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SANTA CRUZ

METAPHORS WE PLAY WITH: A PSYCHOLOGICAL INVESTIGATION OF TRANSFER FROM GAME SYSTEMS

A thesis submitted in partial satisfaction of the requirements for the degree of

MASTER OF SCIENCE

in

COMPUTATIONAL MEDIA

by

Barrett Anderson

December 2018

The thesis of Barrett Anderson
is approved:

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Lori Kletzer
Vice Provost and Dean of Graduate Studies

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2018

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Abstract

Metaphors we play with: A psychological investigation of transfer from game systems.

by

Barrett Anderson

Games are capable of conveying meaning via their mechanics. This is an information channel unique to games, which has been called procedural rhetoric (Bogost, 2007). What a player takes from a game depends on their personal reading (Summerville et al., 2018; Treanor, Schweizer, Bogost, & Mateas, 2011), but game creators and scholars can benefit from understanding a typical player's experience and interpretation. Learning from analogy involves transferring insights from one system to another (Day & Goldstone, 2011; Hofstadter, 2001). This kind of transfer can be encouraged by metaphorical language, as demonstrated in an experiment examining the influence of the language used to describe crime in a newspaper article on reader's crime-related policy preferences (Thibodeau & Boroditsky, 2011). The contribution of the current study is a psychological experiment investigating the influence of a novel rhetorical game, replacing these differences in metaphorical language in the preceding experiment with differences in game mechanics. Additional interpretive context was gained from the inclusion of other rhetorical games. We found that players perceive rhetorical games to be making an argument, but player interpretations of these arguments and the games' influence on their attitudes were not necessarily consistent with the games' intended message.

Introduction

Games are capable of conveying meaning in a variety of ways that they have in common with other forms of media (e.g., aspects of media such as visual art, narrative, etc.), but among popular media forms games are unique in being able to communicate via their rules and mechanics. One critic has described the way that games are capable of conveying meaning via these interactive systems as their "procedural rhetoric" (Bogost, 2007). A player's understanding of this meaning depends in part on what they are bringing to the experience (Summerville et al., 2018; Treanor et al., 2011), and in part on their experience and facility with this kind of comprehension. This is a form of literacy specific to games (Gee, 2007; Mateas, 2005), which implies that there will be differences between the readings of experienced critics and the readings that many players (perhaps the majority) will construct. Developing an understanding of a typical player's experiences can help ground critical conversations about games in a broader psychological reality and help game scholars and critics avoid the trap of falling into excessive self-reference.

Methods for investigating player's common experiences are found in psychological research, but prior work on the possible benefits of games has focused primarily on their educational potential (Mayer, 2014; Plass, Homer, & Kinzer, 2015; Sherry, 2015). Psychological research on analogical transfer, which looks at stories as systems where elements from one example can be mapped onto another (Gentner, Holyoak, & Kokinov, 2001), appears to be a good fit for investigating the psychological of procedural rhetoric. Research has also found that this kind of

transfer can also take place in the context of metaphorical language (Thibodeau & Boroditsky, 2011), which directly inspired the creation of a rhetorical game for the present study. Specifically, this research found that newspaper articles which metaphorically framed crime as a “beast” or as a “virus” can influence policy preferences. Reading an article which used a “beast” framing increased endorsement of enforcement-related policies, while reading an article that used a “virus” framing increased endorsement of prevention-related policies.

The present study is a psychological experiment investigating transfer from a rhetorical game created with the explicit intent of recreating this metaphorical framing effect in a new medium. While procedural rhetoric has been subject to critical analysis (e.g., Colby, 2014; Doucet & Srinivasan, 2010; Ferrara, 2013; Seiffert & Nothhaft, 2015; Treanor & Mateas, 2009), it has yet to be explored from a psychological research perspective. Therefore, this work could also be described as an initial test of the psychological reality of procedural rhetoric, exploring the nature of its existence independent of critics’ interpretations. This is a novel application of a psychological research method to concepts that were generated, and have primarily been explored, via more humanistic critical methods.

There is evidence that analogical transfer is part of how we understand simple physical systems (Day & Goldstone, 2011).We think that our understanding of transfer from game systems can be informed by existing research on transfer from analogy and metaphor, because they both rely on mapping between domains based on underlying similarities. The present study attempts to examine this relationship in the

context of a simple rhetorical strategy game. The primary contributions of this work are as follows:

- To supplement more humanistic games criticism with another way of understanding how individuals experience rhetoric in games
- To extend research on analogical and metaphorical transfer to the context of game systems
- To provide an example of a research method that can be employed by anyone interested in another way of investigating these concepts in games

One secondary contribution is the development of a game for research purposes, which is grounded in theory, has built-in player data collection, and was designed to be modified. Another secondary contribution is the development of a scale to quantify a game's perceived rhetorical content. These contributions will primarily be of value to game creators and scholars.

Meaning from Game Mechanics

Bogost (2007) coined the term procedural rhetoric and defined the concept as "the art of persuasion through rule-based representations and interactions rather than the spoken word, writing, images, or moving pictures." Focusing on the positive aspect of this definition, he discusses the way that videogames make claims through their mechanical systems, beginning with an example from a simulation *Tenure* (Gaedes, 1975). In this program, the player took on the role of newly hired high school teacher. The player is then presented with difficult situations where social, educational and

professional goals come into conflict, and their decisions could potentially have unknown long-term consequences. In doing this, Bogost argues, the system is making a claim about how the process of high school operates, in this case the claim that personal politics are intertwined with pedagogical decisions. This concept has been explored and expanded on by other researchers, who have written about interpreting and generating procedural meaning in games (Colby, 2014; Summerville et al., 2018; Treanor, Blackford, Mateas, & Bogost, 2012).

An important related concept is the SimCity effect, which Wardrip-Fruin defines as the effect of a system that "through play, brings the player to an accurate understanding of the system's internal operations" (Wardrip-Fruin, 2007, p. 2). Here the canonical example comes from the game *Sim City* (Wright, 1989), in which a player manages a developing city by zoning districts, creating transit links, and making other adjustments to infrastructure and policy. The player is provided with some guidance about what their city needs, but their choices can also interact in ways that are not immediately apparent (e.g. a residential area might be negatively impacted by proximity to a power plant). A player comes to understand these interactions through play, internalizing a mental model of the simulation. The player becomes more skilled at the game to the degree that they do so completely and accurately, and this simulation can help players develop an intuitive understanding of complex processes (Wardrip-Fruin, 2009). For any simulation, there are choices being made about what aspects of reality to model. While this might lead players to an understanding of the limitations of such a computational model, it could also be

understood as a way of making an argument about what aspects of a situation or system are most important.

One common type of cognitive bias involves replacing an unsolved and difficult question with an already solved problem, described by Kahneman (2013) as "answering an easier question." Like most other cognitive biases this is usually a useful mental shortcut, but it can sometimes lead to error. If a player has internalized a simplified model of a complex system, as in the SimCity effect example above, they might use that model as a cognitive shortcut when trying to reason about a real-world city. Wardrip-Fruin points out that the game models "some relationships (e.g., crime and police presence) and not others (e.g., crime related death and weapons availability)" (2009, p. 310). While it is possible to read these simplifying assumptions as a statement, made in the procedural rhetoric of the game, about which relationships are more important, it seems possible that a less reflective player would internalize the model less critically. In this way biases in the game's model might reappear in the player's mental model of a city, and impact their real-world decisions.

Games and Learning

Because the present study is a psychological experiment, it also exists in relation to previous psychological research on games. Prior work in this tradition has, when exploring the possible benefits of games, primarily focused on their educational potential (Mayer, 2014; Plass et al., 2015). While transfer from procedural rhetoric is certainly a form of learning, it is closer to learning from story than it is to learning

from drill or from a lecture, which are the typical comparisons considered by psychologists investigating educational games.

For the past thirty years, educators have been encouraged to engage and motivate students through computer and video game based instruction (Abt, 1987; Devlin, 2011; Gee, 2007; McGonigal, 2011; Prensky, 2006). Seeing school age players deeply engrossed in electronic games led researchers and educators to an interest in adapting effective game features for an educational context (Loftus & Loftus, 1983; Malone, 1981), often to mixed results (Mayer, 2014). Educational video games have developed a poor reputation (Van Eck, 2006), with "edutainment" often being a term of derision (Egenfeldt-Nielsen, 2011; Salter, 2016).

Many mediocre learning games have been released (Shuler, 2012), disparaged by critics as based on a flawed model of education as simple content delivery (Gee, 2013). One criticism stems from low quality educational games that attempt to sugarcoat information with irrelevant game features, e.g., "chocolate-covered broccoli" (Bruckman, 1999, p.76), which distract from rather than reinforce their educational content. Educators who do not understand the affordances of games fail to take advantage of their properties in ways that serve learning goals (Bruckman, 1999; Plass et al., 2015).

Those advocating the use of games in education describe the ways that many commercial games are designed to encourage learning by including features like low consequences for failure, or scaling difficulty to the player's abilities (Gee, 2007). But commercial games often use these features only in service of learning the game itself

(e.g., in a tutorial, or by dynamically adjusting difficulty to encourage a flow state), while educational games often fail to implement them at all.

It has been argued that the flexibility of games means that they have the potential to implement almost any given theory of education (Plass et al., 2015), but doing so effectively requires deep knowledge of both the subject being taught and of game design. This unusual combination of skills may explain the limited success of educational games in research settings. The implication is that when a game is developed for a study, which is typically done with less resources than either a commercial or educational game, it tells us very little about the effectiveness of games more generally. However, once the effectiveness of a specific research game has been established, if it has been designed for easy modification, it can be then be used examine the impact of individual features. While they are often more challenging to modify, the mechanics of the game can be considered on such feature.

If a game is ineffective perhaps all we have learned is that it was not a good game (and this limitation is exacerbated when attempting to compare learning from a game to learning the same content from another medium), but when a game is effective we can take a closer look to find out why, particularly when the game design was grounded in theory. Although our intent at the outset of the present study was to create a persuasive, rather than educational game, our evaluation of its effectiveness might also be relevant in an educational context.

Analogical Transfer and the Analogical Paradox

Analogical transfer is the ability to apply information from an older solved problem to a newer, seemingly unrelated, one. While this is often presented in popular culture as a flash of brilliant insight, it is also an ordinary part of human cognition. Researchers describe two related problems where this kind of transfer is possible as having an underlying "structural similarity," even when their superficial "surface similarity" is low (Holyoak & Koh, 1987). Having structural (or deep) similarity means that the elements in the source problem can be mapped, one-to-one, to elements in the target problem, and that this mapping generally preserves the relationships between these elements. Having surface similarity means that both the source and target problems are in ostensibly the same domain (e.g., politics, medicine, etc.). This ability, to understand a new situation as a variation on a familiar one, is often considered a central pillar of human cognition (Barsalou, 2010; Hofstadter, 2001; Holyoak, Holyoak, & Thagard, 1996). When describing these insights researchers will typically refer to the familiar problem as the source, and the novel problem as the target. Near transfer is the application of knowledge from a problem in one target domain to a problem in the same domain, while far transfer is the application of knowledge to a problem to a novel domain.

