29.00	4
C	18	92	.29	27.50	4
T	19	66	.41	27.00	3
T	20	92	.54	29.33	3
T	21	66	.72	29.50	3
T	22	65	.22	29.33	3
T	23	63	.66	27.25	4
T	24	71	.38	29.00	4
T	25	58	.39	26.00	4
T	26	91	.77	28.67	3
C	27	51	.65	27.25	4
C	28	72	.60	27.00	3
C	29	62	.43	26.50	4
C	30	79	.31	24.50	3
C	31	83	.85	29.00	3
	**Reading in the mind's eye test; measure of social empathy*				

An independent samples *t*-test was conducted to assess whether or not a significant difference existed between the turn-taking of Treatment and control groups. There were no outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box.

Figure 4-3: Box-plot of turn taking

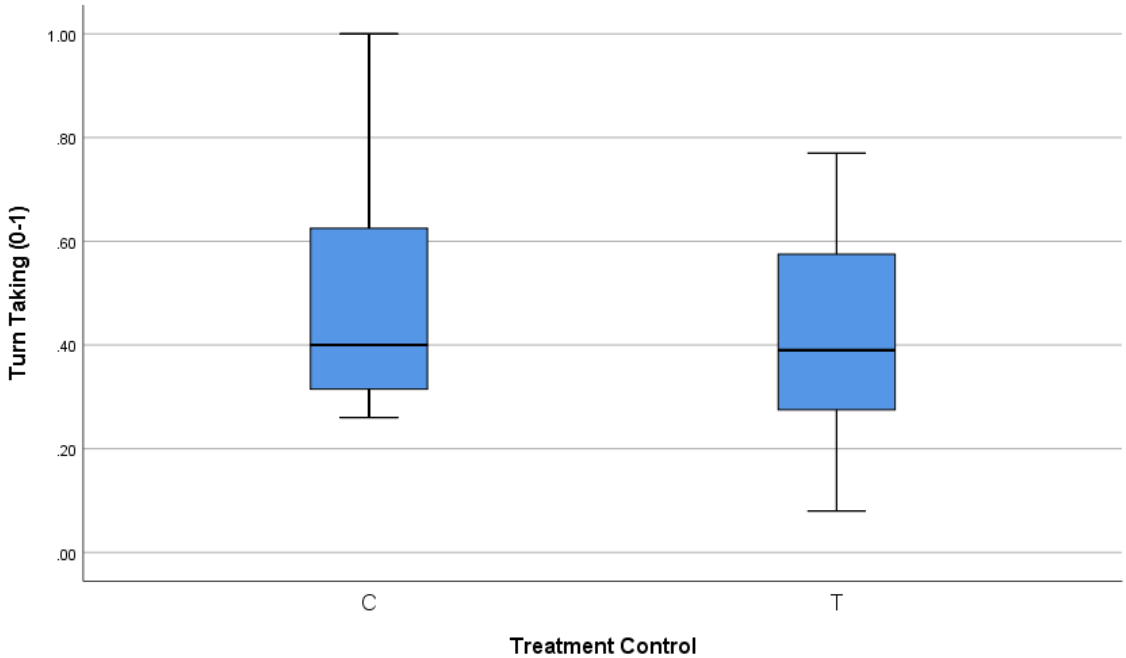


Figure 4-4: Turn Taking for Treatment & Control Groups

Turn Taking for Treatment & Control					
Treatment Control		N	Mean	Std. Deviation	Std. Error Mean
Turn Taking (0-1)	T	15.000	0.413	0.212	0.055
	C	15.000	0.478	0.223	0.058

Turn-taking was normally distributed for the Treatment group as demonstrated in the Shapiro-Wilk's test ($p > .05$), but not normally distributed for the Control Group ($p < .05$). The independent samples *t*-test handles violations from normality especially when samples sizes are equal or nearly equal (Kang & Harring, 2012). Given this characteristic of the test, despite the violation of normality among turn-taking in the Control group, we chose to use the independent sample *t*-test to analyse the difference between turn-taking among groups. Data are mean +/- standard deviation, unless otherwise stated. There were 15 Treatment groups and 15 control groups. Mean turn-taking of Treatment groups is .413

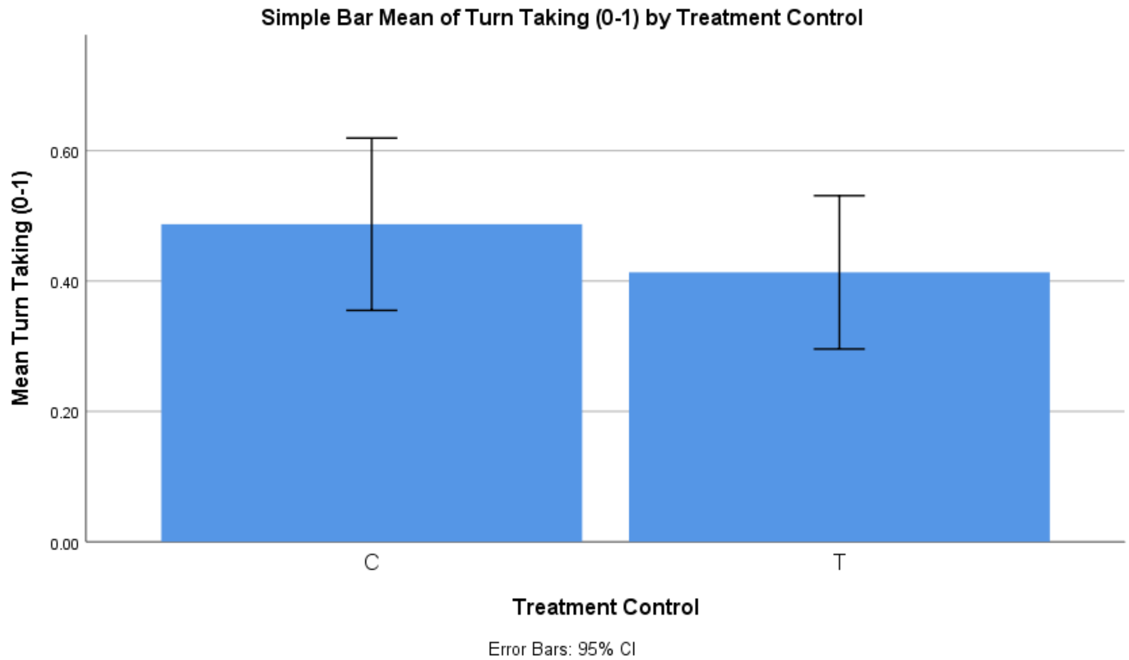
+/- .212 and was lower than control groups (.478 +/- .223). Higher turn-taking values correspond with less equal distribution of turns. The means of each group indicated that Treatment groups demonstrated a slightly more equal distribution of turn-taking. There was homogeneity of variances for turn-taking for control and Treatment groups, as shown by Levene's test for equality of variances (*p= .664).* These results are reported in the Table below.

Table 4-7: Independent samples *t*-test for turn-taking

Independent Samples Test: Turn-Taking between Treatment & Control										
				t-test for Equality of Means						
				t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Turn Taking (0-1)	Equal variances assumed	0.193	0.664	-0.812	28.000	0.423	-0.065	0.080	-0.228	0.098
	Equal variances not assumed			-0.812	27.929	0.423	-0.065	0.080	-0.228	0.098

Control group turn taking was .065 (95percent CI, -.228 to .098) higher than Treatment group turn-taking. However, there is not a statistically significant difference between means (*p* > .05*)* of the control and Treatment groups. While there was no significant difference in turn-taking, the Treatment group did exhibit a lower mean indicating more even turn-taking (.413 vs. .478). A larger sample size may have shown a statistically significant result. However, given the small n of this study, the mean of the two groups provides support for further investigation on the role in which game-based interventions can play in creating more equally distributed turn-taking in unfacilitated groups. A visual comparison of the means in the bar chart below reveals the difference between the two groups.

Figure 4-5: Bar chart of means of turn-taking

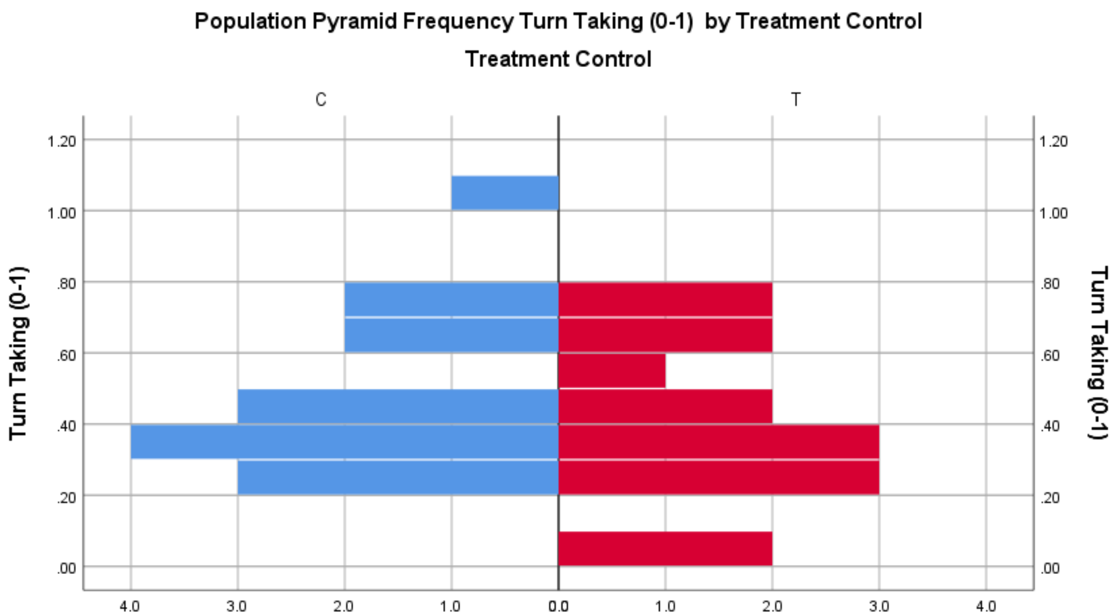


Because the data violated normal distribution for one of the groups (control), we also ran a Mann-Whitney U test to nonparametrically assess whether a significant difference existed between Control and Treatment groups. Distribution of the turn-taking results were similar, as assessed by visual inspection (Figure 4.7). Median turn-taking was not statistically significantly different between Control (.4) and Treatment (.39) groups, *U= 98, z = -.602, p =.567).*

Table 4-8: Mann-Whitney U test for Turn-Taking

Test Statistics	
	Turn Taking (0-1)
Mann-Whitney U	98
Wilcoxon W	218
Z	-0.602
Asymp. Sig. (2-tailed)	0.547
Exact Sig. [2*(1-tailed Sig.)]	.567b
a. Grouping Variable: Numeric Coding of Treatment &	
b. Not corrected for ties.	

Figure 4-6: Pyramid Frequency of Turn-Taking



Control groups shown in blue. Treatment groups shown in red

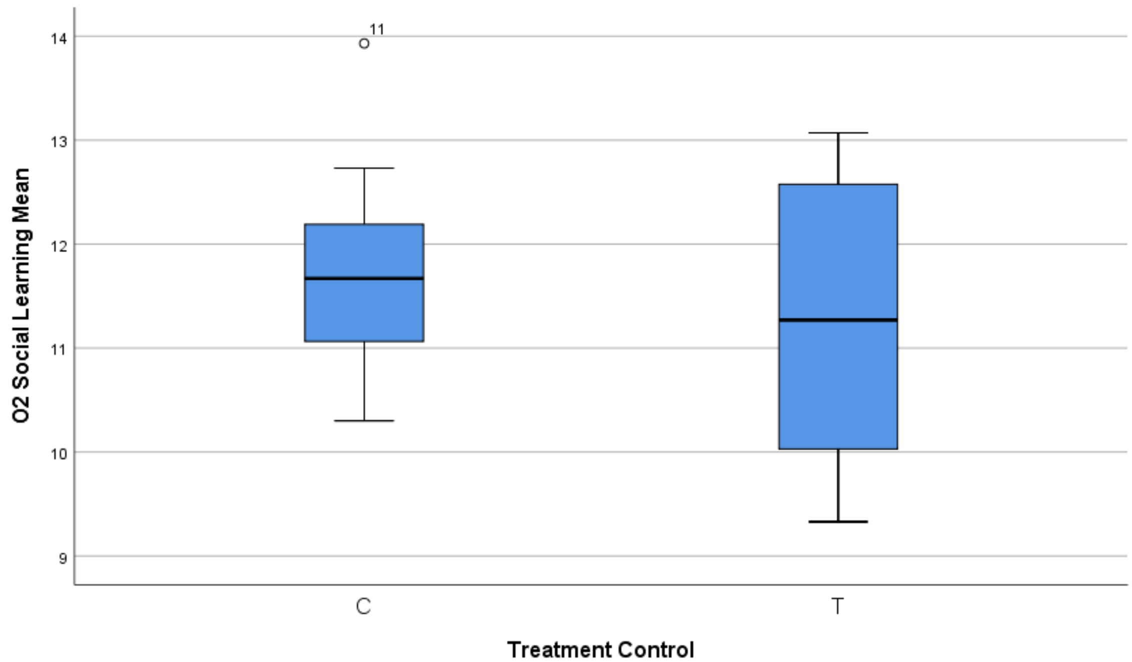
The third hypothesis tested in this work, that higher self-reported social learning among Treatment groups will correlate with more equal distribution of turn-taking was not supported by these analyses. There was not a higher reported social learning among Treatment groups. In reviewing the analysis of the post face-to-face survey, the extent to which social learning occurred did not differ significantly between the groups that played the game (Treatment) and the groups that did not (control). The descriptive results of reported social learning between Phase One and Phase Two are shown in Table 4-9.

