Playing for Real: Designing Alternate Reality Games for Teenagers in Learning Contexts

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ABSTRACT

An Alternate Reality Game (ARG) is a form of transmedia storytelling that engages players in scavenger hunt-like missions to collectively uncover, interpret, and reassemble the fragments of a story that is distributed across multiple media, platforms, and locations. ARGs are participatory experiences, because players have a central role in reconstructing the storyline. Furthermore, players interact with the game as themselves, not via avatars. Although transmedia formats like ARGs have garnered increasing attention in entertainment and education, most have been targeted for adults 18 and older. Few studies have explored the design process of education-based ARGs for children. In this paper, we detail the design and implementation of an ARG for middle school students (13-15 years old). We describe the strategies we used to distribute story elements across various media and to encourage players to participate in an authentic inquiry process. We found that a "protagonist by proxy", or in-game character with whom players related closely, served as a strong motivator and a model for positive participation. We highlight student interactions and offer insights for designers who implement ARGs and similar immersive learning experiences.

Categories and Subject Descriptors

K.3 [Computers and Education]: General.

General Terms

Design; Human Factors.

Keywords

Alternate reality games, teens, learning, transmedia storytelling.

1. INTRODUCTION

Imagine a Monday afternoon in April. You're a 13-year-old 8th grader, on your way to social studies class, which today is in the computer lab. Your teacher and school librarian told you that you'll be working on a new project with some university researchers, and that it's supposed to be a game. You're hoping that it'll be something like Call of Duty®: Black Ops, but you're guessing it's a lame "educational" game on the web. When you get to the lab, however, you find that the websites that you'll be using are filled with cryptic messages and hints that history is not as black-and-white as textbooks imply, since it depends on the perspectives of the people who record it. Your help is needed to inspect a set of historical artifacts that were allegedly discovered by staff members from the Smithsonian Museum. You also learn about an actual, but secret philanthropic society established by one of America's founding fathers (Benjamin Franklin), called the Junto. You and your classmates accept the researchers' invitation to be part of a modern version of the Junto, called JENIUS (Junto of Enlightened Naturalists and Inventors for a United Society). You meet the JENIUS Ambassador, an authoritative figure who sometimes gives you bits of information, but more often, urges you to discover the truth for yourself as you undergo training to become a full-fledged JENIUS member. You and your classmates earn badges when you complete different tasks, like finding historic sites on maps, learning how to decrypt messages and verify archival records, and to restore the patent models of inventions. You share information on your community wiki. You meet another JENIUS member, a college student named April. She helps you and your classmates when you get stuck, via chat sessions on the JENIUS Status Wall. But she also knows about a big mission that she needs your help on. Every day, she has a new video blog post that tells you a bit more. You realize that all your training will be needed to help April complete a final mission for JENIUS. Some classmates collaborate to pinpoint the locations of clues, others work to decrypt some clues and encrypt others, and still others have to ensure the communications tools are ready to go when needed. With all your combined skills, April gets the mission done, and by the end of your two-week experience, you feel as though you have saved a part of United States history.

The above is a recap of the *Arcane Gallery of Gadgetry* (*AGOG*), an Alternate Reality Game (ARG) designed to expose middle school students to the information research process behind history and the early telecommunications of the 19th century. It was played with 60 middle school students (13-15 years old) for two weeks during their school year. The students were immersed in a historically grounded narrative in which they played as themselves, but also assumed the roles of inventors, archivists, cryptographers, and surveyors in a secret society (*JENIUS*) to gather historical evidence, decode data embedded in historic maps, and tinker with technology. As they interacted with the story, the students began to interpret information presented in their classes in new ways. When they noticed that information was missing or suspect, they were encouraged to play with available data and consider plausible alternatives. While the game's fictitious elements may seem contrived, the collaborative inquiry process the students followed to connect disparate data into a coherent storyline was an authentic representation of

IDC '13, June 24 - 27 2013, New York, NY, USA

methods used by professional historians and scientists. A few students expressed frustration at being asked to move beyond repeating answers from textbooks that they had been taught not to question. However, many students expressed a new awareness of the investigative process behind historical research, calling themselves detectives and problem-solvers (Figure 1).

In this paper, we detail the design challenges we encountered and the strategies we used to integrate a distributed, interactive narrative with game-based challenges in order to engage teenagers in inquiry-based learning. We examine how the effects of these designs emerged during gameplay, focusing on issues of authentic inquiry, transmedia navigation, and individual/community participation. We conclude with design insights for designers and educators interested in implementing ARGs and similar immersive learning experiences. The following research questions guided our investigation:

1. What are the challenges and opportunities of designing an education-based ARG specifically for teenagers?
2. How can the core elements of ARGs, such as distributed multimedia, collaborative tools, physical objects, and a blurring of fiction with reality, be tailored for teenagers in a learning environment?

Figure 1: Players collaborate in *AGOG*.

2. ARGS AS AUTHENTIC, TRANSMEDIA LEARNING EXPERIENCES

From a narrative perspective, ARGs are a genre of transmedia storytelling [22] because they engage players in scavenger-hunt-like missions to collectively uncover, interpret, and reassemble the fragments of a story that is distributed across multiple media, platforms, and locations. From a game design perspective, ARGs are a subset of pervasive games [28], because their multiplatform distribution of content spills into players' everyday lives via chat messages, email, and social media or chances to meet non-player characters (NPCs) face-to-face. For example, in an ARG rendition of *Alice in Wonderland*, a player could receive a text message from the Rabbit with GPS coordinates to an encrypted clue, which the player would photograph and upload to a website for other players to help decode, then email the result to the Mad Hatter to advance the story. Rather than being confined to the pages of a book, the story spills into the real world. During *AGOG*, NPCs delivered narrative clues via podcasts, videos, and blog posts; likewise, players shared information that they uncovered using Facebook-like status updates, blog posts, and a community wiki.

