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Playing with your research

Circulating narratives and cultivating audiences through text-based games

ABSTRACT

Interactive digital narratives (IDNs) created by academic researchers from STEM, humanities, and social science disciplines help spread important messages while developing scientific and media literacies. The affordances of digital games and IDNs allow researchers – in this study, undergraduate students – to think more deeply about their research subjects and the implications of their research. Through the use of the software Twine, student researchers were able to create IDNs that resituated their research in terms of systems thinking and audience-based reasoning. Drawing on lessons and methodologies of game designers and game studies theorists, this article describes the implementation of IDNs into research-based courses as a means to foster deeper, ecological thinking about research subjects. Additionally, the remixing and transformation of academic research from both qualitative and quantitative data into text-based IDNs allows for new, broader audiences to discover and engage with the formation of scientific and literary knowledge. Ultimately, this paper argues that IDNs can help researchers spread awareness and publicize their findings in new, persuasive ways.

1. INTRODUCTION

All across the eastern United States, from small liberal arts colleges to major research universities, students spend their summers catching turtles. These turtles are typically of common species such as the eastern painted turtle or the red-eared slider turtle. They are of very little commercial or economic value. What makes them valuable is what the students do with the turtles: they use them to perform research. At my institution and dozens of others like it, students trap, tag, sample, and release turtles as part of small research projects with seasonal regularity. These turtles may seem quite insignificant in face of the many challenges we face today: climate change, the energy crisis, war in Ukraine, economic collapse in Sri Lanka, famine. However, the students use the turtles to

form their own understandings of how research operates in the real world, how data is constructed, and what scientists do on a daily basis. From their samples, students study the transmission of diseases such as the ranavirus or the effects of particulate matter in aquatic habitats. In addition to a better understanding of the scientific process, these researchers contribute small, incremental advancements in scientific knowledge and the accumulation of useful data.

These are enviable goals, but the process of getting there is often tricky. Furthermore, the typical methods for circulating research – poster sessions and expensive conferences – can often be isolating, exclusive, or just plain boring. Games, on the other hand, tend to be social, accessible, and fun. If researchers can begin to play with their models, systems, and data, we could build new ways of understanding and circulating the narratives surrounding our research. In this paper, I will argue that games – specifically text-based games and other forms of interactive digital narratives (IDNs) – can help researchers spread awareness and publicize their findings in new persuasive ways. Additionally, as researchers and students design and build these IDNs, they are forced to think about their research concepts with new, innovative perspectives.

To showcase the effectiveness of involving student researchers in developing IDNs based on their research, I will begin by analyzing conventional methods of disseminating and circulating research, as well as exploring established correlations between gaming and learning. From there, I will connect the issues of narrative and research to show the persuasive potential of using stories to help share new qualitative and quantitative evidence. With these theoretical concepts in place, I will then describe a set of procedures inspired by Koenitz, Roth, and Dubbelman's (2021) notions of "Reuse" and "Unlearn" in which student researchers use the software Twine to turn their data and conclusions into a playable game. The goals, processes, and results of the transformation of research into IDNs are highlighted to indicate how particular elements of interaction and choice present in IDNs can lead to a deeper understanding of the material for both the researcher and the audience.

2. RESEARCH COMMUNICATION, IDNS, GAMES, AND LEARNING

Academic research has long been positioned as one of the key societal contributions made by colleges and universities. In the United States, public funding and support for higher education are typically predicated on the idea that these institutions will eventually discover and develop new ways of thinking about and interacting with the world. In the higher education system of the United States, public institutions receive tax funding to support research, researchers receive grants from the federal government, and some institutions are deemed "land-grant institutions," meaning that the college receives the property rights to the land for free from the government but must provide scientific research value to its constituents. However, the vast majority of research produced in higher education – whether at private or public colleges – is siloed and hidden

behind paywalls and other barriers. With the exception of open-access journals, citizens must pay to read the research that their taxes have produced. In addition to the standard articles published in academic journals, the other way research is circulated is through academic conferences. These conferences often require substantial attendance fees and necessitate attendees to cover travel expenses, as well as childcare and other dependent care arrangements while the caregiver is participating in the conference. The conference presentation itself has become its own genre, typically a 15-20 minute lecture accompanied by slides and data. The audience for academic conferences is typically other academics and occasionally industry partners. The general public is rarely ever a consideration in these matters, be they conference presentations or journal publications.

