Designing Game Based Microgames as Intervention for Health Misinformation

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Abstract

This paper offers lessons learned about appeal and potential efficacy in the design and implementation of three distinct small-scale game interventions to help increase audience resilience to health misinformation and disinformation. Applying elements of inoculation theory and transportation theory, collecting appropriate aims for the interventional context, and applying fundamentals of microgame design the researchers created three games to help increase resilience to misleading health information. Semi structured interviews with the target audience and their health care providers, and community educators offered positive feedback on the potential to address misinformation and disinformation in a health vulnerable population through microgames. This paper outlines the design process, implementation, and appeal feedback collected from the intended audience. Feedback indicated strongest appeal and potential for a narrative based interactive fiction, secondarily for a social media simulation and least for a trivia game.

Keywords: communication theory, disinformation games, misinformation games, game design, health games

1. Introduction

As the COVID-19 pandemic emphasized, health misinformation can have deadly consequences. These include avoiding medically necessary treatment, using treatments that are detrimental to personal health, and encouraging others toward similar mistakes. The scale of these problems not only shape the health of the decision maker, but the communities to which they belong. The World Health Organization's Director-General emphasized the problems with this information succinctly in the context of COVID-19, "we're not just fighting an epidemic; we're fighting an infodemic" (Zarocostas, 2020). A Kaiser Family Foundation study indicates that in 2021, 78% of adults say they have heard at least one of eight different false statements about COVID-19 and that they believe it to be true or are unsure if it is true or false (Hamel et al., 2021).

While social media (Zhu et al., 2021) and digital media literacy (Guess et al., 2020) are often emphasized as problems amplifying health misinformation, the dominant strategies for increasing resilience to the influence of misinformation persist as likely solutions to this pervasive problem. In response, increasingly game designers have explored opportunities to improve resilience to misinformation and disinformation in general contexts. Such work combines the long history of educational games (Dondlinger, 2007) persuasive games (De La Hera, 2021) and social impact games (Grace, 2019). Such work in misinformation and disinformation includes games like Harmony Square (Roozenbeek & van der Linden, 2020), Cat Park (2022) and Factitious (Grace & Hone, 2022). These games are largely focused on the general consumption of what is commonly referred to as fake news. Such sources are often presented as credible news sources or presented as trusted authority.

However, fake news interventions only address one dimension of the misinformation and related disinformation dynamic, namely the consumption of news sources. Game designers have previously experimented with tools to demonstrate the relationship of trust and influence in social networks (Cambridge Social Decision-Making Lab, 2018) and the ways they also shape inaccurate understandings (Case, 2017). While one method of misinformation and disinformation resilience aims at helping people interpret news sources, another aims at helping people develop the skills that will make them less susceptible to the myriad of misinformation and disinformation sources that may be complicating their understanding of reliable and unreliable information. These include trusted networks like friends and social media communities that may also be misinformed or engaged

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in disinformation. In contrast to misinformation and disinformation provided through news-like sources, such networks may be trusted without critical judgement or the habits of mind at which traditional fake news interventions may be aimed.

The focus of this research is to examine the potential of games designed to help train players toward more critical examinations of information from trusted social networks in addition to news and news-like sources. Instead of training media or news literacy, this work aims to encourage a kind of trusted network information literacy. The pragmatic context includes health information collected from non-medical family and friends, social media, Internet chat rooms, and similar communities.

While such networks may shape decisions as varied as politics (Kleinnijenhuis et al., 2019) or consumer preference (Malik, 2016), this research focuses on the objective and scientifically informed domain of health. The objectivity of best practices in health offers a solid foundation and immediately relevant case study from which to explore improving wider domains of information resilience. It's also a domain of grave importance.

The global pandemic was subject to widespread information issues relating to both misinformation and disinformation. Disinformation is typically focused on misleading information broadcast intentionally to mislead. Disinformation is typically used to describe sources that aim to provide inaccurate or misleading information by design or intention (Nemr & Gangware, 2019). Disinformation is often linked to messaging that aims to profit through providing misleading information (e.g., political messaging, advertising). In contrast, misinformation is often an unintentional interpretation. While message broadcast intent is emphasized in both, misinformation also includes the possibility that reliable information was misinterpreted or misunderstood (Vraga & Bode, 2020). More nuanced definitions are available, but this fundamental dichotomy is sufficient for the scope of this research.