Like traditional videogames, ARGs were initially developed for entertainment, but have garnered increasing attention as a potentially transformative vehicle for education [6, 13]. The set of skills needed to tackle an ARG, such as information evaluation, transmedia navigation, and collaborative problem solving, includes the same set of skills needed to succeed in learning environments and to solve real-world problems [6, 23, 27, 29]. A small number have already been developed with educational goals in mind, such as *World Without Oil* (*WWO*) [35], which asked players to imagine their lives in the midst of a global oil crisis, and *Black Cloud*, which engaged at-risk high school students in scientific investigations of climate change issues in their own local neighborhoods [29]. However, nearly all ARG implementations to-date, even in learning environments, have been targeted for players who are 18 years and older [5, 26, 34].

ARGs share many characteristics with other game-based learning initiatives (e.g. videogames, virtual worlds). For example, ARGs require their players to be active participants, demonstrating their knowledge through collaborative activities, just as learning in well-designed videogames can be observed in player performance through game actions [4, 14, 32]. However, ARGs differ from other game environments in several ways that may impact participation and learning differently than other genres. These differences are described below and highlighted in Table 1.

2.1 Integrated, Participatory Narrative

ARG narratives are an integral component of gameplay, not solely comprised of cut-scenes between levels, or rule-driven narrative paths (Table 1). As in videogames, ARGs employ an engaging narrative to draw players into the game world [4, 32]. In traditional videogames, the narrative may provide context and some motivation: if a player finishes a level, s/he gains the chance to watch a cut-scene that celebrates the achievement, and also sets the scene for the next set of challenges. Socially situated opportunities for learning are embedded in the narrative frameworks for all of these games (e.g., players help a civilization similar to ours to solve a critical environmental issue). Unlike videogames, however, ARG players can influence the direction of the narrative based on their gameplay and discussions. Furthermore, in ARGs, story fragments are deeply embedded into game challenges: the ARG narrative is an integral part of the storyline. In the ARG *MetaCortechs*, for example, NPC employee directory entries were encoded in binary (Figure 2) [1]. To make sense of the plot and characters, and uncover new story fragments, players had to find and decode the encoded database entries. For players of ARGs, the endgame is to make sense of the story and contribute their own interpretations.

Figure 2: Encoded clue embedded in a character profile.

2.2 Pervasive, Transmedia Interface

ARGs are not bound by any single interface or physical controller. A pervasive, distributed transmedia storyline is the player's interface into an ARG (Table 1). In videogames, players interact primarily with computer-based NPCs and events that are driven by computational rules. Videogame players rely on joysticks, or mouse and keyboards to interact in predetermined ways with a virtual world that exists behind a single screen or hardware-based interface. In contrast, ARG players rely on familiar social media sites, in-game websites, mobile apps, and even experiences that occur in the physical world (e.g., meeting NPCs in city parks).

Table 1: Comparing ARGs to most traditional videogames

Traditional videogames	Alternate Reality Games (ARGs)
Integrated Participatory Narrative	
• Story provides context • Often shown as "Cut Scenes", with little live interaction • Digitally rendered story world • Challenges are usually external to narrative content (i.e., an iterative cycle of: complete challenges then see story, complete challenges, then see story, etc.)	• The story *is* the game (interactive, malleable story elements) • Participatory: Players contribute story interpretations • Blended, hybrid story world (physical and digital elements) • Challenges are embedded within, and integral to the story elements (e.g., email address, encoded chat message, or clue in narrative content)
Pervasive, Transmedia Interface	
• Require Controllers (e.g., mouse, joystick) • Single platform or interface • Governed by computational rules	• "Everyday" communications tools (e.g., email, chat) • Distributed across media/*Transmedia* (e.g., video, text) • Influenced by player collaboration, and community
Authenticity (TINAG)	
• Players play as avatar (or game token) • "Magic Circle" of play [19, 28] is bound by a digital interface of physical game board, with player avatars or game tokens	• Players play as themselves • Players adhere to the "This is Not a Game" mindset (TINAG), whereby they suspend disbelief to participate in authentic ways, as themselves, not avatars

Because they play with the boundaries of more traditional game spaces (the "Magic Circle" [19, 28]), ARGs hold unique potential to blend game mechanics and learning into everyday experiences [13, 28]. The transmedia interface can be traced through as many media and platforms that are used to build the story world and tell the story (Figure 3). Transmedia offers opportunities for players to practice literacy skills such as transmedia navigation [23] and to relate multiple representations of the same learning concepts [2].

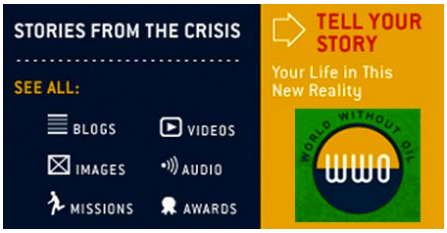

Figure 3: Players contributed a diverse array of multimedia, distributed throughout the ARG, *World Without Oil*.

2.3 Authenticity

ARG players and designers adhere to the "This is Not a Game" (TINAG) mindset, whereby they suspend belief in order to participate in authentic ways, as themselves, not avatars (Table 1). Through TINAG and narrative-driven interaction, players have a central role in assembling the story world and then sharing their interpretations with each other. Videogames have offered similar collaborative means for players to participate as contributing members of virtual communities, such as SWAT teams or environmental research teams [4, 14], through virtual role-playing. Role-playing activities (e.g., "playing an environmental scientist") enable players to adopt ways of knowing and working within specific in-game contexts that can transfer to "real-world" contexts [14]. However, players in ARGs do not take on roles as digital avatars or specific character types. Instead, players inhabit the game space as themselves, and often begin to identify themselves as detectives, storytellers, and problem-solvers.