Table 4-9: Comparison of reported communicative learning

Questions	Mean (Treatment, Phase One)	Mean (Treatment & Control, Phase Two)
I thought about the problems in a new way	4.88	6.44
I understood the perspective of my group members	5.54	5.73
At the end of the game, I shared views with more than one other participant	5.38	6.54
I was able to imagine new solutions to problems	5.02	6.01
We had more points of agreement than disagreement at the end	5.30	6.62

An independent samples *t*-test was run to assess the degree to which Treatment Groups and Control Groups reported social learning during Phase Two of the experiment.

Figure 4-7: Social Learning Mean (O2) for Control & Treatment Groups



As assessed, in this box plot, there was one outlier identified among the Control Groups, the data was evaluated to ensure that this outlier did not represent a miscalculation of data. Because this outlier was outside of 1.5 box-lengths but within 3 box-lengths, we decided to keep the outlier in the analysis.

Social learning scores for both control and Treatment group were normally distributed, as assessed by Shapiro-Wilk's test (*p* >.05*)*. Data are mean +/- standard deviation, unless otherwise stated. There were 15 Control groups and 15 Treatment Groups. Control groups reported a higher level of social learning (11.733 +/- .971) when compared to Treatment groups (11.321 +/- 1.321). The assumption of homogeneity of variances was violated, as demonstrated in the Levene's test for equality of variances (*p= .042).* Control group mean social learning was .412 higher (95percent CI, -1.282 to .459) than Treatment group social learning. There was not a statistically significant difference in mean social learning during Phase Two of the experiment between Control and Treatment groups (*p*= *.340)* as reported by the Welch *t*-test and shown in the Table below.

Table 4-10: Independent samples *t*-test of social learning between control and Treatment

Independent Samples Test: Social Learning between Treatment & Control										
				t-test for Equality of Means						
				t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
O2 Social Learning	Equal variances	4.545	0.042	-0.972	28.000	0.339	-0.411	0.423	-1.278	0.456
	Equal variances not assumed			-0.972	25.707	0.340	-0.411	0.423	-1.282	0.459

The lack of contrast between reported levels of social learning across the control and Treatment groups and between the online and face-to-face portions of the experiment indicates that there is opportunity to use ICT to create social learning opportunities and that the design of activities can be used to mimic some of the benefits of meeting face-to-face.

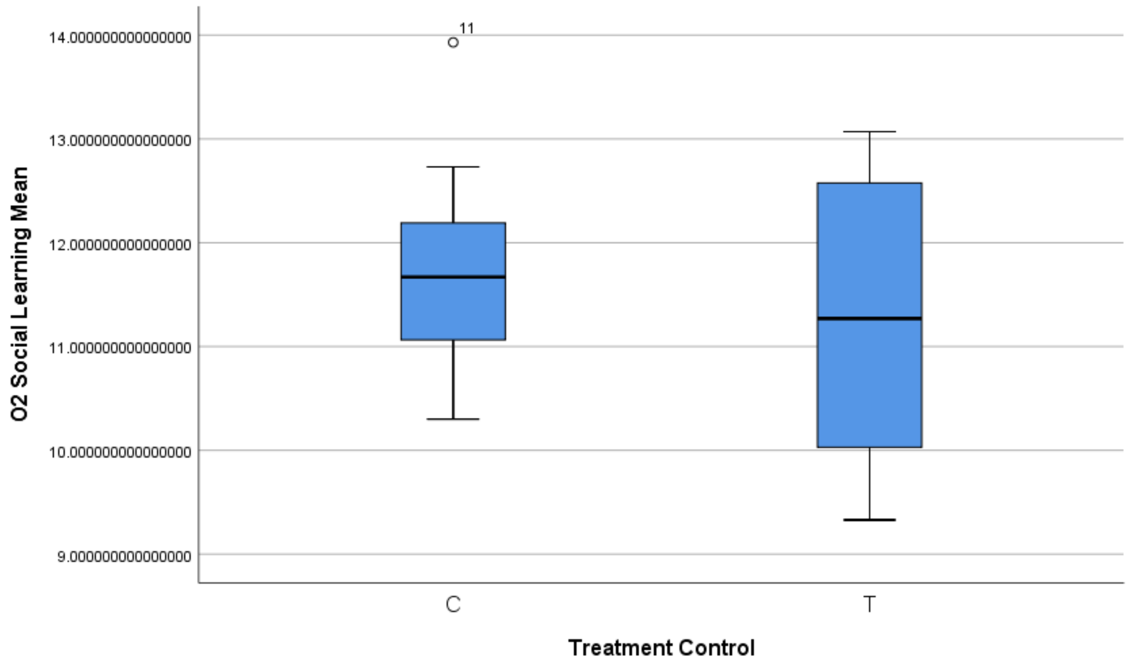
4.6 Phase Two: Do online games positively influence planning outcomes: creativity, consensus and commitment

The final set of hypotheses tested in this work posited a relationship between three planning outcomes and the difference between Control and Treatment groups. Both Control and Treatment teams participated in a face-to-face transit design meeting. For the Treatment groups that participated in the online @Stake process, face-to-face meetings were arranged within a week to five weeks of their @Stake game to mimic the typical timeline of planning engagement activities during a municipal planning project. Each team was sent a follow-up email to schedule their face-to-face meeting.

This experiment was designed to address challenges in public engagement, as discussed in Chapter Two. These challenges included commitment and capacity. Capacity was partially addressed through collective intelligence measures, while commitment was addressed in an evaluation of the survey results after Phase Two. The Treatment group met twice, once in an online chatroom where they played @stake, and once in person in a meeting where they attempted to put together a plan to improve the Georgia Tech Bus & Trolley System. The Control group only met once, face-to-face, to complete the same transit design exercise as the Treatment group. After their in-person meetings, participants completed a survey which included questions on how committed to the process they were as well as how likely they would be to participate in another planning activity. To address questions on capacity, we used the notion of collective intelligence, as discussed in Chapter Two, to measure the extent to which participants who were in Treatment groups demonstrated higher levels of collective intelligence during the face-to-face deliberations. In addition, we asked questions about the extent to which the group felt they achieved consensus in their vision. We also wanted to understand the extent to which the experience of playing the game influenced their stated willingness to participate in a similar activity again. In addition to the audio/video recordings of the group's deliberations, we also evaluated their maps and documents to evaluate efficiency and creativity of plans as two potential proxy measures of plan quality. Evaluating this set of data allowed the researcher to understand the extent to which social learning, online game playing, collective intelligence, and planning related outcomes such as plan quality and commitment to the planning process might relate.

Control groups did not play the @Stake game online, and, instead, only met once to participate in the transit design exercise. Prior to their arrival at the appointed meeting time, team members from both the Control and Treatment groups were told they would be working on a project to help improve the Georgia Tech Bus & Trolley system. No further instructions were provided. Both Control and Treatment teams met at their various times in the basement of the Architecture Building on campus. The meeting room and set up was the same for all groups and included a white board, a circular table, and chairs for each of the team members. Teams were provided with a 24x 36 map of the main Georgia Tech campus that showed bus and trolley routes and stops, a two page description of the activity and constraints and a two page table for them to fill out that helped them determine estimated changes in ridership and cost of suggested changes (see Appendix E). The materials shown in Appendix E were provided to each team as a way to help constrain their thinking and provide them with adequate background in their process. Teams were self-directed in their activity and a facilitator was not present for the duration of the activity.

These materials were returned to us at the conclusion of the experiment. Their deliberations were videotaped and audio recorded and photos were taken of the whiteboard if it was used during their deliberations. Each team was given one and a half hours to complete the exercises, although some teams did not take the entire time. At the conclusion of the face-to-face meeting, both Control and Treatment groups were given a hard copy survey on their experience and observed while they filled it out to ensure that they answered questions individually and without influence from other group members.



Participants in this study wrote/drew on maps and created summary tables from their face to face meeting as part of their planning process. These planning artifacts, as well as the transcribed dialog, were used to further analyze the creativity and quality of their transit plans, as well as the deliberative nature of their dialog.

Planning artifacts were analyzed in two ways. Map documents and summary tables were analyzed to assess the quality of plans through two metrics: creativity and efficiency. We operationalized creativity as the number of new elements each team added to the existing transit system (stops, vehicle types, routes) and we operationalized efficiency as the ratio of dollars spent/saved to the percentage increase in ridership achieved through the reimagined transit system design. The map documents and summary tables generated by planning participants were analyzed to assess the level of creativity among the documents. Each of the thirty team maps was measured to note the number of new elements the team added to the system. For example, a new vehicle, type of service, bus stop or route was considered a "new element"; thus, teams that chose only to modify existing service elements were shown to be less creative than teams that introduced new vehicles or new routes. Secondly, planning artifacts were analyzed to measure the amount of money saved/ spent by each team as well as the increase or decrease in ridership they generated with their proposed plans. This allowed us to look at the efficiency of their proposed plan.

Each group, based on the post face-to-face survey and the distribution of turn taking was then assigned a set of group level variables shown in the Table below.

Table 4-11: Team Level Variables

Variable Name	Type	Description
Team #	Nominal	Team identification for purposes of study (Numbers 1-31, excluding number 7), assigned
Treatment/Control	Nominal	T or C as randomly assigned
O1 Social Learning Mean	Interval	The mean of the reported social learning of each group from Phase One survey (Treatment groups only)
percent Women	Ratio	The percentage of the group members that identified as women (pre-experiment survey, Treatment & Control groups)
Average GPA	Interval	The mean of the self-reported GPAs for each group (pre-experiment survey, Treatment & Control groups)
Average Social Empathy	Ordinal	The mean of the self-reported scores from the Reading in the Mind's Eye test (pre-experiment survey, Treatment & Control groups)
Turn-Taking	Interval/ Ratio	The scaled distribution of turn-taking from 0-1 for each group during Phase Two (scores closer to 1 represented more uneven turns; Treatment & Control groups)
O2 Social Learning Mean	Interval	The mean of the reported social learning of each group from Phase Two (Treatment & Control Groups)
Commitment	Interval	The mean of the reported commitment of each group from Phase Two survey (Treatment & Control Groups)
Creativity	Interval	The mean of the reported creativity of each group from Phase Two survey (Treatment & Control Groups)

Consensus	Interval	The mean of the reported consensus of each group from Phase Two survey (Treatment & Control Groups)

These team level variables are summarized in Appendix F. When analyzed using independent samples t tests, no significant difference was shown between control and Treatment groups across the Social Learning, Commitment, Consensus, and Creativity categories.

