Lost in Translation:
Comparing the Impact of an Analog and Digital Version of a Public Health Game on Players' Perceptions, Attitudes, and Cognitions

Geoff F. Kaufman, Tiltfactor Laboratory, Dartmouth College, Hanover, NH, USA

Mary Flanagan, Tiltfactor Laboratory, Dartmouth College, Hanover, NH, USA

ABSTRACT

In light of a growing body of work demonstrating the ability of games to transform cognitive skill sets and change attitudes toward social issues, including in public health, it is crucial to understand the potentially divergent experiences and outcomes afforded by analog and digital platforms. In a recent empirical study, the authors addressed the basic question of whether transferring a public health game from an analog to a digital format would impact players' perceptions of the game and the efficacy of the game for stimulating changes to beliefs and cognitions. Results revealed that the digital version of the game, despite being a nearly identical translation, was perceived by players to be more complicated than the analog version and, consequently, was less effective at facilitating learning and attitude change. The authors propose several explanations for this finding, based on psychological theories, to help elucidate critical distinctions between non-digital and digital game play phenomenology.

Keywords: *Analog Game, Communicable Diseases, Digital Game, Public Health, Systems Thinking, Vaccination*

INTRODUCTION: GAMES AS TOOLS FOR STIMULATING SIGNIFICANT LEARNING AND ATTITUDE CHANGE

There has been growing enthusiasm among members of both learning science and game studies communities surrounding the notion that games can encourage a significant shift in players' thinking and empower them with a plethora of new cognitive skills. One perspective that has gained particular traction in this regard is the argument that games can effectively facilitate a 'systems thinking' approach to real-life issues: that is, games can equip players with a greater understanding of, and appreciation for, the interrelationships that exist between the individual elements of a system. To illustrate, Zimmer-

DOI: 10.4018/jgcms.2013070101

man (2007) has suggested that games have the capacity to instill a more advanced "systems literacy," one that "stresses the importance of dynamic relationships, not fixed facts." Similarly, Bogost (2007) claimed that games help players "learn to reflect on the natural or artificial design of systems in the material world," and Gee (2004) designated well-designed games as "learning machines," in part because they can facilitate systems thinking. Thus, in the games and learning literature, the argument that games can improve players' systems thinking aptitude has inspired noteworthy levels of consensus and empirical support.

Likewise, work done over the past decade has demonstrated that games can change players' attitudes and behaviors on important social issues. For example, Kato and colleagues' study of the video game *Re-Mission* showed that playing the game inspired higher levels of adherence to treatment plans among adolescent cancer patients (Kato, Cole, Bradlyn, & Pollock, 2008). Gustafsson and colleagues (2009) showed that a digital game that aimed to teach players about energy use inspired a significant long-term drop in household energy consumption among players of the game. In their meta-analysis of studies investigating the effects of playing games with pro-health content, Baranowski and colleagues (2008) showed that out of the 27 studies they reviewed, a majority demonstrated evidence of significant changes in players' pro-health attitudes and behaviors as a result of playing the focal games.