TINAG can be the primary means for prompting critical, inquiry-based, "what-if" thinking, because players are responsible for distinguishing "truth" from fiction and providing evidence for their claims. The cognitive science term for "what-if" thinking is *counterfactual thinking*. It involves imagining what might have been, or considering "what-if" alternatives to specific events [10]. Counterfactual thinking can be a tool that fosters investigative reasoning in many disciplines, including science and business [8]. However, the ARG's porous boundary between a fictional game world and the "real world" does present challenges [8, 33]. Cultural institutions such as libraries, museums, and schools place a high value on the accuracy and trustworthiness of information that they disseminate. How can designers strike a meaningful balance between fact and fiction? How and when might fictional elements be used to fill gaps in existing knowledge, especially when working with children in learning contexts?

Overall, ARGs hold unique potential to promote meaningful learning experiences. The storytelling nature of ARGs can help attract and retain otherwise disinterested players [16, 29] and provide a clear sense of purpose and shared identity among players. Players can also gain a sense of agency about their learning experiences, because ARGs encourage players to participate in hands-on activities that foreground their contributions to the narrative. Today's youth are surrounded by a diverse ecology of media spaces and opportunities to participate in their own interests and learning endeavors (e.g., online communities) [21]. Likewise, given their transmedia nature, ARGs represent an ecological model of participatory learning that recognizes that individuals learn across diverse contexts [9]. Most education-based ARGs have been targeted toward players 18 years and older, and have been implemented in informal learning environments (e.g., museums, libraries) [5, 15, 34]. Our study examined the challenges and opportunities of integrating the above ARG design principles in an education-based ARG created specifically for teenagers (13-15 years old).

3. METHODS

The design and implementation of *AGOG* is part of a larger design-based research initiative to explore the potential for ARGs to support collaborative learning in authentic ways. We followed a multi-method case study framework [36]. The main case traced the design process and observed effects of an ARG developed for a formal education setting and targeted for teenagers (13-15 years old). Building from empirical cases like *AGOG*, our research goal is to develop theories that inform designers' and educators' efforts to design and implement ARGs for learning, with a focus on adolescents. A multi-method approach enabled redundancy of

data collection and triangulation from multiple perspectives, to help verify our analysis and clarify emergent themes [24, 36].

3.1 Participants

The participants for our study included the *AGOG* design team (five adult researchers and one creative writer) and the teenage students who played the game, along with their teacher and school librarian. *AGOG* was designed over the course of eight months, with an average of one 2-hour design session per month for the first seven months, and weekly meetings during the month prior to the game's launch. The design team met almost daily during the week before the game began, and throughout its 2-week run (either in-person or via teleconferencing). Notes taken during the meetings were posted on a design team wiki, which also included digital copies of design artifacts, such as plot drafts, sketches of the lead NPC, and outlines of player challenges and clues.

The game itself took place over a 2-week period in a public school in the U.S. Sixty 8th grade students started the ARG, with about 55 students (13-15 years old) participating consistently. The students played during their American History class sessions (daily sessions, Monday-Friday, 50 minutes each). The 60 students who participated were drawn from two classes (27 students in one class, 33 in the other). To accommodate computer lab scheduling and to facilitate classroom management, the students remained in their respective class sessions, with only one instance of the ARG being played across both groups. Slightly fewer boys participated than girls: 44% boys (26), 56% girls (34). Half the students were eligible for the school's free and reduced meal program, which is an indicator of low socio-economic scale. Six percent had limited English proficiency (LEP). Regarding ethnicity, 43% (26) of the students identified themselves as African American/black, 37% (22) as Caucasian, 13% (8) as Hispanic, one as Asian American, and four as mixed race.

3.2 Data Collection

Design Process Data. Prior to, and during our design process, we conducted interviews with 15 expert ARG designers and researchers. Topics discussed during these interviews included definitions of ARGs and related concepts (e.g., transmedia storytelling), the ARG design process and challenges, and the educational potential of ARGs. Expert interview transcripts formed one source of data about the ARG design process and lessons learned. Additional sources of data related to our ARG design process included 1) notes from recordings of design sessions; 2) field notes, shared documents, and design wiki data from the *AGOG* design team; and 3) draft design artifacts such as a network diagram of planned story elements and clues.

Implementation Data (effects of design). During actual gameplay, we collected data on several levels of player participation: 1) observation and field notes of all in-class sessions; 2) brief daily summary meetings among the *AGOG* design team members and teacher before and after classes; 3) online, print, and physical artifacts created by the students and *AGOG* NPCs; and 4) a post-game survey and discussion with players. We databased all of the students' online interactions (e.g., chat interactions, wiki entries), as well as their post-game survey (e.g., some demographic data, and free-form written responses to open-ended questions).

3.3 Data Analysis

We followed a grounded theory approach to analyze our data, making multiple passes through each data source to categorize observed design issues and participation effects [12, 24]. We constantly compared the patterns emerging from and across these resources to increase the internal validity of our study through triangulation [24, 36]. For example, if player data reflected high interaction with an NPC during the game, was it corroborated in post-game survey data? We framed our analysis with the goal of uncovering strategies for incorporating learning and literacy practices into play-based experiences, along with considerations about player age (e.g., protecting player privacy, providing scaffolds and feedback).

For our *design process* data, specific themes we analyzed included decisions that were made about how to distribute story elements across various media (e.g., when and where will clues be posted if players get stuck?); and discussions that the design team had about challenges and opportunities posed by TINAG (e.g., would the players confuse fictional aspects with factual?). For our *implementation* data, themes we looked for included the ways players used multiple media to navigate across and make sense of the storyline; the collaboration and social interaction of players that supported engagement and learning; and points at which TINAG was evident (e.g., players noted "I feel like a detective!" or questioned, "Is this real?").