Table 4-12: Means of Commitment, Creativity, and Consensus

Commitment, Creativity, Consensus, Means					
Treatment Control		N	Mean	Std. Deviation	Std. Error Mean
Turn Taking (0-1)	T	15.000	0.413	0.212	0.055
	C	15.000	0.478	0.223	0.058
Commitment	T	15.000	5.879	0.578	0.149
	C	15.000	5.888	0.612	0.158
Consensus	T	15.000	6.235	0.606	0.157
	C	15.000	6.494	0.367	0.095
Creativity	T	15.000	5.748	0.725	0.187
	C	15.000	5.961	0.645	0.167

Table 4-13: Independent Samples *t*-test for Commitment, Consensus, & Creativity

Independent Samples Test: Commitment, Consensus, Creativity										
				t-test for Equality of Means						
				t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Commitment	Equal variances assumed	0.000	0.993	-0.043	28.000	0.966	-0.009	0.217	-0.455	0.436
	Equal variances not assumed			-0.043	27.908	0.966	-0.009	0.217	-0.455	0.436
Consensus	Equal variances assumed	4.449	0.044	-1.413	28.000	0.169	-0.259	0.183	-0.634	0.116
	Equal variances not assumed			-1.413	23.058	0.171	-0.259	0.183	-0.637	0.120
Creativity	Equal variances assumed	0.262	0.613	-0.851	28.000	0.402	-0.213	0.251	-0.727	0.300
	Equal variances not assumed			-0.851	27.629	0.402	-0.213	0.251	-0.727	0.300

The commitment and creativity measures for both Control and Treatment groups were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). However, the consensus measures for Control and Treatment groups were not normally distributed as assessed by the Shapiro-Wilk's test ($p < .05$). Given that the independent samples *t*-test deals with deviations from normality fairly well (Kang & Harring, 2012), and because the sample size of both groups is the same, we analyzed the measure of consensus using the independent samples *t*-test without transforming or modifying the data.

In the independent samples *t*-test for commitment, consensus, and creativity, the commitment and creativity measures demonstrated the homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .993$ *and* $p = .613$*, respectively).* The consensus measure did not demonstrate homogeneity of variances, as assessed by Levene's test for equality of variances ($p < .05$).

A Welch *t*-test was run to determine if there were differences in reported commitment between Control and Treatment groups due to the assumption of homogeneity of variances being violated, as assessed by Levene's test for equality of variances ($p = -.043$). The commitment of Control groups was .009 (95percent CI, -.455 to .436) higher than reported commitment in Treatment groups. There was not a statistically significant difference in mean commitment between Treatment and Control groups ($p = .966$). Reported creativity in Control groups was .213 (95percent CI, -.727 to .299) higher than reported creativity in Treatment groups. There was not a statistically significant difference in mean creativity between Treatment and Control groups ($p = .402$).

Reported consensus in Control groups was .259 (95percent CI, -.637 to .119) higher than reported consensus in Treatment groups. There was not a statistically significant difference in the mean consensus between Treatment and Control groups, $t(23) = -1.413$, $p= .171$.

The hypothesis that Treatment groups would show higher levels of commitment, creativity, and consensus because of their deliberative training through participation in the game and higher occurrence of social learning was not confirmed when analyzed using t-tests. However, when the correlations between the planning outcome variables were examined across all teams, there were two significant correlations identified that demonstrated strong relationships with positive directionality between the variables. The correlations among all variables for all teams are shown in Appendix G. Results of this correlation matrix revealed significant correlations between reported social learning during the face to face interaction and commitment and consensus, lending support to claims that social learning has positive planning outcomes. In addition, a significant correlation between average social empathy and creativity was identified. Significant (one tailed) correlations are reproduced in the Table below.

Table 4-14: Significant Correlations (1-tailed)

		O1 Social Learning Mean	Average Social Empathy	O2 Social Learning Mean	Commitment	Consensus
Commitment	Pearson Correlation	.457*	-0.080	.710**	1.000	.575**
	Sig. (1-tailed)	0.043	0.338	0.000		0.000
	N	15.000	30.000	30.000	30.000	30.000
Consensus	Pearson Correlation	0.263	-0.027	.628**	.575**	1.000
	Sig. (1-tailed)	0.172	0.443	0.000	0.000	
	N	15.000	30.000	30.000	30.000	30.000
Creativity	Pearson Correlation	0.173	.352*	.725**	.384*	.487**
	Sig. (1-tailed)	0.269	0.028	0.000	0.018	0.003
	N	15.000	30.000	30.000	30.000	30.000

**Correlation is significant at the 0.05 level (1-tail)*
*** Correlation is significant at the 0.01 level (1-tailed)*

These correlations suggest that there are several positive relationships between social learning and other variables of interest. The positive correlations are shown in Table 4-14, above. Positive correlations exist between social learning and commitment, social learning and consensus, social learning and creativity, average social empathy and creativity, and commitment and creativity. These correlations support future research work on these variables of interests, including experimental work to develop a more nuanced understanding of the causal relationship between the variables of interest.

4.7 Summary of Findings

The six hypotheses of this research design and their associated findings are summarized in the table below.

H_1 Treatment groups will experience social learning In a paired samples *t*-test, there were significant differences shown between the self-reported social learning in the online game and the face-to-face deliberations.
H_2 Treatment groups will demonstrate more equal distribution of turn-taking than Control groups Yes, the mean for turn-taking showed that Treatment groups had a slightly more equal distribution of turn-taking than Control groups. This difference was not significant at the .10 level.
H_3 Higher self-reported social learning among Treatment groups will correlate with more equal distribution of turn-taking No, social-learning and turn-taking were not positively correlated.
H_4 There will be a statistically significant difference in the mean rank of creativity of decision between Treatment and Control groups No, there was no significant difference between Control and Treatment groups for this planning outcome.
H_5 There will be a statistically significant difference in the mean rank of perception of consensus between Treatment and Control groups There was a correlation between creativity and social learning among all groups, however there was no difference in the mean rank of creativity between Treatment and Control groups.
H_6 There will be a statistically significant difference in the mean rank of commitment with the process between Treatment and Control groups There was a correlation between commitment and social learning among all groups, however there was no difference in the mean rank of commitment between Treatment and Control groups.

These findings suggest that online group gaming can build social learning and prepare citizens for planning participation. Furthermore, the correlations between social learning, creativity, commitment and consensus support past research, indicating support for designing research to address the question of how learning is related to planning outcomes. While the evidence from this small sample research cannot satisfy requirements for statistical significance across all measures, the directionality of the findings, the descriptive comparisons between and among groups, and the positive and strong correlations between variables of interest indicate that online gaming improved turn-taking behavior in unfacilitated planning deliberations. These results have two clear take-aways for planners: experimental protocols using college students can help us better understand the effectiveness of public participation methods for planning and more research needs to be conducted to establish a causal relationship between learning and planning outcomes.

4.8 Limitations

This experimental research design demonstrates that experimental research can be used to understand how planners can design public engagement activities to support social learning and associated planning outcomes. While no significant differences were reported between Control and Treatment groups, there is evidence that social learning is correlated with positive planning outcomes and that treatment groups had a more even distribution of turn-taking. Furthermore, by limiting findings to those explained by p values, there is less opportunity to examine how small groups function. Additional descriptive analysis has been provided to demonstrate empirical support for the theoretical argument laid out in chapter 2 of this dissertation. Including this analysis is supported by contemporary debates in the social sciences that implore researchers to look beyond p values to broaden our understanding of relationships between variables (Wasserstein & Lazar, 2016). The number of students who participated in this study (n =102) was substantial, however because the variables of interest were evaluated at the group level (n=30), the power of statistical analysis was greatly lessened. Given the non-normal distribution of some of the data and the small *n* value, nonparametric statistical analysis was used to evaluate the difference between groups (Control & Treatment). While this approach is consistent with experimental research design with small *n* values, it does not allow us to develop a causal model for how social learning can created and used to lead to positive planning outcomes.

The questions used to operate both communicative and instrumental learning can largely be described as questions that evaluate a participant's *perception* of learning, rather than actual learning (Zellner, 2012). Using audio, video, and map footage to further examine the deliberations can address these survey limitations.

The use of students as participants in a research study on public engagement also poses challenges for generalizing claims from this work. On the one hand, the Georgia Tech student has a similar stake in the outcome of a transit planning process as would a resident. Both populations make decisions about their use of transit as it relates to convenience, efficiency, cost, and comfort. However, Georgia Tech students do not represent as diverse a sample as the general population of a neighborhood or community—at the very least students are almost universally highly educated and share similar living and working conditions. All of the students who participated in this study were traditional undergraduate students (attending GT full-time and under the age of 25 years old). We could assume that their lifestyles, habits, and schedules were more aligned than a sample of 102 community residents. Lastly, students were recruited to participate in this study through the offer of extra credit in their classes. This recruitment tool can over select for students who are high academic performers, further skewing the sample size. Over 60 percent of the student participants were enrolled in the Civil Engineering major or the Industrial Systems Engineering major. This fact is consistent with the large enrollment of these fields in undergraduate city planning classes at the Georgia Institute of Technology. The way in which civil engineers and industrial systems engineers frame problems has been shown to be markedly different than other professions, including planning (insert 12 cite). The majority of student participants might have brought this developing professional frame of reference into their deliberations. Lastly, the participation in this exercise as part of an overall academic experience might have contributed more to the development of plans that were competitive or focused on being "right" rather than being creative or equitable. For these reasons, while the work presented here helps support emerging arguments and claims related to collective intelligence and social learning in planning processes, it cannot be used to posit a causal relationship between online game playing and positive planning outcomes. This work does substantiate a need for additional research on these variables of interest and development of social-learning outcomes for use in evaluating public engagement processes within the planning field.

4.9 Discussion

These findings suggest that although the online game playing activity created an opportunity for social learning, although no significant differences were observed between Treatment and Control group. The correlations revealed between self-reported social learning and commitment and consensus demonstrate that there is evidence to support further investigation of the relationship between social learning and other planning outcomes. The results from this analysis suggest that the online version of @Stake, while providing opportunities for social learning, did not significantly affect the experiences of participants in their face-to-face meetings.

While the survey results and analysis do not support the hypothesis that Treatment groups reported higher levels of creativity, consensus, or commitment, there is ample evidence across fields to suggest that survey data is particularly inaccurate (Zellner, 2012). There is additional evidence that suggests that if surveys are administered within a classroom experience, students tend to answer survey questions less sincerely—given the approach of asking students to participate in the survey as part of class extra credit gives us some reason to believe that surveys were not as accurate as they otherwise might be. While the students, anecdotally, commented on and believed that the transit design exercise was real (i.e. that we would give the results of this work to Georgia Tech Parking & Transportation Division), the surveys were ancillary to their work of creating an improved transit system.

However, this experimental design generated a far richer dataset than survey results alone. The other data collected as part of this experiment included maps, summary tables, and video and audio footage that was transcribed. This methodological approach to answer these research questions has created a dataset that can be used to explore the qualitative nature of the deliberations to reveal patterns on framing and conversation that might yield new information for planners.

CHAPTER 5. RECOMMENDATIONS & CONCLUSIONS

The scope of this work was to use an experimental research design to improve our understanding of social learning, planning outcomes, and collective intelligence and to identify the extent to which online games could be used to create opportunities for social learning and enhance collective intelligence. The data gathered in pursuit of these objectives was collected through an experimental research design process that included the participation of 102 undergraduate students enrolled in various planning courses at the Georgia Institute of Technology. Data collected included survey results, maps, tabulations, and audio/video footage of deliberations. The six hypotheses tested included:

Table 5-1: Summary of Hypotheses

H1	Treatment groups will experience social learning
H2	Treatment groups will demonstrate more equal distribution of turn-taking than Control groups
H3	Higher self-reported social learning among Treatment groups will correlate with more equal distribution of turn-taking
H4	There will be a statistically significant difference in the mean rank of creativity of decision between Treatment and Control groups
H5	There will be a statistically significant difference in the mean rank of perception of consensus between Treatment and Control groups
H6	There will be a statistically significant difference in the mean rank of commitment with the process between Treatment and Control groups

Findings indicated that social learning occurred online as a result of role-playing game play and that social learning was positively and strongly correlated among all groups with perceptions of consensus in group deliberation. This finding supports prior literature on the value of social-learning in collaborative planning efforts and as a valuable participation outcome. Social learning not only provides a productive measure of the extent to which participants engaged in deliberative discourse, but on how these participants were able to identified collaborative planning goals. The co-created knowledge generated in these processes can serve to empower participants, engender trust-building between participants and government and promote consensus seeking behavior. Each of these outcomes, on its own, is certainly ample enough evidence to promote continued engagement activities designed to create opportunities for social learning.

These findings lead to several conclusions, including that online gaming environments have the potential to create opportunities for social learning and that designing engagement activities to create social learning may have additional positive planning related outcomes. Furthermore, the significant correlations identified suggest that designing activities around social learning might serve planners well, especially in determining how to evaluate the successes or failures of our engagement activities. There are two sets of recommendations from this work. The first set of recommendations is related to future scholarly inquiry on these variables of interest and the domain of public engagement broadly, and the second set of recommendations is related to planning practice.

