Bringing Constructionism to Action Game-Play

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Abstract

As technology has become cheaper and ubiquitous, children are spending more time playing video games. Surveys suggest that that video game play is an activity that children participate in almost universally and that the amount of time spent playing games is enormous (Lenhart et al., 2008). While new research makes a compelling case for the educational potential of video games, some categories of games are rarely represented. Action platform games in particular, while incredibly popular among today's youth, are seldom mentioned in video game research.

Constructionism is a powerful design tool for transforming passive activities into highly engaging, thought-provoking, educationally rich experiences (Papert, 1993a). While constructionism has been utilized successfully in programs that encourage children to design video games (Harel & Papert, 1991; Kafai, 1995), we believe that constructionism has a place in the playing of video games as well. We propose that action platform games should be designed to incorporate a constructionist paradigm. By incorporating constructionism into action platform video games we believe that such games can become powerful spaces for identity formation and problem-solving skill development.

We believe a constructionist redesign of action platform games will include an opportunity for player-character construction, an open and flexible system for building objects in-game to overcome obstacles, and a medium for sharing game-play with other players. By allowing for the personally meaningful construction of unique in-game characters, players will be allowed to incorporate their own identities into that of their digital avatar (Gee, 2003; Harel & Papert, 1991; Kafai, 1996a; Papert & Harel, 1991). Designing levels so that components, rather than complete objects, are utilized in overcoming obstacles allows the player to systematically build various solutions to problems and to develop new relationships with their constructions as well as with the problem they're building to solve (Cavallo et al., 2004; Wilensky, 1991). Finally, by providing an integrated system that allows player to share their game-play, action platform games can become a space that nurtures a community of learners as players deconstruct one another's methods and construct new ideas and solutions (Kafai, 2006; Papert, 1993a; Papert & Harel, 1991).

We hope that these suggestions will serve as a starting point for a broader dialogue on a wider adoption of constructionism in video games.

Keywords

video games, informal, play, problem solving, identity

Introduction

Constructionist designs have been successfully applied to a wide range of domains including math education (Eisenberg, 2000; Feurzeig, 1989; Noss & Hoyles, 1996; Papert & Harel, 1991; Roschelle, Kaput, & Stroup, 2000; Wilensky, 1996), science education (diSessa, 1997; Sengupta & Wilensky, 2008; Wilensky & Reisman, 2006), computational literacy (Berland, 2006; Hancock, 2001; Harel & Papert, 1991; Kafai, 1996b; Wilensky, 1999), and engineering education (Blikstein & Wilensky, 2004; Martin, 1996; Resnick & Ocko, 1990). However, the design of video games, a domain currently being explored with much enthusiasm by educational researchers, rarely considers constructionism. Video games have always been of interest to constructionist, and many have designed constructionist environments that appoint children the role of game designers. Such research has shown game design to be a powerful way for youth of both genders and varying learning types to make personal connections to content and problem solving (Harel & Papert, 1991; Kafai, 1995, 1996a). While we are very excited by this work we believe that the *playing* of video games could also benefit from a constructionist design. In this paper we propose a set of level design strategies for transforming action platform games into constructionist environments where the player constructs her own solutions and paths through game levels. Such a design would encourage the player to construct sharable characters and artifacts as a means of overcoming obstacles and solving puzzles and provide a medium for sharing these designs. It is our hope that these design ideas will begin a conversation about how to infuse constructionism into game-play where it has traditionally been absent.

Motivation

Video games constitute an important part of the lives of children and youth in today's world. The PEW Internet and American Life Project claims that as many as 97% of all American teens (regardless of gender, age, or socioeconomic status) play video games in some way and 50% play games daily for an hour or more (Lenhart et al., 2008). Such numbers are commonly explained simply by assuming that video games are fun – of course kids like to play them! However, this off-handed dismissal neglects the reality that video games are generally difficult and require a very large time investment to master (Gee, 2003). Papert (1993b) suggests, "some forms of learning are fast-paced, immensely compelling, and rewarding. The fact that they are enormously demanding of one's time and require new ways of thinking remains a small price to pay" (p. 5). Like constructionism, video games are motivating and interesting, despite their difficulty, because they "empower children to test out ideas about working within prefixed rules and structures" (Papert, 1993b, p. 4).

A large body of work has shown that video games contribute to epistemic literacy (Gee, 2003), mimic proven and effective learning environments (Stevens, Satwicz, & McCarthy, 2008), positively impact learning motivation (Orvis, Horn, & Belanich, 2008), alter quantitative reasoning (Satwicz & Stevens, 2008), and can be effective at leveraging expertise in formal learning environments (Shaffer, 2006). Despite the positive nature of this literature, it is clear that different games have different strengths and that some games may be seriously deficient in educational value.