4. ARCANE GALLERY OF GADGETRY

In this section, we share our design strategies for tailoring the characteristic elements of ARGs for teenagers in a formal learning environment (Section 4.1). We include a summary of the observed effects of those design decisions during gameplay (Section 4.2). First, we provide a synopsis of the game's backstory.

The game began when university researchers (the *AGOG* team) recruited the students to help inspect a set of historical artifacts for the Smithsonian museum. To join the game, students accepted an invitation to become part of a modern version of Franklin's Junto, the *JENIUS* society. Once they became members, they learned that their main responsibility was to curate a special subset of inventions from the U.S. Patent Office known as the *Arcane Gallery of Gadgetry (AGOG)*.

The narrative is based on the history the Patent Office during the 19th century, when it was known as a "Temple of Invention," [31] because of the interest that U.S. citizens had in industry and inventions at the time. For example, a model of the telegraph, the "new" telecommunications system, was housed there. The Patent Office was an important landmark not only because it displayed technology of the time; it was also used as a hospital during the U.S. Civil War. Historically significant figures associated with the Patent Office included Abraham Lincoln, the poet Walt Whitman, and Clara Barton, founder of the American Red Cross. Consequently, a rich story world could be created that contained topics from several middle school subject areas. The players' missions revolved around learning about 1) the process of turning ideas into patented inventions, 2) maps that the 19th century version of *JENIUS* might use, 3) their communications tools (e.g., telegraph and Morse code), and 4) important historical figures of the time whose lives and ideologies held messages for future generations (e.g., Whitman's poems, Barton's philanthropy). Details regarding the narrative are available in [7, 8].

4.1 Design Strategies

Note that some of our design strategies support more than one design principle. For example, the variety of media we used to deliver story content gave players the sense of a transmedia interface as well as a means to participate in the unfolding story.

4.1.1 Pervasive, Transmedia Interface

We implemented the *AGOG* story world across two websites: a "rabbit hole" public site and an in-game password-protected site.

Both websites used the Drupal content management system (CMS), with tailored modules that included video/audio recording and publishing tools, chat & instant messaging, geographic and timeline tools, simple assessment tools with a quiz-like format, a badge award system (for successful completion of tasks), and a wiki. Although *AGOG* relied on fewer sites than most ARGs, our goal was for the variety of media used within those sites to ensure they were still rich, interactive transmedia experiences.

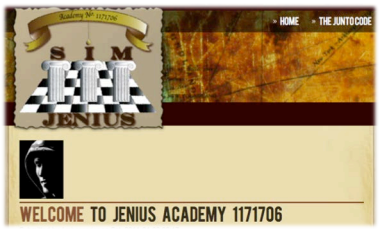

Figure 4: JENIUS Community website

A private, password-protected community site was an important design consideration for teenage participants, based on school requirements to have a safe workspace in which players could collaborate without concern that unknown outside entities might distract players [11]. The desire to have a safe, bounded space in which teen players could work collaboratively also came up in expert interviews. As noted by a librarian who worked with teens to design ARGs to support summer reading programs, "*Internet safety and not misrepresenting yourself…is a very big concern for this age group*" (H. Owings, personal interview, Oct 2010). Creating a private player community site also holds potential advantages in terms of reuse [17], since game data can be reset for each class or group that might want to experience the ARG. Reuse is especially important in education settings, given the time required to develop and tailor new lessons for different classes.

4.1.2 Integrated, Participatory Narrative

To address this design principle, we had to 1) create a hybrid story world that 2) required player participation to unfold.

4.1.2.1 Blended, hybrid story world

In addition to addressing privacy concerns, our two-site format could accomplish two things in terms of narrative delivery and authenticity. First, the public site could provide players with actual historical background on the real Junto and its principles. Second, when the players entered a secret phrase about the Junto from the public site, they would be redirected to the password-protected community site. The division of the two sites offered a design-based means to signal factual information from potentially suspect information to the players. The public site was designed using a Drupal module, *Konami Code*, which is based on the use of cheat codes in videogames that can reveal special information to players [25]. The secret phrase was an anagram of the URL of the public site (*justnoevil*.org) that implied the historical Junto was still active ("*Junto Lives*"). The anagram was a play-based means to lead players into discussions about patterns and codes, as an entrée to the cryptographic missions that some of them would complete during the game.

We created two NPCs to deliver the primary game narrative: a *JENIUS* Ambassador and a college student, April Gravure (known as "April G." by the players). The fictional Ambassador, a mysterious leader in the society, provided information to players at pre-scripted stages in the narrative. For example, he introduced the players to the tenets of *JENIUS* (e.g., importance of careful information evaluation); he delivered the game's Final Mission orders; and presented endgame congratulations. April was a 21-year old college student who needed the players' help to send a message that would successfully end the game. April was *AGOG's* "*protagonist by proxy*", a phrase used to describe a character who discovers the ARG narrative alongside the players [3]. ARG designers commonly use the "*protagonist by proxy*" as a means for players to interact with the narrative. During gameplay, players feel that they are being presented with the same information (e.g., URLs, email, copies of documents) as the in-game protagonist. Players can unearth clues that the protagonist needs, and s/he has the means to communicate new information to the players. Like the players, the *AGOG* NPCs were not avatars. Members of the *AGOG* design team played the *JENIUS* Ambassador and April (Figure 5).

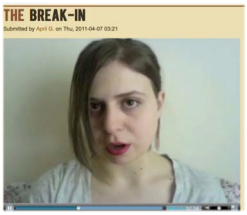

Figure 5: April G. in a video blog post.