5.1 Recommendations for Research

As demonstrated in the literature review prepared for this work, there is a lack of variety in the research design and methods used to evaluate social learning in planning and public engagement processes. The communicative turn in planning and collaborative planning provide strong and comprehensive arguments in support of using deliberative discourse to empower participants, create new knowledge, and move intractable challenges to consensus seeking conversation. The compelling theoretical arguments are supported through limited empirical evidence. The notion that these arguments can be further supported by experimental methodology is an important contribution of this work. Stemming from the findings and conclusions of this work, we recommend that more experimental research be conducted on public engagement and that it be conducted within the scope of on-going planning processes in order to generate findings and conclusions that are valid and generalizable. This future work can overcome one of the limitations of this study, the reliance on findings generated through the participation of undergraduate students. Additionally, we recommend that research design on public engagement move towards the collection of longitudinal data. In this work, the multi-phase approach to understanding social learning and planning outcomes allowed us to ascertain the extent to which social learning was enhanced through participation in more than one planning event. While the results did not prove our hypothesis related to this claim, they did suggest that future scholarly inquiry will yield new knowledge on how participation in multiple planning related events can lead to enhanced social learning.

Forthcoming projects that can address the limitations in this study and expand on the relationships examined here include both experimental and quasi-experimental work that joins learning science and public engagement. The first forthcoming research project asks how the online format of a game compares to the face-to-face format of the game. Addressing the differences shown between groups participating in gaming in these separate formats will allow us to isolate the extent to which the online format mediates the learning experiences. Additionally, we will use the audio/video transcriptions to perform content analysis on the deliberations by each of the student groups. This work will allow us to join the quantitative analysis of survey responses with the qualitative analysis of how participants framed problems and exhibited consensus-seeking language. To generate additional information about the causal link between learning and planning outcomes, a third project will be completed that measures learning and planning outcomes without the use of a survey tool. This project will allow scholars to understand the relationship between these variables without survey data, thereby eliminating the perception of learning as a proxy for learning. In all of these projects, the future work builds on both the findings discussed here as well as the evidence that experimental methodology can be used within the planning domain.

5.2 Recommendations for Planners and Planning

For planning practice, the recommendations are equally important. These include, broadly, a need to focus on designing engagement activities that are centered on social learning. While collaborative planning theorists and communicative planning scholars have long claimed that the value of social learning is an intrinsic part of the engagement process and community building process, planners have not yet explicitly started designing engagement activities around the constructs of learning. This work suggests that an explicit focus on learning can be a pathway to creating activities and engagement processes that generate other positive planning outcomes such as creativity, consensus, and commitment. These have long been concerns of practitioners.

The core challenges to public participation, as identified in Chapter 2, include: (1) scale and representativeness, (2) commitment, and (3) capacity. While this work addresses the extent to which the design of activities can begin to address commitment and capacity of participants, it does not explicitly deal with issues of representativeness among participants. However, by testing the ability of an online version of a game to create positive outcomes, this work suggests that the scale of public engagement activities that have traditionally relied on face-to-face interventions can be expanded. While evidence from this work demonstrates that reported social learning is higher among participants engaged in face-to-face meetings rather than online, this work also demonstrates that social learning can happen online through the facilitative role of @Stake. This finding more forcefully clarifies that planners must approach public engagement strategies armed with a variety of solutions. Given the participant's positive associations and willingness to participate in future planning efforts after engaging in the role-play game, it follows that deploying these activities online might have positive planning outcomes. If face-to-face deliberative discourse and capacity building games are the gold standard, perhaps supplementing these activities with online versions of them is the silver standard. The results of this work indicate that there is a place for both types of activities and that more thorough evaluation is needed to address the outcomes related to game playing in these processes.

Public engagement continues to prove challenging for planners. New professionals frequently espouse engagement as a core foundation of their professional identity; their graduate education prepares them for a life of service to support the identification of the public good and the implementation of policies that seek that good. Yet, planners frequently encounter political, financial and physical constraints to effective engagement. As discussed previously, there is little scholarly empirical research to guide them on evaluation, and they are tasked with engaging larger, more diverse, and busier communities. In the face of these challenges, a wealth of opportunities for working with people online are now available to the planner. This work suggests that relying on synchronous serious games could still yield opportunities for social learning, while also addressing some of the political, financial and physical constraints to scaling up the engagement process. While the methodology and research design of testing these tools to facilitate public engagement needs further refinement, the deployment of these tools by planning agencies is appealing—the ability of one planner to administer games and engagement activities to hundreds of willing participants cannot be underscored enough.

Lastly, we recommend that more work be done on developing evaluation measures of engagement. These measures must be attuned to the needs of research (operationalized, measurable, valid), and also to the needs of planners (related to planning outcomes) so that scholars and planners can better understand the extent to which learning centered engagement activities generate desirable outcomes for planning process.

5.3 Conclusion

This work provides evidence for how experimental methodologies can contribute to increasing our understanding of how to conduct planning activities with our communities and how to evaluate our successes and failures in public engagement. Secondly, it uses the theory of collective intelligence to advance our understanding of the role social empathy and turn-taking play in unfacilitated planning deliberations among community lay persons. And, thirdly, it empirically demonstrates the role that social learning can have in generating positive planning outcomes that have long been the focus of how to improve public engagement processes.

This work also generated a rich dataset to explore additional questions on planning deliberations among unfacilitated groups. Over 30 hours of audio/video recording and the associated transcriptions are available to understand not only what these participants think about transit redesign, but how they frame problems and generate insights on equity, efficiency, and sustainability. This generation of rich data underscores the importance of broadening the traditional set of research design approaches for planning to include experimental methodology. While this work explores the initial relationships between different variables and concepts across different fields, it also creates a baseline for future work and improved experimental design to generate knowledge on causal factors.

This is one of the first pieces of experimental research to suggest that social learning can be achieved in an urban planning process using an online/ chat room format rather than a face-to-face game playing interaction, however, it is not the first piece of planning scholarship to examine the role of social learning in public engagement. A contemporary examination of the public engagement field shows widespread interest across different scholarly domains in addressing known limitations in engagement methods and activities and yet unknown tools for recording, understanding, and sharing data generated in these processes. As planning scholars, we must actively work to generate knowledge on public engagement processes and outcomes that is directly tied to the challenges our practitioners face in the field—this project was one such attempt at generating knowledge with direct planning relevance.

This dissertation was designed to examine how games could be used to provide opportunities for social learning among participants in a planning engagement process and the extent to which role-playing simulation games could serve as capacity building or training to lead to better dialog and more creative plan making by citizens. The design of this experiment was guided by three main bodies of literature, the organizational management field, the game field, and the collaborative planning and dispute resolution fields. The dual notions of “transcending the magic circle” and “going slow at the beginning to go faster later” encouraged us to design a two-phase experiment to test the limitations of participants to engage productively outside of the game as well as the ability of games to create a foundation for enhanced collaborative decision making.

Social learning can become a cornerstone of social capital and institutional capital. While the occurrence of social learning and the establishment of social capital generally require repeated interactions over a longer course of time, the ability for online platforms to allow others to engage with one another on substantive issues in planning dialog is an important contribution of this work. The results contribute to emerging knowledge on how social empathy can contribute to collaborative decision-making, and how planners can use online engagement strategies to give participants the opportunity to experience social learning.

The extent to which these benefits of game playing can generate substantial pay-off in future interactions is not yet fully understood. The ability of players to “transcend the magic circle” of the game was an important point of departure and was used to design an experiment in which we could test this ability through both self-reported survey answers and researcher observation. Participants did not self-report higher levels of creativity or commitment to the planning process because of having played a role-playing simulation game.

The organizational behavior literature has generated the measure of collective intelligence as one that is linked to high performing groups. Collective intelligence refers to turn-taking and emotional intelligence in a group. We tested the correlational effects of collective intelligence with social learning and game playing and found that turn-taking was not significantly different between groups, but that social empathy scores were significantly correlated with a team's reported creativity.

These conclusions confirm that social-learning in and of itself is a worthwhile goal of public participation exercises in planning, and that using methods pioneered in learning sciences to gauge effectiveness of planning interventions in the reported learning of participants should continue to be explored more rigorously in the planning field. These conclusions also support the deployment of synchronous role-playing games online as a method to increase the scale at which planners can create opportunities for social learning. The opportunity for participants to engage in activities designed to provide social learning can lead to the production of higher quality plans and visions. For the planner attempting to design a public engagement process, the results of this work suggest that the benefits of social learning can be generated even through an on-line format. It has previously been demonstrated that unfacilitated groups perform less well than facilitated groups in dialogical processes on complex topics. While we did not compare the unfacilitated group work to facilitated group work in this experiment, the results suggest that with proper capacity building exercises such as role – playing simulation, participants might see gains in dialogical processes, even without a trained facilitator. In this case, the game served as the facilitator, moderating conversation, and ensuring that participants were able to equally contribute to dialog. The extent to which this hypothesis can be proven will also enable planners to design engagement processes that require less person power and can be scaled more effectively to include more participants.

The implications for the planning field are two-fold: 1) online role-playing games can create opportunities for social learning to occur which could, in the future, lower the cost of creating social learning opportunities and be used to make these opportunities more accessible across larger population groups; and 2) social learning does correlate with planning related outcomes, giving us more reason to design engagement activities around social learning. These take-aways substantiate claims made by collaborative and communicative planners on the role that social-learning can play in addressing capacity and social capital in communities through the planning process.

Rigorous analysis of empirical data generated through experimental research designs is an underused methodological approach to understanding how to best design planning processes. The methodological contribution of this work is that there is a way to use experimental research design in planning research and that this type of research can be used as a way to understand planning theory and planning process. Finally, this work also created a rich dataset of audio and video footage that can be used to explore and conduct further qualitative conversational analysis to develop an in depth understanding of how stakeholders talk about, frame, and deliberate on planning challenges in an unfacilitated engagement process.

The work of public engagement can seem thankless to those of us tasked with creating opportunities, recruiting participants, and synthesizing the information generated. However, as distrust in our institutions hovers at historic highs (Report, 2018; Trust

Barometer, 2019), there is no more important work to be doing than that of creating opportunities for members of our communities to learn from one another. It is these face-to-face or keyboard-to-keyboard engagement opportunities that can create allies among foes and establish the necessary trust in local planning institutions to facilitate implementation of important policies.

APPENDIX A. PRE- EXPERIMENT INDIVIDUAL SURVEY

1. Name:
2. Age
3. What year student are you at Tech:
4. What is your current GPA?
5. What is your major field?
6. What is your gender or what do you identify as?
7. What is your ethnicity?
8. What result did you receive on the RME test?

   http://socialintelligence.labinthewild.org/mite/
9. Do you know what "headways" refers to in the context of transit?
10. What types of modes are generally included when we use the word transit? (select all that apply)
11. Have you ever participated in a planning activity before (either at Georgia Tech or in your local community)? Y/N
12. How often do you use the GT trolley/bus service

    Very rarely (once a week or less)
    Occasionally (a few times a week)
    Often (once a day)
    All the time (multiple times a day)

APPENDIX B. POST-GAME INDIVIDUAL SURVEY

1. My role was: ___________________________
2. My hidden agenda items were: _________________________
3. My other teammates roles and hidden agenda items were:
    a. Role:_______________ Hidden Agenda items: ________________
    b. Role:_______________ Hidden Agenda items: ________________
    c. Role:_______________ Hidden Agenda items: ________________
    d. Role:_______________ Hidden Agenda items: ________________
4. I was able to imagine new solutions to problems

   1 2 3 4 5 6 7
5. I thought about the problems in a new way

   1 2 3 4 5 6 7
6. I understood the perspective of my group members

   1 2 3 4 5 6 7
7. At the end of the game, I shared views with more than one other participant

   1 2 3 4 5 6 7
8. We had more points of agreement than disagreement at the end

   1 2 3 4 5 6 7
9. I learned a great deal

   1 2 3 4 5 6 7
10. Did you know anyone in your team prior to this activity? If so, please identify who and the length/type of your relationship.