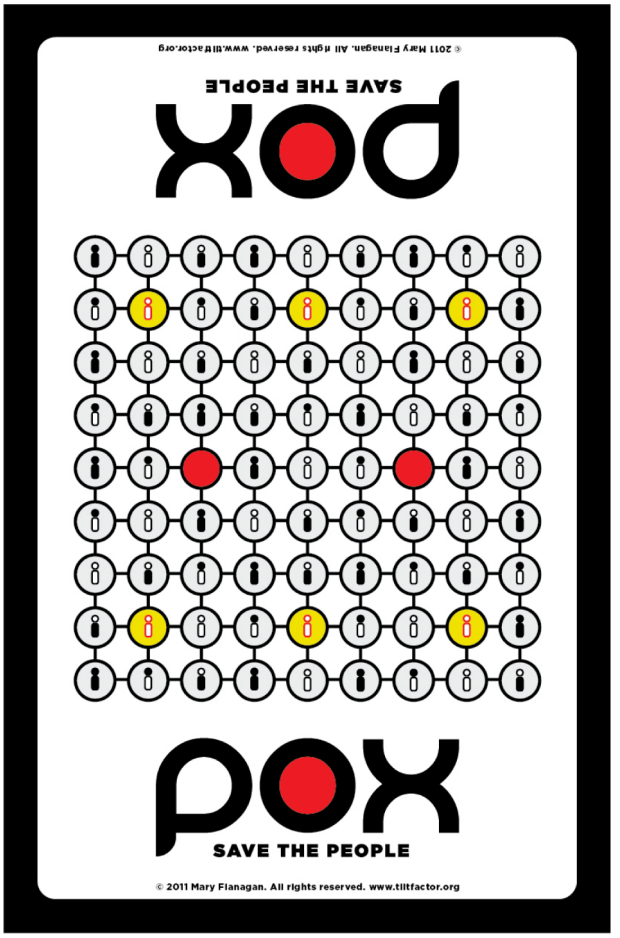
Prior work on the impact of games on cognition and behavior has been provocative, arguably even paradigm-shifting, but there is still much to learn about how designers can effectively model news ways of thinking or acting through their games or systems. One major unresolved issue is the basic distinction between analog and digital platforms – and the potentially divergent experiences and learning outcomes they offer players. As part of a recently completed empirical study testing the efficacy of a public health game, called *POX: Save the People*, created by our design laboratory (Kaufman, Flanagan, & Belman, under review), we sought to answer the fundamental question: does translating the same game from an analog to digital format influence players' perceptions of the game and/or impact the effectiveness of the game as a tool for inspiring changes to attitudes and cognition? And, if such cross-platforms differences were to emerge, to what could we attribute them? In this paper, we present the design of the analog and digital versions of *POX* and an overview of the research approach we employed to address these provocative questions. We then offer a set of explanations for the unexpected finding that the *digital* version of the game, despite being a nearly identical translation of the analog version, proved significantly less effective at facilitating learning and belief change.

THE HISTORY AND DESIGN OF POX: SAVE THE PEOPLE

In 2010, our game design laboratory was asked by the Mascoma Valley Health Initiative, a New Hampshire public health organization, to create a board game that demonstrates the role vaccines play in preventing the spread of disease, for use in classrooms and health fairs. The first game produced from this charge, *POX: Save the People* (2010), is played on a game board of 81 (9x9) spaces, with each space representing one person in a community in which disease has just begun to spread. At the start of the game, two people are infected with a disease; they are represented by red spaces near the center of the board. Six yellow spaces on the board represent people with susceptible immune systems (e.g. pregnant women, babies, individuals with HIV or AIDS, and people with cancer), who cannot be vaccinated and, thus, are especially vulnerable (see Figure 1).

The game proceeds as players alternate drawing cards from the *POX* deck, which reveal either that the disease has spread in a particular direction or that a random outbreak has occurred. Each card also allows players to deploy public

Figure 1. Game board for the analog of POX



health resources either to vaccinate a particular number of uninfected people or to cure a number of infected people on the board. Deaths occur when an infected person is surrounded on all possible sides by all infected people, or when the infection spreads to a vulnerable person on the board. Infections, vaccinations/cures, and deaths are represented by the placement of red, blue, and black chips, respectively, on the spaces on the board. The game is won if infected people on the board are surrounded entirely by vaccinated people, and the disease can no longer spread in any direction, before a pre-specified number of deaths have occurred. *POX* aims to demonstrate the rapidity with which disease can spread and increase players' appreciation for the effectiveness of vaccination for increasing "herd immunity," the effect whereby unvaccinated people are protected by the immunity of others in their population (John & Samuel, 2000). Moreover, by modeling and reinforcing how each individual's decision to be vaccinated or not can impact the health of specific others in a particular population, the game's mechanic is intended to promote an increase in players' systems thinking aptitude.