Although the players interacted with one community website to experience the game, we distributed narrative fragments across multiple media. Each media type served a different purpose, and was delivered at different times, to ensure players worked across a variety of media (transmedia) as they uncovered the story:

- *Videos and text-/image-based blog posts* enabled April G. to reveal secrets about *JENIUS* and clues to the final mission. These were delivered in daily installments.
- *Podcasts* were the primary communications used by the *JENIUS* Ambassador. Because he was characterized as a stereotypical authority figure, his interaction with the players was one-way only. He did not engage in dialogue with them.
- *Facebook-like Status Wall* updates provided an informal, live *chat* mechanism. Like the other narrative information, chat updates would be visible to all players, and posted in a prominent place on the community website.
- *Incomplete Wiki* entries were seeded on the *JENIUS* website, to provide hints and clues to players. The entries were also intended to serve as stubs for the players to contribute new narrative details as they uncovered them. The community wiki included copies of *JENIUS* documents (e.g., historic maps) and images of artifacts (e.g., the Kairograph, an *AGOG* invention fashioned after the telegraph).

Players could use any of the above media during gameplay to interact with the storyline. For example, the first in-game mission was designed to give players an opportunity to create and post videos of themselves taking the same "oath" to scientific inquiry that Benjamin Franklin's original Junto members used.

4.1.2.2 Player Participation

The multimedia that we used supported player interaction with the game narrative as it unfolded, but we also wanted to encourage active player participation. We structured the player community and scaffolded game progression to facilitate this.

Designing for individual player and community participation. To encourage players to collaborate as they reconstructed the fragmented narrative to complete the game, we embedded interdependent puzzle components within the game site's distributed narrative content. Historic maps contained over a hundred landmarks into which clues were embedded; cryptographic key phrases were split across historic documents;

and archival data had to be evaluated to solve a logic puzzle about historical persona. In addition, we wanted to help each teen player feel as though s/he was a contributing member of the *JENIUS* community. Both collaboration and individual accountability were important factors in terms of player participation. Our design strategy was to create four community sub-groups, known as "Orders," within *JENIUS*, with each Order serving a different, but interrelated function. *Archivists* were responsible for determining the authenticity of documents and artifacts, and maintaining accurate records about the society. *Cryptographers* ensured the security of *JENIUS* artifacts, through knowledge of codes and ciphers. *Inventors* were responsible for maintaining and extending existing *JENIUS* inventions, as well as creating new designs. *Surveyors* maintained the society's maps and charts, along with other location-based data, such as the geographic coordinates of *JENIUS* artifacts and locations. *JENIUS* Orders provided a game-based means for students to band into interdependent groups.

Designing for scaffolded game progression and incremental player participation. In most ARGs targeted for adults, player communities share information about skills they already possess that may be used to tackle puzzles and codes that are embedded in the narrative [26]. A musician may find a clue embedded within a music file, a web designer may extract a code from source files in a website, or a videographer may help another player create a video segment in response to an ARG challenge. In *AGOG*, the middle school players had little to no experience with uploading videos, encoding Morse code, decoding simple substitution ciphers, or using GPS coordinates to find locations on maps. Yet all of these skills would be needed to complete the final mission.

Two phases were designed into the game progression to address this challenge: a training phase and the final mission. Training missions were designed to help players to acquire various Order skills, such as using geographic tools like gazetteers and Google Maps™ (Surveyors), searching patent and biographical databases (Archivists), making an electronic circuit (Inventors), and learning about cryptographic keys, Morse code, and substitution ciphers (Cryptographers). Missions were designed so that players could earn badges for each mission they completed (Figure 6). The goal of the training phase was to promote collaboration within Orders and emphasize individual accountability, which are important in formal education settings [7]. Several of the missions were mapped to academic content standards for the middle school level (e.g., geography skills/understanding maps, recognizing patterns in codes/math, and finding and evaluating information).

The final mission was designed to support collaboration and information sharing among groups, as it required players to use the skills of members from each Order. It entailed decoding, decrypting, and reassembling a message that had been scattered across documents in the wiki and presented by the NPCs. The endgame goal was to ensure that the players could complete the game successfully only by collaborating across Orders and applying the individual skills acquired during training.

Figure 6: *JENIUS* Order Badges.

4.1.3 Authenticity (TINAG)

As noted earlier, TINAG presents opportunities for players to take part in an authentic narrative, which can be highly engaging and offer personally meaningful learning opportunities [26, 27]. At the same time, denying that the experience is a game may be seen as an attempt to misrepresent the truth to players, especially if they are young. Writers of historical fiction face similar challenges in addressing the tension between staying true to the historical record while presenting counterfactual, but plausible scenarios that can engage audiences who might not consider history to be interesting (like teens).

Our counterfactual, TINAG design goal was to maintain an immersive experience while supporting player efforts to separate fact from fiction [8, 33]. We tried to scaffold the play context (in-game website and player discussions) with subtle visual markers to support player efforts to make sense of the fact/fiction divide. In blog posts, a change in fonts (e.g., regular to *italic*) was one visual marker we used to signal a move from fact to fiction. When historical information on the community wiki was purely fact, it was hyperlinked to credible sources. For story elements that were questionable and required investigation by players, wiki text posed questions, such as "*Cause: unknown?*" When players read about real historical figures with a fictional, game-based secret identity, the data was divided into two sections: "*public*" reflected known, publicly available data, and "*private*" or "secret" reflected fictional aspects of these entities.

In addition, the Orders offered players the opportunity to assume roles in which they had a personal interest. This was not only an important design decision in terms of authenticity, it was also an important consideration for teens, who are just beginning to explore and reflect on their identities [18]. To help the players decide which Order might be the best fit for them, we created an "Orders Quiz." The Quiz posed questions such as: "*You're an explorer setting out for uncharted territories. You can take only one of the following things. What do you take?*" The choices listed for each question related to the dispositions of members of each Order (e.g., "*A pocket knife. I'll think of a million ways to use it*" or "*A compass. I need to know where I'm going*"). Our goals were to help players feel 1) that they had a choice, and 2) that they could personally identify with the Order they chose.