For research to have a meaningful impact, it must be shared, comprehensible, and actionable by both practitioners and stakeholders affected by the research (Garbarino and Mason 2016). Unfortunately, research on topics such as climate change, toxic chemicals, depression, forestry, social services, and more, often fail to reach these stakeholders and the general public (Shanley and Lopez 2009). Sometimes this is due to the paywalls of academic publishing. At other times, this is due to the specialized jargon and high level of discourse required to discuss these topics, making research and journal articles seem inaccessible to the public. However, just as documentaries and podcasts have proven effective in reaching new audiences, IDNs can also serve as a means to bridge the gap between academia and the public. By utilizing IDNs, research can be made more accessible and easily understood, thereby empowering those affected by pollution, climate change, and other critical issues that are investigated on a daily basis in colleges and universities worldwide.   It is important to note some of the similarities and differences between digital games and IDNs in order to demonstrate the utility of text-based IDNs to create a playful, interactive environment for users to experience research findings. This article positions text-based digital games as a specific subset of IDNs. IDNs include a wide range of digital texts that share the desire to move audiences out of passivity and into active participation in a story (Koentiz et al. 2015). While many digital games share this desire, there are also genres of games that do not enact stories. Puzzle games such as *Tetris* (Pajitnov 1984) or *Candy Crush* (King 2012), for example, typically do not have narratives. Because of the possibility for a project to veer out of the realm of IDNs, the researchers in this study were given explicit directions to include a goal, at least one character or role, and a narrative with at least two possible endings. Not only did this push the researchers to think about what users would accomplish and experience in their projects, but it also ensured that the projects would be using the affordances of interactivity and narrative. In this way, the projects analyzed here are classified as both text-based games and IDNs.

A considerable amount of scholarship exists that demonstrates how narratives are able to transport readers into their world. Green and Brock's (200)

concept of narrative transportability analyzes this process of immersion. Their concept has since been tested and analyzed across many mediums and subjects with results indicating that narrative in any form possesses great persuasive and educational potential (Green 2021).

Games have also been shown to be excellent teachers, and many researchers and theorists have demonstrated the relationship between games and learning. Dubbelman, Roth, and Koenitz (2018) have shown how narrative-driven games can help foster social and emotional change in players, and Mäyrä has argued for the importance of context in facilitating the process of play (2019). This is due in part to how games engage and immerse players in their reality. Part of the reason games in general and narrative-driven games, in particular, are so engaging is their connection to learning. Literacy scholar James Paul Gee (2008) has analyzed the many connections between games and well-designed learning opportunities, concluding that learning happens best when we adopt the identity of a learner and repeatedly challenge ourselves in tasks – all traits present in digital games. Game designer Raph Koster (2014) argues that games represent novel learning opportunities, and it is the sense of learning and growing that we find so fun and satisfying. From Koster, psychologists Deterding et al. (2022) have built upon this to hypothesize that our fascination with the uncertainty in narratives and games is driven by predictive processing – the mind's desire to continually learn about the environment and adapt to our surroundings. These qualities make games in general and IDNs in particular excellent candidates for reinvigorating interest in science and research.

The use of IDNs to help disperse and diversify audiences for research can largely be attributed to three qualities: narrative, interaction, and meaningful choice. In this way, IDNs have been positioned as a bridge between media studies and posthumanism (Hoydis 2021). IDNs in particular have been used as tools to teach a wide range of audiences about alcohol and risky behaviors (Engelbrecht et al. 2022), racial injustice (Fisher 2022), emotion perception (Zhang & Liu 2022), handwashing (Molnar & Kostkova 2015), English language acquisition (Ezeh 2020) and climate change (Skains et al. 2022) among many other topics. Their effect is twofold. First, the narrative aspects of these projects have the potential to transport the reader and increase the persuasive efficacy of changing values and beliefs (Mazzoco et al. 2012). Second, the interactive elements allow the user to test out assumptions and engage with the model. Each of these research studies puts different amounts of emphasis on narrative, interactivity, and choice, but they all engage with these qualities as demonstrated ways to connect IDNs to learning outcomes. I will elucidate each of the three qualities in order to demonstrate how research-based IDNs have the ability to persuade a general or specialized audience.

Narrative has been used by humans throughout recorded history to help transmit knowledge and continue traditions and cultures. It is both powerful and efficient. NASA-communications researcher Charlotte Linde (2015) argues

that "narrative is intrinsically social: that is, narratives have an audience, and an audience who cocreate the narrative through their responses, agreements, or objections" (p. 5). The chronological act of telling a story prompts the storyteller to think about both what they would like to be understood and how they can best be understood. Not only do narratives facilitate remembering, but they also have the potential to become persuasive. Communications researchers Olivia Bullock, Hillary C. Shulman, and Richard Huskey (2021) demonstrate empirically that information presented in the form of a narrative is more persuasive and sees greater change in the participants than non-narrative-based information. In our contemporary moment, narrative in games has become increasingly culturally relevant to the point where the *New York Review of Books* now features reviews of video games as well (2022). The narrative power of video games is now as accepted as that of movies or other forms of popular culture. And, while all narrative has been shown to have persuasive potential, the addition of interactivity, agency, and choice in games allows for the narrative to become even more powerful in teaching and changing perspectives.

