"How Does The Story End?" The Role of Unfinished Games in Supporting Kids' Learning

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Abstract: Formative research suggests that there is great potential for using incomplete games as a tool for extending learning in the regular school classroom, in after-school clubs, and in field trip experiences. By placing deliberately unfinished games in front of pre-teen and early teen players and inviting them to offer constructive suggestions for the game's completion, students have structured opportunities to reflect on and deepen their understanding of relevant academic content and game mechanics. The paper cites specific examples from recent practice and offers suggestions as to the attributes needed by effective program leaders to make the best use of these games.

Generally, the game studies literature suggests that having a clearly defined and attainable "win state" is part of good game design. That is to say, it is important for the player to know when they have completed the challenge successfully. Ideally, there is also good feedback along the way so that the player knows how well he or she is progressing. For most game situations, these are no doubt important considerations. However, there is an alternative worth considering: *Is there value in having an unfinished game space?* This paper and presentation will advance the counterintuitive notion that there is a great deal of productive learning that can happen when the game doesn't play out to a win state. Rather, it is the very ambiguity of outcomes and the potential for "something more" that can spark the best learning. Without the computer sorting out winners and losers, students can more readily be guided into productive discussion based on what they experienced.

To investigate this potential use of games in education, the author has created several "games in progress" for use with pre-teen learners in field study programs at an environmental education center and in after-school programs in the community. These include an augmented reality game investigating which among several species is the most important part of the forest, and agent-based modeling games investigating pollinator populations and the role of bioretention in managing floodplains. The goal in these is not to provide a complete game experience, but rather to engage the kids in an interesting space that sparks discussion. The resolution comes in the reflection that follows the game immersion experience.

For example, in the pollinator game, students start by deciding how many pollinators there should be in the model ecosystem. As the game begins, the player moves into observer mode as the action unfolds on the screen. In many ways this is a "god game" where the player's interventions are limited: You create the conditions and watch what happens. The pollinators go about their business in pre-programmed action paths driven by a degree of randomness, pollinating or not as they are able. As plants are pollinated, they reproduce and thereby enhance the ecosystem. At a simplistic level, students come to understand that more pollinators leads to more pollination and thus more plant growth. The real educational value, however, comes from the post-game discussion in which players are led to consider critically various aspects of the game. Prompted by the instructor to offer ideas of "what would help me to finish this game," students have a chance to demonstrate their understanding (or misunderstanding) of ecosystem dynamics. Do the pollinators seem to favor some plants over others? (Based on what you know about ecology, should they?) Is the random movement of the pollinator realistic? How would the game be different if the pollinators engaged in a seeking behavior? Should there be limits to how much the plants can grow?

As provocative questions are raised, the game dynamics can be investigated by looking at the underlying programing blocks. Since the software used in designing these games makes the programing transparent, students can see how the game they just played unfolds. Depending on the time available, quick modifications can be made by the instructor or by the students, and the game replayed with the new rules. The iterative play – discuss – modify – play cycle sparks a higher level of thinking about ecosystem dynamics than are possible in a textbook-driven environment where facts are the coin of the realm. Instead, understanding of interactions and contingencies becomes essential. Arguably, these discussions around an imperfect game space are richer than would happen in a more polished, scientifically validated environment. With "holes" in the game and an invitation to help complete the game, students attempt to draw on what they know to fill in the gaps. Or, the game raises questions that prompt further reflection and investigation. In the author's experience, students sorted into winners and losers are less likely to engage in such focused reflection.

To be clear, the argument here extends only to specific learning contexts. As commercial, off-the shelf games played individually or among peers for recreation, they would be a first-order flop. Games for those audiences should follow game norms for win-state and appropriate levels of feedback. But, there is great potential here to use incomplete designs to extend the use of games during the school day, in after-school settings such as environmental clubs, and as a part of field trip programs offered by science and cultural institutions.

Students in these settings can be supported by a guide with a reasonable degree of expertise both in the academic content area and in the mechanics of the game's underlying design. To be successful, this person needs enough pedagogic content knowledge (Shulman, 1986; AACTE Committee on Innovation and Technology, 2008) to know which areas are most fruitful for discussion, and enough understanding of the software to quickly modify the model to allow a re-run. Or—in contexts where there is enough time to do so—having the students modify the model directly might offer even more learning potential. A skilled leader will need to exercise judgment about how quickly to turn the students loose on a re-design vs. making the modification to one version of the game projected on a large screen for the group. There is a very real trade-off here between giving students more ownership of the game through direct manipulation of the software and maintaining focus on the question at hand. As with many other issues in structured learning environments, the time available drives many decisions. In the author's experience, short experiences allow a quick "Let's all change this..." level of manipulation, whereas longer multi-session programs allow the time to support students in their own manipulation of the underlying program, which in turn enables students to explore more fundamental re-workings of the game dynamics.

This effort remains a work in progress, but to date the results have shown promise and warrant further work in the design of the games and in developing protocols for supporting effective project leaders.

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Art Games: Creating Video Games Within an Art Curriculum

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Abstract: As an influential form of digital visual culture, video games offer art educators numerous pedagogical opportunities. My paper intends to show how making video games through an art-based curriculum provide young people one of those opportunities.

Many supporters of games in education discuss learning from playing games, but fewer studies focus on the creative learning from making games. Research focusing on game creation primarily connects game development to Science, Technology, Engineering, and Math (STEM) subjects. However these studies do not focus on the creative, metaphoric, interactive components of game creation. Yet for many of the 20th century art movements, game practices were foundational to developing an aesthetic that rejected standards, practices, and systems within art.