Adapted from Goodspeed's attempt to operationalize Wenger's social learning criteria (2013). Likert scale from 1-5 where (5) is strongly agree and (1) is strongly disagree

APPENDIX C. FACE-TO-FACE BRIEFING PROVIDED TO PARTICIPANTS

I turned this on to record myself giving you all the instructions. I will turn the video camera on when I am done giving the instructions. Both the audio and visual recordings will be stored on a secured drive on the Georgia Tech research drive. The only people who will ever watch the video or listen to the audio are the research personnel listed in the consent document you all signed when agreeing to participate in this experiment. This data will be deleted after 3 years, as per the IRB requirements for Georgia Tech.

Feel free to speak as you would as if nothing were recording. The task that you all have been asked to complete today is detailed on the worksheets in front of you. We are trying to improve or enhance the existing bus and trolley network on Tech's campus. This is a constrained exercise, meaning that you have a limited amount of money that you can use to make improvements. These are not exact figures, but the orders of magnitude are accurate. You can see that you can either spend or save money depending on the changes you choose to make. You can see on the back that you can either increase or decrease ridership, so one of the goals of this process is to be creative, but to make the system more efficient and better serve students.

The reason we are asking students to do this is not necessarily because we think you are experts in transportation and transit, but because we believe your ideas are really valuable. Even if you don't ride or use the system there are reasons why you don't, so hopefully after going through this exercise we can have a winning proposal from one of our groups to present to Parking & Transportation Services to implement, or we can pick and choose from lots of good ideas from several proposals to bring to them.

There are certain other details about the exercise. If you see on this large map in green and blue, we are considering these as “underserved locations”, so if you make changes in those areas, for example, adding a stop, you get a ridership bonus because we assume there is an unmet need for services there. This is your map—this is where we are going to take most of the information from, so please put your team number on it. Feel free to draw and write all over this, and feel free to use the whiteboard for other notes. I will take a picture of the whiteboard when you all are done. The last thing we will ask you to do is fill out this tally sheet, which on one side asks you to estimate the ridership increases based on the information we have given to you and the changes you have made and the other side asks you total how much money you’ve saved or spent.

Are there any questions?

The way it will work is that I’ll leave you all in here for an hour. I’ll check back in after an hour to make sure you’re all still working. A lot of times people have questions for me then, which I’m happy to answer. You have an hour and a half, some teams take longer, some take shorter. At the very end of the process, after you’ve provided the map and tally sheet to me, there is a very short hard-copy survey we ask you to fill out individually. Once you’re done with the survey, you all are free to go.

If there are no other questions, I will start the video recording and exit the room.

[Estimated time: 5 minutes]

APPENDIX D. POST-PLANNING SIMULATION SURVEY

1. I believe our group achieved consensus in our vision for the GT Bus and Trolley System Changes

   1 2 3 4 5 6 7

2. I could imagine new solutions to problems

   1 2 3 4 5 6 7

3. I thought about the problems in a new way

   1 2 3 4 5 6 7

4. I understood the perspective of my group members

   1 2 3 4 5 6 7

5. My group discussed all issues

   1 2 3 4 5 6 7

6. When conflict arose, we discussed it

   1 2 3 4 5 6 7

7. At the end of the game, I shared views with more than one other participant

   1 2 3 4 5 6 7

8. We had more points of agreement than disagreement at the end

   1 2 3 4 5 6 7

9. I felt a sense of loyalty to my group's creation

   1 2 3 4 5 6 7

10. I learned a great deal.

    1 2 3 4 5 6 7

11. I was satisfied with the process as a way of working with Georgia Tech on making changes to this service.

    1 2 3 4 5 6 7

12. I would participate in another event like this in the future.

    1 2 3 4 5 6 7

Adapted from Goodspeed's attempt to operationalize Wenger's social learning criteria (2013). Likert scale from 1-5 where (5) is strongly agree and (1) is strongly disagree

APPENDIX D. @STAKE GAME PIECES

Included in this appendix are sample @Stake roles and the agenda items for each role. Participants in the Treatment group will play the mobile version of @Stake using their computer or cell phone and will be randomly assigned one of the roles from the "Civic Deck" when they begin the game in their groups. While the mobile version of @Stake will self-facilitate the game by timing participants and prompting each person to play according to the rules, the communication during the game will take place via a Slack Channel so that conversation and deliberation will be recorded. Participants will be asked to take screen shots of the roles they were assigned, the prompt for their idea formation, and a final screen shot of who won each round and the final tally. Examples of this documentation are also shown below.

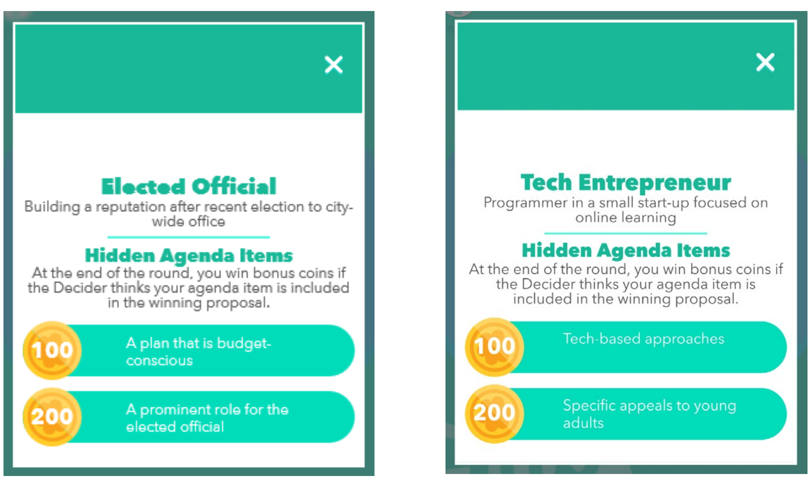
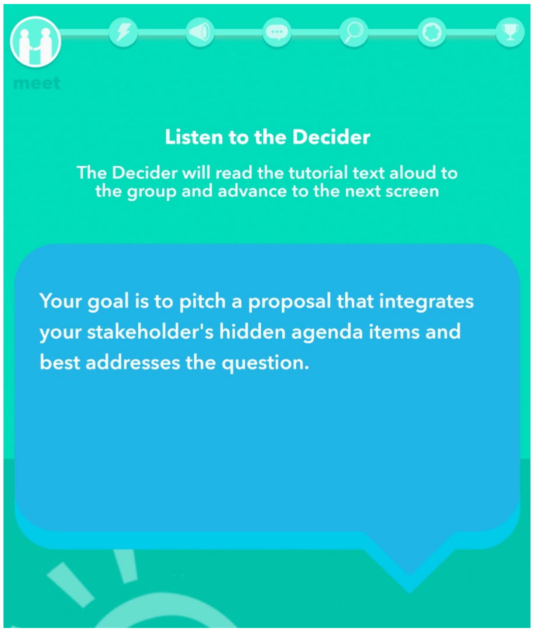
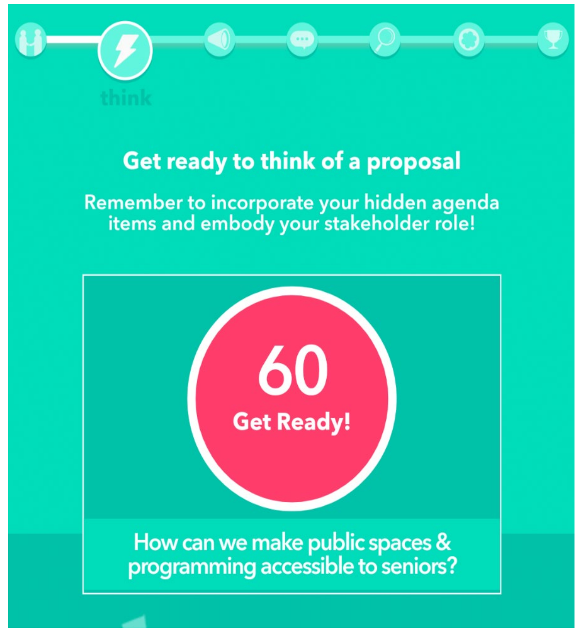
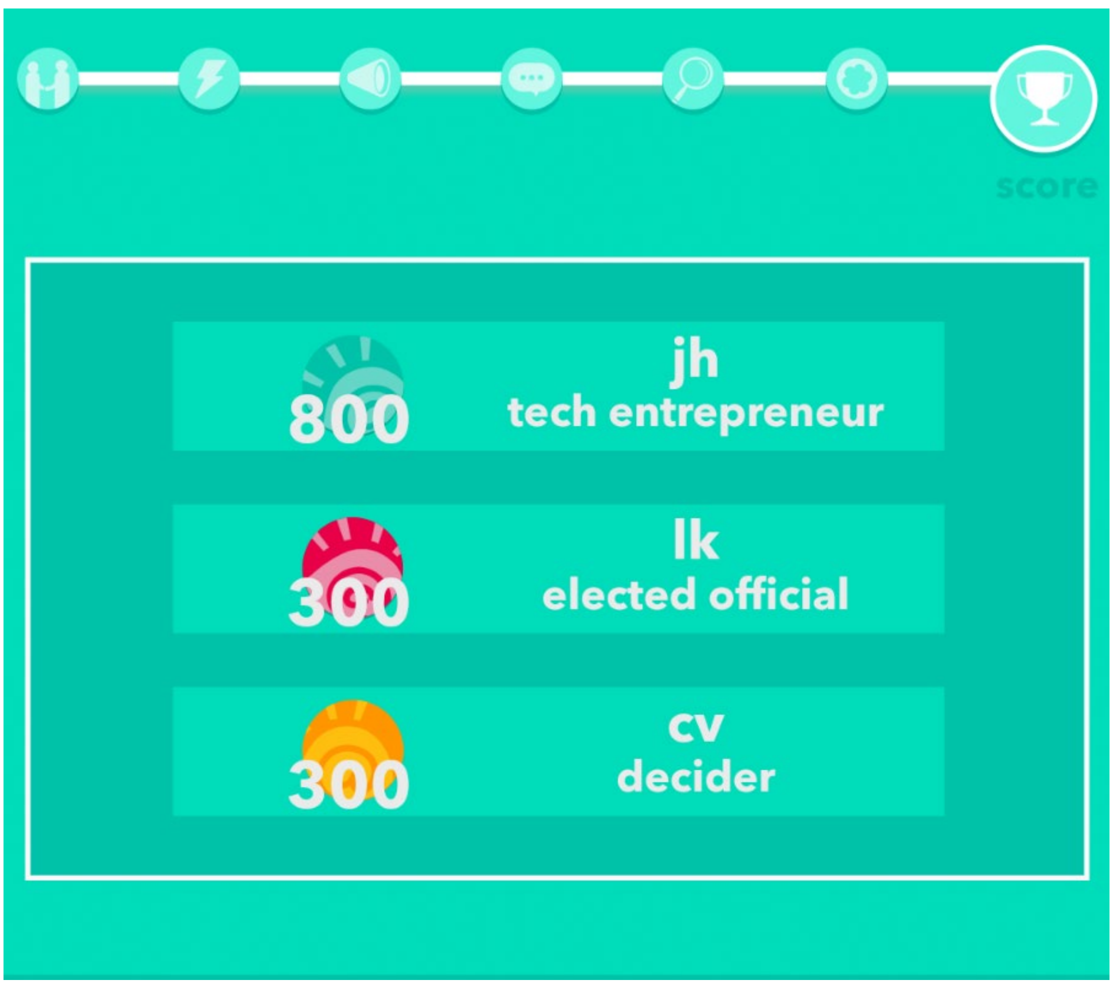


Figure 0-1: Sample @Stake Role Cards


meet
Listen to the Decider
The Decider will read the tutorial text aloud to the group and advance to the next screen
Your goal is to pitch a proposal that integrates your stakeholder's hidden agenda items and best addresses the question.


think
Get ready to think of a proposal
Remember to incorporate your hidden agenda items and embody your stakeholder role!
60
Get Ready!
How can we make public spaces & programming accessible to seniors?


score
800
jh
tech entrepreneur
300
lk
elected official
300
cv
decider

APPENDIX E. PHASE TWO GEORGIA TECH TRANSIT IMPROVEMENT DELIBERATIONS

Participants in both the Control and Treatment group were asked to work in groups of three to four to address how they might improve the Georgia Tech Bus and Trolley network. This exercise is like direction setting exercises in collaborative planning efforts and is similar in scope and content to what we ask many lay person participants to do when they are involved in a long-range planning process. This simulation has been designed around the Georgia Tech system to approximate the connection participants feel towards planning projects in their communities. Improvements and changes to the Georgia Tech Bus and Trolley system have direct impacts on the population from which the participants in this experiment were drawn.

