Martian Boneyards: Can a Community of Players be a Community of Practice

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Abstract

Martian Boneyards is a prototype game in a massively-multiplayer online environment designed to entice gamers to partake in collaborative scientific inquiry. This case study examines the steps designers took to foster a community of inquiry within the game. Designers played characters in the game, allowing them to be responsive to players' activities and accumulating knowledge. Players were drawn to the narrative and close relationships they developed with the designers' characters and other players. An informal and communal reward system was used to further nurture collaboration among the community. Findings suggest games like this one show promise for fostering science identity and scientific inquiry.

Keywords

Virtual worlds; game design; community knowledge building; game-based learning; scientific inquiry.

ACM Classification Keywords

K.8.0 [Personal Computing]: Games, J.4 [Social and Behavioral Sciences]: Psychology, Sociology

Introduction

Our research group is looking beyond today's schools to envision learning environments up to a decade in the

future. One booming environment that we think yields great promise for inquiry-based science learning is collaborative Internet-based games.

Our research group implemented a game called Martian Boneyards in a high-definition massively multi-player online environment (MMO) called Blue Mars, using this prototype game to learn how to build and support a community of scientific inquiry among players. A core group of 66 players engaged in collaborative activity to solve the game's mystery. The players used tools designed for collaborative evidenced-based reasoning and built knowledge together that scientific experts described as accurate and "very good" as compared to an introductory undergraduate class on comparative anatomy [1].

This case study explores the community's practices of scientific inquiry that emerged in Martian Boneyards. Specifically, we examine the research questions:

1. What design features may have been useful to support a community of scientific inquiry in Martian Boneyards?

2. What impact did the community have on players' experience in the game?

The research on Martian Boneyards uses netnographic methods [2], blending digital records with ethnographic methods such as surveys, participant observations, and interviews. The goal of this research is inform researchers on the lessons drawn from this prototype study on how to support and study communities of scientific inquiry in free-choice MMO games, an

increasingly popular environment where people spend their time [3].

Research Problem

While U.S. learners are becoming increasingly disengaged with formal and informal learning environments, nearly all youth and most adults are engaging more and more in Internet-based free-choice experiences [3,4]. Youth and adults, both male and female, are spending increasing amounts of time playing computer games [3,4].

Free-choice Internet environments also factor significantly into American youth and adult attitudes about science and their knowledge in science [5]. Significant inquiry practices have been observed within gaming communities [6]. With the phenomenon of digital games exploding in today's society [3,4], it behooves the educational community to understand how this new venue can be leveraged to foster productive scientific learning experiences.

Design of Martian Boneyards

Martian Boneyards is prototype game designed to foster and measure the scientific inquiry within a community of gamers. The designers in our research group created the game using a framework of scientific inquiry stemming from Toulmin's model of argumentation [7] and a theory of scientific inquiry that examines the conscious coordination of evidence and theory [8]. This prototype showed evidence of autonomous scientific inquiry within a community of self-perceived non-science oriented gamers, and the results of their inquiry were seen as comparable to a very good undergraduate university project [9]. This case study examines the steps our designers took to

foster a community of inquiry within Martian Boneyards and the emergent findings from the game that show promise for fostering science identity in social games of scientific inquiry.

Martian Boneyards' game experience was designed as an ecosystem where the interactions among the elements of the gaming environment are key (Figure 1). In this type of participative game environment, designers kick off an initial game design with resources and a storyline, but that design is far from static. It is the interactions of the players with those design elements and with each other from which the game arises. Player activity creates player progress, which in turn feeds into the evolving gaming design. The ultimate game storyline and activity is a product of the player community, with the structures carefully designed by the design team.

Figure 1. A model for a participatory gaming ecosystem

In An Ecosystem Gaming Model The Storyline Evolves with Gameplay

One game designer explains:

"Our design relies on community input and not overly structuring the inquiry. We try to give a really strong scientifically accurate base but let the community take it where they are going to take it. In Martian Boneyards, we made a deliberate choice that the game player community was part of our design team—we were going to let them help us design something we couldn't do alone. We were modest enough to realize that what we would do with them would be so much better in the end."

In this model, a game is not delivered to the community, but rather emerges from it. This type of ecosystem framing is consistent with research on supporting online communities. Because Internet-based communities can be tenuous and amorphous, designers such as Kim [10] advocate for building flexible environments that continuously address the needs of the audience. In an ecosystem model, game designers create an environment with tools and resources, and create an initial storyline that evokes player activity, but the design is not finished once the players start interacting with the game.

For a game like this to succeed, the players create social structures and form into a community of practice, building a language, habits, and practices that help them advance in the game. Etiquette, rituals, and events help to cohere the community [10]. The activities, traits, and behaviors that take place in some role-playing and social digital games are in common with many facets communities of practice. In a community of practice, people work together on domain-specific activities using common habits, language, and cultural rules of engagement and developing an accompanying body of knowledge. In games, players often work together as part of a community to solve (often domain-specific) problems with access to informational resources and tools necessary for each problem [11].