For example, one classic study asked participants to read about a problem in a military domain, which was presented along with its solution, to see if they would see the analogical relationship when asked to solve a problem in an unrelated (medical) domain (Duncker & Lees, 1945). The first problem was about a general who wanted

to attack a tower surrounded by land mines. He had to split his forces into small groups and send them all along different roads to avoid setting off the mines, planning for them all to arrive and attack the tower at the same time. This was called the "convergence" solution. A short while after reading about this problem and its solution, participants were asked to suggest solutions to an ostensibly unrelated problem. In this problem a patient had an inoperable tumor (tower), that the doctor (general) wanted to destroy with lasers (army). The problem was that if the lasers were strong enough to destroy the tumor, they would also destroy healthy tissue in the way (set off the land mines) and kill the patient. Solutions suggested by the participants were evaluated to see if they suggested a "convergence" solution (i.e., several weak lasers that come together on the tumor) Participants in this study were generally unlikely to see the structural similarity, or to suggest an analogically similar solution (converging weak lasers on the tumor), unless they were explicitly cued to think about the previous story. Subsequent studies have found a similar pattern of results (Gick & Holyoak, 1983; Novick, 1988; Perfetto, Bransford, & Franks, 1983; Simon & Hayes, 1976).

Despite clear advantages of perceiving connections from one domain to another for problem solving, research suggests that analogical transfer is not very likely unless surface similarity between problem domains is high (Holyoak & Koh, 1987; Novick, 1988), or participants are explicitly cued or given hints about which earlier solutions apply (Gick & Holyoak, 1983). In contrast, naturalistic observations indicate that people have a greater facility with creating and applying analogical

mappings outside of the lab setting (Detterman, 1993), although even in these cases analogies are usually drawn between very similar domains. This difference in performance has been called the "analogical paradox" (Dunbar & Blanchette, 2001). The findings above paint a discouraging picture for the potential of transfer (or learning) from a narrative description, but more recent research suggests that transfer from an interactive system (and therefore from game mechanics) may be a different matter.

Analogical transfer from game systems. Researchers taking another look at factors that influence analogical transfer, examined analogical transfer not from a story, but from a simulated physical system (Day & Goldstone, 2011). Participants interacted with a computer simulation of a ball oscillating between two pins. The ball was attached to each pin by an elastic band, and participants could manipulate the motion of the ball by adjusting an adjacent fan. Participants were given a specific goal to achieve; either keeping the ball stationary or maximizing its movement in one direction. Succeeding at either goal would require developing a strategy through trial and error. After an appropriate interval, participants were presented with an ostensibly unrelated task that involved managing the population of a city. For this task participants chose the time in which to buy advertisements for their city, with the goal of either stabilizing or maximizing the population (goals analogous to the stabilize or maximize goals in the fan task). The interface for this task was entirely textual, and changes took place in discrete time steps, but the underlying principles (e.g., the system mechanics) were identical between both the fan and population management

tasks. Participants required reliably fewer trials to complete the population task when the goal was aligned with the training task, and they were more likely to complete the task before a given deadline. Significantly, this transfer was independent of reported recognition of the analogical relationship between these tasks.

These findings suggest that analogical transfer might occur more readily in dynamic presentations in the form of interactive simulations and games than in static stories in which content is conveyed via narrative only, even in the absence of explicit cues. This is consistent with the argument that instead of thinking about games as teaching specific content, we should think about games as an opportunity to practice learning new systems of relationships (Gee, 2013), and contrasts with the approach that views any learning or improvement obtained from game play as the same kind of benefit obtained from practice or drilling, where games are seen as a kind of enticement to perform these useful exercises, but not otherwise beneficial themselves. Instead, these finding suggests two kinds of values that might come from experience with games, improved practice at learning and adapting to new systems (e.g., "I can learn this new software because I'm used to learning new games"), and exposure to a variety of systems that might be recognized or adapted to other contexts (e.g., "I recognize this kind of problem because I solved something similar in a game."). This second kind of value is a kind of analogical transfer. This approach fundamentally considers games as systems, and considers the possible benefits or learning from games to be a consequence of mastering those underlying systems. This perspective also allows for the possibility of presenting a covert lesson, in which someone might

learn a relationship from game mechanics and apply it to their interaction with a novel system without ever making that understanding explicit. Games may be uniquely suited to examining this possibility, because a message can be embedded in game mechanics and interactions rather than explicitly stated via instructions or narrative.

Transfer from Metaphorical Language

Research on the influence of metaphorical language provides a contrast with that on analogical transfer. Where, as we have seen, it is difficult to get analogical transfer to occur without explicit cues, research on the influence of metaphorical language has found it to sometimes have an unexpected and unconscious influence (Barsalou, 2010; Lakoff, 1987; Lakoff & Johnson, 1980). The embodied cognition argument attempts to explain these findings by stating that all thought is ultimately metaphorical, unless it is directly grounded in bodily experience. According to this perspective, there is in fact no ordinary language without metaphorical content, and we cannot avoid being influenced by the metaphorical content of ordinary language, which continues to influence our thoughts and actions even when we are not consciously aware of it (Lakoff & Johnson, 1999). Previous studies have found that metaphors used in natural language can covertly influence reasoning.

For example, as mentioned above, if a newspaper article describes crime as a beast, or crime as a virus, readers will become more likely to align their policy preferences with those suggested by that metaphorical framing (Thibodeau & Boroditsky, 2011). This change in preferences happens even without any awareness

on the part of the readers of the metaphorical connection implied in the passage (Thibodeau & Boroditsky, 2013). If the thoughts and attitudes about complex and abstract ideas like crime are subject to the subtle influence of ordinary language choices, there is every reason to think that they might also be subject to influence of other systems that we interact with when a mapping is suggested.

Current Study

To investigate the psychological reality of rhetorical games, the current study builds on previous work that examined the covert influence of natural language metaphors on reasoning. We extend this work to examine the potential influence of interactive game systems. As in the metaphorical language study described above, we attempted to influence real world policy preferences related to crime and law enforcement. To provide context for these responses we also asked participants to play other games that critics have identified as good examples of procedural rhetoric, as well as a control game for comparison.

Research questions. In order to better understand the possible influence of rhetorical games, we asked four questions:

1. Will our participants identify a rhetorical game they play as containing an argument?
2. What argument will participants perceive, and how well will it match what we would have expected given our understanding of the game's intended procedural rhetoric?

3. Will playing a rhetorical game result in any change in the participants behavior or values, as it related to the game's content?
4. Does the influence of a rhetorical game depend on the player's understanding of the game's rhetoric?

While it is possible that participants will be aware of and influenced by the game they play in the course of this study, based on our understanding of analogical transfer from systems, and of the influence of metaphorical language, it also seems plausible that games will exert a covert influence on players. This has theoretical and practical implications, for both how we understand analogical transfer and for and for the analysis and development of meaningful games.

Method

Participants

Participants included 43 undergraduates enrolled in psychology courses, recruited from the UCSC subject pool, ranging from 18-33 years of age (M = 21.00, SD = 2.73) including 33 who identified as female (76.74%) and 8 who identified as male (18.60%). Slightly more than one third of participants identified as Latinx (n = 15, 34.88%), and slightly less than one third identified as Asian (n = 13, 30.23%) The remaining participants identified as White (n = 9, 20.93%), Multiethnic (n = 5, 11.63%), and Black (n = 1, 2.33%). Because of its potential relevance to the content of the persuasive games in this study we also asked participants to report their political identification at the end of the experiment. A slight majority of participants identified their political affiliation as Democrat (n = 26, 60.47%), with the remainder

roughly evenly divided between Republican (n = 4, 9.30%), Other (n = 4, 9.30%), and None (n = 5, 11.63%).

Materials

Games.

Crime Metaphor Game. For the present study, I developed a game with an intentional procedural rhetoric, which the researchers (myself and Chris Karzmark) referred to as our *Crime Metaphor Game*. This game was inspired in part by the board game "Pandemic" (Leacock, 2007), which included mechanics that modeled the spread of a "virus" through a network of cities, although the final version of the *Crime Metaphor Game* was substantially different in several ways (e.g., computer-based, single-player, with different rulesets for modeling the spread of crime).

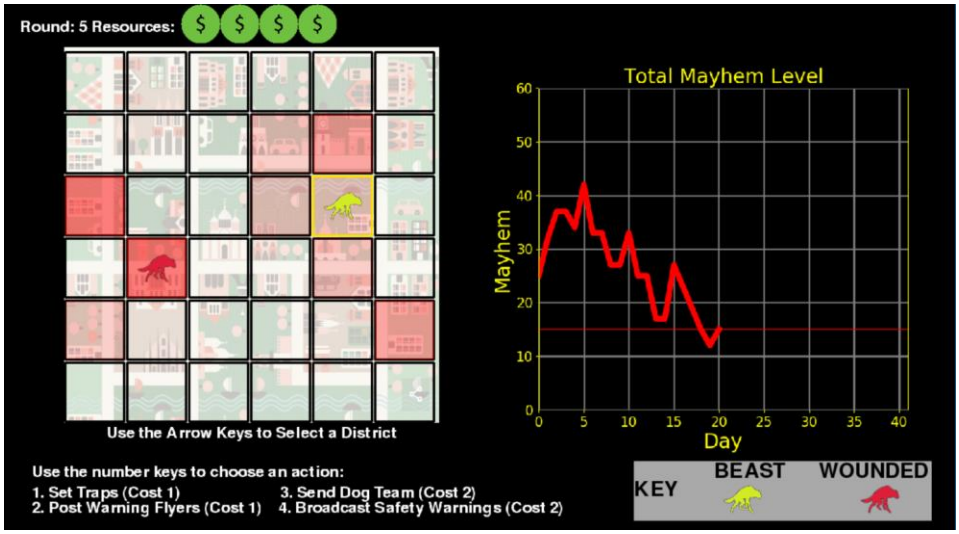

Figure 1. Crime Metaphor Game layout for the Beast version. See city map (left), feedback graph (right) and player actions (bottom left).

The intent, as in the language-based study described above (Thibodeau & Boroditsky, 2013) was to reinforce the concept of "crime as a disease." A second version of the game was also developed, with distinct mechanics, with the intent of contrasting with the "crime as a virus" version and to reinforce the concept of "crime as a beast." The game has been designed in such a way that it can be presented as managing either the spread of disease/beasts or the spread of crime (by a simple change in graphics and text) The "Beast" version and the "Virus" version have unique mechanics and themes, while the "Crime-as-a-Beast" and "Crime-as-a-Virus" versions of the game have different mechanics but an identical theme.

All game versions. Participants were presented with a grid representing a city on the left hand side of the screen (See Figure 1), where each square in the grid is one neighborhood. On the right hand side of the screen a chart tracks overall progress (virus/crime/mayhem level over time). Players can also see, based on the opacity of a red overlay, how bad the current problem is in each individual neighborhood. (Pretesting with one color impaired individual indicating these levels are visually distinguishable via non-color cues, though a more accessible design will be appropriate for future revisions.) The lower left hand side of the screen summarizes the four possible actions available to players, including a general description and resource cost. In each of the framings (crime, disease) these actions include two "prevention" type options (i.e., after school programs, or vaccinations) and two harsher "enforcement" type options (i.e., police raid, quarantine). While it is certainly possible to read these differences, the distinction between these types is not explicitly

presented to the player with any on-screen indicators. The game is played in a series of rounds, and each round ends once a player has spent all of their resources on actions. The game will not allow actions which have no impact on the city map (e.g., an action to remove crime from a neighborhood that is already at zero crime). Any such action will be met with an appropriate warning message, and player resources will not be spent. At the end of each round crime/disease/mayhem grows or spreads, based on the mechanics of the current game version. The game ends either after eight rounds, or (less frequently) as soon as the player has eliminated all crime/disease/mayhem from the city.