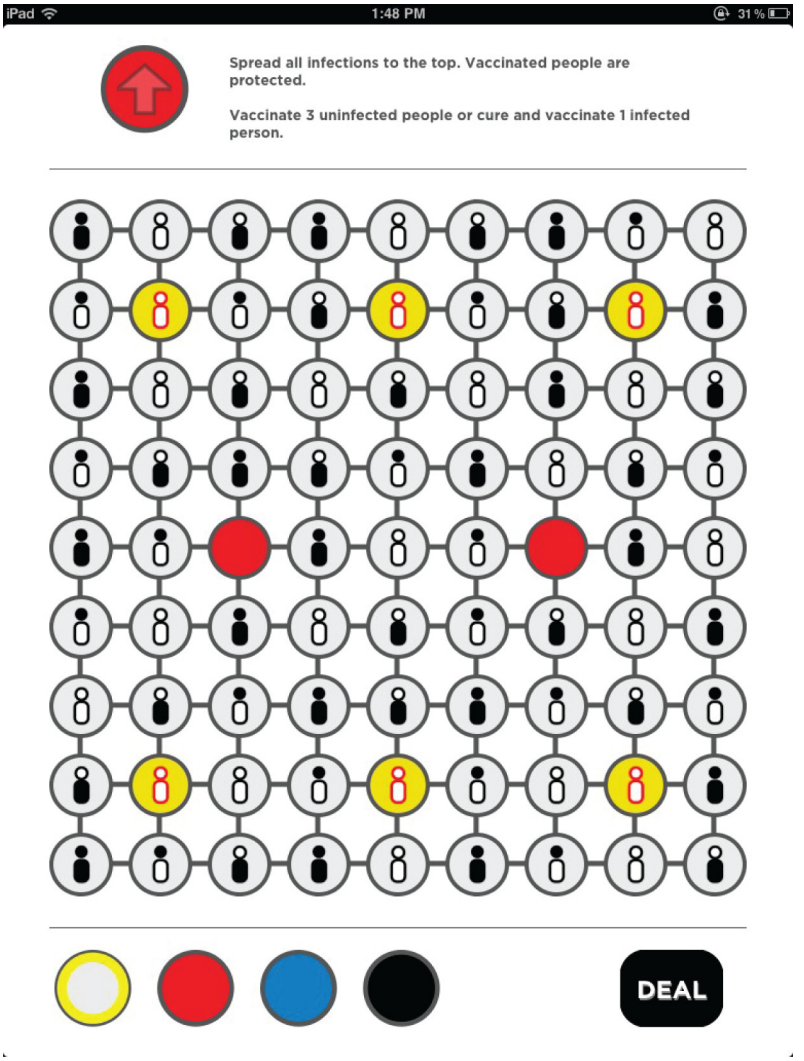
COMPARING THE ANALOG AND DIGITAL VERSIONS OF POX

As part of a multifaceted experimental study assessing the impact of *POX* (Kaufman, Flanagan, & Belman, under review), we randomly assigned a sample of twenty-six middle school and high school students from New England to play, in pairs, the original analog version of *POX* or a new digital version of the game we created for the Apple iPad. In designing and implementing the digital version of *POX* to be used in the study, we took great care to minimize any differences between the analog and digital versions of the game beyond those necessitated by platform (see Figures 1 and 2 for a comparison). Specifically, in place of the card deck from the analog version of *POX*, the digital version featured a "Draw" button, which players tapped to reveal the next event card, and displayed the card text at the top of the screen. Likewise, in place of the physical chips used in the analog version of the game, the digital version featured color-coded circles, which players tapped to select a particular chip type; players were then required to tap a particular space on the game screen to place an infection, vaccination/cure, or death. In addition, tapping a gray circle allowed players to "undo" the placement of a chip (e.g., in cases when players made errors in placing infections or reconsidered the spaces on which they wished to place vaccinations or cures). All other elements of game play – including the scripted rules read to participants by the experimenter and the sequence of cards drawn by players – as well as the experimental procedure were held constant to allow a fair and unambiguous comparison between the physical, analog version of the game and the digital, tablet-based version.

The results revealed that the analog version of *POX* instilled in players a greater appreciation for the value of vaccination (as assessed by a subjective valuation measure requiring players to allocate as much or as little of a $10,000 fund to either vaccinating uninfected citizens or curing infected citizens) and significantly improved players' scores on a validated measure of systems thinking aptitude (Sterman, 2002), compared to the baseline scores reported by participants in a no-game control group. In contrast, there was *no* evidence of significant attitude change or increased systems thinking aptitude among players of the digital version of the game. Furthermore, players of the digital version of the game rated the game as significantly more "complicated" on a post-game questionnaire than did players of the analog version of the game. To reiterate: this strikingly divergent pattern of results emerged despite the fact that, apart from the cosmetic differences noted above, the analog and digital versions of the game were essentially identical to one another.