Gee [12,13] argues that in game playing, people model how they need to learn and this is in stark contrast to the way learning activities are implemented in traditional learning environments. Gamers are found to construct new roles and identities [12, 14] as they engage in collaborative problem solving [15] and

systemic thinking [16]. Learners' sense of identity and science self-efficacy are often overlooked indicators of people's willingness to participate in furthering their science skills and knowledge [17,18] and may be particularly important factors to consider for typically excluded members in science, such as girls or minorities [19,20].

An important part of our framework for games of scientific inquiry is that if players see themselves as an important member of a community of scientific inquiry in a game, they may then gain confidence and motivation for science learning in other venues. Science identity is developed not only by seeing one's self as a science person, but also in having one's performance and contributions recognized by a community [21]. Lee and Roth [22] argue that relationships at the community level are important mediators of scientific activity and identity.

For example, peer-review, collaboration, sharing and analysis of data, and evidence-based reasoning are occurring in many popular role-playing games (e.g., World of Warcraft) [7]. These gaming activities are similar to the habits of practicing scientists in professional communities who share data and observations, challenge and confirm each others' claims, and work together to build theories through a well-recognized and explicit peer-review system [23]. To date, science learners' habits have been shaped largely by formal learning environments and thus may have been stifled as compared to their potential in free-choice learning environments [6].

Designing games with a range of possible roles may help foster identity in games [11]. In a game, a

character can also become an extension of a player's agency. In early (textual) online environments, Turkle [24] and Berman and Bruckman [25] found evidence of people "trying on" new identities in online games and communities, later to enact the same behaviors in real life. Pearce [26] suggests that some players emerge as leaders and creators through this process of improvised emergent identity formation, and many discovered and developed new talents and abilities as a result. Furthermore, when motivated and supported by group cohesion, these identities can be portable and malleable over time, and lead to a high level of productivity [27,28]. Pearce [26] also warns, however, that much of this potential lies in the interface design because relationships and identities are driven by the expressive mechanisms and presence allowable by the environment. Dalgarno and Lee [29] take the view that the constructs of presence and co-presence, often available in 3D avatar based environments, are key to construction of identity in gaming environments.

Based on the literature on the affordances and design strategies for immersive and social gaming, our research group created a prototype social digital game that could foster and measure the community's scientific inquiry.

Designing a community in a small MMO

Martian Boneyards was designed in the Blue Mars MMO to take advantage of the social presence and immersiveness that this high-definition environment offered and also to take advantage of the early adopter MMO audience who were searching for fun activities in this new environment. We are not seeking to make more gamers in the world, but rather to provide

productive scientific inquiry to those gamers who are out there seeking "hard fun" [30].

As designers, we played the characters of three explorers of this new planet who had found an abandoned science center. The Science Center was surrounded by beautiful grounds (Figure 2) and a gruesome mystery. We placed bones from humans, Neanderthals, chimpanzees, and other animals around Arcadia in ways that could seed a variety of storylines. Our characters told players they had discovered the bones, cordoned off different areas to protect them from damage, reactivated some of the tools, and then called upon the Blue Mars community to help them figure out what had happened in the boneyards.

Figure 2. The Martian Boneyards

Players were allowed to take the story in any direction that the community agreed was evidence-based. For example, a skull was found some distance away from a nearly full skeleton. It was near a stream and there were lemur bones nearby. Was it moved from its original location by scavengers or water or other means? Did a skeleton wind up at the base of a cliff due to being pushed or having fallen, or just dying in that

place? These types of questions and the subsequent scientific topics of inquiry were left open for the players to investigate (or not).

We used an evolving set of storyline tools, such as a secret journal from a primary (dead) character) that allowed us to unfold a dynamic storyline that was responsive to players' interests and accumulating knowledge. We scheduled events two evenings a week so that players would know we would be there then and released the game areas in phases so that we could pace players' activities according to their progress. We also attempted to set a culture and set of common practices among the community, through modeling of our behaviors and through guided facilitation (asking questions such as "hmmm…what makes you say that?" or "Did you talk with so-and-so about that to see if that agrees with her evidence?"

This combination of pre-developed artifacts, tools and environment along with a nimble and evolving storyline facilitated by the designers was the framework that allowed the design and research of Martian Boneyards.

Methods
To examine the development and impact of community in Martian Boneyards, the research relies primarily on interviews with designers and players as well as participant observations. Three top players (two female and one male) were interviewed near the end of the game and were asked their impressions about inquiry in the game, their motivation to start and stay in the game, and the factors that they saw as important to their learning and their enjoyment in the game. Similarly, one game developer and two educational designers were interviewed to understand their

intentions for game design features. The two designers were also participant observers who played characters in the game so they also described their strategies for facilitation in the game. Digital records from Internet-supported interactions were combined with ethnographic methods [31,32] to provide a well-rounded picture of participants' behaviors and culture in the environment. These multiple viewpoints address the interdependency of environment design, players' activity, and players' progress by representing the game as a distributed system of players, knowledge, and scientific tools and resources in Arcadia.