4.2 Gameplay

Here, we highlight the observed effects that our design had on players, mapping them to ARG design principles (Table 1).

4.2.1 Pervasive, Transmedia Interface

Although our transmedia interface was a single private community site rather than a more multi-sited network, players interacted with every type of media we used within that site. Based on our analysis of databased transactions of online player activity, field notes from observations in the classroom, and our post-game survey, the multimedia distribution of the *AGOG* narrative by live characters proved to be one of the most engaging design elements for players. Students would often replay April's daily video blog posts multiple times to ensure that they uncovered all the clues that they thought might be revealed by her. Videos and audio podcasts garnered the most attention; however, it was often difficult to get players to read through any text beyond the chat-like messages on the Status Wall. This may have impacted the effectiveness of the visual markers we used to highlight factual from fictional data (e.g., "*public*" versus "*private*" wiki entries described in *section 4.1.3*).

In-person media was also an important aspect of *AGOG's* transmedia interface. Physical artifacts and objects feature prominently in almost all ARGs, and in *AGOG*, several players in the Inventor Order enjoyed working with a simple telegraph and creating LED bracelets during their training. In addition, players could post concerns, questions, or evidence that they felt should be shared with their class community on "big paper" posted at the front of the lab. As more and more clues were posted, the big paper became a working "wall of evidence". One player used the "wall of evidence" to post an idea she had pieced together about an historical event that was critical to the game (a Patent Office fire). In her post-game survey, she proudly explained how her efforts had advanced the game's progress: "*I had an idea and I wrote it down. It kinda gave a hint to the others of what April needed to do.*"

4.2.2 Integrated, Participatory Narrative

The same types of media we used to distribute narrative elements were also used by players to participate in the story. Throughout the game, players used Status Wall updates to chat with April and each other. Over 1000 chat messages were logged during the game. Chat topics included players publicizing their mission accomplishments, sharing data, and exhorting their fellow players to collaborate:

Avery: *"WOHOO jus finished my second mission"*

TonyV: *"I Got A BADGE ! (:"*

Anton: "*Wheww!!! Just finished two of the missions of cryptographer. Very happy {kinda getting into this game}*".

Ben: "*who is a cryptoghrapher? I NEED UR HELP!"*

Keara: *"@Spence - How You Complete Mission 1?"*

Morgan: *"@Kamry - What mission you doin? Ima do it…"*

Claire: *...go under collaborate ->wiki -> unsolved questions -> message to charles mason (CM) to see the message or to -> cabinet of curiousities document to find the hidden key phase, 'YOU DELAY BUT TIME WILL NOT'... but I dont know what "A PLACE FOR EVERYTHNG" means... can anybody help?"*

Most players felt a strong connection with their protagonist by proxy, April. Over the course of the game, April received many chat messages (almost 20% of the messages were directed to April or were April's responses to questions from players):

Henry: "*Hi April, my name is Henry - these missions are hard"*

Kamry: *"So Im Going to Need Your Help With Mission 1 of Cryptographer. Cant Quite Get the Morse Codes, Any Ideas?"*

Kalea: *"hey how r u doin... im with you… i saw ur video its great and ill do anything 2 help… talk 2 u 2marrow!!!!!"*

In the post-game survey, several players commented that they felt April was a major reason they participated: "*I tapped the code for April*"; "*I helped April G*"; and "*April was in trouble and we had to help her*". This data corroborates several ARG designer and player assertions that players often see the protagonist by proxy as people "just like them" [3]. From a learning perspective, players may be motivated to regard these in-game protagonists as both mentors and investigative partners.

The chat feature proved a double-edged sword for teen players, as many chat messages were purely social, such as:

Jess: "*In social studies with all my friends!*"

Morgan: "*How ya doin from across dah rumm!"*

Toward the end of the game, as many players rushed to complete the Final Mission, some spent more time testing their ability to get live reactions from their peers through chat. While unsurprising from a teen social development perspective [18, 30], we decided to turn off the site's chat feature during the last 3 days of the ARG to help refocus attention on the endgame. A few players expressed their disappointment about this decision in their post-game survey. However, during gameplay, we observed that limiting this one mode of participation helped us re-engage several teen players in the game activities.

4.2.3 Authenticity (TINAG)

The players' Status Wall updates also offered evidence that players were personally engaged in helping advance the narrative:

Kamry: *"Ready Start This Good Ole Mission! I Feel Like Sherlock Holmes ;)"*

Ben: *"I feel like a boy scout when I get a badge… so proud"*

Claire: *"i feel like a secret agent..."*

Rachel: *"I feel like james bond…"*

In response to open-ended questions in their post-game surveys, (e.g., What did you like most?; What surprised you?) about 15% of players mentioned that they felt like detectives or spies, "*saving the past.*" One student noted that "*treating it like it was real*" was the best aspect for her, and 20% of her classmates were surprised at "*how real*" the game felt. Over 70% said they would play an ARG like this again, because it was "*fun to solve a mystery*," "*fun to help*," and "*it was a strategizing game that keeps you thinking*."

In addition to their enthusiasm at being "real-live agents" within a secret society, players had many questions about which aspects of the narrative and game puzzles were "real," and which were not (TINAG). To help players work through their questions, we would meet with them at the beginning of class sessions each day, to collectively summarize events and activities of the previous day and introduce new plot points (e.g., video post by April). Players could ask for help or share information during these group-processing sessions, which typically lasted 10-15 minutes. We also recorded player questions and clues on the working "wall of evidence" (posted at the front of the lab, e.g., Figure 7). Our discussions afforded the players an opportunity to debate and share insights with their peers about how to interpret and evaluate information when they were working in the "*imaginary real*" (in the words of one student). For teens learning to critically evaluate information, these discussions helped "lead to productive explorations on why and how" and "emphasize creative thinking rather than memorization" [23, p. 17].