While children play a wide variety of video games, the action platform game is one genre with which nearly every child has experience. The basic structure of these games varies drastically, however, the defining characteristic of an action platform game is the need to overcome obstacles with quick reflexes. This basic game-play structure makes up a huge proportion of some of the most popular console games (Mario, Donkey Kong, and Sonic the Hedgehog are some classic examples) and leads to the quick and exciting play often preferred by younger audiences. Unfortunately, the literature rarely cites such games as having educational value. We believe that bringing a constructionist design to action platform video games that allows players

to construct characters, construct tools and artifacts within the game, and provides a medium to share designs and strategies will transform passive reflex-driven interactions into an opportunity for thoughtful, reflective, and interesting game-play.

Character Construction

A key characteristic of action platform games is their linear nature. While these games have always allowed for some amount of exploration, players are always pushed towards a specific locational goal. For example, in the popular and extremely successful action platform game LittleBigPlanet (a game that we feel comes the closest to integrating constructionist design aesthetics) players can find additional "prize bubbles" by exploring out-of-the-way areas in a level. However, despite the slight bonus for curiosity, players are inevitably forced to get back onto the main pathway to finish a level. In addition, many action platform games have dramatically limited the way in which players can reach this goal. Even when offering various tools and powers as was done in the Super Mario Bros. series of games (flowers that allow the player to shoot fireballs, or a feather that gave the player the ability to fly), levels generally have a "best solution." This tendency to push players to a particular path is at least partially due to the inflexibility of the player character – when characters are designed only one way, there becomes only one logical path for level completion.

Constructionism places a very high premium on making learning experiences personal. In *Mindstorms,* Papert (1993a) suggests that learning (in this case physics) is about bringing content "into contact with very diverse personal knowledge" (p. 122). Constructionist environments allow learners to build artifacts that reflect their interests and goals – to take ownership of learning and to develop an "intellectual identity" (Papert, 1993b, p. 24). Whether it's turtles, gears, or LEGOs that are especially salient to the learner, constructionist designs generally allow the learner to "own" and customize this artifact. In addition, cultural and gender differences are not only supported by the environment, but also leveraged in artifact construction (Harel & Papert, 1991; Kafai, 1996a; Papert & Harel, 1991). The uniformity of player characters and consolidated game-play found in action platform games severely limits the possibility for personally meaningful construction.

One key difficulty in designing constructionist levels for action platform games is the limited abilities of the player character. In a game like LittleBigPlanet, where the player character can only push, pull, and jump, obstacle designs are severely constrained. We believe a constructionist design should allow the player to customize character traits and abilities. There are a variety of possible ways one might achieve this. One method, which we refer to as the "backpack design," is based on the classic game *Lemmings*. *Lemmings* allows the player to activate various character abilities in order to solve complex puzzles. Every lemming in the world is the same, however every level has a selection of backpack abilities (dig down, build stairs, climb up) the player can assign to any lemming. Most of these abilities are temporary; when the lemming runs out of materials or is unable to continue (digs through the wall or climbs up to the top), he turns back into a basic walking lemming. The player solves the level by assigning lemmings abilities that will remove obstacles and bypass hazards, allowing the remaining lemmings to travel safely to their home. We believe a "backpack design" which allows the player to obtain temporary special ability is a powerful idea to consider when building constructionist action platform games. The available abilities could change dynamically throughout the level or the player could preselect abilities before beginning levels. Classic action platform games such as *Super Mario Bros. 2* and more modern games such as *Trine,* have explored the notion of preselected or dynamic unique abilities to great effect. In these games predefined characters that each have different strengths or abilities allow players to move through the level and solve puzzles in *character-specific* ways. We believe that tweaking such a design to allow for flexible ability assignment would allow for puzzle and level completion that is *player-specific*. In addition, such an approach could lead to especially interesting results in multiplayer situations. In a

multiplayer level players would select complimentary backpack abilities that they could then coordinate as they moved through the level.

Key to this design, and what distinguishes it from traditional action platform games, is the player directed nature of ability choice and the flexibility of level design to accommodate these choices. In a constructionist action platform game the player should be able to construct the character identity in a way that is personal and meaningful for them and obstacles and puzzles in the level should be designed in such a way that different abilities make for novel and interesting solutions.

Object Construction

Because action platform games are designed for a quick pace, elements encountered during game-play are already pre-fabricated. While a player might need to find a tool or utilize a vehicle in order to overcome some obstacle, there is usually only one correct way to solve these challenges. In LittleBigPlanet, complex vehicles that players could easily build in the game's highly constructive "create" mode," are simply there, waiting for the player to press the button to turn them on in the completely separate "play" mode. The tendency for action games to provide the player with complete objects to use allows for the possibility of speed, but removes a golden opportunity for construction.