From my current research, I provide examples of students learning about complexity thinking by producing video games as part of a 4-8th grade art-based curriculum.

Games as Art Making

While few research studies on the value of making games as art projects exist (Keifer-Boyd, 2005; Gill, 2009; Peppler, 2010), currently, research studies in art education have not looked at the impact of making video games with students. Studies in disciplines outside of art education have concentrated on whether or not student-made games were efficient and effective to teaching math (Kafai, 1995) language (Robertson & Good, 2005), or computer science (Seif El Nasr & Smith, 2006; Dalal, Dalal, Kak, Antonenko, & Stansberry, 2009). However these studies were not focused on the creative, metaphoric, interactive components of game creation.

Games, defined in this study as structured play, provided the foundation for many of the works from 20th century art movements, such as Dadaism, Surrealism, Situationism, and Fluxus, embodied issues of complexity in their use of game making methods by exploring and exposing rules of political, economic, and environmental systems (Flanagan, 2009). By contextualizing games within the historical practices of artists throughout the 20th century and digital media practices of the 21st century, game creation can be understood as credible art content for parents, school administrators and the contemporary art classroom.

My study included four classes of students, ages 8-13, learning concepts and methods of game development including physical, tabletop, and video games over a 5-day period in a camp-styled course. This research relies on using complexity theory as an umbrella concept, designed to include, combine, and elaborate on the insights of any and all relevant domains of inquiry, such as economics, physics, and biology (Sumara & Davis, 2009). By making games as a method to approach concepts of complexity, the finite scope of the game creator's abilities and emergent game behavior are exposed to reveal how complex and interconnected our daily lives are.

Students in this study learned video game programming through the visual interface of Game Maker, using a curriculum developed around the language of move, avoid, release, and contact (MARC) (1). The abstracted concepts of MARC framed scenarios that can have social, philosophical, theoretical, political, or psychological implications for students (2). Considered as metaphors for procedural options in different types of systems, MARC is theorized to connect students to video game unit operations as a way to develop artistic metaphors for the systems of everyday lives.

Sam: The Unit Operations of MARC Everywhere

Conducting interviews 3-months after the course, Sam, age 10, saw a connection between the complicated 3-D games he plays and the game he made in the course:

> I have these 3-D video games that are very large complicated worlds, but I still try to figure out how the game works, and if the designers used Game Maker, how to get the game to work … I actually thought once that the world could be like a game because if somebody made it a game and if you touched your desk, or you touch a

table, it would need to be solid to move it … But that's impossible to make a game like that because it would take like a million years.

Sam immediately established the difference between games as being simple and complicated, describing the complexity of the vast worlds of his 3-D games. Sam noted the games he plays have many types of objects interacting in complex ways, a programmable task that would be difficult to recreate in all the ways we interact in daily life.

Gina: MARC Important to Gameplay

Learning the how to make games and using the MARC concepts, Gina age 11, began seeing games as a maker, glimpsing below the playing surface to understand how video games work with interdisciplinary knowledge:

> When the course was over, I went home and would talk to my parents about what we were doing and try to explain to them, how you put actions and objects in the game…us(ing) actual examples…I would pick up a pencil then I would be contacting it. Then if you released the pencil…you are dropping it. If you catch something, that would be contacting it, and all this different stuff … if this was happening in real life and if they were throwing this, then it would be releasing it and if I were catching it, then I would be contacting it.

Thinking about MARC in the games they played, students considered how computational systems of video games work. Students, like Gina, understood that MARC actions work simultaneously, acting as connected parts of a system to make the game function properly.

During the course, students continued to use the basic concepts of MARC to make personal decisions to change the forms of complexity in their games. When students moved beyond the introductory tutorial, they changed their game systems, determining the level of complexity by creating new rules, game objects, and behaviors. Designing pedagogical strategies in a game development curriculum that explores complexity encourages students to expand their knowledge base. Applying the open metaphors of MARC to art-based game making, the course content demonstrates the interconnection of academic subjects and deeper understanding of cause and effect to situations in life. By making games in the traditionally less rigid, creative space of the art classroom, gives students the freedom to play and learn by taking risks or failing.

Conclusion

It can be explained to parents that this game-based art pedagogy honors and values the history of art, inspired by the game practices of the Dadaists, Surrealists, Fluxus, and Situationists. Students-made games can be considered a form of action research, an iterative process of theorizing, testing, and receiving feedback to the game systems they created. In this iterative process of making, students problematize and problem-solve complex and emergent ideas.

Endnotes

(1) I developed MARC as a way to abstract the actions of many video games into a language showing commonalities across video game genres (shooter, action-adventure, role-playing, strategy, etc.) and describes events in everyday life within a game context.

(2) **Social**: *Making Friends* – move (moving towards a desirable person), avoid (getting away from undesirable people), release (removing friends from social circles), contact (take actions to becoming friends).
Philosophical: *Aesthetics* – move (steer towards aesthetic preference), avoid (steer away from aesthetic pitfalls), release (masking aesthetic mistakes), contact (making aesthetic choices).
Theoretical: *Semiotics* – move (grab signs that have multiple meanings), avoid (strengthening established meanings), release (send signs to the vocabulary pool), contact (combine signs with other signs to create new meanings or remove meanings).
Political: *Universal Healthcare* – move (getting the health bill passed), avoid (losing votes), release (messages to the public promoting the bill), contact (persuade and acquiring votes).
Psychological: *Anxiety in public speaking* – move (give speech in front of the class), avoid (poor inflection, students laughing), release (saying words at the proper time), contact (making eye contact, using inflection).

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