Both misinformation and disinformation shape a patient's and caregiver's ability to determine appropriate strategies to maintain health. This work aims to help address the ambiguity of fact and fiction in health information, resulting from either misinformation or disinformation. While it is often important to discern the difference between misinformation and disinformation in the context of such research, the researchers use mis/disinformation to cover both types of misleading information. It's commonly understood that intention differentiates misinformation from disinformation. Misinformation is inaccurate information shared without intention to mislead, while disinformation is explicitly designed to mislead. For the purposes of this work, conflating the two helps de-emphasize intention and instead emphasize the ambiguity of the information itself. As people misled by mis/disinformation are still subjected to the same problems as those who have not been misled, the goal is to move the focus from production to reception. The focus of this work is on building resilience to receiving unreliable information.

The researchers aim to help address this problem through their proximity to communities subject to it. This research was conducted in Miami-Dade County, Florida one of the densest communities of HIV positive, health vulnerable people in the United States (Escudero et al, 2019). Given the pandemic's effect on this community, the work is aimed at creating scalable impact through patients and patient health providers. The first iteration of this effort is focused on a health vulnerable community with which the researchers have ready access. To do so, the researchers combined health communication strategies with game design theory to create 3 game prototypes as interventions to increase mis/disinformation.

2. Theoretical and Practical Frame

Prior to this research, a member of the team had conducted a widescale analysis of mis/disinformation games (Grace and Liang, 2023)The analysis yielded findings on dominant tested communication theories that could be employed for effective behavior change in the mis/disinformation domain. This work is informed by prior analysis and prior work in creating small-scale playful interventions commonly referred to as microgames (Rahmadi et al., 2021b).

In the context of mis/disinformation games the dominant communication theory applied to game designs is inoculation theory (McGuire & Papageorgis, 1961). Inoculation theory's core premise in this context is that exposure to small doses of misinformation or disinformation, including the ways in which it is produced or spread, should help increase a player's resilience to it beyond the game world. Inoculation theory-based work has had clear success in general mis/disinformation contexts (Traberg, Roozenbeek, & van der Linden, 2022) with replicated positive results (Iyengar, Gupta, and Priya, 2023) and some limited debate of its efficacy (Modirrousta-Galian & Higham, 2023). Popular examples of inoculation theory informed games include The Fake News Game (Roozenbeek & van der Linden, 2019) and Cat Park (2022). The researchers identified the core tenants of inoculation theory as likewise useful in this context.

In addition, transportation theory seemed an appropriate frame for game design. The core tenets of

transportation theory emphasize how an engrossing narrative situation can shape the attitudes and interests of the person consuming the media (Green et al., 2004). It is typically framed as providing a conforming set of values. From the theory, a foundation of empathetic storytelling can result in persuasive sentiments toward the relatable subject of that media. Simply, the viewer, player, or other witness to the media can be transported to the values, likes and dislikes of the story's portrayals. Examples of explicit use of transportation theory in games are widely varied but include research into perception of morality (Mahood & Hanus, 2017), changing physical activity (Lu et al., 2019) and evaluating efficacy in gamified tasks (Schmidt-Kraepelin et al., 2023). A non-theoretically informed application of story underpins many educational and persuasive games, but the theory's relatively new introduction in 2004 may shape the number of research projects that explicitly state its application. Given the common application of story to persuade in games, researchers have attempted to examine existing games based on their relationship to transportation theory (Fitzgerald & Green, 2017). This combined with the author's prior research in the domain informed the use of the newer transportation theory in addition to the more than 40-year older inoculation theory.

While these two communication theories helped shape the designs, two additional research precedence helped shape the specifics of implementation. First, was the notion of microgames, which had previously been experimented with for formal assessment in an author's prior work (Grace et al, 2015). Microgames are short, 2–5-minute games as interventions, comprised of small repeatable microtasks (e.g., selecting, sliding, tapping) that are frequently repeated over very short periods of time. Microgames have been used with success, as more engaging in educational contexts (Brom et al., 2011) although very dependent on appropriate mechanics (Rahmadi et al., 2021a). The work for this project aimed to experiment with a range of game mechanics to help interpret potentials. The opportunities in microgames for this context include offering gameplay during doctor visit waits (via check-in stations or personal devices), in social environments or other interstitial moments. Core to microgame interventions is the expectation that players have been exposed to the topic in other modalities (e.g., other media like printed documents and public service announcements) and that player time investment is significantly limited (i.e., minutes not hours).