This curious finding was not one that we hypothesized would emerge, and it begs the obvious question: why would translating the same game to a digital format, carefully crafted to maintain the rules and mechanic to be as close as possible to the original analog game, so significantly impact players' perceptions – and, consequently, reduce the effectiveness of the game as a tool for stimulating attitude change and learning? Next, we offer some alternative conjectures that might elucidate why the translation from analog to digital impacted players' subjective experience and perceptions of the game's complexity. The first set of explanations center on the general idea that analog and digital games may mentally activate, or prime, different mindsets or emotional states. We then explore the notion that analog and digital games encourage typical play styles that differ in their pace of play as well as their levels of between-player collaboration, discussion, and reflection. Finally, we discuss the possibility that the digital game we used in the study may have defied players' expectations about the features and mechanics that a digital game *should* contain – particularly ones that serve to facilitate game play in a digital format.

Figure 2. Game screen for the digital version of POX



Do Analog and Digital Platforms Activate Different Cognitive or Affective States?

The most basic explanation for the finding we reported would be that a digital platform by itself is more likely than an analog platform to activate, or "prime," concepts related to cognitive complexity. That is, most individuals may have formed a schematic representation of "digital" (or of "technology" more generally) that contains links to attributes such as "complex," "intricate," or, as our results suggest, "complicated." At the same time, perhaps most individuals' representation of "analog" contains links to such attributes as "uncomplicated" or "straightforward." Psychologists have shown that the traits or attributes that are incorporated

in individuals' schematic representations of categories (such as "analog" versus "digital") can be automatically – and subconsciously – activated upon exposure to a general category or a specific exemplar from that category (Bargh & Chartrand, 1999; Mandler, 1984; Rumelhart, 1980) and subsequently influence perceptions, judgments, and behaviors (e.g., Bargh, Chen, & Burrows, 1996; Higgins, 1996; Jacoby & Kelley, 1987). If, indeed, people are more inclined to link "digital" with "complex" and/or "analog" with "simple," this divergent associative pattern could explain why participants in our study reported perceiving the digital version of the game as more complicated than the analog version, despite the uniformity in the game elements between the two platforms.

A second, and related, possibility is that players may enter into analog and digital play experiences with different mindsets or affective states, which influence their judgments of game complexity. For instance, perhaps digital platforms stimulate heightened levels of arousal or an increased sense of urgency, whereas analog platforms, as a benefit of their greater familiarity and accessibility, may decrease player arousal and increase their level of relaxation and comfort. If so, one could argue that, particularly with a new game with a somewhat intricate set of rules and mechanics, the heightened arousal and urgency activated by a digital platform could serve to exacerbate the game's level of difficulty from players' points of view. Indeed, prior research in psychology has shown that increased arousal levels usually impair performance on novel or complex tasks (Lupien et al., 2007; Yerkes & Dodson, 1908). Given that the game of *POX* was both novel and subjectively complex in its rules and mechanics for our sample of participants, any additional arousal caused by the digital platform itself– and any lack of self-efficacy participants might have experienced in regard to their ability to navigate an unfamiliar form of technology – could explain both why players of the iPad version of the game perceived it to be more complicated as well as why they were less able to grasp the game's key concepts related to herd immunity and systems dynamics.

Do Analog and Digital Platforms Inspire Different Play Styles?

In addition to the possibility that analog and digital platforms activate different mindsets or emotional states, the two formats may also prompt different sets of mental "scripts" about the game play experience itself – scripts that, at least in the case of *POX*, were more conducive to comprehension and learning in the analog version of the game compared to the digital version. For instance, players of digital games, and users of technology more generally, may be more accustomed to solitary use (i.e., interacting with the technology without a fellow user or co-player alongside them) and a faster pace of action and information delivery requiring a lower level of sustained attention or concentration. In contrast, players of analog games are likely more inclined to expect an experience shared with at least one other player (and, consequently, one involving more between-player conversation) that is more slowly and deliberately paced. To the extent that thoughtful, meaningful deliberation and between-player collaboration are essential ingredients for successful game play with *POX*, these divergent play styles inspired by digital and analog games would explain why participants who played the iPad version of the game subsequently failed to demonstrate significant attitude change or improved systems thinking. Indeed, the analyses of the audio recordings of the game play sessions in our study revealed that participants who played the analog version of *POX* exhibited a longer average turn length and, during each turn, spoke aloud and to each other more often, than did participants who played the digital version of the game.