Constructionism claims that by building and sharing personally meaningful artifacts learners become not only more aware of their own methods and style of problem solving, but also more aware of the nuances of the problem (Papert, 1993a; Kafai, 1996). By providing learners with the "pieces" with which to build solutions to problems, the learner is able to focus on different aspects and features of the design as they become necessary. As described by Cavallo, Papert, and Stager (2004), such an approach allows for "out of the box" thinking that can lead to creative and surprising designs. Constructionism's focus on components, rather than finished objects, allows the player to imagine a variety of possible endpoints. This increase in connections with the components and representations of the constructed objects increases the quality of the relationship the player will have with their final construction (Wilensky, 1991).

One way to make action games more constructionist would be to provide pieces of useful or necessary objects that could be put together in multiple ways, allowing each player the opportunity to build one of a number of different solutions – each of which could be used to solve the same challenge. In other words, rather than provide the player with the object used to overcome obstacles, the player would be provided with the materials to make such an object. One example of this would be to have the player build a vehicle rather than just providing it for her. A large variety of components would be provided and the player would have the opportunity to construct their vehicle in a way that is meaningful to her. In one case the player may create a small vehicle made of light material so that it can easily jump an obstacle of boxes, while another player may construct a metal vehicle with large wheels that can simply crash through the boxes. In this way players are not only encouraged to think about the design of their solution, but also to consider the many nuances of the obstacle for which they're designing a solution. In addition, the flexibility of design would likely encourage in-room interactions as other players or even non-playing friends and family members offered their suggestions and advice on the "best" object design. These in-room interactions have been shown to be an especially powerful aspect of the learning environment created by video games (Stevens et al., 2008).

Sharing

The public sharing of artifacts is a concept that is vital to constructionism and completely absent from the design of nearly every action platform game. Games and software that encourage players to create content – and these games are increasing in popularity – are often very successful at incorporating a public sharing component, but as mentioned previously, the

"playing" aspect of video games lack this important feature. For example, when in LittleBigPlanet's "create" mode players have the opportunity to share object and item constructions as well as entire levels. However, once the player switches to "play" mode, nothing about the action is shareable. The absence of a public space or method to share the constructions that we propose should happen while playing action platform video games is a problem that must be solved before such games can be considered constructionist.

In constructionism, the words *public* and *sharable* are always present (Papert & Harel, 1991). Stemming from Lave and Wanger's (1991) idea of legitimate peripheral participation, and Papert's interest in Brazilian samba schools (1993a), public constructions give learners an entry point at all levels. Working side by side both novices and masters are able to participate at all levels of construction. Whether building a computer program or a tangible object, learners should have the ability to see other's ideas, borrow from them, deconstruct them, and to present one's own ideas. A constructionist design creates a community of learners much wider than the traditional model of only teacher and student (Kafai, 2006).

How does one share when playing an action game? One medium that players have adopted ad hoc to make their game-play public is online videos. A quick search on YouTube reveals thousands of videos recorded and cut by players to show game-play. These videos are often recorded to show off successes or to illustrate how one overcomes a particularly difficult obstacle. We believe this is one way action platform game-play could be shared publicly. Action video games could include a feature that would allow the player to record their actions at any given point in their play. This recording would then be tagged as relating to the player that created the recording and relating to a specific area of a level. Another feature would be available that would allow players to activate these videos when struggling with a construction or obstacle. Either a random video recorded of the obstacle could be played, or a player could choose specific videos made by a particular player. The previously recorded action would then be overlaid on the player's screen allowing her to see how other players have solved the challenge. Some of the actions depicted on the video may be particularly useful, while other actions might be irrelevant (perhaps the player who created the video has selected different starting abilities than the watching player making some actions impossible). This feature allows the player to deconstruct the actions of other players to find the useful bits, and it allows players to present in a public forum their own play.

Conclusions

In this paper we've tried to argue for the inclusion of constructionist designs in action platform video games. While there have been some interesting instances of constructionism in video game creation – which has begun to be included in some popular commercial games – the "play" aspect of games has been left without. We have argued that the opportunity to construct the player-character would allow for flexibility in game-play and variety in problem and obstacle solutions as well as a space for identity projection and experimentation. In addition, we believe that players should build objects, tools, and vehicles within game levels. While action platform games often create interesting opportunities to interact with such objects, we believe that providing players with the components to construct personal versions of these objects would necessitate systematic design thinking, highlight the power of emergent systems, and encourage in-room interactions. Finally, no constructionist design is complete without an opportunity for the public sharing of artifacts. We propose that action platform games should provide an opportunity to share one's game-play with other players and allow individuals to deconstruct and piece together other's strategies. Including these designs in the playing of action platform games will potentially transform a fairly intellectually passive game type into a powerful constructionist environment. We believe this is a starting point for a broader dialogue on a wider adoption of constructionism in video games.

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