Microgames as Intervention for Health Misinformation

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ABSTRACT
This work outlines a case study in using three microgame interventions to prevent misinformation in a health vulnerable community of Latinos living with HIV. Microgames are small-scale playful experiences designed to serve as 2–5 minute interventions. This work rests at the apex of three research foci, engaging game mechanics, health communication interventions, and information literacy. The research aimed to directly address health disparities exacerbated by COVID misinformation among Latinos living with HIV. Its focus is on a marginalized community for whom the health risks of misinformation and disinformation are particularly important. This case study explains the theories that informed the design and implementation and highlights the findings from end-user examinations. Findings indicate the possibility of narrative microgames as engaging and hint at how games as short as 2.5 minutes can encourage natural, meaningful reflection on misinformation and disinformation among players.

Keywords
health interventions, serious games, misinformation games, educational games, health communication

INTRODUCTION
There are many examples of traditional digital and analog games to shape players interests, activities, and opinions (De La Hera et al., 2021). The research domains for this work are typically considered persuasive gaming (Bogost, 2010) serious games (Laamarti and Saddik, 2014) or educational games (Tanenbaum, Antle and Robinson, 2013). This research continues the opportunity to employ games as interventional strategies for improving player's health related behavior (Baranowski et al, 2008) and knowledge (Noemi and Maximo, 2014).

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Such games as interventions have expanded to include work aimed at decreasing the effects of misinformation and disinformation in players. Fundamentally, disinformation describes sources that aim to provide inaccurate or misleading information by design (Nemry and Gangware, 2019). Misinformation, alternatively, is focused on the misinterpretation of accurate information or the unintentional spread of unreliable sources or data. Where disinformation is focused on intent, misinformation is typically focused on interpretation

Practically, consumers of both types of negative information are not necessarily aware of the source's intention. As such, it is often useful to conflate these when aiming to improve a user's ability to identify them. This work describes misinformation and disinformation as a single problem needing address as mis/disinformation. The contemporary problems resulting from climate change misinformation (Winkler and Cook, 2022), political radicalization (Roozenbeek and van der Linden, 2020), news literacy (Grace and Hone, 2019), social media news spread (Micallef et al, 2021), education (Literat et al, 2021) and others are typically linked to mis/disinformation and have games designed to help address them. As is common, much of the work applies a few fundamental theories around psychological engagement (Nakamura and Csikszentmihalyi, 2014), the character of play (Cowley et al., 2008) and around varied theories in communication.

Of these theories, inoculation theory (Compton, 2013) has been particularly effective at improving player outcomes in accurate identification of misinformation (Compton et al, 2021). Inoculation theory is a resistance model, in which repeated exposure to weakened versions of mis/disinformation may strengthen a user's resistance to it. The theory is based on a medical analogy, for which certain inoculations are derived from tempered versions or small doses of real medical threats.

Recognizing that both misinformation and disinformation pose substantial societal threat to the continued health of global populations, the researchers set out to investigate the opportunities to implement short games that both inoculate players from mis/disinformation and improve health outcomes. When contrasted with other interventions in misinformation, the goal is to help solve the problem with small doses instead of large ones. The most notable misinformation interventions, such as Harmony Square (Roozenbeek and van der Linden, 2020) are typically experiences requiring users to play repeatedly over weeks or even months. They are also often designed as 60-minute or more gameplay experiences.

By inoculation theory's analogy, these existing experiences are large needles with large doses. It is the research team's theory that there may be greater opportunity in creating inoculating experiences that retain the engaging characteristics of games, but offer the inoculating content in small, rapid play experiences. Instead of providing one single experience, the aim is to create multiple very small experiences that aim at very specific needs. Via a medical analogy, these microgames aim to do what narrow band antibiotics do, inoculating very specific threats, instead of walloping the user with a large broad-spectrum dose of misinformation or disinformation inoculation. The expected benefit of small playful experiences is more specific efficacy and a more inviting lure through lower investment for hesitant players. This helps address one of the recent critiques of such design, which emphasized the need to fine tune game generality (Modirrousta and Higham, 2022) to support designers to aiming the analogous small needle more accurately.

The work draws from the researchers' prior experience working with microgames in the educational context (Grace et al., 2015) and examining the smallest units of play to create playful interfaces (Grace, 2021). The hope is that the smaller time commitment

of microgames may allow for interventions to be integrated into daily routines such as work (Zhang and Qin, 2021), while waiting for doctors' visits or other interstitial moments supportive of transmedia intervention (McCarthy, Tiu and Liu, 2018). Similar work has been conducted in education, such as acquiring facts and definitions in high stakes military contexts (Godrey S.B. et al., 2021) . This work applies elements of both knowledge delivery and assessment to encourage three information consumption habits: maintaining reliable access to information; understanding and scrutinizing information; and maintaining resiliency . By helping players practice these three habits of mind, the researchers expect to improve players' long-term ability to defend themselves from misinformation and disinformation.