Did the Specific Game Play Experience We Provided Deviate from Players' Expectations of Digital Games?

In our study, we employed a digital version of *POX* that was admittedly – and intentionally – "bare-bones" in its design in order to facilitate a valid comparison between the analog and digital versions of the game. In fact, our team had previously produced a digital tablet version of the game replete with a number of advanced features (including the automatic placement of infections and deaths; a visual indicator highlighting all of the possible board locations for placing vaccinations and cures; and the use of audio cues and signals) that were removed from the game for purposes of the study. Perhaps by stripping the game of its veritable "bells and whistles," most of which serve to facilitate game play, we also took away components that players have come to expect from the typical digital game. As a result, participants who played the digital version of *POX* devised for the study may have perceived the game to be complicated because, essentially, the game they played *was* more complicated than what their preconceived notions of digital games would have led them to expect. In other words, the lack of in-game guidance and responsiveness may have led players to contrast their actual play experience with the experience they anticipated upon learning they would be playing a digital game.

CONCLUSION AND FUTURE DIRECTIONS

Going forward, we will seek to disentangle the alternative explanations we proposed above by subjecting them to systematic empirical tests. To measure individuals' schematic representations of "analog" versus "digital," for example, we can employ a *semantic priming* procedure, in which we subliminally expose participants to a particular word or image (such as the word "digital" or the image of a digital tool) and then, using a *lexical decision task*, measure their reaction time for judging a subsequent string of characters as words or non-words (Meyer & Schvaneveldt, 1971). To the extent that individuals implicitly associate "digital" with attributes such as "complicated," participants should be faster to respond to word strings that connote complexity than to neutral word strings after being primed with "digital" words or images (versus neutral words or images). Likewise, measuring participants' arousal and emotional states, as well as their perceived level of self-efficacy, upon learning that they will be playing an analog or digital game (or upon initial exposure to an analog or digital game) will allow us to determine the extent to which players go into an analog or digital game play experience in divergent physiological or psychological states. To assess the extent to which the significantly lower levels of attitude change and learning exhibited by players of the digital game in our study can be attributed to a play style marked by a faster pace and less between-player collaboration and discussion, we could instruct players of the digital game to adopt a slower, more deliberative style and determine the impact on players' beliefs and cognition. Finally, to evaluate the possibility that the digital game we used in our study violated participants' expectations of typical digital games, we could systematically compare the tablet version of the game from the study with versions that introduce additional features (such as in-game guidance for the placement of vaccinations) and measure the level of subjective complexity players of each version report. Taken together, this set of investigations will help elucidate what was "lost in translation" between the analog and digital versions of *POX* and, more broadly, provide valuable insights regarding the patterns of expectations, perceptions, experiences, and consequences evoked by digital and non-digital platforms.

REFERENCES

Baranowski, T., Buday, F., Thompson, D. I., & Baranowski, J. (2008). Playing for real: Video games and stories for health-related behavior change. *American Journal of Preventive Medicine*, *34*, 74–82. doi:10.1016/j.amepre.2007.09.027 PMID:18083454.

Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *The American Psychologist*, *54*, 462–479. doi:10.1037/0003-066X.54.7.462.

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology*, *71*, 230–244. doi:10.1037/0022-3514.71.2.230 PMID:8765481.

Bogost, I. (2007). *Persuasive games: The expressive power of video games*. Cambridge, MA: MIT Press..

Gee, J. P. (2004). Learning by design: Games as learning machines. *Interactive Educational Multimedia*, *8*, 15–23.

Gustafsson, A., Bång, M., & Svahn, M. (2009). Power explorer: A casual game style for encouraging long term behavior change among teenagers. In *Proceedings of the International Conference on Advances in Computer Entertainment Technology* (pp. 182-189). New York, NY: ACM.