Beyond game and communication theory, this work required a clear set of learning outcomes that would be developed as training from playing the games. These were commonly referred to as aims within the context of the project. These aims were developed through a formative research approach similar to the first phase of participatory design (Spinuzzi, 2005). As previously published (Grace et al, 2023) the researchers collaborated with two local community partners Open Arms and Borinquen conducting qualitative interviews with infectious disease providers and community health workers to determine 12 appropriate aims for the project. They generally focused on developing media literacy, enhancing coping skills, and increasing resilience. For each of the aims, at least one game concept was generated, focusing a primary game mechanic that would require practice of the specific aim. These 12 aims were winnowed to a subset of 3 aims, based on their ability to map to the simple mechanics of microgames.

The design of each game was informed by three specific aims to help make players more resistant to the effects of mis/disinformation. The final 3 aims were:

- Aim 1: Managed Access - encourages users to remain informed while avoiding information overload and information from bad sources.
- Aim 2: Scrutiny - aims at increasing the user's ability to understand and scrutinize the information they receive.
- Aim 3: Mental Health Hygiene - encourages positive mental health through applying reliable knowledge and remaining resilient to mis/disinformation.

These three aims served as the foundation for both in-game assessment and knowledge delivery. Thus, the educational outcome aimed for each game was improving the players' ability to maintain reliable access to information, understand, and scrutinize information, while maintaining resiliency to counterinformation unreliably sourced.

3. The Games

Originally the team ideated a list of 22 game concepts, choosing from that list three games to interpret potential efficacies in microgame design to create a basic 1:1 ratio of aim and game. This decision helped focus the work and increase the clarity of further research in efficacy. This included assessing appeal and fidelity to the aim's objective. The small scale of microgames helped make this possible.

The final three concepts were a trivia game, a social media simulation and an interactive fiction narrative. The three games created were mapped to at least one primary aim, with any relevance to secondary aims considered an increased value. Those game concepts that did not clearly map to a primary and secondary aim were eliminated.

Each game prototype was produced in 2-3 days. Save for the interactive fiction, the games were designed to use external data sources so that subject matter experts could relatively simply update content within the game. This allowed for several timely updates to the games after the initial prototype was created, adjusting to changes in global health data. In short, the mechanics and aesthetics were divorced from content in much the way a standard n-tiered, data driven website is designed with tiers of technology for aesthetics (CSS), logic (server-side software) and data (e.g., SQL database). Separating the data tier allowed for modular, timely updates to microgame content. In this case, comma separated (aka CSV) text files provided the content for both the trivia game and the social media simulation.

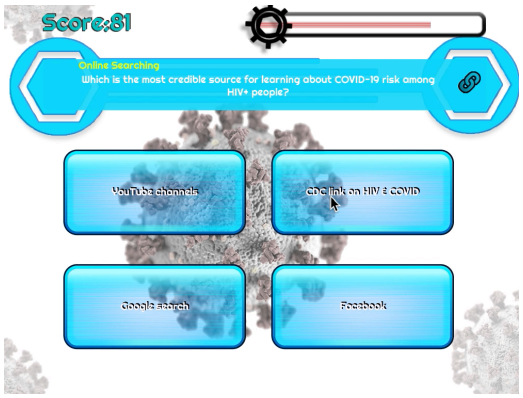

Figure 1. Trivia Game after a few question rounds.

The first game, a fairly standard trivia game contained 24 questions containing common mis/disinformation as wrong answers. Each 15 second round offered either 2 or 4 answers from which to choose. The aesthetic was chosen for its technical character, with a combination of linear and hexagonal forms that were designed to provide a sense of technical novelty. The game takes as little as 1 minute to complete, typically 3 minutes or a maximum of 6 minutes if all questions are answered correctly and all 15 seconds are used per round. The trivia game, with its onslaught of missed reliability information was primarily focused on aim 2.

The second game was designed to simulate a social media environment and was named Myth Busters. Players were presented with a meme-like image, followed by a stream of fake social media profile comments appearing after. Each comment was associated with an AI-generated fake profile image of a person, created through Generated.photos. The comments stream upward, and the player must decide which comments to remove from the upward stream. If a comment is inaccurate the player can tap or click it, to eliminate the comment and gain 10 points. If the player selects an accurate claim, they earn a strike and receive no points. The game ends when either 3 strikes are earned or when the player finishes reviewing 50 comments. The data set includes 39 accurate claims and 38 inaccurate claims, which were randomly shared every 3 seconds. The game increased challenge in round 2, when the comments were offered in 2 second increments. The slowest pace of completion results in 2.5 minutes of gameplay, thus supporting the microgame time constraints. Typos and other hints at inaccuracy were included in the data collected from real-world social media. The Myth Busters mechanics was primarily focused on aim 3, mental health hygiene, in that players were encouraged to scrub or remove false information.