With the explosion in popularity of digital games, academic and industry researchers have sought to identify the various affordances and aspects of games that differentiate games from other media. Games studies scholar Espen Aarseth posits that nontrivial action is what separates digital games from other more traditional media such as movies or books (1997). Whereas books require little more action than scanning one's eyes and flipping pages, digital games demand the player's input. Because of this demand, researchers such as Alexander Galloway argue that action is the defining characteristic of games as a medium (2006). Furthermore, the types of inputs required by digital games ultimately take the user to different places. While not everyone may turn the page of a book in the same manner, everyone will end up on the same page. However, in a digital game, the paths and decisions a player makes have a large impact on their understanding of the game's narrative and message.

Scholars have demonstrated how reflection and engagement with the decisions a user makes in an IDN can lead to a greater awareness of socio-cultural and cross-cultural issues (Bertolo & Mariani 2013). This reflection can also occur as the researcher creates the IDN. Hartmut Koentiz highlights the importance for creators of IDNs to center the user in order to produce a good experience (2014). This emphasis on agency and user choice does not negate the meaning of the IDN. Instead, game studies scholars such as David Myers (2017) highlight how interactivity in digital environments places a demand on the user to actively create belief in the situation they are encountering in the game. This is opposed to the notion that fiction and the literary form of the novel require the reader to suspend disbelief in order to accept the fiction of the narrative. Through IDNs, researchers can effectively express and communicate their message to this captivated and engaged audience.

3. INCORPORATING TWINE AND IDNS INTO RESEARCH-BASED CLASSES

This study seeks to answer the following two questions: how can the creation of IDNs help researchers think more deeply about the audience for their research and how does their audience typically experience a research-based IDN. In order to answer these questions, I developed a series of assignments and peer-review sharing opportunities for undergraduate researchers. Initially, students from a variety of disciplines were tasked with creating an IDN from their research. From there, the participants experienced and evaluated each other's IDNs with both written and oral feedback. This process and the results are explained in detail below.

IDNs in the form of text-based games represent a low-barrier-to-entry way for researchers to turn their data and evidence into a playable media format. Twine is a software application originally developed by Chris Klimas in 2009 – potentially avoiding the "Sisyphus" problem noted by Koenitz and Eladhari (2019) of having tools made for IDNs that are then allowed to decay over time. Twine still has an active community and sees new updates. In addition to its longevity, it allows users to create interactive web apps with little to no coding. Simply by placing text in brackets, users of Twine are able to set up branching paths and hypertext links. When the file is played back, the user is able to pick the different paths and see the ramifications of decisions and choices made. While this is the most basic feature of Twine, it demonstrates the quick utility of the software for someone who may not be an expert in coding, game design, or digital media. On top of the branching paths, Twine allows for easy integration of variables to help track stats or items and simple conditional statements to act as checks and balances as the player works their way through the Twine-created game.

The process of creating the game helps the creator separate the research itself from how it is being communicated to a specific audience. The research paper is a common culmination to first-year writing classes across the U.S. These papers are often designed to take new college students through the ins and outs of evaluating sources, navigating library databases, and producing evidence to back up claims. While these are enviable outcomes, the reality is that students often struggle rhetorically situating their research and end up with a vague collection of annotated bibliographies, extended summaries, and a few already established talking points. These results are very different from the "critical moments" Salter and Moulthrop discuss as potential critical intervention points for contemporary students (2021). After students have conducted research and written traditional papers or constructed typical posters, the students then create two IDNs in Twine: an interactive conversation and a game with a purpose similar to their research. Because Twine can actively recreate space and choice through branching paths and interactivity, Twine can reinvigorate research, bringing students' projects closer to their audiences and these critical moments. As a storytelling tool, it helps students develop a working set of credible sources through an imagined, structured conversation between the claims of their vari-

ous sources. Students are then tasked with envisioning several specific audiences, determining those audiences' stances or attitudes, and then providing paths and options to give that audience new, credible information.