Like the exercises we ask participants to complete in on-going real world planning projects, each student will be provided with a brief introduction of the exercise prior to their participation. This documentation will introduce the goal of the activity, and the scope. Participants will be asked to work with a map to change the bus and trolley system to add or subtract stops, redirect routes, reduce headways, or add new routes. Their final plan will be cost constrained and will be measured according to how successfully they optimized the design to increase ridership, increase efficiency, and minimize costs. There are no rules for what the deliberative process of this planning simulation will look like—each group asked to complete this challenge is unfacilitated and provided with the same information as all other groups.

The maps used for this challenge are shown below in Figures D-1 and D-2.

The headways for each route are shown in Tables D-1 and D-2.

Table 0-1: Current Bus Headways

Frequency/Route	Red	Blue	Green
7am- 5:30pm	Every 6 minutes	Every 7 minutes	Every 30 minutes
5:30 pm- 6:45 pm	Every 12 minutes	Every 14 minutes	Every 15 minutes
6:45pm -10pm	Every 24 minutes	Every 24-28 minutes	Every 30 minutes

Table 0-2: Tech Trolley Headways

Frequency/Route	Trolley
5:45am – 6:20am	Every 36 minutes
6:20am- 7:30am	Every 12 minutes
7:30am- 5:45pm	Every 6 minutes
5:45pm– 6:45pm	Every 7-10 minutes
6:45pm- 7:40pm	Every 10- 16 minutes
7:40pm- 10:30pm	Every 20 minutes

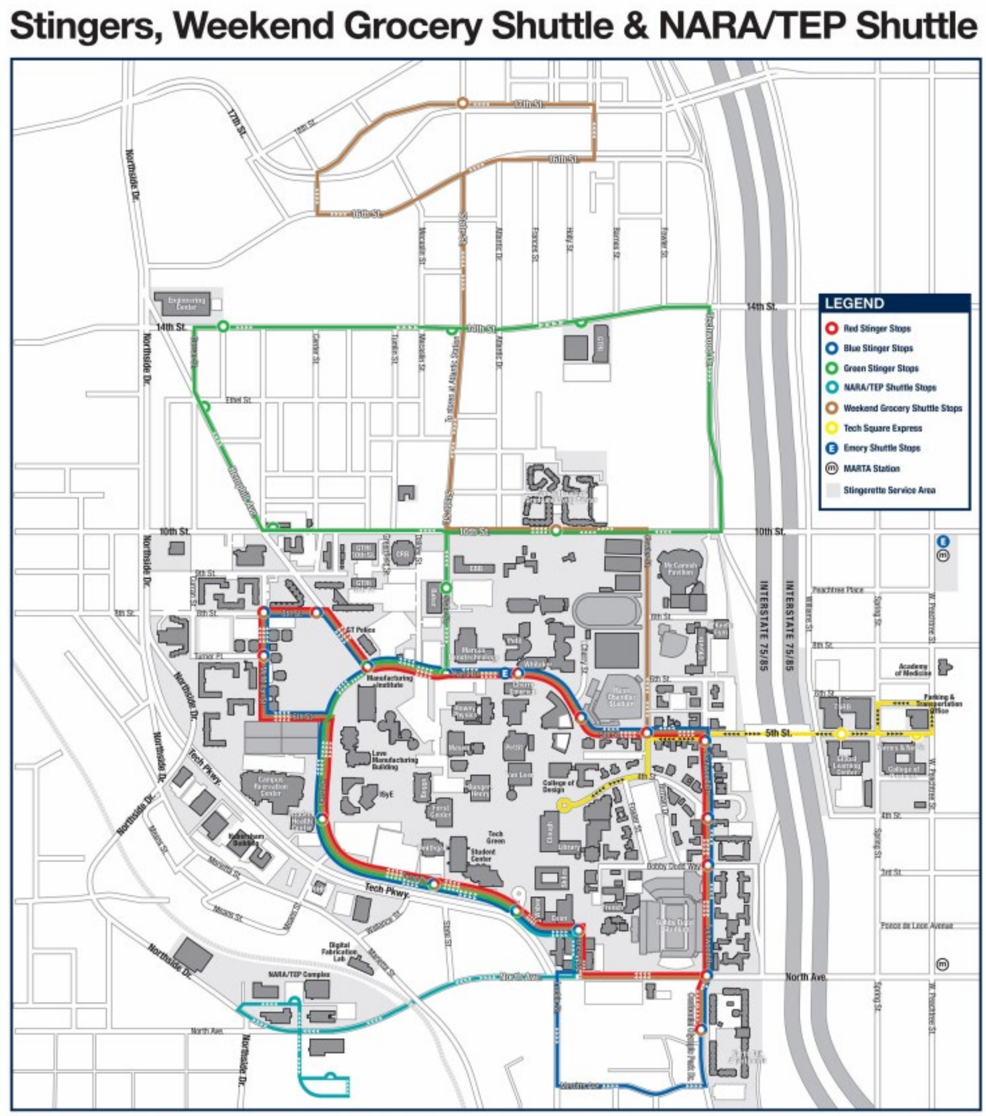


Figure 0-1: Georgia Tech Bus Map

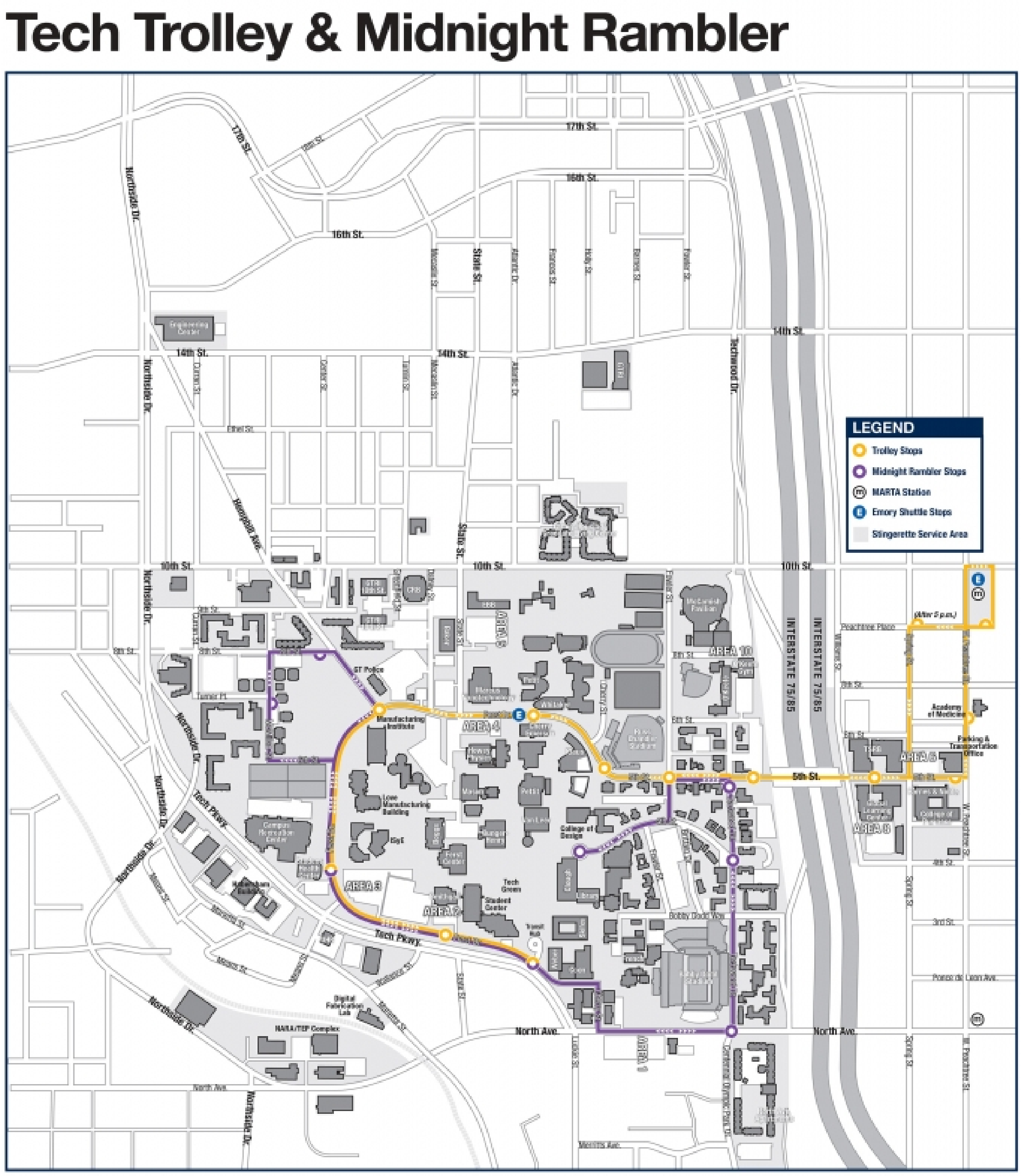


Figure 0-2: Tech Trolley & Midnight Rambler Map

APPENDIX F. SUMMARY OF TEAM LEVEL VARIABLES

Team Number	Treatment Control	O1 Social Learning Mean	% Female	# Team Mem	Average GPA	Average Social Empath	Turn Taking (0-1)	O2 Social Learning Mea	Delta SL 1-2	Neg/Post change in Del	Commitment	Consensus	Creativity	Cost	Ridership	New Elements
1	C		33.33	3	3.45	29.33	1.00	11.33	11.33	11.33	5.78	6.47	6.17	$ 290,000	360%	12
2	T	10	66.67	4	3.44	26.33	0.73	9.8	0.2	-0.2	5.11	5.13	4.5	$ 295,000	135%	6
3	T	11.05	50	4	3.31	29	0.29	12.55	1.5	1.5	6.75	6.75	6.75	$ 300,000	200%	5
4	T	8.2	50	3	3.45	28.25	0.41	10.6	2.4	2.4	5.75	5.95	6	$ 405,000	22%	15
5	T	10.13	66.67	3	3.75	28.33	0.54	11.27	1.14	1.14	6	6.2	5.67	$ 270,000	170%	5
6	T	7.87	66.67	3	3.34	25.33	0.72	11.87	4	4	5.67	6.6	6.33	$ 55,000	-50%	3
8	T	9.2	33.33	3	3.01	29	0.22	10.8	1.6	1.6	5.67	6.6	5.33	$ 90,000	40%	2
9	T	8.4	33.33	4	3.79	29	0.66	9.33	0.93	0.93	5.22	6.13	5	$ 120,000	55%	1
10	C		25	3	3.32	26	0.74	10.3	10.3	10.3	4.92	5.5	5.63	$ 250,000	75%	1
11	C		66.67	4	3.25	28.33	0.29	13.93	13.93	13.93	6.56	6.87	7	$ 35,000	-65%	4
12	C		25	4	3.84	28.5	0.38	11.55	11.55	11.55	5.67	6.6	5.75	$ 155,000	70%	2
13	C		50	3	3.62	31	0.08	12.33	12.33	12.33	4.83	6.7	7	$ 170,000	260%	2
14	C		50	3	3.58	28.5	0.61	10.55	10.55	10.55	5.17	5.9	5.75	$ 490,000	170%	12
15	C		33.33	3	3.83	26.67	0.09	11.67	11.67	11.67	6.67	6.8	6.33	$ 310,000	20%	3
16	C		66.67	3	3.67	25.33	0.26	12	12	12	6.78	6.67	4.83	$ 295,000	25%	8
17	C		75	4	3.57	29	0.79	11.5	11.5	11.5	5.5	6.35	5.13	$ 415,000	85%	4
18	C		25	3	3.63	27.5	0.32	12.05	12.05	12.05	5.58	6.4	6.25	$ 55,000	60%	4
19	T	9.4	33.33	4	3.51	27	0.38	10.13	0.73	0.73	5.44	5.67	4.33	$ 105,000	30%	0
20	T	8.93	33.33	4	3.52	29.33	0.39	12.67	3.74	3.74	6.44	6	6.33	$ 175,000	-5%	5
21	T	10.73	33.33	3	3.4	29.5	0.77	13.07	2.34	2.34	6.67	6.6	6.5	$ 430,000	80%	11
22	T	9.4	33.33	4	3.3	29.33	0.65	9.93	0.53	0.53	5.33	4.93	5.67	$ 190,000	120%	3
23	T	10.7	50	3	3.66	27.25	0.60	12.4	1.7	1.7	6.33	6.7	5.88	$ 200,000	165%	0
24	T	10.55	50	4	3.41	29	0.43	12.9	2.35	2.35	6.5	6.95	6.38	$ 475,000	120%	14
25	T	10.15	50	3	3.29	26	0.31	9.9	0.25	-0.25	5.08	6.65	5.38	$ 360,000	5%	5
26	T	9.13	33.33	3	3.27	28.67	0.85	12.6	3.47	3.47	6.22	6.67	6.17	$ 80,000	-5%	5
27	C		50	4	2.67	27.25	0.40	12.7	12.7	12.7	6.17	6.45	6	$ 160,000	10%	4
28	C		33.33	4	2.88	27	0.41	12.73	12.73	12.73	6.33	6.6	6	$ 90,000	95%	3
29	C		25	4	3.38	26.5	0.28	11.95	11.95	11.95	6.25	6.7	6.75	$ 500,000	195%	10
30	C		33.33	3	3.55	24.5	0.26	10.8	10.8	10.8	6.22	6.87	5.33	$ 125,000	330%	15
31	C		33.33	3	3.04	29	0.35	10.6	10.6	10.6	5.89	6.53	5.5	$ 470,000	110%	4