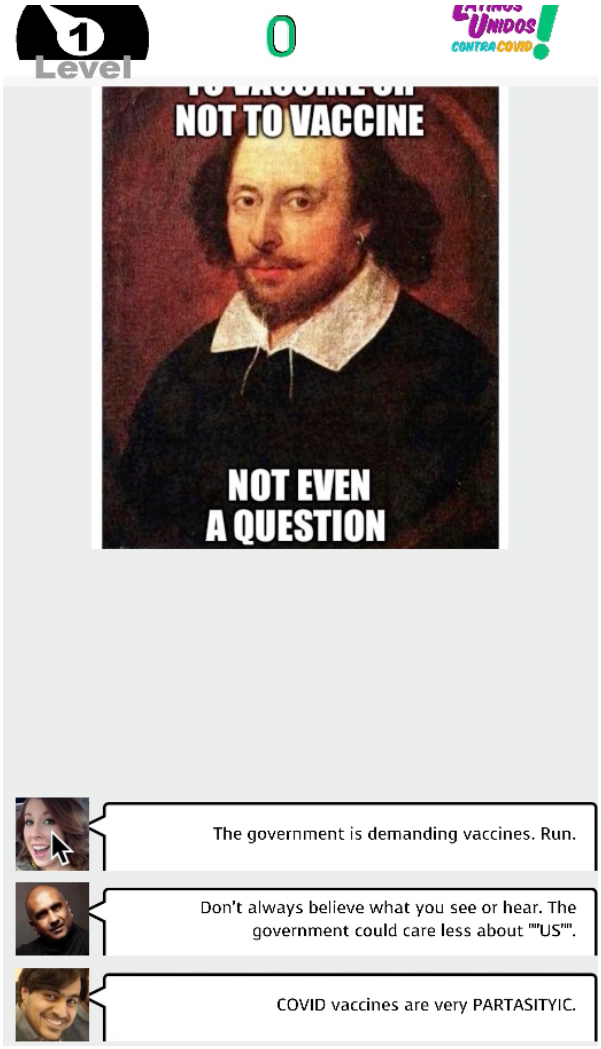

Figure 2. Myth Busters Social Media Simulation at startup

For both Myth Busters and the Trivia game the inoculation content was the repeated exposure to

misinformation in both wrong answers and in inaccurate claims. Trivia questions included true/false and multiple-choice questions. An example multiple choice question asked, “The group at greatest risk for COVID transmission is:” with answer options, “the unvaccinated”, “the vaccinated”, “remote works and corporate CEOs”. All answers were randomly sorted and presented to players in a no distinct order. A slightly more challenging question read, “where can you go to locate a vaccine?”, with “vaccines.gov”, “payforshot.com”, “donotvaccinate.net” and “covidshots.com” as options. A true/false question, of which there were 5, read “Children 5-11 get a smaller dose of the vaccine.”

For Myth Busters, each of the inaccurate claims was derived from common misinformation spread through real world social media. Misinformation examples from the game range from the political “More vaccines = more cases. What is the point.... MONEY!!!” to the seemingly medically informed “Chlorine dioxide will cure us! No vaccines are needed!!” and “COVID vaccines will change your DNA. Watch out!”

These two games relied less on transportation theory, as there was little narrative around them. It’s also important to note that the number of questions and decisions for both games was optimized toward the 2.5-minute constraint, which is the same amount of time as the average commercial break for broadcast television in the area. While a seemingly arbitrary constraint, part of the logic included the opportunity to offer these games in place of television commercials that might be running in a health care provider’s waiting room.

The third and final game was designed around a narrative involving supporting a friend who may be making unhealthy, mis/disinformed decisions regarding their immunocompromised health. The player makes dialogue and action choices that are designed to be informed by best practices. These best practices are integrated as opportunities to refer to trusted information sources (e.g., the US Center for Disease Control or the World Health Organization websites) which are integrated into the game’s choice system. For each reliable information quest, the player is helping their non-player friend, Daniel, find reliable information. Player selections were provided as both dialogue and action links, as is common to this type of experience. For testing purposes, the game was written in English because it was the common language among the multi-lingual research team. This experience was designed primarily to address aim number 1 and involved transportation theory most directly. Inoculation theory was applied only in the repeated exposure to trusted sources that the player uses to guide decisions.