The Emergence of a Community of Inquiry in *Martian Boneyards*
Players and designers noted several factors that were responsible for emergence of a community in Martian Boneyards. As per the suggestion of professional game designers [11,12], minimalizing the instruction (both for tools and for content learning) gave authority and responsibility to the players for their own experience. The immersive environment and compelling storyline were key to getting players engaged and the communal rewards, such as swag and an award ceremony, were visible means of recognition of player progress, fostering identity and roles.

The Environment and Storyline
Players were initially attracted to the aesthetics of the Martian Boneyards environment. While they were there, they found interesting artifacts, a storyline, and a friendly community of co-explorers. The insular nature of the gaming environment (being a high-end MMO, it is still in beta-testing) also curbed the ability of Martian Boneyards to reach a wider audience and inhibited

some of the ability for designers to be responsive to players' interests.

Though the aesthetics of the Arcadia environment drew people in, it was the Martian Boneyards storyline that kept them coming back. The bones and artifacts were laid out by designers with an intricate storyline in mind, but the designers let the players choose how to interpret that evidence. The characters that we played in the storyline were useful in holding the threads of the community together. Players' relationships with the our characters changed throughout the storyline, without intention on the part of the designers other than their responding the best they could to where the players wanted to take the storyline. Players were at first mistrustful and cautious with the designers' characters, but as their trust began to grow (and sometimes wane again) the participant observers felt it was the relationship that players developed with these characters that brought them back night after night.

Recognizing Success
To make a visible connection between players' advancement and their role in the community, each week we awarded avatar clothing to players who had made significant contributions. These t-shirts, cargo vests, and water bottles were clearly identified as from the Martian Boneyards game and showed others that they had been recognized (Figure 3).

Later in the game, the designers used an award ceremony as a way to wrap up the storyline, and held a community event where players were publicly recognized. Laurel's announcement that the award ceremony was going to be held in the Arcadia Science

Center created much excitement among the players. An observed noted:

"They were that invested communally—they weren't just going to go off to work alone, they were going to MEET and do it!"

Figure 3. Top players and designers characters in their Arcadia t-shirts

Players were excited in the build-up to the awards ceremony—planning outfits and discussing who would be there. When the evening arrived, over 40 players showed up in full evening wear that they had purchased from the stores in Blue Mars (Figure 4). People gathered in the entrance hall until called en masse into the theory-building room.

Figure 4. Screenshot from the theory-building room on awards night

The enthusiasm and pride demonstrated by the players at the awards night was noted by all the designers. There was a palpable sense of accomplishment in the community, as well as pride and respect expressed for the top players.

Reflections on Identity in The *Martian Boneyards* Case Study

We noted many interesting cases of identity revealed in the interactions among players. Participant observations revealed that even early in the game, top players were emerging as leaders, but their leadership was not a product of a strong confidence in their own science abilities. When one top player, Jespau, told us (via in-game chat) that she had many files of information on her computer containing measurements and Internet sites with data, we asked if she wanted to share it with others. She replied, "Why would anyone else want to see it? It is not like I know what I'm doing. I just do this for myself because I am a little OCD …lol."

Figure 5. Siegfried teaching a newbie to hunt (while wearing his bunny slippers!)

Throughout the game we rewarded players like Jespau for their persistence, innovation, and ability to teach others. For other players, these science leaders became the heroes of the game. A male player said of Jespau: "I nicknamed her 'Doc' because for me…she was the person who had the most, the acutest brain. I followed her around eschewing the company of other so-called 'Scientists'…Jespau and I became suspicious. Stories did not ring true. We or perhaps I decided to trust no one except Jespau…Her account explains so much."

Players also took on roles of teachers, although sometimes they took on that role in response to a request from another player. On June 24, Jespau was lingering after an event with Siegfried, a player who had many technical troubles with Blue Mars, yet still came to nearly all of the Martian Boneyards events in the first months (Figure 5). Near the end of the evening, Siegfried said to Jespau "I don't think I'll be coming back until the workstations are up, there is nothing for me to do here anymore." Jespau said "oh darn, I thought you'd come back and help me find more bones." Siegfried replied "oh yeah – I guess I could come back and help other people" and did return many times.

This adoption of roles and players' sense of identity within the community may be an important leverage point for designers to use to foster communities of practice in games. Turkle [32] explains that identity and players' sense of self, and what is salient to players, can change as they spend time in Internet-based social settings. Researchers must be careful to remember that characteristics of players, their activity, and their progress that are measured in the virtual

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game may or may not transfer into real-world identity and behaviors.

Professional game designers use the ability to nurture roles and identity in social games as a mechanism for building and sustaining community [11,12]. This case study is a step in showing how those same design strategies can be used by educators to foster communities of scientific inquiry in social games, and how that research may be useful in fostering science identity within a new audience.

Conclusions

The prototype game, Martian Boneyards, has raised many interesting questions and shed light on how gaming communities may be supported as communities of practice. In particular, this research shows that the players in this game showed indicators of belonging to a community of scientific inquiry, which in turn had impact on their behaviors, language, and maybe even identities. Social digital games continue to be an exciting place to study communities and identity formation among learners.

Acknowledgements

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