After students have constructed their imagined conversations as IDNs, they then move on to thinking about the variables and quantifiable elements of their research. For example, while studying the sharp decline in insect populations, one student noticed that very little of this vital knowledge was reaching a key audience: homeowners and gardeners. Based on their research, they developed a game where players help an ant navigate a modern home and yard. Foods and substances that are more likely to carry or contain pesticides and other toxic substances were scattered around safer food sources and environments. Interacting and navigating through the game, players begin to see and feel how toxic chemicals, both purposely and unintentionally, fill our houses and lawns. Other students have dramatized crucial chokepoints in the cycle of poverty for an audience of first responders or helped gamify the process of exponential fungal reproduction for hikers in areas with large bat habitats.

Whereas typical student-research papers are rarely if ever seen outside of the classroom, Twine expands the possibilities for collaboration beyond classmates through the materialization of a "playable" form of research housed in an accessible, browser-readable file. After the completion of their Twine games, the researchers participated in peer review of each other's projects. They were asked to provide written and oral feedback on the project with special attention paid toward the role the IDN put them in, the choices they were offered, the effects of their decisions, and their overall understanding.

4. THE FISH GAME AND USER FEEDBACK

The IDNs produced as part of this project varied in subject matter from microplastic pollution to gentrification to mental health support. In order to demonstrate the transformational potential of turning research papers into IDNs, I will detail one particularly successful project and highlight how several researchers thought about their work before and after the project as well as comments made while experiencing other students' IDNs.

Several of the participants in the project were avid fishers and connected their hobby with their research. This resulted in one particularly effective project where the researcher analyzed whether upstream pollution or river-bank land development was more harmful to the local largemouth bass population. After researching the ideal conditions for bass to spawn, the student continued their research with ethnographic work, interviewing older fishers in the area about how the hobby had changed over the last thirty years. With this information, the researcher was able to craft an IDN that demonstrated the conditions necessary for the healthy habitation of bass and how that often conflicted with modern desires for riverfront property and ever-increasing suburban sprawl.

At the start, the user is able to select from one of three roles: fisher, real estate developer, or largemouth bass. For the fisher role, the player is tasked with winning a bass fishing tournament across one week of fishing. As they explore mountain streams, inlets, coastal areas, and brackish water, they encounter different types of fish as well as different ways of upgrading their gear and boat as they travel to bigger cities. The fisher role is set up as a push-your-luck game mechanic where the user wants to catch a lot of fish but will be severely punished toward the end of the week for overfishing and decimating bass populations. The real estate developer travels the area trying to develop riverside homes and putting on fishing tournaments to attract homebuyers. The driving mechanic to this role was a stock-market-like investment system that saw home prices rise and fall. The final role of the fish saw the user tasked with staying alive and avoiding bait and finding food by moving into and out of the various habitats, each with its own degree of likelihood for the food versus bait options.

The project was fun and provided an interactive opportunity for audiences to engage with the research. However, when the project underwent peer review, the comments from peers indicated that they weren't aware that some habitats were more likely to have fish than others, or fishers were more likely to be in some habitats than others when playing as the fish. While the IDN accurately portrayed the student's research, it wasn't clear to users why they sometimes got a satisfying ending and other times suffered a quick defeat. This lead the researcher to revisit and revise both their IDN and their research to see what was missing.

The student soon realized that while the ideas were all connected in her head, they were not connected in the research paper or her IDN. The process of peer review of the IDN led her to revise and rethink her overall project. In revising her work, the student began to research the different impacts various sizes of motors on boats have on habitats and particulate matter in the water. Her research also led her to discover the numerous philanthropic and ecological organizations headed by fishers to protect and preserve the natural world. The student's revisions of IDN and research paper highlighted these interdependent connections and complicated her argument by adding nuance and pragmatic considerations.

Throughout the peer review, participants noted two main benefits of transforming their research into an IDN. Many had to wrestle with the task of quantifying subjective or qualitative bits of information. For example, in the previously described game, the researcher had to decide values on a ten-point scale to attach to different habitats in terms of how suitable they are for largemouth bass. A mountain stream and a mountain stream with lots of trees on its bank, and thus lots of shade, dictate different scores. Participants said they were compelled to think of as many scenarios and potential connections as possible. The second benefit was the feedback they received. Participants noted that the feedback on their IDNs was of a different type than what they received on their written research papers. The feedback on the writing was largely focused on the writing – grammar, citations, organization, word choice. The feedback

they received on their IDNs was on how the research was communicated to a new audience, how it connected and intersected with other experiences the user had, and possible resources or historical events to add to their projects. In short, the feedback on the IDNs allowed the researchers to more deeply engage with the research than the medium in which it was delivered.