APPENDIX G. CORRELATION MATRIX, TEAM LEVEL VARIABLES

Correlations

		O1 Social Learning Mean	% Female	Average GPA	Average Social Empathy	Turn Taking (0-1)	O2 Social Learning Mean	Commitment	Consensus	Creativity
O1 Social Learning Mean	Pearson Correlation	1.000	0.106	0.004	0.165	0.007	0.368	.457*	0.263	0.173
	Sig. (1-tailed)		0.353	0.494	0.278	0.491	0.088	0.043	0.172	0.269
	N	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
% Female	Pearson Correlation	0.106	1.000	0.053	-0.089	-0.085	0.139	0.034	0.039	-0.104
	Sig. (1-tailed)	0.353		0.391	0.321	0.331	0.231	0.430	0.420	0.291
	N	15.000	30.000	30.000	30.000	29.000	30.000	30.000	30.000	30.000
Average GPA	Pearson Correlation	0.004	0.053	1.000	0.018	-0.242	-0.184	-0.094	-0.030	-0.116
	Sig. (1-tailed)	0.494	0.391		0.462	0.103	0.165	0.310	0.437	0.272
	N	15.000	30.000	30.000	30.000	29.000	30.000	30.000	30.000	30.000
Average Social Empathy	Pearson Correlation	0.165	-0.089	0.018	1.000	0.005	0.187	-0.080	-0.027	.352*
	Sig. (1-tailed)	0.278	0.321	0.462		0.490	0.161	0.338	0.443	0.028
	N	15.000	30.000	30.000	30.000	29.000	30.000	30.000	30.000	30.000
Turn Taking (0-1)	Pearson Correlation	0.007	-0.085	-0.242	0.005	1.000	0.269	0.033	0.060	0.143
	Sig. (1-tailed)	0.491	0.331	0.103	0.490		0.079	0.432	0.379	0.230
	N	15.000	29.000	29.000	29.000	29.000	29.000	29.000	29.000	29.000
O2 Social Learning Mean	Pearson Correlation	0.368	0.139	-0.184	0.187	0.269	1.000	.710**	.628**	.725**
	Sig. (1-tailed)	0.088	0.231	0.165	0.161	0.079		0.000	0.000	0.000
	N	15.000	30.000	30.000	30.000	29.000	30.000	30.000	30.000	30.000
Commitment	Pearson Correlation	.457*	0.034	-0.094	-0.080	0.033	.710**	1.000	.575**	.384*
	Sig. (1-tailed)	0.043	0.430	0.310	0.338	0.432	0.000		0.000	0.018
	N	15.000	30.000	30.000	30.000	29.000	30.000	30.000	30.000	30.000
Consensus	Pearson Correlation	0.263	0.039	-0.030	-0.027	0.060	.628**	.575**	1.000	.487**
	Sig. (1-tailed)	0.172	0.420	0.437	0.443	0.379	0.000	0.000		0.003
	N	15.000	30.000	30.000	30.000	29.000	30.000	30.000	30.000	30.000
Creativity	Pearson Correlation	0.173	-0.104	-0.116	.352*	0.143	.725**	.384*	.487**	1.000
	Sig. (1-tailed)	0.269	0.291	0.272	0.028	0.230	0.000	0.018	0.003	
	N	15.000	30.000	30.000	30.000	29.000	30.000	30.000	30.000	30.000

** Correlation is significant at the 0.05 level (1-tailed); ** Correlation is significant at the 0.01 level (1-tailed).*

REFERENCES

Afzalan, N., & Evans-Cowley, J. (2015). Planning and Social Media: Facebook for Planning at the Neighbourhood Scale. *Planning Practice & Research*, *30*(3), 270–285. https://doi.org/10.1080/02697459.2015.1052943

Arciniegas, G., & Janssen, R. (2012). Spatial decision support for collaborative land use planning workshops. *Landscape and Urban Planning*, *107*(3), 332–342. https://doi.org/10.1016/j.landurbplan.2012.06.004

Argyris, C. (1976). Single-loop and double-loop models in research on decision making. *Administrative Science Quarterly*, 363–375.

Arnstein, S. R. (1969). A Ladder Of Citizen Participation. *Journal of the American Planning Association*, *35*(4), 216–224. https://doi.org/10.1080/01944366908977225

Baba, N., & Ieee. (2006). Gaming: A helpful approach for city planning. In *2006 SICE-ICASE International Joint Conference, Vols 1-13*. New York: Ieee.

Baum, H. S. (1996). Why the rational paradigm persists: Tales from the field. *Journal of Planning Education and Research*, *15*(2), 127–135. Retrieved from http://jpe.sagepub.com/content/15/2/127.full.pdf

Brabham, D. C. (2009). Crowdsourcing the Public Participation Process for Planning Projects. *Planning Theory*, *8*, 242–262. https://doi.org/10.1177/1473095209104824

Brandt, E., & Eva. (2006). Designing exploratory design games. *Proceedings of the Ninth Conference on Participatory Design Expanding Boundaries in Design - PDC '06*, *1*, 57. https://doi.org/10.1145/1147261.1147271

Breuer, J. S., & Bente, G. (2010). Why so serious? On the relation of serious games and learning. *Eludamos. Journal for Computer Game Culture*, *4*(1), 7–24.

Bugs, G., Granell, C., Fonts, O., Huerta, J., & Painho, M. (2010). An assessment of Public Participation GIS and Web 2.0 technologies in urban planning practice in Canela, Brazil. *Cities*, *27*(3), 172–181. https://doi.org/10.1016/j.cities.2009.11.008

Bull, G. (2010). The Always-Connected Generation. *Learning & Leading with Technology*, *5191*, 28–29.

Bull, R., Petts, J., & Evans, J. (2008). Social learning from public engagement: Dreaming the impossible? *Journal of Environmental Planning and Management*, *51*(5), 701–716. https://doi.org/10.1080/09640560802208140

Cecchini, a., & Rizzi, P. (2001). Is Urban Gaming Simulation Useful? *Simulation & Gaming*, *32*(4), 507–521. https://doi.org/10.1177/104687810103200407

Charnley, S., & Engelbert, B. (2005). Evaluating public participation in environmental decision-making: EPA's superfund community involvement program. *Journal of Environmental Management*, *77*(3), 165–182. https://doi.org/10.1016/j.jenvman.2005.04.002

Coleman, J. S. (1993). The rational reconstruction of society. *American Sociological Review*, *58*(6), 898–912.

Conroy, M. M., & Evans-Cowley, J. (n.d.). *E-participation in planning: an analysis of cities adopting on-line citizen participation tools*. https://doi.org/10.1068/c1k

Creighton, J. L. (2005). *The public participation handbook: making better decisions through citizen involvement*.

Daniels, S. E., & Walker, G. B. (1996). Collaborative learning: Improving public deliberation in ecosystem-based management. *Environmental Impact Assessment Review*, *16*(2), 71–102. https://doi.org/10.1016/0195-9255(96)00003-0

Declerck, C. H., & Bogaert, S. (2008). Social value orientation: related to empathy and the ability to read the mind in the eyes. *The Journal of Social Psychology*, *148*(6), 711–726.

Desouza, K. C., & Bhagwatwar, A. (2014). Technology-Enabled Participatory Platforms for Civic Engagement: The Case of U.S. Cities. *Journal of Urban Technology*, *21*(4). https://doi.org/10.1080/10630732.2014.954898

Deyle, R., & Schively, C. (2009). Group Learning in Participatory Planning Processes: An Exploratory Quasiexperimental Analysis of Local Mitigation Planning in Florida. *Journal of Planning Education and Research*, *29*, 23–38.

https://doi.org/10.1177/0739456X09333116

Duhigg, C. (2016, February 25). What Google learned from its quest to build the perfect team. *New York Times*.

Ellis, J. B., Luther, K., Bessiere, K., & Kellogg, W. a. (2008). Games for virtual team building. *Proceedings of the 7th ACM Conference on Designing Interactive Systems - DIS '08*, 295–304. https://doi.org/10.1145/1394445.1394477

Engel, D., Woolley, A. W., Aggarwal, I., Chabris, C. F., Takahashi, M., Nemoto, K., … Malone, T. W. (2015). Collective Intelligence in Computer-Mediated Collaboration Emerges in Different Contexts and Cultures. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems - CHI '15*, 3769–3778. https://doi.org/10.1145/2702123.2702259

Evans-Cowley, J., & Griffin, G. (2012). Microparticipation with Social Media for Community Engagement in Transportation Planning. *Transportation Research Record: Journal of the Transportation Research Board*, *2307*, 90–98. https://doi.org/10.3141/2307-10

Evans-Cowley, J., & Hollander, J. (2010). The new generation of public participation: Internet-based participation tools. *Planning, Practice & Research*, *25*(3), 397–408. https://doi.org/10.1080/02697459.2010.503432

Forester, J. (1999). *The deliberative practitioner: Encouraging participatory planning processes*. MIT press.

Fredericks, J., & Foth, M. (2013). Augmenting public participation: enhancing planning outcomes through the use of social media and web 2.0. *Australian Planner*, *50*(3). https://doi.org/10.1080/07293682.2012.748083

Frewer, L. J., & Rowe, G. (2005). Evaluating public participation exercises: Strategic and practical issues. *Evaluating Public Participation in Policy Making*, 85–106.

Gaber, J. (2007). Simulating Planning: SimCity as a Pedagogical Tool. *Journal of Planning Education and Research*, *27*(2), 113–121. https://doi.org/10.1177/0739456X07305791

Garmendia, E., & Stagl, S. (2010). Public participation for sustainability and social learning: Concepts and lessons from three case studies in Europe. *Ecological Economics*, *69*(8), 1712–1722. https://doi.org/10.1016/j.ecolecon.2010.03.027

Geertman, S. (2002). Participatory planning and GIS: A PSS to bridge the gap. *Environment and Planning B: Planning and Design*, *29*(1), 21–35. https://doi.org/10.1068/b2760

Goodspeed, R. R. C. (2013). *Planning support systems for spatial planning through social learning*. Massachusetts Institute of Technology.

Gordon, E., & Baldwin-Philippi, J. (2014). Playful Civic Learning: Enabling Lateral Trust and Reflection in Game-based Public Participation. *International Journal of Communication*, *8*, 28. Retrieved from http://ijoc.org/index.php/ijoc/article/view/2195

Gordon, E., Baldwin-Philippi, J., & Balestra, M. (2013). Why We Engage: How Theories of Human Behavior Contribute to Our Understanding of Civic Engagement in a Digital Era. *SSRN Electronic Journal*, *7641*. https://doi.org/10.2139/ssrn.2343762

Gordon, E., Haas, J., & Michelson, B. (2017). Civic Creativity: Role-Playing Games in Deliberative Process. *International Journal of Communication*, *11*, 3789–3807. Retrieved from http://ijoc.org.

Gordon, E., & Schirra, S. (2011). Playing with empathy: digital role-playing games in public meetings. *Proceedings of the 5th International Conference on Communities and Technologies*, 179–185. ACM.

Gray, B. (1989). *Collaborating: Finding common ground for multiparty problems*.