Comparison of game versions. The major mechanical differences between the "Virus" and "Crime-as-a-Virus" versions of the *Crime Metaphor Game* and the "Beast" and "Crime-as-Beast" versions of the game were in what player actions did (even when those actions had the same cost and description), and in how the current problem (Crime/Mayhem/Virus level) spread through the city.

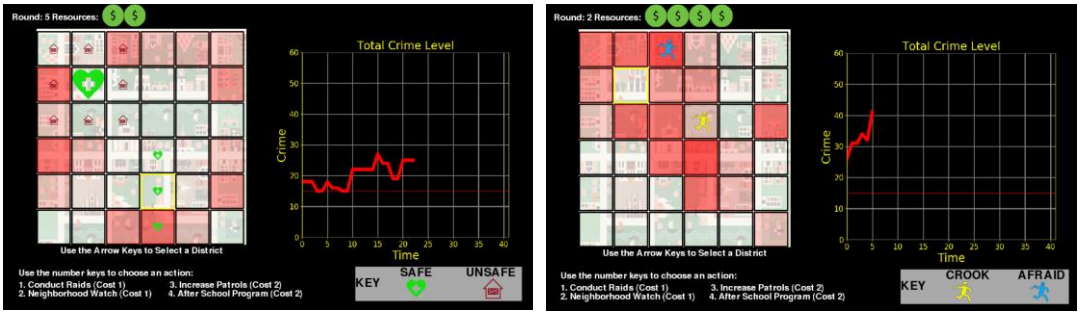

Figure 2. Example of the Crime-themed game versions with Virus (left) and Beast (right) mechanics.

In the “Virus” and “Crime-as-a-Virus” game versions, player’s “enforce” actions eliminated or reduced the problem in the targeted neighborhoods, at the cost of making them more likely to become worse on future turns. In contrast the “prevent” actions reduced the chance of any neighborhood becoming worse, but did nothing to mitigate current problems. Between player turns, a fixed amount of additional crime/virus would always appear, in random map locations. Independently, each of the neighborhoods that had been put at risk by an enforce action also had a small chance to become worse, which increased for each time they had been impacted by those actions.

Game Version	Mechanics	Theme
Beast	Beast	Beast
Virus	Virus	Virus
Crime-as-a-Beast	Beast	Crime
Crime-as-a-Virus	Virus	Crime

Table 1 Differences in theme and mechanics between versions of the *Crime Metaphor Game*. Note that the “Virus” version of the game was not included in this study.

In the “Beast” and “Crime-as-a-Beast” versions of the game, all crime or mayhem spread from beasts/crooks. Player enforce actions could either harm beasts/crooks (causing them to become wounded/afraid) or eliminate them entirely. However, these enforce actions would also make any neighborhoods they were conducted in worse. In contrast, prevention actions could reduce the problem level in neighborhoods, but would not have any effect on beasts/crooks. At the end of the

player's turn each beast/crook remaining would make the problem worse in their own neighborhood if possible, and possibly move on to an adjacent neighborhood if not. If the level of crime/mayhem in their current neighborhood was already at maximum, the beast/crook was guaranteed to move on.

Anticipated Rhetoric. While we acknowledge that each player's reading and interpretation of our *Crime Metaphor Game* might vary, we did create every version of the game with explicit rhetorical intent (See Table 2). We attempted to translate the metaphorical framings in the Thibodeau & Boroditsky (2013) study described above into their procedural rhetoric equivalents. We intended for players in the "Crime-as-a-Virus" version of our *Crime Metaphor Game* to see the game as making a pro-prevention argument, and for those in the "Crime-as-a-Beast" to see the game as making a pro-enforcement argument. This was achieved by varying the effectiveness of "prevention" and "enforcement" related moves between versions.

Based on our playtesting, the ideal play in the "Beast" or "Crime-as-a-Beast" version the *Crime Metaphor Game* was initial strong enforcement actions followed by small number of prevention actions. These versions of the game were winnable, and crime was a solvable problem. In contrast, the best outcome in the "Virus" and "Crime-as-a-Virus" *Crime Metaphor Game* versions was stability or slight improvement. In these versions of the game, no matter how well the player performed crime was always going to be present to some degree. While strong enforcement actions were also initially helpful, they also had a greater ongoing negative impact that outweighed these benefits. Differences in winnability and the consequences of

Game Version	Enforcement Action Names	Enforcement Action Effects	Prevention Action Names	Prevention Action Effects	Virus/Mayhem/Crime Spreads
Beast	Set Traps Send Dog Team	Harm/Remove Beasts Increase Mayhem	Post Warning Flyers Broadcast Safety Warnings	Reduce Mayhem	From Beasts
Virus	Restrict Travel Implement Quarantine	Remove Virus Make neighborhoods unsafe	Health Education Vaccination Clinic	Make neighborhoods safe	At Random More likely in unsafe Neighborhoods
Crime-as-a-Beast	Conduct Raids Increase Patrols	Harm/Remove Crooks Increase Mayhem	Neighborhood Watch After School Program	Reduce Crime	From Crooks
Crime-as-a-Virus	Conduct Raids Increase Patrols	Remove Crime Make Neighborhoods unsafe	Neighborhood Watch After School Program	Make neighborhoods safe	At Random More likely in unsafe Neighborhoods

Table 2. Differences in action names and effects between versions of the crime

ideal play were consistent with our rhetorical intentions. “Crime-as-a-Beast” implies that crime is an acute problem that can be definitively solved with enforcement actions. “Crime-as-a-Virus” implies that crime is a chronic problem, and while some choices can make things better or worse it does not have any permanent solution.

Extensive feedback that helped us in the development of this game was provided by game scholars and game creators. While the game was improved immeasurably based on this feedback, it is also important to note that these experts presumably had high levels of procedural literacy. Given our interest in the influence of rhetorical games on a more general audience, the success of our attempt should be evaluated based on our participant’s interpretations.

Other games. For comparison and contrast, other existing games were included in our study. These games included *September 12th* (Frasca, 2010), an example of a game (Treanor & Mateas, 2009) with a clear and explicit rhetorical purpose, *LIM* (Kopas, 2013), a minimalist abstract stealth game with an implied social message, which could be understood as ambiguously rhetorical, and a math puzzle game called *Threes JS* (Vollmer, Wohlwend, Hinson, & Li, 2014), as a non-rhetorical control.

September 12th. When the *September 12th* (Frasca, 2010) program is launched the player is presented with a messages stating that it is not a game, but a “simulation” or “simple model” that can be used to explore aspects of the war on terror. Consistent with this, the player is given no explicit goal and informed that the game does not have an ending. Illustrations on the left-hand side of the screen show

the players silhouettes of “terrorists” and “civilians.” After dismissing this dialogue, players see a city from above, bustling with activity. The mouse cursor becomes a target and a click will, after a brief delay, send down a bomb that destroys the city and any figures it lands on. Players can try to eliminate terrorists, but will inevitably cause civilian casualties. When other civilians come across those who have been killed, they will wail and mourn briefly, and then transform into additional terrorists. This game has been described as having “an easy to understand procedural message, making it an excellent point of entry for understanding procedural rhetoric” (Treanor & Mateas, 2009, p.5).

LIM. In *LIM* (Kopas, 2013) players use the arrow keys to move a block through a two dimensional maze. This is another game that does not give players an explicit goal, although they typically pick up on the only one afforded (trying to get to the end of the maze). The maze is inhabited by other blocks, which can violently push the player’s block around, and will impede progress if they become hostile. It’s possible to avoid this by holding a key to “blend in” while navigating around these blocks, which causes the normally multicolored player block to temporarily resemble one of the other block types that inhabits the maze However, blending in also causes the player to move more slowly, reduces the visible space of the map, and if the key is held for too long, the player will come to a complete stop. If they do manage to reach the end of the maze, the player is rewarded by meeting another block that exhibits the same multicolor pattern that they do, before the screen fades to black. *LIM* was described by a friend of the author as being about “the tension and violence and dread

and suffocation of passing" (Jenkins, 2013). The game has also been described by other critics as a metaphor for passing in a queer context, where the mechanics reinforce the idea that the effort of blending in is constant emotional labor (Chess, 2016). In a previous study, we observed that individuals who had to deal with conflicting social categories interpreted *LIM* as relating to their personal experiences (Anderson, 2017). Here *LIM* is included as an example of a possibly ambiguously rhetorical game.

Threes JS. In the game *Threes JS* players match number tiles on grid, attempting to achieve a high score before further moves become impossible. It is an abstract puzzle game, which was a precursor to and conceptual inspiration for the popular game *2048* (Cirulli, 2014). While it is possible to interpret any game rhetorically, for the purpose of this study *Threes JS* serves as a control in comparison to the more explicitly and intentionally rhetorical games described above.

Questionnaires.

Game Experience Questions. For all games we asked questions related to the game experience. This included asking the participant the degree to which they felt they understood and enjoyed the game they had just played, qualitative questions about their interpretation of the games' meaning, and responses to a scale intended to provide a more quantitative measure of their perception of the game's rhetorical content.

Qualitative game experience questions. For each game, all participants were asked what they thought the game was about, if they thought the game was making an argument, and to describe the argument that the game was making.

Rhetorical content scale. For the current study we also developed a scale intended to capture the degree to which player's perceived it as having rhetorical content, and the degree to which they perceived the game as being biased or reflecting a specific authorial intent. Example items included in the rhetoric content scale included "This game made an important point" and "The game I played was trying to teach me something." Example items in the authorial intent /bias scale included "The game I played was biased" and "The game I played was misleading." For the full scale, see Appendix B.

Game Specific Content Questionnaires. For each of the games with an intentional rhetoric we included questions in the pre-test and post-test that were related to our interpretation of the game's message. For the *Crime Metaphor Game* we adapted questions from the Thibodeau & Boroditsky study (2013) described above. This included questions that asked participants to rank the priority that should be given to several possible approaches to dealing with crime that could be categorized as more enforcement or prevention oriented (e.g., "Increase police patrols that look for criminals," and "Expand economic welfare programs and create jobs," etc.). We also asked participants how resources should be distributed between these priorities. Additionally, we adapted questions from existing questionnaires on attitudes toward crime (Carroll, Perkowitz, Lurigio, & Weaver, 1987) that looked for

individual vs. external attribution (e.g., “Once a criminal, always a criminal” vs. “Poverty and inequality in society are responsible for much of crime) and punitive vs. rehabilitative goals (e.g., “More emphasis should be placed on keeping criminals behind bars” vs. “If judges would divert more people from prisons into rehabilitation programs, there would be less crime.”)

For the *September 12th* game we adapted questions from an existing moral disengagement scale (Eckstein & Sparr, 2005), to measure the degree to which participants were willing to downplay or ignore moral concerns in the context of fighting terrorism. Participants were asked to indicate their degree of agreement with statements such as “In fast and clean military actions, central bases of hostile movements can be neutralized and collateral damage can be minimized,” “If extreme political groups are guilty of cruel crimes against humanity and serious human rights violations, they do not deserve to be treated sparely,” and “Terrorists are like pests in cornfields - one has to approach them relentlessly.”