Higgins, E. T. (1996). Knowledge activation: Accessibility, applicability, and salience. In E. T. Higgins, & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles*. New York, NY: Guilford Press..

Jacoby, L. L., & Kelley, C. M. (1987). Unconscious influences of memory for a prior event. *Personality and Social Psychology Bulletin*, *13*, 314–336. doi:10.1177/0146167287133003.

John, J. T., & Samuel, R. (2000). Herd immunity and herd effect: New insights and definitions. *European Journal of Epidemiology*, *16*, 601–606. doi:10.1023/A:1007626510002 PMID:11078115.

Kato, P. M., Cole, S. W., Bradlyn, A. S., & Pollock, B. H. (2008). A video game improves behavioral outcomes in. adolescents and young adults with cancer: A randomized trial. *Pediatrics*, *122*, 305–317. doi:10.1542/peds.2007-3134 PMID:18676516.

Kaufman, G. F., Flanagan, M., & Belman, J. (under review). *Can a game change how people think about public health? Lessons learned from the design and assessment of POX: Save the People*. Manuscript submitted for review.

Lupien, S. J., Maheu, F., Tu, M., Fiocco, A., & Schramek, T. E. (2007). The effects of stress and stress hormones on human cognition: Implications for the field of brain and cognition. *Brain and Cognition*, *65*, 209–237. doi:10.1016/j.bandc.2007.02.007 PMID:17466428.

Mandler, J. M. (1984). *Stories, scripts, and scenes: Aspects of schema theory*. Hillsdale, NJ: Lawrence Erlbaum Associates..

Meyer, D. E., & Schvaneveldt, R. W. (1971). Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. *Journal of Experimental Psychology*, *90*, 227–234. doi:10.1037/h0031564 PMID:5134329.

Rumelhart, D. E. (1980). Schemata: The building blocks of cognition. In R. J. Spiro, et al. (Eds.), *Theoretical issues in reading comprehension*. Hillsdale, NJ: Lawrence Erlbaum..

Sterman, J. (2002). All models are wrong: Reflections on becoming a systems scientist. *System Dynamics Review*, *18*, 501–531. doi:10.1002/sdr.261.

Yerkes, R. M., & Dodson, J. D. (1908). The relation of strength of stimulus to rapidity of habit-formation. *The Journal of Comparative Neurology and Psychology*, *18*, 459–482. doi:10.1002/cne.920180503.

Zimmerman, E. (2007). Gaming literacy: Game design as a model for literacy in the 21st century. *Harvard Interactive Media Review*, *1*, 30–35.

Geoff Kaufman is a postdoctoral researcher in psychology at Tiltfactor Laboratory and the inaugural scholar-in-residence at Dartmouth College's Office of Pluralism and Leadership. He holds a Ph.D. and M.A. in psychology from Ohio State University, and a B.A. in psychology from Carnegie Mellon University. His research focuses on how experience-taking – the mental simulation of characters' experiences in fictional narratives, virtual worlds, or games – can change individuals' self-concepts, attitudes, behaviors, and emotions (Kaufman & Libby, 2012). He has investigated how such experiences can build interpersonal understanding and empathy, reduce stereotypes and prejudice, and inspire higher levels of social consciousness and civic engagement.

Mary Flanagan is an award-winning artist, scientist, and inventor who believes that there are social problems and public health challenges that can be best addressed through compelling games. Dr. Flanagan's research has focused on the use of games to change minds and behaviors for the better using play as a compelling motivation for engagement. Recently she has worked to address public health, social biases and stereotypes, and new knowledge gathering. Dr. Flanagan's lab Tiltfactor aims to change mindsets, and in randomized control studies they have proven that the games do just that. Flanagan has written over 20 critical essays and four books, including Critical Play *(2009, MIT). She is the creator of the Grow-a-Game brainstorming tool, POX games, Awkward Moment, buffalo, and more. She serves on the White House Office of Science and Technology Policy Academic Consortium on Games for Impact and is the Sherman Fairchild Distinguished Professor in Digital Humanities at Dartmouth College.*