Because of its ease of use and ability to produce game files that can run on any smart device, Twine has been adapted into academic contexts. Salter and Moulthrop (2021) have written about how they have adapted Twine into the classroom to foster students' learning in web design, storytelling, and creative thinking. These same qualities make Twine an ideal piece of software for helping students take their research and turn it into a playable experience. The benefit here is also twofold.

First, as students construct their IDNs via Twine, they have to abstract the concepts they are studying into a quantifiable form. This is a form of systems thinking that researchers and thinkers from Zimmerman (2013) to DeVane et. al (2010) have argued as one of the chief literacies of twenty-first-century life. For students in the humanities and the social sciences working with qualitative data, this can be an especially important task. While it may be easy to quantify the number of snakes that pass over a sensor in a given week, it can be much harder to translate feelings of depression experienced by male college students and how they respond to various therapies. This type of work results in students reflecting on the strengths and limitations of qualitative data as they tweak the narrative's playable experience to accurately reflect the lived experiences they captured in their data. Similarly, students working with more quantitative data are forced to think of the implications, complications, and ecological networks of the data they collect and attempt to gamify in their narratives.

Second, as narratives are intrinsically social, the student researchers are forced to reckon with the question of audience and who will ultimately end up playing through their IDNs. The idea of "playing" a game instead of viewing or listening to research helps the students see research as an active process. While traditional conference presentations help transmit knowledge, they are typically expensive and out of reach of the average student who is taking science courses for required course credit. Rather than pushing out the general education student, turning research into a playable IDN helps students see that even small contributions to scientific data end up helping researchers track larger trends, all while helping the students see themselves as researchers and scientists in training. The group of literacy scholars known as The New London Group (1996) advocated for emphasis on both consumption and production – reading and writing in a traditional literacy sense – in the development of multiliteracies such as visual and digital literacy. When students make IDNs they become more thoughtful consumers of the digital narratives they continually encounter in their daily lives. When students work and shape their research

beyond collecting it in a single essay, they begin to see their identities as those of a scientist and a researcher and not just that of a student.

In addition to the transformative potential to the creator of a research-based IDN, there is also the power to reshape how the user experiences the research. The memorable and persuasive power of narratives and the creation of belief demanded by IDNs requiring the input of a user to move the narrative forward allow for a different expectation and procedure for user participation in research. Digital games as IDNs also demonstrate a degree of interactivity and customizability that make them particularly fruitful for communicating important research to wide audiences. Media studies scholar Katherine Isbister has identified three ways in which games are designed "to evoke rich emotional responses in players: coordinated action, role-play, and social situations" (p. 45, 2016). Each of the three techniques can be found in IDNs, but roleplaying and designing social situations are particularly applicable to this discussion. Research-focused IDNs can quickly and simply transplant the player into the role of climate scientist, hepatologist, or political activist. Similarly, the act of taking research and finding ways to give players choices and meaningful decisions oftentimes means placing the game in a social setting that would be familiar to players. Players are then able to manipulate, change, or fiddle with the rules of these social settings – such a player who repeatedly tries to subvert expectations by intentionally polluting the environment or making poor decisions on purpose to see their outcomes. IDNs offer their own form of experimental setup where players are free to take risks and subvert social orders with little to no consequence. If the social setting in which these narratives are experienced is that of an academic conference, then players are able to compare and contrast their experiences playing the IDN. In addition to these discussions, players are also able to compare their own internal model of how the world works with how the researcher has represented that model in a text-based game format.

In this way, Twine's representation of the research process helps students form a literal flowchart that can help identify unexplored connections, future paths for research, and future collaborators. Ultimately, Twine presents an exciting alternative to poster boards and PowerPoints for the remixing and circulating of student research and writing.

5. CONCLUSION

The ponds, lakes, and rivers of the eastern United States have proven to be excellent laboratories for thousands of student researchers. Ranavirus is widespread across the globe in amphibians, reptiles, and fish. Currently, it does not seem to affect the host species nor is the virus transmittable to mammals. If that were to ever change, the work of these student researchers would become much more valuable. As natural habitats decrease and climate change extenuates hot seasons and stresses species into increased human contact, these issues will become increasingly important. Students studying the genetics of turtles or the

effects of particulate matter on the local catfish population are not only excellent ways to train future scientists, but they also give us insight into how heat stress, microplastics, and other factors affect marine life. This type of science and data collection is not always the most glamorous or fun thing to do during the summer. IDNs, on the other hand, use interaction and systems thinking to engage audiences in pleasurable ways. Using IDNs via Twine to help motivate students to create and engage with research presents a viable future for the media literacy of students, the development of more sophisticated and deeper IDNs, and the world in which we all live.

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