For *LIM* we adapted questions about identity and conformity from an existing scale about multiracial challenges and resilience (Salahuddin & O’Brien, 2011). Because *LIM* can be interpreted to be about different aspects of identity (e.g., not only racial, but also gender, etc.), we made most of these questions more generic. For example, participants were asked to indicate their degree of agreement with “Generally, changing yourself to fit in with a group is harmful” and “I feel pressure to distance myself from a group to which I feel connected.” This resulted in a measure of anti-conformity attitude, and a measure of conformity related stress.

No separate scale was adapted in relation to *Threes JS*, because it was included as a control game without explicit rhetorical content. For the full contents of all game-specific questionnaires, see Appendix C.

Media Relationship Questions. Because we suspected that an individual participant's relationship to media, and particularly to games, might have a moderating effect on their perception of and reaction to a game's rhetoric, we also asked participants questions about this relationship. These questions were placed after all game play and responses to avoid any demand characteristics. Degree of agreement with statements such as "I think about the meaning of the games I play," and "When I'm playing a game, I just want to have fun." (reverse coded) were combined to create a measure of media criticality. We also asked participants to indicate the degree to which they identified as a "gamer" and for the number of hours each week they played any kind of (non-sports) games. For the full list of media relationship questions, see Appendix D.

Demographic Questions. The final questionnaire that players completed in this study asked them to provide their age, gender, ethnicity, and political affiliation. Participants were also asked if they were native English speakers. All demographic questions are included in Appendix E.

Procedure

Participants in this experiment played answered questions about themselves and their values before and after playing several rhetorical games, including the "Beast" version of the *Crime Metaphor Game*, followed by either the "Crime-as-a-

beast" (consistent) or the "Crime-as-a-Virus" (inconsistent) version (See Figure 3). The detailed procedure is described below.

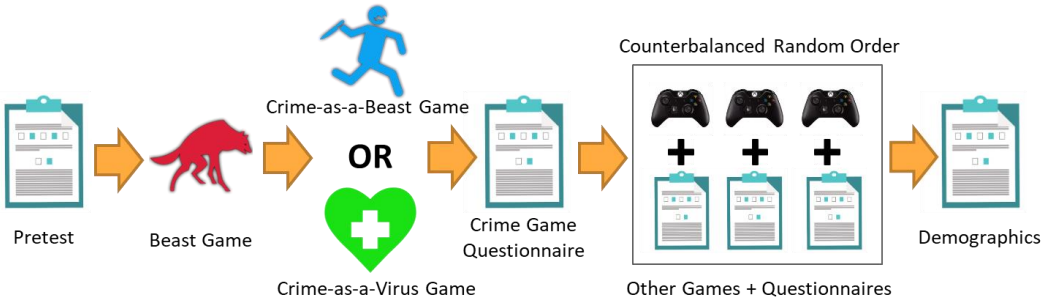

Figure 3. Summary of the experimental procedure.

There are two important caveats about this procedure. Another version of the study would have had players play only the Crime-as-beast or Crime-as-virus versions of the game. We did not do this for two reasons. First, because this was an initial investigation this procedure serves to make the rhetorical intent more explicit, and to make analogical transfer more likely. Secondly, we constructed the study this way because we anticipated that there might be interesting behavioral consequences in gameplay choices based on the initial game played. At time of writing, data collection with a comparison group, which begins with playing the "Virus" version of the game, is ongoing and will be part of a future analysis.

After arriving and providing informed consent, participants were asked to complete a battery of questionnaires to establish baseline values related to the topics of each of the games they were to play (e.g., attitudes towards policing and crime, terrorism, and conformity). The variety of question topics may have served to distract from the study's purpose. Following the completion of this general pretest, all

participants played the “Beast” version of the *Crime Metaphor Game* (beast framing and beast mechanics). Immediately after, participants were randomly assigned to play either the “Crime-as-a-Beast” (crime theming and beast mechanics) or the “Crime-as-a-Virus” (crime theming and virus mechanics) versions of the *Crime Metaphor Game*.

After completing the *Crime Metaphor Game* participants responded to a questionnaire about the game experience, and their attitudes toward strategies for dealing with crime (enforcement vs. prevention). After completing these game-related questions, all participants played other games that had been selected for their rhetorical content (*LIM*, *September 12th*, and *Threes JS*). The order that these games were presented in was counterbalanced across all participants to mitigate any order effects. The *Crime Metaphor Game* was not included in this counterbalancing due to time constraints, in order to ensure that the game we were primarily interested in was played by all participants. After playing each game participants responded to a questionnaire about the game experience and, for those games where it was relevant, to questions about their attitudes towards issues addressed by the game.

After playing all games and responding to the related questions, participants completed two final questionnaires, asking about their experience with and attitudes towards games and media in general, and for a variety of other demographic information.

Results

Our findings are organized around answering four questions: (1) Did our participants identify the game they played as containing an argument? (2) What

argument did participants perceive, and how well did it match what we would have expected given our understanding of the game's procedural rhetoric? (3) Did playing the game result in any change in the participants' behavior or values, as it related to the game's content, and if so (4) did this change depend on their understanding of the game's rhetoric? We are primarily interested in this in relation to the rhetorical *Crime Metaphor Game* that we created for this study, but have included responses to these questions for other rhetorical games, to establish an appropriate context for interpretation. We will consider each of these questions in turn.

Q1. Did the game contain an argument?

Crime Metaphor Game. After playing the *Crime Metaphor Game* participants were asked whether they felt the game that they had just played contained an argument. Most participants answered yes (n =33, 84.6%) to this question. As another way of evaluating how participants perceived a game's intended message, we also asked them to respond to questions intended to capture their reading of the game's rhetorical content. Overall, on a five point scale (Strongly disagree to Strongly agree), participants were more likely to agree than to disagree with statements that implied the game contained rhetorical content (M = 3.74, SD = .48).

Crime-as-a-Beast vs Crime-as-a-Virus. In interpreting the difference between the responses to the two versions of the game, it's important to remember that all participants played the "Beast" version before they were randomly assigned to play one of the two "Crime-as-a-X" versions. No questions were asked between these

games for both practical (working around time limitations) and theoretical (avoiding demand characteristics) reasons.

Most participants who played the “Beast and “Crime-as-a-Beast” versions also said yes when asked if the game was making an argument (n = 14, 82.4%). This was also true, to an even greater extent, for participants who played the “Beast” and “Crime-as-a-Virus” versions (n = 19, 90.5%), although a Chi-square test did not indicate that this difference in responses between the game versions was statistically significant, X^2 (2, n = 36) = 0.09, p = .759. We also did not detect a statistically significant difference in responses to our rhetorical content scale between participants who played the “Beast” and “Crime-as-a-Beast” games (M = 3.88, SD = .59), and those who played the “Beast” and “Crime-as-a-Virus” games (M = 3.63, SD = .34), t(37) = 1.59, p = .108, 95% CI: [-.07, .57]. Given this lack of differences observed between game conditions, for comparisons between games in response to this question we will collapse across all version of the *Crime Metaphor Game*.

September 12th. Participants were asked, after playing *September 12th*, whether they felt that the game that they had just played contained an argument. The majority of participants answered yes (n = 37, 90.24%). Participants were also very likely to agree with statements that implied the game contained rhetorical content (M = 3.79, SD = .99).

LIM. After playing *LIM*, participants were asked whether they felt that the game that they had just played contained an argument. The majority of participants indicated that they felt that the game contained an argument (n = 24, 60.00 %),

although it was a smaller majority than for the games above. Participants were also more likely than not to agree with statements that implied the game contained rhetorical content (*M* = 3.26, *SD* = .97).

Threes JS. As with the other games, participants were also asked to report if they felt that *Threes JS* contained an argument. Here, as we expected, only a minority of participants indicated that they felt that it did (*n* = 2, 5.26%). Similarly, participants were unlikely to agree with statements that implied that the game contained rhetorical content (*M* = 1.67, *SD* = .66).

Comparison across games. Looking across all games, we saw that participants generally perceived an argument in those games that we understood to be explicitly rhetorical (See Table 3).

Game	Did this game contain an argument? (% Yes)	Rhetorical Content Score (Low 1 to High 5)	
		Mean	SD
Crime Metaphor Game	84.60	3.74	.48
September 12th	90.24	3.79	.99
LIM	60.00	3.26	.97
Threes JS	5.26	1.67	.66

Table 3. Summary of responses to research Q1, "Did the game contain an argument?"

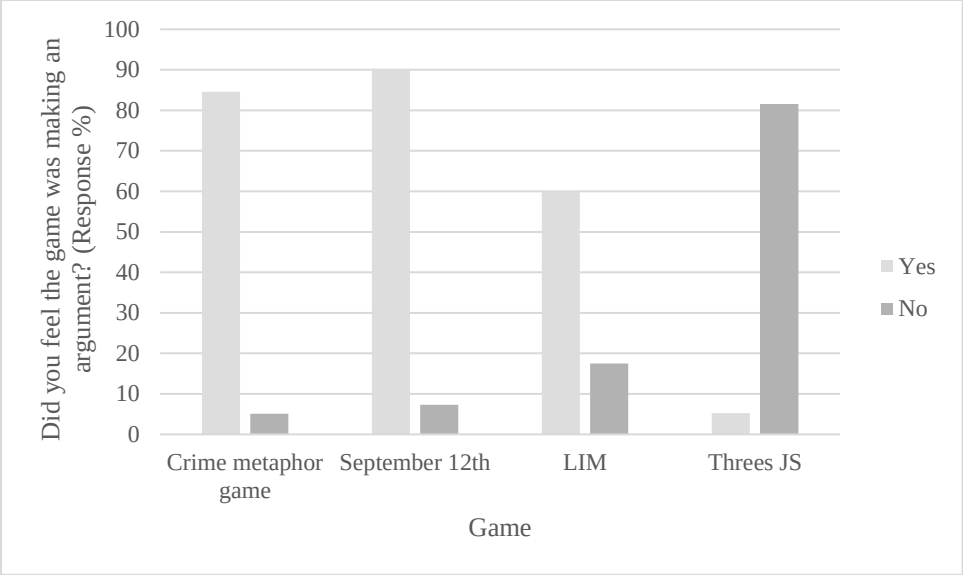

Figure 4 Responses to "Did you feel like the game was making an argument?" by game.

A within-subject ANOVA indicated that overall there were significant differences between the rhetorical content score across all games, $F(1,31) = 151.46$, $p<.001$ (See Figure 4). Post hoc tests indicated that rhetoric content score was significantly lower for *Threes JS* than for the *Crime Metaphor Game*, $t(34) = 16.24$, $p <.001$, for *September 12th*, $t(35) = 11.26$, $p <.001$, and for *LIM*, $t(35) = 8.64$, $p <.001$. They also indicated that the rhetorical content score was significantly lower for *LIM*, than for the *Crime Metaphor Game*, $t(36) = 2.9$, $p = .005$ or for *September 12th*, $t(38) = 2.99$, $p =.005$. This means that in terms of perception of rhetorical content, *LIM* ranks below our *Crime Metaphor Game* and *September 12th*, and above *Threes JS*. We did not observe a significant difference between the perceived rhetorical content of our *Crime Metaphor Game* and *September 12th*, $t(36) = .10$, $p = .925$. Given that *September 12th* has been described as an excellent entry point for understanding

procedural rhetoric (Treanor & Mateas, 2009), this is exactly where we want our explicitly rhetorical game to rank.