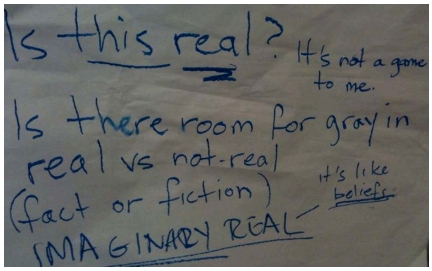

Figure 7: Player questions and comments on TINAG, as recorded in group-processing sessions.

There was also some evidence that players applied what they had learned during our discussions as they evaluated data from their Order missions. In response to an archivist mission that required research on the authenticity of specific inventions, one player posted the following blog entry:

"Although Eli Whitney was known for his famous invention "the Cotton gin", how can we be sure he was the first? How do we know that people such as William Bell, … John McBride, or Obadiah Crawford hadn't invented it first? Long-staple cotton gins had existed long before Whitney's but with such an image is difficult to prove it's authenticity. It could easily be proven fake."

5. DISCUSSION AND IMPLICATIONS

In this section, we summarize lessons learned from *AGOG*, highlighting options for designers and educators who are considering ARGs as authentic learning experiences for teens.

5.1 Pervasive, Transmedia Interface

Use one player community site, with narrative distributed across multiple media within the site, to support youth privacy and technology literacy practices while simultaneously maintaining the sense of puzzle-like transmedia that is a staple characteristic of ARGs. In most ARGs that have been targeted for adults, the quantity, variety, and distribution of media used to craft the storylines is high. In contrast, our *AGOG* experience showed that in formal learning environments, limiting the number of sites that contain story fragments was beneficial. At the same time, players had little problem working with the variety of multimedia that was used to deliver story fragments within the single site. Indeed, the use of different media by different characters seemed to increase the teen players' immersion in, and engagement with, the storyline and its associated activities. One factor in our success was the way we matched the media type used to deliver the story fragment to the character presenting it. The Ambassador was an authority figure who could dole out mission assignments and make assessments. As a result, we kept his interaction with players one-way only (recorded podcasts, memos). In contrast, April's video blog posts were personal and conspiratorial, and she chatted dynamically with the players throughout the game. The private community site also provided a shared, safe public space for players to discuss their ideas about the story, to post solutions to clues, to ask for help when they were stuck, and to celebrate when they finished missions and earned badges.

Use one player community site (or limited points-of-entry) to support formal school Internet policies and reuse of educational resources. From an infrastructure standpoint, having a single, private in-game player community site supported school information technology policies regarding the number and types of websites that students are allowed to access from school [11]. None of the external websites that *AGOG* used were of concern; however, maintaining links to external sites at a central web location (the community site) helped to ensure that a school librarian and teacher could organize and manage them more easily. The community site may serve as a useful assessment and reusable lesson-planning tool: it provided a repository of player performance that could be used in formal academic assessments, and has potential to be reused by teachers from year to year.

Take advantage of open source social media tools (e.g., CMS like Drupal; video-sharing sites like SchoolTube), rather than more complex virtual environments (e.g., Unity 3D). ARGs remove traditional videogame requirements to remain tethered to a desktop or to invest in specialized tools and skills necessary in virtual environments. Educators can appropriate relatively low-cost social media technologies such as blogs, podcasts, and online community tools like wikis and discussion forums to support the creation and distribution of narrative elements, and students can use these same tools to share their progress through the game.

5.2 Integrated Participatory Narrative

Offer players the same media production tools that NPCs and designers use to deliver content, to help maximize player participation and engagement. Our teenage players not only enjoyed interacting with the various media that NPCs used to present the storyline (see *5.1 Pervasive, Transmedia Interface*), they also took opportunities to use these same media to engage in their own productive literacies [32]. For example, all the players created and posted a video blog of their initial Junto oath, which was the same oath they witnessed April take in one of her early video blogs. This small video production represented the first opportunity that many players had to create, upload, and share a personal video on a community site. Over one-third of the players (24) created at least 2 blog posts, a few of whom began to use the same conversational, conspiratorial style that April's blogs had as they summarized and reflected on the game's progress:

> Ben: "*...Last week we observed April G's [recorded] notes. The morse code translated out to be 'Message Across Time.' This is obviously linked to the Kairograph, which can send messages in the past, present, and future. SCAR is obviously on the hunt for this. We need April to write that message on the 15th!!!!! We need to work together for clues & find out why SCAR wants April. You can talk to me about my blog at Ben05*."

Every player posted at least one chat message. One player posted 72 messages to decode clues as she interactively chatted with April and members of the design team. These findings suggest that ARGs for teens can and should afford players with multiple media tools to share their knowledge. This also aligns with recommendations from new media literacy frameworks [23].

Establish guidelines for in-game collaboration, so that teen players can enjoy social features such as interactive chat while they complete game-based missions. Many players used chat to participate in ways that supported teenage social needs, but not the explicit academic requirement to engage with mission-based learning activities. Five students who sent over 30 chat messages during gameplay used the Status Wall only to socialize with friends. The high number of social messages did not detract from the player experience, but neither did it support player efforts to solve puzzles and meaningfully advance the narrative. Laying ground rules for positive social interaction has been recognized as a standard design guideline in more adult-oriented ARGs [6, 27], and can help simultaneously support a sense of community and productivity. In future ARGs for teens, options for establishing guidelines include: 1) incorporating it into the narrative and missions (e.g., secret society code of conduct) and 2) reinforcing them through the protagonist by proxy (e.g., April).