While the work is aimed at scaling to a larger health vulnerable population, the researchers worked with community partners Open Arms and Borinquen, two Miami, Florida based organizations to focus the work for a case study. This paper focuses on the work produced after conducting 27 qualitative interviews with Latino people living with aids, infectious disease providers, and community health workers. The research team presented the functional intervention games to the health vulnerable population of Latinos living with HIV. In this context, health vulnerability describes those who have may be immunocompromised as a result of disease or medication. This vulnerability includes decision making about the use of vaccines (e.g. COVID-19 vaccine) and other treatments. Vulnerability also describes the amplified risk that health misinformation or disinformation such populations. This case study reflects on the designs, implementations, lessons learned, and audience reception from exposing 5 users to the intervention experiences.

INTERVENTION GOALS

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

Each of these aims is informed by formal theories in communications interventions. The aims were chosen from a subset of findings reflected in formal interviews with members of the intended audience, health care works and health providers. These aims were derived from a series of the most common questions among the community, including common sources of mis/disinformation. The process of collecting these aims resulted from an exhaustive analysis of community needs informed through interviews and qualitative analysis (Dunleavy et al, 2022). The resulting aims informed the core goals of the final microgame designs. Like designing a traditional educational game, the researchers used these three aims 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 maintaining reliable access to information, understanding, and scrutinizing information, and maintaining resiliency to counterinformation unreliably sourced.

To conceptualize playful experiences from these aims, the team followed a game verb driven design approach (Sicart, 2008). The team identified verbs common to each aforementioned aim and then designed a playful problem set around each verb. Some aims shared verbs, such as choose (good information from bad) and ignore (bad

information). Others were distinct to the aim, such as remain positive (aim 3), persist against unreliable counterinformation (aim 3), and scrutinize source (aim 2).

This work applies these three aims through three individualized microgames aimed at inoculating players from misinformation. Each game was designed to primarily address a single aim in the hope that feedback would be more accurate tied to outcomes and large-scale iterations with large audiences would provide higher resolution data. In short, instead of making one big game that addresses all outcomes, the team implemented very small games that addressed one. It is hoped that 1:1 ratio supports more accurate assessment of what is working and what is not. It is also expected that a suite of experiences, tied together with narrative or related by multi-mechanic dependent goals would unify a single game with all such aims. This possibility follows trends like the increased audience for match-2 and build games, for example, which require players to complete 2 small, simple, but disparate mechanics (i.e., matching two items to earn utility to build).

THE GAME DESIGNS AND IMPLEMENTATIONS

The team ideated a list of 22 game concepts, choosing from that list three games to interpret potential efficacies in microgame design. The team elected to create one game per aim for the best understanding of appeal and fidelity to the aim's objective. The final three concepts were a trivia game, a social media simulation and an interactive fiction narrative. These games, shown in figure 1, were applied to aims one, two and three respectively.

Given the small scale of microgames, the core game experience for each was developed in 2-3 days, with iterative refinement of content over a few short weeks. This production pipeline is notably shorter than many traditional games.

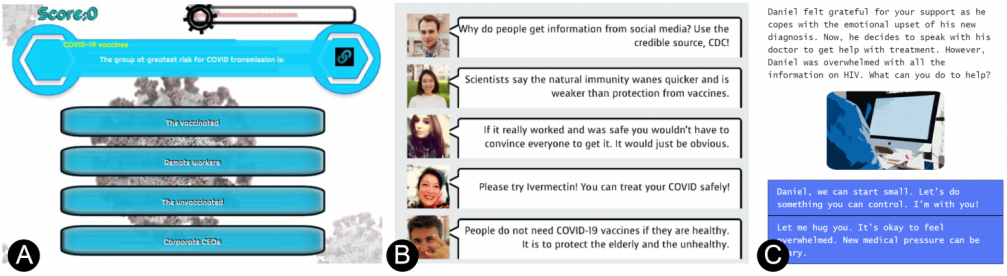

Figure 1: Figure 1: The three games [A] COVID Trivia Game, [B] Myth Busters, [C] interactive narrative, listed in order by production date and case study review order.