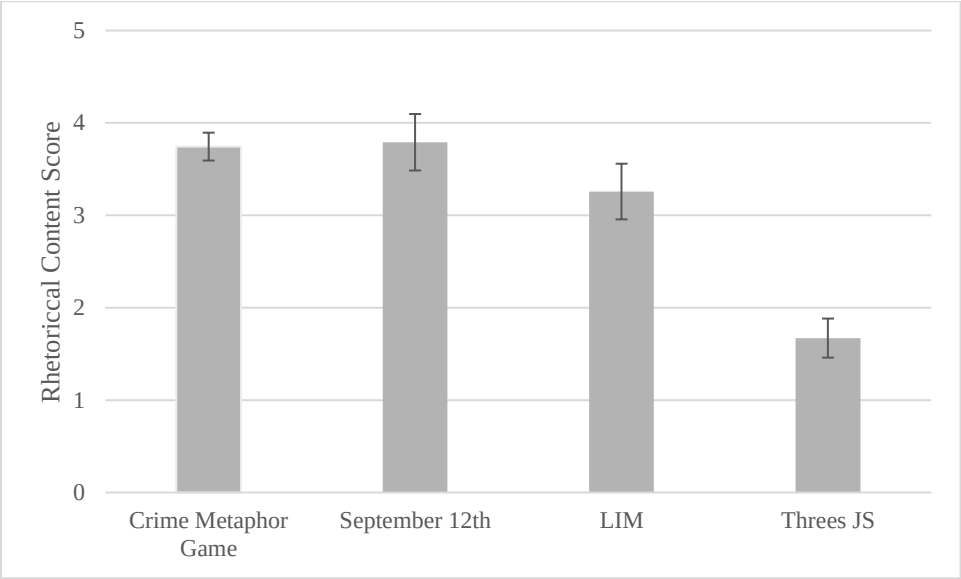

Figure 5. Rhetorical content scale score by game. Note: Error bars are 95% confidence intervals.

Q2: What argument did participants perceive from the game, and how well did it match our understanding of the game's intended procedural rhetoric?

Crime Metaphor Game. For each game, we asked participants to respond to two prompts, "What was the game about?" and "What argument was the game making?" All responses were then coded into categories, generated using a grounded theory based process (Glaser, 1992). For each question, some categories were shared across all games, and some categories applied only to specific games. Similarly, some categories appeared in responses to both questions, while others appeared only in response to the meaning or argument question. Each response was coded for whether it belonged in each category, independently. For example, one response was "If trying

to educate people about crime early it could lessen the amount of crime happening, but if doing so late, more police involvement will need to happen" which was coded as being in the pro-prevention category and also coded as being in the pro-enforcement category. Responses were coded by three to five independent raters, and any categories that achieved less than 80% inter-rater agreement were dropped from the analyses. Our analyses below are focused on responses to the "What argument was the game making?" question, since those responses are more directly applicable to our research question.

Category	Example Responses
Pro-prevention	"Increase education and community involvement" "Making more after school programs for kids to spend their time doing more productive activities is what keeps that neighborhood safe"
Pro-enforcement	"creating reform programs isn't as good as increasing patrols" "more enforcement leads to safety"
Anti-enforcement	"Harsher tactics do not work" "increasing raids and police activity actually makes the neighborhood unsafe"
Balance	"It was trying to persuade how safer it will be using certain methods to decrease the rate of crime, however they cost more." "there needs to be a balance of what types of fights to fight in certain cities"

Table 4. *Crime Metaphor Game* "What argument was the game making?" qualitative response categories.

For the *Crime Metaphor Game*, response categories for the argument question included pro-prevention, pro-enforcement, anti-enforcement, and balance (See Table 4). The identified categories were generally consistent with our intended interpretation of the *Crime Metaphor Game*. Arguments for balance are one possible exception.

Crime-as-a-Beast vs Crime-as-a-Virus. Comparing the two versions of the game, there were quantitative differences in the number of responses coded into each category between the game versions (See Figure 6), although these differences were minor. Tentatively, it appeared that players of the "Beast" and "Crime-as-a-Virus" versions of the game were more likely to see the game's argument as pro-prevention

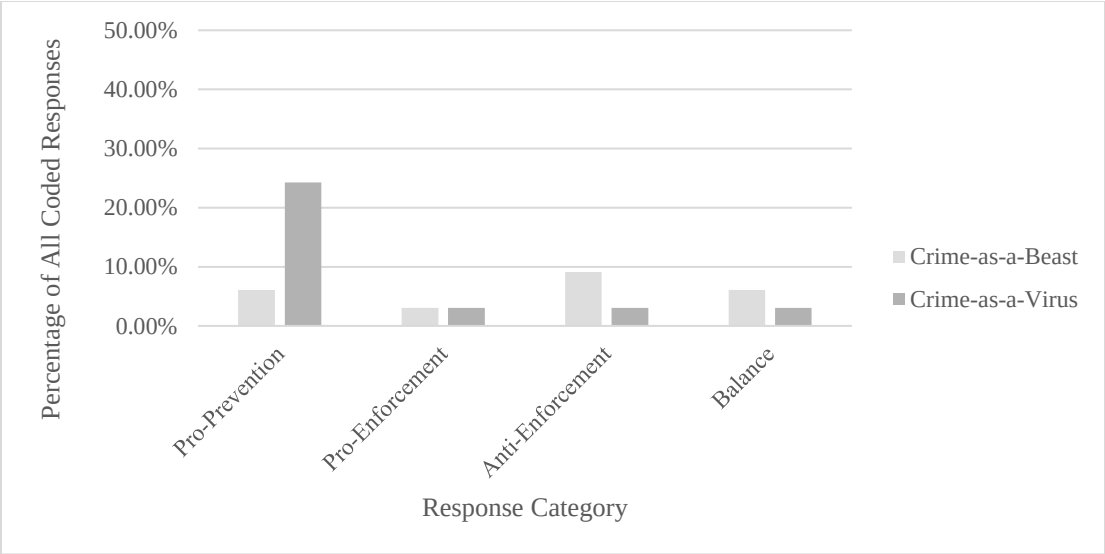

Figure 6. Comparison of argument category response counts between the "Beast" and "Crime-as-a-Beast" game versions and the "Beast" and "Crime-as-a-Virus" game versions.

(24.24%) than players of the "Beast" and "Crime-as-Beast" versions (6.06%). This is consistent with the rhetoric we intended for that game version.

September 12th. For *September 12th* the generated categories included civilian deaths, the cycle of violence, unintended consequences, and the futility of war (See Table 5). All identified categories were consistent with our understanding of the intended rhetoric of *September 12th*. Overall the most common response category was civilian deaths (58.82%). This was followed by cycle of violence (38.24%) and unintended consequences (35.29%). The fewest responses were coded as being about the futility of the war on terror (26.47%), (See Figure 7).

Category	Example Responses
Civilian Deaths	"It is very difficult, if not impossible, to avoid civilian casualties when attempting to combat terrorism" "There could be innocent lives that are involved."
Cycle of Violence	"Preemptive strikes are a horrible measure that only make a problem worse" "Violence will only lead to more violence"
Unintended Consequences	"no matter what you choose to do there will be consequences" "The military force, inevitably has a negative impact on innocent people"
Futility of War	"War does more harm than good" "There really is no safe and secure way to have no innocent casualties."

Table 5. *September 12th* "What argument was the game making?" qualitative response categories.

The lowest category response count for *September 12th* was higher than the highest category response count for our *Crime Metaphor Game*. Perhaps this is because of the clarity of *September 12th*'s procedural rhetoric.

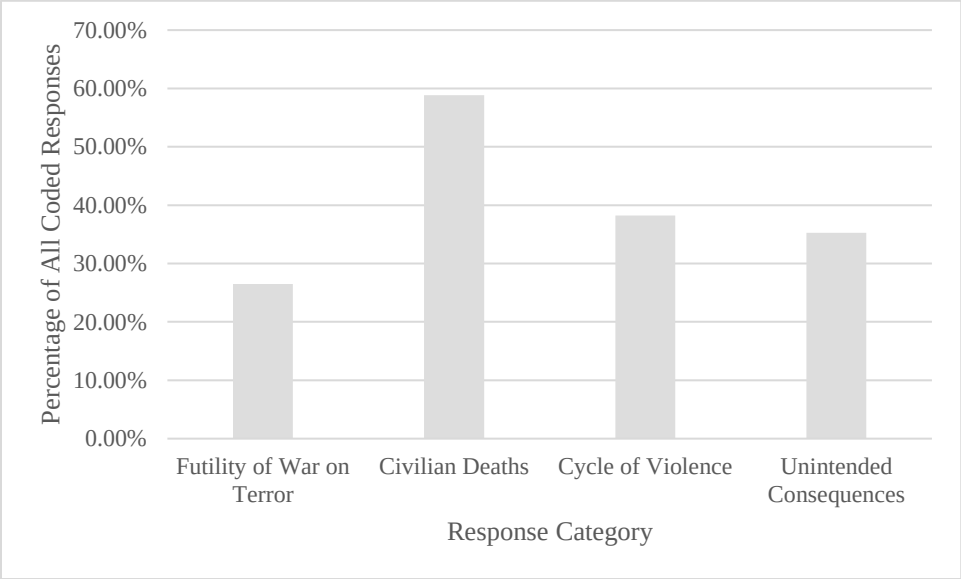

Figure 7. September 12th argument category response counts.

LIM. For *LIM*, the generated categories included the necessity/benefits of conforming, that conformity can induce stress/harm, an encouragement of individuality, and an acknowledgement of the power of peer pressure (See Table 6). There categories do appear to be consistent with the intended rhetoric of *LIM*, though perhaps they are missing an explicit reference to violence. The biggest surprise here was the high response count for the necessity/benefits of conforming (44.00%) in contrast with the lower response count for the encouragement of individuality (16.00%), (See Figure 8).

Category	Example Responses
Necessity/Benefits of Conforming	"That you need to blend in to get through certain parts of your life." "Sometimes you need to blend in for certain situations"
Conformity Induces Stress/Harm	"Trying to blend in and becoming something you're not causes a lot of pressure on the individual" "trying to fit in can have a damaging effect, especially once you get found out"
Encouragement of Individuality	"It was trying to persuade people...You should not hide who you are." "Hiding yourself to match with others is a process that shouldn't be done"
Power of Peer Pressure	"People are pressured to change their image to fit what a group finds acceptable or tolerable." "there are individuals out there who change to fit in"

Table 6. *LIM* "What argument was the game making?" qualitative response categories.