Figure 3. Interactive Fiction Game

The interactive fiction game was implemented using Twine (Twinery.org) while the other two were implemented using GameSalad (GameSalad.com). The tools provided low-cost, low-tech solutions for implementing games quickly. They also supported HTML 5 and mobile app release, assuring that the games could be scaled and distributed easily with or without Internet connectivity. For study purposes the games could be shown on user devices and a controlled environment via the same device. The structures in each also support data collection for future iterations, so that performance metrics can be tracked for efficacy analysis and long-term assessment.

4. Test Group

Our qualitative thematic approach to data collection is appropriate for the study objective, which was to identify varied participant perspectives on the appeal and utility of our microgame platforms. The semi-structured format permits questions to shift and emerge as researchers learn and adapt further questioning to the participants’ experiences and perceptions (Creswell & Poth, 2018).

We were able to use respondent triangulation to center the voices of the target audience, medical providers, and community health workers directly involved in the audience’s care. These multiple perspectives function to validate our results through cross-verification (Rothbauer, 2008) and aid in message tailoring. The test group was selected from a volunteer subset of 27, matching the target demographic for these health interventions and their care providers.

Two members of the research team conducted 27 in-depth, semi-structured interviews in English or Spanish based on the language preference of the interviewee. Participants consisted of 12 Latinx people living with HIV (PLWH), 10 community educators, and 5

infectious disease healthcare providers. Among PLWH participants, 58% identified as White, 50% male (6), and 50% non-US-born (6). The community educators and infectious disease providers worked with the PLWH community for an average of 11.00 years, and more than 58% identified as male, and 67% identified as heterosexual. Given the small sample group, comments are reported in aggregate to better support anonymity in the particularly privacy-sensitive health domain.

4.1. Appeal and Feedback - Trivia Game

The quiz format of the trivia game was perceived as appropriate to test and educate Latino people's COVID and health knowledge. The researchers collected positive feedback on how correct answers were mixed with mis/disinformation which was commonly misunderstood as true.

For the trivia game, participants commonly shared a desire for more interactivity. It was interpreted as a simple test that people could take and there was a desire for something they could play at any time. Examples from participants included a Tik Tok game or challenge to help people 'consume' COVID knowledge/information through the game. One participant highlighted this by offering "I like that the answers are vague because maybe when you're taking the quiz you think 'oh, does someone else think this answer' and it's right there. So, they work great together." This comment seemed particularly important in the context of the micro-dose structure of an inoculation theory informed design. Such reflection hints at the opportunity to pre-form counterinformation for scrutiny as well as the opportunity to create an asynchronous trivia experience in which questions are available at any time but contribute to an aggregate score.

Participants assessed that the game was culturally appropriate to launch. They thought most of the questions were appropriate to areas of confusion, as most people struggled to find correct answers. One participant wanted more questions that could be related to senior citizens. However, for those who just moved to the community participants though it was a little bit challenging to sit down and play the game. One participant suggested employing a narrative so that they could relate more to this game. They also suggested enhancing perceived relevance and engagement for people in Latino communities, specifically by adding pictures or videos of family members and Latino people in the game.

4.1. Appeal and Feedback – Myth Busters

Participants showed positive responses toward the Myth Buster social media simulation. Participants identified that the interface was similar to social media discussions like YouTube or Instagram, where people share their comments. They thought all the comments, including misinformation in the game were something they often see on social media. They indicated that by clicking correct and incorrect comments, the game will bring interest to participants, their families, and friends to discuss which statements are true or false. Participants agreed that this game is feasible and accessible to the target community.

Regarding cultural appropriateness, participants suggested including misinformation or comments related to government or conspiracy theories. The target audience was identified as holding skeptical views on what the government suggests to their communities. Some of the community members doubt the government's controlling power over their lives. Other conspiracy theories are also dominant in the community, which is critical to fighting against myths through the game.