The COVID Trivia Game, contained 24 questions on facts sourced from the United States Centers for Disease Control fact sheets. Players were given 15 seconds per multiple choice question, with 2-4 possible selections available each round. Questions were presented in random order and players were allowed 3 wrong answers before being presented with a final score. The game aimed to evaluate the appeal and potential impact on players' habits to access credible sources and accurate information (i.e., aim 1). The game typically takes 3 minutes to complete, or a maximum of 6 minutes if all questions are answered correctly and all 15 seconds are used per round.

The inoculation content for the COVID Trivia Game included incorrect answers based on common myths and misunderstandings for each question. 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 answer were randomly sorted and presented to players in a 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.”

The second game, named Myth Busters, emulated a fictitious social media environment with an automatically scrolling set of comments and profile pictures. At the start of each round players were provided an image of a vaccine related meme followed by a stream of comments. Each comment is attached to a random, fictitious person’s profile picture (i.e., A.I. generated face). Players scored points for identifying comments that had mis/disinformation in them. Players lost points for misidentifying accurate claims. The constant flow of comments serves as a timer and provides visual feedback for right or wrong selections. In the test prototype, 39 accurate comments are available, with 38 mis/disinformation comments. One comment is generated every 3 seconds at start, but the pace of commenting increases as score increases (down to 2 seconds) . The slowest pace of play completes the review of 50 comments in 2.5 minutes.

The inoculation content for game two was again the misinformation offered through inaccurate claims. Each of these 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 inaccurate statements were collected from public social media. It’s worth noting in the context of inoculation theory that the exposure to misinformation increased (via rate of play and frequency) as the player succeeded in the game. The better a player performed the more misinformation they received. This is analogous to traditional game mechanics, where an onslaught of enemies increases as the player advances.

The third game was an interactive fiction similar to 1980’s era choose-your-own-adventure games. The player made choices to support a friend who was struggling with health issues and vaccine hesitancy. The player was presented with narrative and external United States Center for Disease Control (CDC) resources to help make the best decision for the fictional character they were supporting. The narrative included text and image, with choices expressed as text actions (e.g., call friend, call family) and dialogue choices (e.g., “I think you should…”). Because reading speed varies greatly between players, the range of time to complete the game is not easily calculated. Informally, a fast reader can complete the game’s 7 decisions in 4-5 minutes. The inoculation content for this experience was centered on common pitfalls in communication (e.g. failing to share or acknowledge information vital for making informed decision).

Very distinct game mechanics were chosen to help better identify strengths and weaknesses of a given experience. The first game offered a very traditional trivia experience. The second offered an action-selection mechanic based on a simulated social media environment. The third relied most heavily on narrative. The researchers hoped to learn which dimensions of these distinct experiences might resonate most strongly with the intended audience. The first two games were implemented in GameSalad (Gendai, 2022) and the third was creating using Twine (Klimas, 2009).

TEST GROUP AND FEEDBACK

The test group was selected from a volunteer subset of 27 South Florida based community members matching the target demographic for these health interventions and interviewed for the project. Two members of the research team conducted 27 in-depth, semi-structured interviews in English or Spanish. Participants consisted of 12 Latinx people living with HIV (PLWH), 10 community educators and 5 infections disease health care providers from the two partner Miami-based organizations, Borinquen and Open Arms. Among PLWH participants, 58% identified as White, 58% as heterosexual, 50% male, and 50% non-US-born. 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.

The research team asked this group of adults to evaluate the games. The feedback session was conducted live, in-person with playable versions of each of the games offered to all participants. Following a standardize script for all feedback collected, the participants were encouraged to freely offer their observations about each of the games**,** regarding each of four categories: goal, suitability, feasibility, and cultural appropriateness.

As hoped, feedback was positive towards the experiences. All participants praised the efforts but were also quick to offer suggestions for improvement. For each of the games, the general sentiment encouraged further development. All games were identified by all participants as "effective", "culturally appropriate", and "easy to play" when asked upon play of each game. When asked about feasibility, participants differed on their reactions. The quiz game received the most critical response to feasibility, collecting multiple suggestions for improvement.

While participants admitted enjoying the trivia experience, they **i**mmediately recognized it as a test masquerading as a game. A participant volunteered without prompt that "I think it does test the person's knowledge of the information of COVID" and another noted "I mean it looks like a PowerPoint presentation." Feasibility reflections focused largely on the aesthetic elements and suggested additional feedback elements to the user interface. Participants suggested "I think there should be a little bar maybe in the in the bottom that says that you are in the 40%, 60%, so you know exactly how you can measure your own time, in order to answer all…" and noted that "Yeah, I have an idea where I think right now the interface is kind of like cold feeling." Suitability was somewhat adversely affected by these perceived impersonal characteristics.