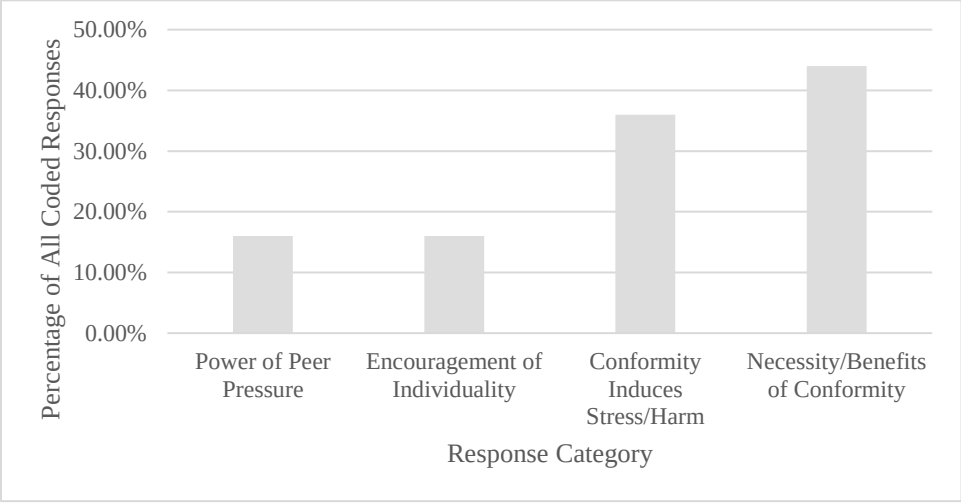

Figure 8. LIM argument category response counts.

Q3/4. Did playing the game result in any change in the participants behavior or values, as it related to the game's content? Did any change in player's behavior or values depend on their understanding of the game's rhetoric?

"Beast" and "Crime-as-a-Beast" vs "Beast" and "Crime-as-a-Virus" influence on attitudes towards criminality and prevention/enforcement policy preferences.

We conducted an ANOVA comparing differences general view on criminality (e.g., agreement with statements such as "once a criminal, always a criminal") before and after playing the *Crime Metaphor Game*, comparing between participants who played the "Beast" and "Crime-as-a-Beast" game versions, and participants who played the "Beast" and "Crime-as-a-Virus" game versions. We observed no interaction, $F(1,35) = .019$, $p = .891$, and no main effect of time (Pre: $M = 1.95$, $SD = .85$, Post: $M = 1.97$, $SD = .89$), $F(1,35) = .019$, $p = .891$, or of game version ("Beast" and "Crime-as-a-Beast": $M = 1.86$, SD = .15 , "Beast" and "Crime-as-a-Virus": $M = 2.05$, $SD = .14$) , F(1,35) = .865, $p = .359$ (See Figure 9). The inclusion of media criticality as a covariate did not change the significance of these results.

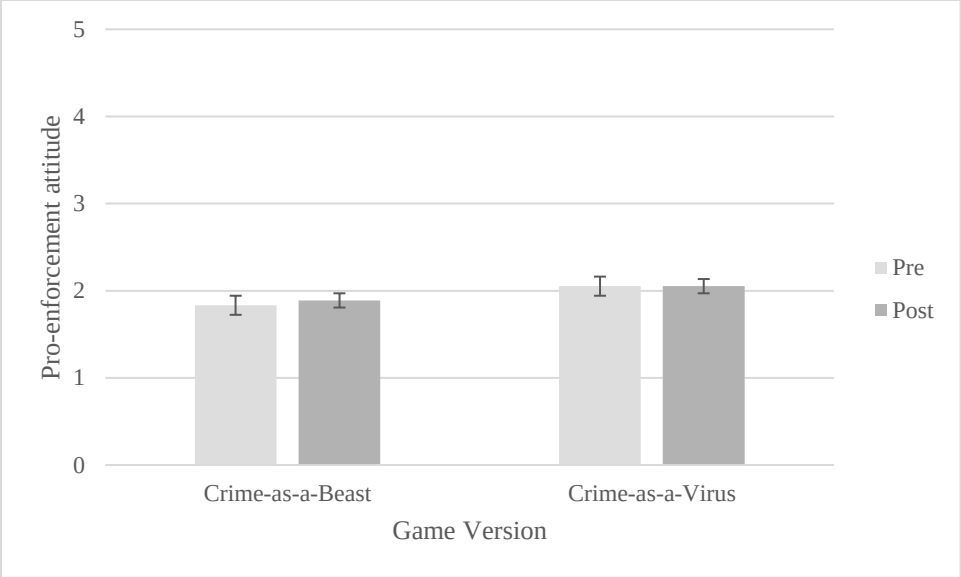

Figure 9. Pro-enforcement attitude before and after the *Crime Metaphor Game* for each game version.

Conducting a similar analysis, we did observe an interaction between time (Pre v Post) and game version ("Beast" and "Crime-as-a-Beast" v "Beast" and "Crime-as-a-Virus") on the amount of resources participants felt should be devoted to enforcement or prevention, $F(1,37) = 8.43$, $p = .006$. An analysis of simple main effects indicated that after playing the "Beast" and "Crime-as-a-Virus" game participants felt that more resources should be spent on enforcement (Pre: $M = 11.24$, $SD = 7.33$, Post: $M = 16.52$, $SD = 8.86$), $p = .003$, while there was no significant difference in resource allocation for who played the "Beast" and "Crime-as-a-Beast" versions, (Pre: $M = 11.55$, $SD = 12.49$, Post: $M = 9.72$, $SD = 7.57$), $p = 922$.

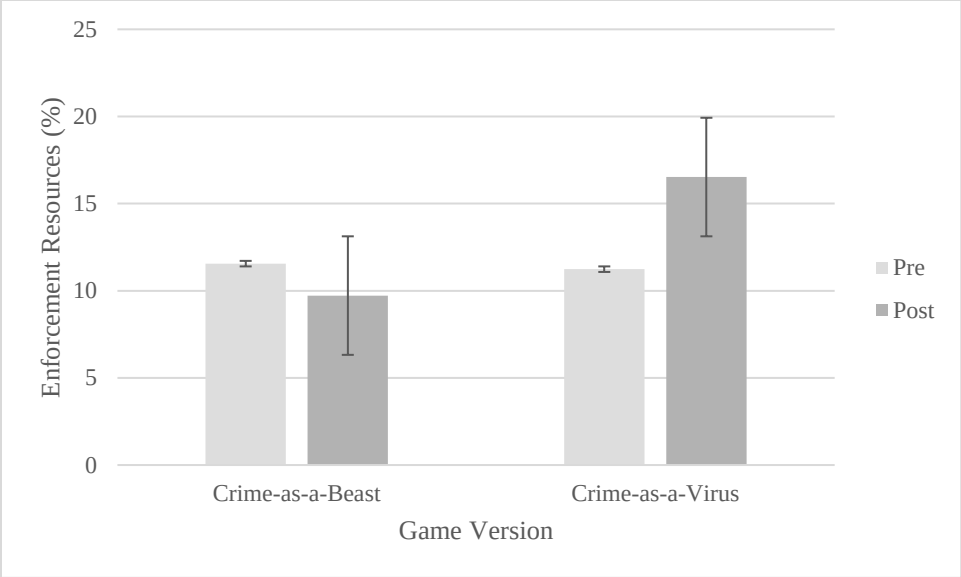

Figure 10. Resources allocated to enforcement before and after the *Crime Metaphor Game* for each game version.

Comparing ranking preferences for prevention/enforcement in the same way, we saw a significant interaction, $F(1,37) = 4.72$, $p = .036$, but no significant simple main effects. This is an unusual pattern of results, suggesting that the sum of sub-significant differences in each condition sums up to a significant result. Additional data collection will be necessary to clarify the nature of this interaction (See Figure 11), however at first glance it appears to suggest either that after playing the "Beast" and "Crime-as-a-Beast" games players are more likely to prefer prevention, after playing the "Beast" and "Crime-as-Virus" game players are more likely to prefer enforcement, or both.

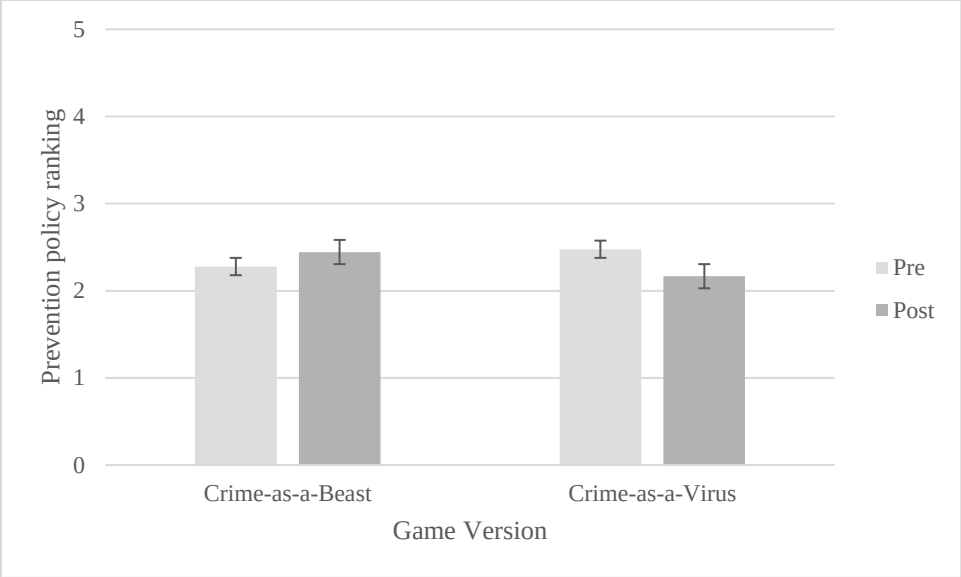

Figure 11. Crime prevention policy ranking before and after the *Crime Metaphor Game* for each game version.

September 12th influence on moral disengagement. For *September 12th*, playing game had a quantifiable impact on the participant's response to a values related question. Playing the game may have changed the player's mind in a way that was consistent with the games' intended message. Participants level of moral disengagement from the pretest (M = 2.90, SD = .81) was dropped after playing *September 12th* (M = 2.41, SD = .92), $t(38) = 3.73$, $p = .001$.

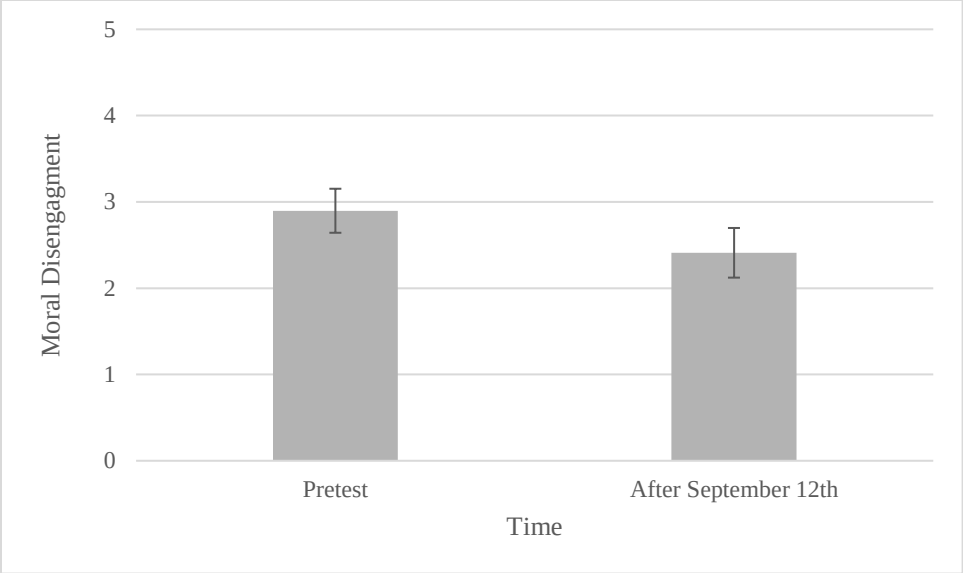

Figure 12. Moral disengagement for fighting terrorism before and after playing *September 12th*.