Guhathakurta, S. (2002). Urban modeling as storytelling: using simulation models as a narrative. *Environment and Planning B: Planning and Design*, *29*(6), 895–911. https://doi.org/10.1068/b12857

Guy, B., Bidwell, N. J., & Musumeci, P. (2005). Gameplan: Serious gaming for place making. *Proceedings of the Second Australasian Conference on Interactive Entertainment*, 252. Creativity & Cognition Studios Press.

Habermas, J., Habermas, J., & McCarthy, T. (1985). *The theory of communicative action*. Retrieved from https://books.google.com/books?hl=en&lr=&id=uQv2VH-

wmHwC&oi=fnd&pg=PP7&dq=habermas&ots=SxbjtLNP6s&sig=o0Kk_G7XTCCGJUrjXmWJMjFN-gY

Hacker, J. F., Krykewycz, G. R., & Meconi, J. M. (2009). Dots & Dashes Transit Planning Outreach and Education in a Board Game Format. *Transportation Research Record*, (2138), 127–134. https://doi.org/10.3141/2138-17

Hacker, K. L., & van Dijk, J. (2000). *Digital democracy: Issues of theory and practice*. Sage.

Healey, P. (1998). Building institutional capacity through collaborative approaches to urban planning. *Environment and Planning A*, *30*(9), 1531–1546.

Healey, P. (2003). Collaborative Planning in Perspective. *Planning Theory*, *2*(2), 101–123. https://doi.org/10.1177/14730952030022002

Innes, Judith E., & Booher, D. E. (2004). Reframing public participation: Strategies for the 21st century. *Planning Theory and Practice*, *5*(4), 419–436. https://doi.org/10.1080/1464935042000293170

Innes, Judith E, & Booher, D. E. (1999). Consensus Building as Role Playing and Bricolage. *Journal of the American Planning Association*, *65*(1), 9–26. https://doi.org/10.1080/01944369908976031

Innes, Judith Eleanor, & Booher, D. E. (2010). *Planning with complexity [electronic resource] : an introduction to collaborative rationality for public policy / Judith E. Innes and David E. Booher*. Retrieved from http://prx.library.gatech.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=cat01819a&AN=gatech.1073498&site=eds-live&scope=site

Irvin, A., & Stansbury, J. (n.d.). *Citizen Participation in Decision Making : Is It Worth the Effort ?*

Kang, Y., & Harring, J. R. (2012). Investigating the impact of non-normality, effect size, and sample size on two-group comparison procedures: An empirical study. *Presented at the Annual Meeting of the American Educational Research Association (AERA)*, 29.

Klein, C., DiazGranados, D., Salas, E., Le, H., Burke, C. S., Lyons, R., & Goodwin, G. F.

(2009). Does Team Building Work? *Small Group Research*, *40*(2), 181–222. https://doi.org/10.1177/1046496408328821

Kleinhans, R., Van Ham, M., & Evans-Cowley, J. (2015). Using Social Media and Mobile Technologies to Foster Engagement and Self-Organization in Participatory Urban Planning and Neighbourhood Governance. *Planning Practice & Research*, *30*(3), 237–247. https://doi.org/10.1080/02697459.2015.1051320

Klosterman, R. E. (1985). Arguments for and against planning. *Town Planning Review*, *56*(1), 5. Retrieved from http://www.jstor.org.prx.library.gatech.edu/stable/pdfplus/40112168.pdf

Kozlowski, S. W. J., & Bell, B. S. (2001). *Work Groups and Teams in Organizations Work Groups and Teams in Organizations*.

Kozlowski, S. W. J., & Bell, B. S. (2003). Work groups and teams in organizations. *Handbook of Psychology*.

Kozlowski, S. W. J., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological Science in the Public Interest*, *7*(3), 77–124. Retrieved from http://psi.sagepub.com.prx.library.gatech.edu/content/7/3/77.full.pdf

Landis, J. D. (1995). IMAGINING LAND-USE FUTURES - APPLYING THE CALIFORNIA URBAN FUTURES MODEL. *Journal of the American Planning Association*, *61*(4), 438–457. https://doi.org/10.1080/01944369508975656

Laurian, L., & Shaw, M. M. (2008). Evaluation of Public Participation: The Practices of Certified Planners. *Journal of Planning Education and Research*, *28*(3), 293–309. https://doi.org/10.1177/0739456X08326532

Making Blocks & Lots: A Window into Learning and Creativity. (n.d.). Retrieved January 13, 2015, from http://blocksandlots.net/wp-content/uploads/2011/09/Making-Blocks-and-Lots.pdf

Michael, D. R., & Chen, S. L. (2005). *Serious games: Games that educate, train, and inform*. Muska & Lipman/Premier-Trade.

Oser, J., Hooghe, M., & Marien, S. (2013). Is Online Participation Distinct from Offline Participation? A Latent Class Analysis of Participation Types and Their Stratification.

Political Research Quarterly, *66*(1). https://doi.org/10.1177/1065912912436695

Paxton, P. (1999). Is Social Capital Declining in the United States? A Multiple Indicator Assessment. *American Journal of Sociology*, *105*(1), 88–127. https://doi.org/10.1086/210268

Peleg, B., & Sudhölter, P. (2007). *Introduction to the theory of cooperative games* (Vol. 34). Springer Science & Business Media.

Poplin, A. (2012). Playful public participation in urban planning: A case study for online serious games. *Computers Environment and Urban Systems*, *36*(3), 195–206. https://doi.org/10.1016/j.compenvurbsys.2011.10.003

Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community*. Simon and Schuster.

Qualman, E. (2010). *Socialnomics: How social media transforms the way we live and do business*. John Wiley & Sons.

Reality Check - Urban Land Institute. (n.d.). Retrieved January 2, 2017, from http://uli.org/councils/district-councils/reality-check-regional-planning-sustainable-development/

Report, G. (2018). *2018 Edelman Trust Barometer Trust Barometer*.

Rupasingha, A., Goetz, S. J., & Freshwater, D. (2006). The production of social capital in US counties. *The Journal of Socio-Economics*, *35*(1), 83–101. Retrieved from http://ac.els-cdn.com.prx.library.gatech.edu/S1053535705000971/1-s2.0-S1053535705000971-main.pdf?_tid=9f0bfab0-62bb-11e4-a24a-00000aab0f01&acdnat=1414952049_0d587edec40636f9d3341e8bbb275b7b

Sacks, H., Schegloff, E. A., & Jefferson, G. (1974). A simplest systematics for the organization of turn-taking for conversation. *Language*, 696–735.

Salas, E., Rozell, D., Mullen, B., & Driskell, J. E. (1999). The Effect of Team Building on Performance An Integration. *Small Group Research*, *30*(3), 309–329. https://doi.org/10.1177/104649649903000303

Schirra, S. M. (2013). *Playing for Impact : The Design of Civic Games for Community Engage ment and Social Action By*.

Schusler, T. M., Decker, D. J., & Pfeffer, M. J. (2003). Social Learning for Collaborative Natural Resource Management. *Society & Natural Resources*, *16*(4), 309–326. https://doi.org/10.1080/08941920390178874

Schweitzer, L. (2014). Planning and Social Media: A Case Study of Public Transit and Stigma on Twitter. *Journal of the American Planning Association*, *80*(3), 218–238. https://doi.org/10.1080/01944363.2014.980439

Shalinsky, W., & Norris, R. G. (1981). *The Place of Small Group Processes in Planning Education*. 119–130.

Simpson, D. M. (2001). Virtual Reality and Urban Simulation in Planning: A Literature Review and Topical Bibliography. *Journal of Planning Literature*, *15*(3), 359–376. https://doi.org/10.1177/08854120122093078

Straus, S. G. (1999). Testing a Typology of Tasks: An Empirical Validation of McGrath's (1984) Group Task Circumplex. *Small Group Research*, *30*(2), 166–187. https://doi.org/10.1177/104649649903000202

Susi, T., Johannesson, M., & Backlund, P. (2007). *Serious games: An overview*.

Susskind, L., Mnookin, R., Rozdeiczer, L., & Fuller, B. (2005). *What We Have Learned About Teaching Multiparty Negotiation*. (July 2005), 395–408. Retrieved from http://web.mit.edu/publicdisputes/projarea/pdf/TeachingNeg.pdf

Takahashi, D. (2013). More than 1.2 billion people are playing games | GamesBeat | Games | by Dean Takahashi. Retrieved January 3, 2017, from Venture Beat website: http://venturebeat.com/2013/11/25/more-than-1-2-billion-people-are-playing-games/

Terzano, K., & Morckel, V. (2015). Sim City in the Community Planning Classroom: Effects on Student Knowledge, Interests, and Perceptions of the Discipline of Planning. *Journal of Planning Education and Research*. https://doi.org/10.1177/0739456X16628959

Trapenberg Frick, K., Weinzimmer, D., & Waddell, P. (2015). The politics of sustainable development opposition: State legislative efforts to stop the United Nation's Agenda

21 in the United States. *Urban Studies*, *52*(2), 209–232. https://doi.org/10.1177/0042098014528397

Trust Barometer, E. (2019). *Trust Barometer*.

Tuckman, B. W., & Jensen, M. A. C. (1977). Stages of small-group development revisited. *Group & Organization Management*, *2*(4), 419–427.

Verba, S., Schlozman, K. L., Brady, H., & Nie, N. H. (2012). Participates ? What Do They Who Say ? Activity : Citizen. *Political Science*, *87*(2), 303–318.

Vicente, M. R., & Novo, A. (2014). An empirical analysis of e-participation. The role of social networks and e-government over citizens' online engagement. *Government Information Quarterly*, *31*(3), 379–387. https://doi.org/10.1016/j.giq.2013.12.006

Voinov, A., Kolagani, N., McCall, M. K., Glynn, P. D., Kragt, M. E., Ostermann, F. O., … Ramu, P. (2016). Modelling with stakeholders – Next generation. *Environmental Modelling & Software*, *77*, 196–220. https://doi.org/10.1016/j.envsoft.2015.11.016

Wasserstein, R. L., & Lazar, N. A. (2016). The ASA's Statement on p-Values: Context, Process, and Purpose. *American Statistician*, *70*(2), 129–133. https://doi.org/10.1080/00031305.2016.1154108

Webler, T, Tuler, S., & Krueger, R. (2001). What is a good public participation process? Five perspectives from the public. *Environmental Management*, *27*(3), 435–450. https://doi.org/10.1007/s002670010160

Webler, Thomas, Kastenholz, H., & Renn, O. (1995). Public participation in impact assessment: a social learning perspective. *Environmental Impact Assessment Review*, *15*(5), 443–463. Retrieved from http://ac.els-cdn.com.prx.library.gatech.edu/019592559500043E/1-s2.0-019592559500043E-main.pdf?_tid=bec843a0-62ba-11e4-800d-00000aab0f6b&acdnat=1414951673_f61d4e8e8407eebdee2a1b8bc5228d60

Webler, Thomas, & Tuler, S. (2006). Four perspectives on public participation process in environmental assessment and decision making: combined results from 10 case studies. *Policy Studies Journal*, *34*(4), 699–722. https://doi.org/10.1111/j.1541-0072.2006.00198.x

Woolley, A. W., Aggarwal, I., & Malone, T. W. (2015). Collective Intelligence and Group Performance. *Current Directions in Psychological Science*, *24*(6), 420–424. https://doi.org/10.1177/0963721415599543

Woolley, A. W., Chabris, C. F., Pentland, A., Hashmi, N., & Malone, T. W. (2010). Evidence for a collective intelligence factor in the performance of human groups. *Science*, *330*(6004), 686–688. https://doi.org/10.1126/science.1193147

Woolley, A. W., Malone, T. W., Woolley, A. W., & Aggarwal, I. (2015). *Collective Intelligence and Group Performance Collective Intelligence and Group Performance*. (March 2016). https://doi.org/10.1177/0963721415599543

Yankelovich, D. (2001). *The magic of dialogue: Transforming conflict into cooperation*. Simon and Schuster.

Zeleny, M., & Cochrane, J. L. (1982). *Multiple criteria decision making* (Vol. 25). McGraw-Hill New York.

Zellner, M. L., Lyons, L. B., Hoch, C. J., Weizeorick, J., Kunda, C., & Milz, D. C. (2012). Modeling, Learning, and Planning Together: An Application of Participatory Agent-based Modeling to Environmental Planning. *Journal of the Urban & Regional Information Systems Association*, *24*(1).

Zyda, M. (2005). From visual simulation to virtual reality to games. *Computer*, *38*(9), 25–32.