Include a protagonist by proxy NPC who acts as both peer and guide, to motivate active participation and engagement of teen players (Figure 8). When players needed help to negotiate the narrative and complete missions, April pointed them to wiki resources that could help them solve puzzles and reassemble the fractured storyline. Players could use sample wiki entries and blog posts that April created as templates for their own work. She also encouraged players to collaborate amongst themselves and work closely with members of the design team who facilitated in-class work. Viewed through a participatory learning lens [23], the protagonist by proxy often models productive information-seeking and problem-solving behaviors that teen players can emulate.

In addition to creating protagonists by proxy who are close in age and sensibility to teen players, one of our expert designers added that a sympathetic authority figure would also be helpful: "*In an adult-run game, if there's not clear directions, adult [players]*

might take the initiative to create directions and …meet the needs however they see best, but teens really, they're just, well they're in a culture of education and they are looking for directions on how to do [ARGs]…Once they know the structure they are more than happy to interact and respond and that's what we found. We found that with a librarian character they had someone to look to that would give them direction whereas our teen characters kind of filled in the storyline" (H. Owings, personal interview, Oct 2010).

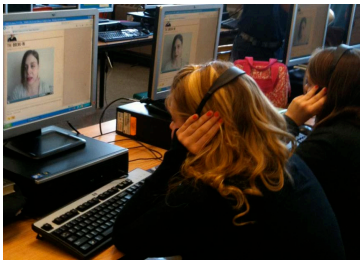

Figure 8: Players listen closely to a video blog post by April.

Give players agency to help the narrative progress, through their dynamic interaction with NPCs and required puzzle-solving tasks. Many ARGs are open-ended, asking players to *co-create* a narrative. In contrast, other ARGs are more close-ended, with players responsible for collectively making sense of and *co-constructing* a fractured narrative arc that has been hidden by designers *pre*-game. Both are viable ARG narrative structures, but the participatory trick in the close-ended ARG lies in the ways in which designers deliver story fragments incrementally over time in response to player interaction. There is no guarantee that every fragment will be found or used, so players continue to feel as though their actions can influence the story. The ARG is still participatory and dynamic, but narrative advancement is propelled by traditional ludic elements such as collecting clues, solving puzzles, and helping in-game characters. *AGOG's* training phase and live interaction with April contributed to the teen players' sense that their participation made a difference.

5.3 Authenticity (TINAG)

Enable teen players to take on personally meaningful roles while still interacting with the narrative and game content ***as themselves****.* This promotes active participation and lends a sense of authenticity to gameplay. In their post-game survey and in chat logs, we found a substantial number of players identified with the roles they assumed during the game (e.g., "*I was a beast archivist*" and "*I invented things*"). Others enjoyed the variety of tasks they could participate in: "*there were many jobs we could choose from.*" Most of them felt like real detectives, and worked hard to complete challenges, ask for, and give help (e.g., "*i got past my first mission!!!! with help from Beth and Megan. Getting on at home!!"*).

Make time for group processing discussions to help teen players distinguish between factual and fictive information presented in an ARG. Like the chat feature, TINAG proved to be a double-edged sword for teen players. Live chat sessions with April gave players a strong sense of immersion, but they also contributed to some players' complaints about the effort needed to distinguish between factual and fictional information. During our group processing sessions, a handful of students asked the design team to tell them "the answers" about which data were "real," and which were not. On the positive side, our group processing sessions engendered rich discussion and debate about ways to question and evaluate information rather than simply accepting it, suggesting that designers of education-based ARGs for teens should take advantage of these teachable moments and build in "sense-making" discussion time. Because TINAG proved both engaging and confounding to the teens, designers should look for ways to hold dedicated how-to discussions on the critical evaluation of information (e.g., an online TINAG discussion forum, an "unsolved mysteries" category in a wiki repository, or face-to-face processing time, as was used during *AGOG*).

Experiment with various visual features that can signal to players in learning environments that they must judiciously question and evaluate the information they are finding. We used visual and text-based "markers" to help players evaluate information and distinguish between factual and fictive elements within the ARG narrative, in addition to holding group discussions and getting protagonist by proxy help. These markers met with mixed results. While a few players recognized the "public" and "private" sections on the community wiki, most did not respond to them as much as they heeded April's advice about what information to look for and evaluate. One possible explanation for this mixed result is that many of the wiki entries were not central to the final mission or training tasks. Consequently, not enough players noticed these features to be significant.

6. CONCLUSION

Our work was motivated by existing views in HCI and learning sciences communities that more design-based examples are needed to develop and establish effective models for game-based learning [20, 32]. Our study builds upon a growing body of research that has examined the potential for ARGs to be novel learning experiences [e.g., 5, 29, 34]. Our findings extend existing work by focusing on opportunities and challenges that designers face when creating and implementing ARGs with teens (13-15 years old). Our contribution offers an early foundation of best practices for designers/educators to follow when implementing ARGs and similar immersive learning environments for teens.

Similar case studies are needed by designers and educators to test our design implications in their own learning contexts. Future work might include 1) evaluating design strategies for reuse [17], such as resetting private player community website data whenever an ARG is restarted, or recruiting players who are experienced with an ARG narrative to extend it with their own player-produced "chapters"; 2) devising ways to develop a protagonist by proxy model that not only engages individuals who are already playing, but could also help recruit larger player populations; and 3) investigating the impact of visual markers on player efforts to critically evaluate ARG narrative information and to distinguish between factual and fictive elements more effectively.

Despite challenges we faced to ensure that teen players did not come away from the game with an inaccurate impression of historical events, many players reported that *AGOG* made history both interesting and interactive: "*I was surprised at how intricate it was*", "*I was saving history*", and "*it let you learn more of the past and interacts with you and is fun*".

7. ACKNOWLEDGMENTS

We thank the expert interviewees, students, teachers, and librarians who participated in the study, and NSF IIS-0952567.

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