LIM influence on conformity/adaptation. Based on our interpretation of *LIM* we examined its influence on attitudes toward conformity generally and on participant's personal adaptation-related stress. We did not observe any significant difference in anti-conformity attitude before (M = 3.69, SD = .80) or after (M = 3.69, SD = .98) play, $t(38) < .001$, $p > .999$ (See Figure 13). Similarly, we did not observe any significant difference in self-reported conformity-related stress before (M = 1.81, SD = .89) or after (M = 1.94, SD = 1.05) play, $t(38) = 1.03$, $p = .308$, (See Figure 14).

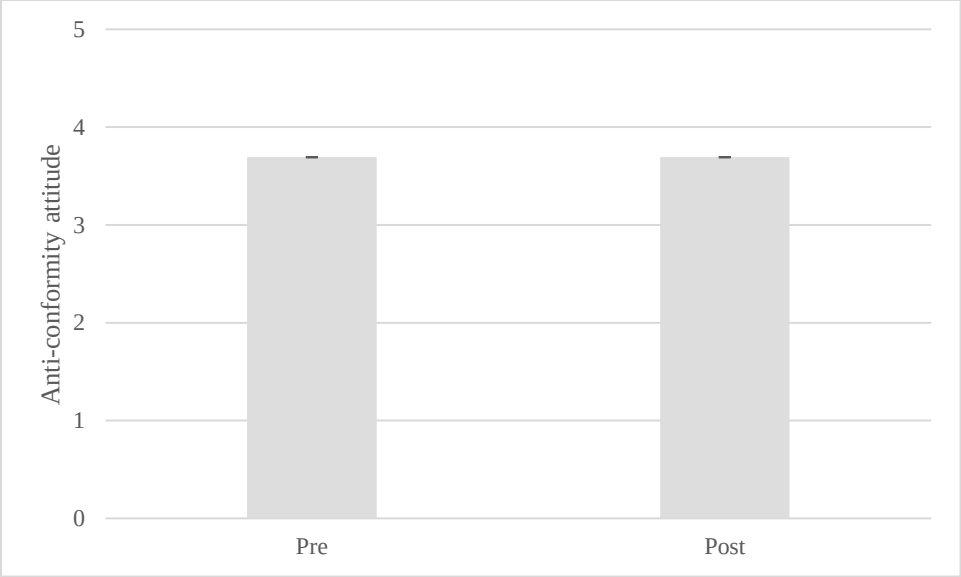

Figure 13. Anti-conformity attitude before and after playing *LIM*.

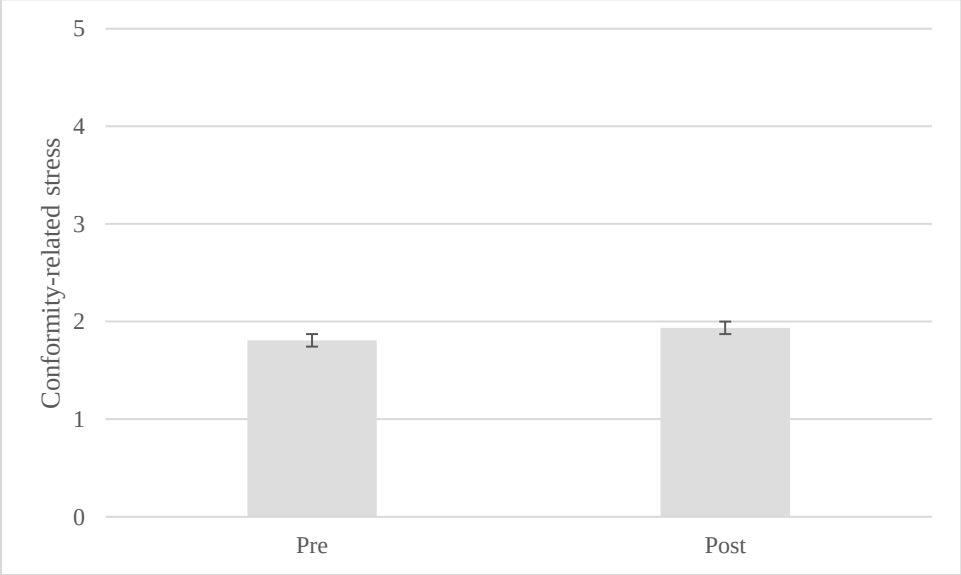

Figure 14. Conformity-related stress before and after playing *LIM*.

Discussion

We examined the psychological reality of the rhetorical content of games, examining individuals' awareness of and interpretations of a game's procedural rhetoric, as well as its influence on their attitudes and beliefs. Our initial results were promising, and they suggest many more questions to investigate.

Summary of Results

Our first research question asked if people would perceive persuasive games as having any rhetorical content, and we found that they did. This response confirmed our intuitions and was a necessary precursor for our other research questions. It also serves as an initial external validation for our novel scale of rhetoric content.

Our second research question asked if participants perception of the game's rhetoric matched what we expected. This was generally true as well. Participants were at least aware of the domain in which the game was arguing. The message of game that we created to argue for prevention (vs. enforcement) in dealing with crime was understood. Our biggest surprise here was from the abstract rhetorical game *LIM*, which many participants said argued for the benefits of conformity. This is almost the exact opposite of what we understood the game to be about. Perhaps this different reading should be the expected impact of taking a very abstract message game out of context.

Our third research question asked if our *Crime Metaphor Game's* argument could influence attitudes and values outside of itself. Here our results were much more mixed. While we found little to no impact on several measures, in at least one

case we saw an impact in the opposite direction we would have expected. Participants who played a game intended to make the case for crime prevention ended up convinced that more resources should be spent on enforcement. In contrast, the other rhetorical games that we included in this study had their intended impact (or none at all).

Challenges and Limitations

There are two important limitations to note here. First, because we used language and mechanics together, we cannot definitively say that the influence of our *Crime Metaphor Game* was not partially influenced by prior linguistic associations. Secondly, unlike the purely language-based study that inspired us (Thibodeau & Boroditsky, 2013) we did intend for our participants to be explicitly aware of our *Crime Metaphor Game*'s arguments. Both choices were made because this is an initial study, and we hope that future work can explore the persuasive impact of purely mechanical differences and the distinction between awareness and influence.

There are at least two major challenges to this kind of work. The first is that any message in the mechanics of a game is also embedded in all the other specifics. No matter how abstract, an interactive game will have a certain appearance, and a certain set of affordances. There is no way to make all those elements of the game neutral. Experiment is arguably the best answer to this challenge, holding as much of the game experience as possible constant while trying to isolate and vary only the feature we are interested in. The second related challenge is that the understanding of that message is an interactive process that depends on making a particular reading,

which is dependent on the player's previous experiences, attitude, and other factors outside the experimenter's control. The best answer to this challenge is going to depend on both maintaining good control of the context, and making good estimates of which individual differences are most likely to be relevant.

In retrospect, there was a mismatch between the intended and actual meaning of the games created for the study. From observation, the optimal strategy for the Beast or Crime-as-a-Beast game versions was to frontload enforcement actions, removing the source of crime/mayhem, and spend the rest of the game cleaning up with prevention actions. In the Crime-as-a-Virus game, with no way to remove the source of crime/virus, the optimal strategy was to carefully balance actions between enforcement and prevention. The latter strategy was more difficult to discover than the former. Neither strategy can simply be reduced to a pure pro-prevention or pro-enforcement argument, and the mixed results on simpler questions may reflect this complexity.

Implications and Future Directions

There are several ways that we can building on the present study. Now that we have a clearer understanding of how participants perceived our *Crime Metaphor Games*'s rhetoric, we might include measures that are appropriate to those interpretations. Participants in the present study also experienced two versions of our rhetorical game before we evaluated its impact. The tradeoff for not including measures between games was avoiding demand characteristics, but the cost was an

inability to tease apart the impact of one version of our *Crime Metaphor Game* from another.

While we may not have been able to tease apart the exact nature of our *Crime Metaphor Game*'s influence, we did observe that it had an impact on some of our participant's perceptions. This is more effective than typical examples of analogical transfer, which usually require explicit cues to encourage participants to link source and target domains, and should continue to be investigated. We took several measures of player performance during this game but had not developed an effective general plan for analyzing them. Perhaps an even closer look at the experience of playing the game could give additional insight into why players interpreted the game in an unexpected way. The addition of a comparison group which began with playing the "Virus" game version will simplify this analysis. This work expands how we understand analogical transfer, extending its reach from language to interactive systems (such as games or simulations). The variety of outcomes we observed are evidence for the value of conducting this kind of investigation, which has unique insights to offer those who seek to understand, evaluate, and create games. There is evidence for the psychological reality of procedural rhetoric, and that evidence calls for a critical approach that examines the impact of game systems with a variety of methods and perspectives.

References

Abt, C. C. (1987). *Serious Games*. University Press of America.

Anderson, B. (2017). *Preliminary Evaluation of the Procedural Rhetoric of LIM.* Unpublished poster, UC Santa Cruz.

Barsalou, L. W. (2010). Grounded cognition: Past, present, and future. *Topics in Cognitive Science*, *2*(4), 716–724.

Bogost, I. (2007). *Persuasive Games: The Expressive Power of Videogames*. The MIT Press.

Bruckman, A. (1999). Can educational be fun. In *Game developers conference* (Vol. 99, pp. 75–79).

Carroll, J. S., Perkowitz, W. T., Lurigio, A. J., & Weaver, F. M. (1987). Sentencing goals, causal attributions, ideology, and personality. *Journal of Personality and Social Psychology*, *52*(1), 107–118. https://doi.org/10.1037/0022-3514.52.1.107

Chess, S. (2016). The queer case of video games: orgasms, Heteronormativity, and video game narrative. *Critical Studies in Media Communication*, *33*(1), 84–94. https://doi.org/10.1080/15295036.2015.1129066

Cirulli, G. (2014). *2048 [Flash game]*. Retrieved from https://gabrielecirulli.com/2048

Colby, R. (2014). Writing and assessing procedural rhetoric in student-produced video games. *Computers and Composition*, *31*, 43–52.

Day, S. B., & Goldstone, R. L. (2011). Analogical transfer from a simulated physical system. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *37*(3), 551.

Detterman, D. K. (1993). The case for the prosecution: Transfer as an epiphenomenon. In D. K. Detterman & R. J. Sternberg (Eds.), *Transfer on trial: Intelligence, cognition, and instruction* (pp. 1–24). Westport, CT.

Devlin, K. (2011). *Mathematics education for a new era: Video games as a medium for learning*. CRC Press.

Doucet, L., & Srinivasan, V. (2010). Designing entertaining educational games using procedural rhetoric: a case study. In *Proceedings of the 5th ACM SIGGRAPH Symposium on Video Games* (pp. 5–10). ACM.

Dunbar, K., & Blanchette, I. (2001). The in vivo/in vitro approach to cognition: The case of analogy. *Trends in Cognitive Sciences*, *5*(8), 334–339.

Duncker, K., & Lees, L. S. (1945). On problem-solving. *Psychological Monographs*, *58*(5), i.

Eckstein, L., & Sparr, J. (2005). Introducing a new scale for the measurement of moral disengagement in peace and conflict research. *Conflict & Communication Online*, *4*.

Egenfeldt-Nielsen, S. (2011). What Makes a Good Learning Game?: Going beyond edutainment. *ELearn*, *2011*(2), 2.