The second game, Myth Busters, received universal praise with minor specific improvements in interface. Participants found the linear simulation very appropriate and praised the clarity of the mission. The experience incited two participants to discuss the challenge of misinformation in more nuanced dimensions than the right/wrong experience in the trivia game. They focused on trust and the geopolitics that may shape their community of origin's understanding of mis/disinformation. A participant suggested:

> "Or maybe you know you could throw in some questions about the government for Hispanics like the government wants to control you, you know. And some of them, yes, they do come from countries that [have] dictatorship or communism, so they have that. That the government wants to know everything about. Something maybe something about the government like see it's not information for the government to control you."

This perspective was echoed in another participant's comments:

> "I believe that not government, but also conspiracies you know, whatever it is. You hear a lot of that, I mean not only government, conspiracies, you name it. I mean you need to see that the Latino population is very susceptible to what their friends say… well, my friend said this and that sticks in there, so. Anything that you could do to fight those conspiracies and government information, etc." I guess, it would be beneficial. "

In the least, these participant reflections illustrate the ways in which such play can inspire introspective analysis about community spread of mis/disinformation. Nothing in the session script asked players to reflect on the origins of mis/disinformation or any distinct cultural characteristics that promote their spread.

Feedback on the interactive fiction was most effusive. Participants used the adjectives "love" and "engaging" in their feedback. The praise focused on the emotional connection to the non-player character, Daniel. It was described as a mystery and a problem that "if you refer anyone to this site or this application … the person will definitely find the information that they need in order to help his friends or to deal with any mental health issue that the person may have." Despite the simplicity of the interface and graphics, there were no critics of aesthetic or interactions. The participants suggested culturally specific elements to improve the cultural appropriateness of the experience. Participants suggested the addition of food, dancing, and rumors to further develop the engaging characteristics of the narrative.

One of the most surprising qualitative feedback items about any of the experiences was provided by a user who immediately understood the benefits of a microgame without prompting:

> "It will be successful… We need to have something that is handy because, in this specific society where we have very few times, you can have access, when you are waiting for a doctor, or you are your bed by and you can answer and play or maybe if you are the copilot and you can just check your phone and answer that would be better"

This observation clearly supports the opportunity for microgames to fit where other games may not. The opportunity to make such play available while waiting at the doctor's office is particularly appropriate for the aims of this work.

CONCLUSION

A few generalizable themes can be noted from the experience of developing and collecting qualitative feedback on the health mis/disinformation games created for this case study. First, there is interest in such experiences as short, microgames.

The researchers found the greatest interest in story-driven experiences over mechanics driven by action or competition. The trivia game, with its very familiar experience, collected the least favorable feedback. This is likely a product of the transparent gamification of a test. Players recognized the experience as quiz-like and explicitly sought more playful elements of user-interface and user-experience.

The social media simulation, an original concept with little precedent in mis/disinformation interventions, demonstrated potential and offered some of the quickest complete play. This hints at the possibility that short play may still engage players. Notably, the experience of this game precipitated open discussion of historical patterns and community characteristics that none of the other games inspired. Players were eager to talk about the origins of misinformation in their communities,

hypothesizing a link to political histories. As researchers it was invigorating to see such thought generated from a 2.5-minute experience that never highlighted these facts.

The interactive fiction game compelled this small user group most substantially. The draw of story in interactive fiction is clearly effective. It's worth noting that similarly to the trivia game, players were offered right and wrong answers to propel the narrative. Wrong answers simply lead to a longer path to success or prompted players to try another decision. This technique, common to many choose your own adventure games, may have obscured the right-wrong dichotomy of the choices. While much microgames' work focuses on short, quick game actions, it is evident that very short stories might also be an opportunity.

These case study observations are useful in helping other researchers think critically about the most compelling opportunities in microgames and general intervention games. It is likely that more conventional games might be built from a collection of integrated or disparate microgames. Disparate microgames are demonstrated in the Nintendo Title Warioware (2003), where integrated microgames are apparent in experiences like Florence (2018) where multiple microgame styled experiences are woven into a single narrative. Microgames may serve as a compelling way to deliver interventions to communities that may be reluctant to engage in educational experience. They may also prove as a practical way to test playful elements that can be integrated into larger games with more general entertainment goals. Simply, microgames need not only exist on their own, but they can also be an integral part of communication interventions in widely played games or provide niche experiences in interstitial moments like waiting in a doctor's office.

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