4.3. Appeal and Feedback – Interactive Fiction

Participants demonstrated delight toward the interactive fiction game. They found appeal in the narrative, its subject, Daniel a young Latino recently diagnosed with HIV. Players were engaged by the task of helping the non-player character cope with this situation during the COVID pandemic. Participants especially loved that they were guided to help Daniel no matter which option they chose. They were excited to see the behind-the-scenes of Daniel's mystery and behavior and willing to help him to select healthy choices. The game was perceived as engaging, informative, and personal. As one participant articulated, "I love the story, how it relates. There's no right or wrong answer. It's actually engaging because you're helping someone. And the resources are right there if you need more information about where to go. And it's very smooth and changes from one screen to the other."

Participants suggested including more than one type of scenario involving bigger families and friends to make the game more culturally appropriate. They highlighted a family value in Latino culture, which should be reflected in the game scenarios. More conversational scenarios, spinning stories, and rumors around the main characters seemed attractive to participants. Also, scenarios related to food as a cultural aspect were recommended.

6. Conclusion

This exploration into the feasibility and potential appeal of microgames as interventions for health mis/disinformation was relatively successful. The primary aim was to determine if such games offered appeal and if both patients and healthcare providers saw potential in such interventions. It helped illuminate the intersection between the two tested communication theories, inoculation, and transportation.

The greatest appeal was demonstrated in the story-driven, but mechanically simple narrative fiction. The trivia game, a common solution in educational and interventional context was the least appealing. The mechanically novel microgame simulating social media had some appeal but did not solicit the request for more content to the scale that the interactive fiction game did. Perhaps unsurprising to narrative focused designers, the value and potential impact of narrative situations is underscored by user feedback. Even in the context of microgames, where reading slows pace and offers less game mechanic novelty, the greatest appeal was in the simplest implementation.

This appeal hints at a greater potential in using transportation theory in such interventions. While the initial goal was to employ microgames, the tensions of developing an engaging story in less than 2.5 minutes of gameplay are not lost. Future work will likely employ episodic interactive narratives that support both the short-term engagement of microgames with the repeated exposure needed for inoculation theory and engaging narrative. This reveals a new opportunity for research, examining the opportunity to develop episodic, narrative based microgames that deliver micro-dosed interventions designed to reduce mis/disinformation vulnerability.

In terms of the three aims, the feedback offered from each round of review indicates that each of these game experiences are likely to support the aims of addressing mis/disinformation. As hoped, this work can be used to inform future iterations of this and similar work. For designers and developers creating other interventions, this microgame level feedback provides some sense of what types of mechanics may appeal for specific reasons.

It's also important to note, as hinted by the shared comments, that participants may have responding to the experiences relative to one another. In short, since each of the games was presented to participants in the same order, the knock-on effect of quizzing (trivia game) followed by a selection task (Myth Busters) may have amplified the appeal of the interactive fiction game. Further research and more rigorous study design should help determine if this is the case.

Some new ideas were also generated from the feedback sessions, including the idea of breaking a trivia game into smaller subsets of asynchronous content. The prevalence of media like Tik Tok and Instagram reels clearly shaped player expectations, perhaps indicating a growing opportunity to engage audiences through Tik Tok sized games (aka microgames). Other reflections emphasized the interest in portraying family and friends among this demographic. Since both the trivia game and MythBusters failed to do so, subsequent work may evaluate how such additions shape appeal. These new ideas not only help shape subsequent game designs, but also highlight some considerations for the target demographic across other media.

It is likely that future work integrates these findings. While amplification of effect and appeal is not always about offering more there is obviously potential in combining elements of these individual microgames into a more convention game. Interactive fiction might, for example, integrate elements of social media simulation. The benefit of doing work at this micro-granularity is that it provides specific feedback that hopefully will inform similar work. Subsequent research will move toward a mixed methods user study, aiming to determine efficacy of such interventions beyond the focus on appeal and perceived effect evaluated here.

Through this research it seems evident that microgame creation supports targeted evaluation of playful elements and decouples confounding elements for more focused feedback. Microgames allow for very specific feedback that can inform subsequent iterations clearly, within a limited budget, and with highly targeted goals. It also highlights the opportunity to provide small exposure interventions potentially unified through narrative. This would be a clear facility for binding the efficacy of both transportation theory and inoculation theory for what is expected to be greater impact and utility. It is reasonable to interpret these findings as an indication that episodic interactive fiction or interactive fiction bound by a series of mechanically diverse microgames offers the repeated exposure needed for inoculation theory with transportation theory's ability to shape attitudes. By using both theories, players are not only made more resilient to mis/disinformation, but they may also have their attitudes shifted about it. Given the proliferation of mis/disinformation games, it is hoped that this particular project can help shorten development time and provide lessons learned for future work.

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