Highlighting MazeStar: A Platform for Studying Avatar Use in Computer Science Learning Environments

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Short Game Description: MazeStar is a platform developed as part of a National Science Foundation-funded project researching effective uses of virtual identities in STEM learning environments. Contained in MazeStar is both a game (*Mazzy*) and an editor. In *Mazzy*, players solve maze-like levels by creating short computer programs. As levels become increasingly complex, players learn fundamental computing concepts such as code blocks, procedural thinking, looping, conditional statements, etc.[1] In the level editor, players create custom maps with a high degree of customizability in terms of map size, map layout, and artwork.[2] *Mazzy* has been used as a testbed for studying virtual identity in a STEM learning environment (Kao & Harrell, 2015a-e; 2016a-c), while the addition of the level editor will allow us to take new directions as we begin studying intersections of virtual identity, social identity, and education in the context of game play as game creation.

MazeStar

The MazeStar platform is a key component of an NSF-funded project to better understand the role digital identities play in STEM learning. Avatars are a selective projection of a player onto a virtual representation (Harrell, 2013). A central aim is to assess how avatars can support broadening participation in STEM fields by attending to learners' social and STEM identities. Towards identifying best practices in avatar use, early studies compared avatars such as photos of player faces, shapes, player likenesses, etc. in online studies now cumulatively involving 8,357 participants. These studies have led to publications in the areas of human-computer interaction, games, artificial intelligence, and education (Kao & Harrell, 2015a-e; 2016a-c). Also integrated with MazeStar is AIRvatar, an interface for studying avatar customization (Lim & Harrell, 2015a-b). Understanding how avatars may affect individual learners is crucial, since virtual identities are now ubiquitous in video games, Massive Open Online Courses (MOOCs) and forums, intelligent tutors, and more.

The Game

The STEM learning game is called *Mazzy* (Kao & Harrell, 2015f). *Mazzy*'s design is grounded in a constructionist pedagogical approach (Papert & Harel, 1991) and was influenced by Gee's design principles (Gee, 2003). The goal in *Mazzy* is to author a program that results in the character reaching the end of each maze. Players in *Mazzy* use code blocks, procedural thinking, looping, conditional statements, etc. See Figures 1 and 2. There are twelve levels in the version of *Mazzy* here.

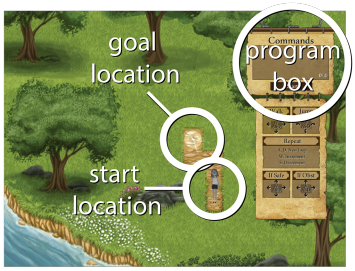

Figure 1. Level 1 in *Mazzy* introduces the basic game mechanics.

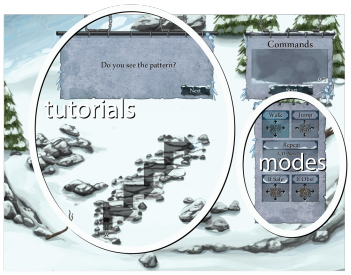

Figure 2. Level 6 introduces looping.

[1] Gameplay video: http://tinyurl.com/mazzyquick
[2] Mapping video: http://tinyurl.com/mazestarquick

The Editor

The editor takes a constructivist approach to learning, i.e., learning is most effective through the activation of one's own experiences (Piaget, 1976). Therefore through level creation, students use generative themes (e.g., personal interests) (Freire, 1970). Most recently, we have run a small study of 12 middle and high school students over a single day. Students were given only basic instructions on how to use the interface (e.g., creating a new map, moving around the map, etc.), but were able to quickly begin creating and customizing their own maps. Figures 3, 4, and 5 are three of the many student maps created that day. Many of the students spoke excitedly about how their level incorporated, e.g., the famous Boston Zakim bridge, or all the different Boston sports arenas, etc.

Figure 3. "PATVBRO" (or Patriots versus Broncos)

Figure 4. "Boston Sports Map"

Figure 5. "Underwater Coral Fish Party"

We aim for young STEM learners to become, and see themselves as, learners and doers of Computer Science. Ultimately, we believe that MazeStar can be a step towards this goal, through both use of virtual identities and level construction, with both acting as technological supports valuing students' broader sociocultural identities and interests.

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Acknowledgments

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