Ferrara, J. (2013). Games for Persuasion: Argumentation, Procedurality, and the Lie of Gamification. *Games and Culture*, *8*(4), 289–304. https://doi.org/10.1177/1555412013496891

Frasca, G. (2010). *September 12th: A Toy World [Flash game]*. Newsgaming. Retrieved from http://www.newsgaming.com/games/index12.htm

Gaedes, O. (1975). *A simulation of the first year teaching* [PLATO]. University of Illinois: Control Data Corporation.

Gee, J. P. (2007). *What video games have to teach us about learning and literacy* (Rev. and updated ed). New York: Palgrave Macmillan.

Gee, J. P. (2013). *The Anti-Education Era: Creating Smarter Students through Digital Learning*. St. Martin's Press.

Gentner, D., Holyoak, K. J., & Kokinov, B. N. (2001). *The analogical mind: Perspectives from cognitive science*. MIT press.

Gick, M. L., & Holyoak, K. J. (1983). Schema induction and analogical transfer. *Cognitive Psychology*, *15*(1), 1–38.

Glaser, B. G. (1992). *Basics of grounded theory analysis: Emergence vs forcing*. Sociology press.

Hofstadter, D. R. (2001). Analogy as the core of cognition. *The Analogical Mind: Perspectives from Cognitive Science*, 499–538.

Holyoak, K. J., Holyoak, K. J., & Thagard, P. (1996). *Mental leaps: Analogy in creative thought*. MIT press.

Holyoak, K. J., & Koh, K. (1987). Surface and structural similarity in analogical transfer. *Memory & Cognition*, *15*(4), 332–340.

Jenkins, H. (2013). A Game Level Where You Can't Pass. Retrieved July 1, 2018, from http://henryjenkins.org/blog/2013/01/a-game-level-where-you-cant-pass.html

Kahneman, D. (2013). *Thinking, Fast and Slow* (1st edition). New York: Farrar, Straus and Giroux.

Kopas, M. (2013, June 5). Lim [online game]. Retrieved December 13, 2017, from http://www.gamesforchange.org/play/lim/

Lakoff, G. (1987). *Women, fire, and dangerous things: What categories reveal about the mind*. Chicago, IL: University of Chicago Press.

Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: University of Chicago Press London.

Lakoff, G., & Johnson, M. (1999). *Philosophy in the Flesh* (Vol. 4). New york: Basic books.

Leacock, M. (2007). Pandemic [boardgame]. Z-Man Games.

Loftus, G. R., & Loftus, E. F. (1983). *Mind at play; The psychology of video games*. Basic Books, Inc. Retrieved from http://dl.acm.org/citation.cfm?id=577988

Malone, T. W. (1981). Toward a theory of intrinsically motivating instruction. *Cognitive Science*, *5*(4), 333–369.

Mateas, M. (2005). Procedural literacy: educating the new media practitioner. *On the Horizon*, *13*(2), 101–111. https://doi.org/10.1108/10748120510608133

Mayer, R. E. (2014). *Computer games for learning: An evidence-based approach*. Cambridge, Massachusetts: MIT Press.

McGonigal, J. (2011). *Reality is broken: Why games make us better and how they can change the world*. New York: Penguin Press.

Novick, L. R. (1988). Analogical transfer, problem similarity, and expertise. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *14*(3), 510.

Perfetto, G. A., Bransford, J. D., & Franks, J. J. (1983). Constraints on access in a problem solving context. *Memory & Cognition*, *11*(1), 24–31.

Plass, J. L., Homer, B. D., & Kinzer, C. K. (2015). Foundations of game-based learning. *Educational Psychologist*, *50*(4), 258–283. http://dx.doi.org/10.1080/00461520.2015.1122533

Prensky, M. (2006). *"Don't bother me Mom, I'm learning!": How computer and video games are preparing your kids for twenty-first century success and how you can help!* (1st ed). St. Paul, Minn: Paragon House.

Salahuddin, N. M., & O'Brien, K. M. (2011). Challenges and resilience in the lives of urban, multiracial adults: An instrument development study. *Journal of Counseling Psychology*, *58*(4), 494–507. https://doi.org/10.1037/a0024633

Salter, A. (2016). Educational Games. In Henry Lowood and Raiford Guins (Ed.), *Debugging Game History: A Critical Lexicon* (p. 119). MIT Press.

Seiffert, J., & Nothhaft, H. (2015). The missing media: The procedural rhetoric of computer games. *Public Relations Review*, *41*(2), 254–263.

Sherry, J. (2015). Debating how to learn from games. In R. Kowert & T. Quandt (Eds.), *The Video Game Debate: Unravelling the Physical, Social, and Psychological Effects of Video Games* (pp. 116–130). Routledge.

Shuler, C. (2012). What in the World Happened to Carmen Sandiego? The Edutainment Era: Debunking Myths and Sharing Lessons Learned. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.362.5753

Simon, H. A., & Hayes, J. R. (1976). The understanding process: Problem isomorphs. *Cognitive Psychology*, *8*(2), 165–190.

Summerville, A., Martens, C., Harmon, S., Mateas, M., Osborn, J. C., Wardrip-Fruin, N., & Jhala, A. (2018). From Mechanics to Meaning. *IEEE Transactions on Computational Intelligence and AI in Games*, 1–1. https://doi.org/10.1109/TCIAIG.2017.2765599

Thibodeau, P. H., & Boroditsky, L. (2011). Metaphors we think with: The role of metaphor in reasoning. *PloS One*, *6*(2), e16782.

Thibodeau, P. H., & Boroditsky, L. (2013). Natural language metaphors covertly influence reasoning. *PloS One*, *8*(1), e52961.

Treanor, M., Blackford, B., Mateas, M., & Bogost, I. (2012). Game-o-matic: Generating videogames that represent ideas. In *Proceedings of the The third workshop on Procedural Content Generation in Games* (p. 11). ACM.

Treanor, M., & Mateas, M. (2009). Newsgames-Procedural Rhetoric Meets Political Cartoons. In *DiGRA Conference*.

Treanor, M., Schweizer, B., Bogost, I., & Mateas, M. (2011). Proceduralist Readings: How to Find Meaning in Games with Graphical Logics. In *Proceedings of the 6th International Conference on Foundations of Digital Games* (pp. 115–122). New York, NY, USA: ACM. https://doi.org/10.1145/2159365.2159381

Van Eck, R. (2006). Digital game-based learning: It's not just the digital natives who are restless. *EDUCAUSE Review*, *41*(2), 16.

Vollmer, A., Wohlwend, G., Hinson, J., & Li, A. (2014). *Threes JS*. Retrieved from http://threesjs.com/

Wardrip-Fruin, N. (2007). Three Play Effects–Eliza, Tale-Spin, and Sim City. *Digital Humanities*.

Wardrip-Fruin, N. (2009). *Expressive Processing: Digital fictions, computer games, and software studies*. MIT press. Retrieved from https://books.google.com/books?hl=en&lr=&id=rfZH_JzdKaQC&oi=fnd&pg=PR7&dq=expressive+processing&ots=VS2lN1NqSm&sig=ptlClkVVir3dV8cih48Ya2xeNnk

Wright, W. (1989). *SimCity*. Maxis.

Appendix A – Game Experience Questions

1. Did you enjoy playing the game?

   Not at all 1-2-3-4-5 Very Much

2. Did you feel that you understood what was going on in the game?

   Not at all 1-2-3-4-5 Very Much

3. What did you think the game was about?

   Free text response.

4. Did you feel that the game was making an argument?

   Yes / No / I don't know.

5. If you were asked to describe the argument the game was making, what would you say?

   Free text response.

6. Was it an argument you agree with?

   Yes / No / There was no argument.

7. Did you feel that the game had any influence on you?

   None at all 1 – 2 – 3 – 4 – 5 A substantial influence

8. I have played this game before.

   Yes / No / Maybe

9. If you have played a similar game, what was it?

   Free text response.

Appendix B - Procedural Rhetoric Scale

For the following questions, please indicate your degree of agreement with various statements:

1. The game was making an argument.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

2. The game I played was trying to teach me something.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

3. The game I played was biased.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

4. The game was misleading.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

5. The game made an important point.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

6. I considered a new perspective because of the game.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

7. The rules of the game were based on wrong ideas.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

8. The game rules captured an important truth.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

9. The rules of the game were created with a point of view.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

10. The game was convincing.

Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

Scoring: These questionnaire response were summarized in two scales. The first indicated the degree to which the participants perceived the game as being rhetorical. The second indicated the degree to which the participant perceived the game as an expression of the author's point of view.

PR Scale – PR Score: Average of responses to Q1, Q2, Q5, Q6, Q8 and Q10

PR Scale – Authorial Intent/Bias: Average of responses to Q3, Q4, Q7, and Q9

Appendix C – Game Specific Questionnaires

Crime Metaphor Game related questions:

1. How would you rank the following approaches to addressing crime? (please pick a different rank for each approach):
    a. Increase police patrols that look for criminals.
    b. Longer prison sentences for convicted offenders.
    c. Reform education practices and create after school programs.
    d. Expand economic welfare programs and create jobs.
2. Now, imagine that the city has given you a special fund of money to solve their crime problem. How would you split that money between the 4 approaches from before? Please answer in the form of a percentage (your 4 %s should add up to 100).
    a. How much money for "Increase police patrols that look for criminals."
    b. How much money for "Longer prison sentences for convicted offenders."
    c. How much money for "Reform education practices and create after school programs."
    d. How much money for "Expand economic welfare programs and create jobs."

Please rate the degree to which you agree with the following statements

3. More emphasis should be placed on keeping criminals behind bars.

    Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

4. If judges would divert more people from prisons into rehabilitation programs, there would be less crime.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

5. Poverty and inequality in society are responsible for much of crime.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

6. Once a criminal, always a criminal.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

September 12th related questions:

1. In fast and clean military actions, central bases of hostile movements can be neutralized and collateral damage can be minimized.
2. In the struggle for peace I find the use of military force justified if death of innocent people is avoided.
3. If extreme political groups are guilty of cruel crimes against humanity and serious human rights violations, they do not deserve to be treated sparely.
4. Terrorists are like pests in cornfields - one has to approach them relentlessly.

LIM related questions:

1. Generally, changing yourself to fit in with a group is harmful.
2. I hide parts of myself when interacting with some friends.
3. I feel pressure to distance myself from a group to which I feel connected.
4. I feel the need to prove my racial identity to others.

   Note: Q4 was omitted from the summary score because of its specific focus on racial identity.

Appendix D – Media Relationship Questions

1. I consider myself a gamer.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

2. How many hours a week do you play games? (including video games, phone games, board games, etc. Not including sports.)

   Free text response

3. When I'm playing a game, I just want to have fun.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

4. I often think about the meaning of the games I play.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

5. I like to approach media critically.

   Strongly Disagree 1 – 2 – 3 – 4 – 5 Strongly Agree

Scoring: To create a Media Criticality score for each participant we averaged responses from Q3 (reversed), Q4, and Q5.

Appendix E - Demographic Questions

1. What is your age (in years)?

   Free text

2. Are you a native English speaker?

   Yes / No / Other (free text)

3. What gender do you identify as?

   Free text

4. What is your ethnicity?

   Free text.

5. What is your political affiliation?

   Democrat / Republican / Other (free text)