Games & Learning in Landscape Architecture
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1 Introduction

Games catalyze learning. From a very early age, and in quite memorable ways, we learn from games and play. Games offer people, through practice and variety, opportunities to experience the ways a particular discipline (or practice) considers and solves problems. Digital games are considered by many to be a mainstream American leisure activity. The Federation of American Scientists found that kids aged 8-18 average nearly one hour per day playing video games. Similarly, the average adult spends about 7.5 hours per week playing video games (Derryberry, 2007). It is unlikely that much of this game playing is done for educational purposes.

Games, particularly the computer or video variety, are good for learning in many ways. They are interactive, giving people the ability to affect outcomes. They empower people to test new worlds and consider other perspectives. They encourage people to explore issues through systems with multiple variables. They are good for tailoring experiences to an individual’s learning/ability level. Games are not “mere entertainment.” They offer much more than violence and first-person shooter experiences. Perhaps most importantly, games allow people to fail in safe ways, while bringing together ways of knowing, doing, being, and caring. Good and appropriate games can help develop situated understandings, effective social practices, powerful identities, and shared values that make someone an expert (Shaffer, 2005).

Games are sticky - people play them over and over. Games are persuasive – they can make arguments and possess the power of rhetoric (procedural rhetoric – a game’s ability to persuade players through rule-based representations and interactions). Many good games embody systems – sets of things that affect one another within a discipline or an environment (e.g., cities, international politics, the human experience, the natural or built environment) to form a larger pattern that is different than any of the individual parts (Games for Change, 2009). Because games have rules and they typically do not exchange information with the real world, they are usually considered closed systems.

Games can help design students gain a deeper and more comprehensive understanding of an issue by exploring the motivations and problems of the actors and environments involved. They offer more active discovery and less passive listening. They facilitate taking actions and feeling consequences. The good ones build authentic details and constraints into the system to help move people to think and even act differently around an issue. Because games are sticky, players likely to explore intricacies of a problem longer and in ways unlike a documentary, news article, or book. Games can create new social and cultural worlds where players learn by integrating thinking, social interaction, and technology…all in service of doing things they care about (Games for Change, 2009).
2 The Good in Serious Games

2.1 Serious and Epistemic Games

A serious game is “…a mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives.” (Zyda, 2005). More specifically, serious games are immersive learning simulations (computer and video games) designed to enhance and improve a specific aspect of learning. They typically involve adult or higher education audiences, are often persuasive in their approach, and are intended to make learning more fun. Play, while critical to human development, maturation, and learning, is a mandatory ingredient for serious games. Serious games are designed around learning objectives, where skills practice is contextualized or situated, making the learner responsible for exploration. They facilitate situated understanding – understanding concepts without losing connections between abstract ideas and real problems those ideas can be used to solve. They offer a constructivist approach to learning that includes just enough guidance to optimize learning. Serious games share some of the following common characteristics: background and storyline, game mechanics, rules, immersive graphical environment, interactivity, challenge/competition, and risks & consequences. Approximately US$1.5 billion was spent on serious games worldwide in 2008 (Derryberry, 2007).

Epistemology refers to the way of thinking of a practice. It determines how someone in a community decides what questions are worth answering, how to go about answering them, and how to decide when an answer is sufficient. Assuming that a community of practice is a group with a local culture, an epistemic frame is essentially the grammar of that culture – the ways of thinking and acting that individuals learn when they become part of that culture. Like serious games, epistemic games are simulations that preserve the linkages between knowing and doing that are central to a reflective practice. They offer learners opportunities to think like and work as planners, doctors, journalists, engineers, landscape architects, and other valued professionals (Shaffer, 2005). These different communities of practice have very unique epistemic frames.

Serious and epistemic games offer people, through practice and variety, opportunities to experience the ways a particular discipline (or practice) considers and solves problems. They also represent an excellent response to the tendencies of many of today’s students. Students tend to prefer: (1) receiving information quickly from multiple multimedia sources; (2) parallel processing and multitasking; (3) processing pictures, sounds, and video before text; (4) random access to hyperlinked multimedia information; (5) interacting/networking simultaneously with many others; (6) learning “just-in-time”; (7) instant gratification and instant rewards; and (8) learning that is relevant, instantly useful, and fun (Derryberry, 2007). Educators can begin appealing to these preferences by better understanding relevant literature on how & why games should be used for learning.

2.2 Games & Learning Research

There is a growing body of research that supports games in education. Although exploring games in education challenges some fundamental notions about learning, especially at the
college/university level, educational games are being designed based on sound learning theory and research (Derryberry, 2007). This section reveals only a small, yet compelling, sample of evidence that suggests digital game-based learning tools & approaches have excellent potential to stimulate change to current/traditional landscape architecture pedagogies.

Game critics often want to know how learning transfer from games to real life happens. Unfortunately, few studies exist that can answer that question. Scot Osterweil (The Education Arcade, MIT) believes learning is better when it happens in conjunction with gaming. To that end, he has defined Four Freedoms of Play: (1) The Freedom to Experiment, (2) The Freedom to Fail, (3) The Freedom to Try on Identities, and (4) The Freedom of Effort. Osterweil claims that most educational games do not possess all of these. As he and others have said, it is not what one knows, but how one learns.

Cognitive scientist and gamer James Gee, (2005) believes we should look to good computer and video games for enhancing school and workplace learning. It is not just about simply using game technologies in school or at work, but applying the many successful principles of learning that good game designers have mastered. Gee defines 13 principles of learning organized in three areas.

I. Empowered Learners
   1. Co-design: Good learning requires that learners feel like active agents (producers), not just passive recipients (consumers).
   2. Customize: People should be able and encouraged to try new/different styles of learning that work best for them; people should be agents of their own learning.
   3. Identity: Deep learning requires commitment, and commitment is made easier when people take on a new identity they value and in which they become heavily invested.
   4. Manipulation and Distributed Knowledge: Cognitive research suggests that perception and action are deeply inter-connected. People feel empowered when they can manipulate powerful tools in intricate ways.

II. Problem Solving
   5. Well-ordered Problems: The problems learners face early on are crucial and should be well-designed to lead them to hypotheses that work well, not just on these problems, but as aspects of the solutions of later, harder problems.
   6. Pleasantly Frustrating: Challenges feel difficult, but doable. Learners feel, and get evidence, that their effort is paying off in the sense that they can see, even when they fail, how and if they are making progress.
   7. Cycles of Expertise: Learners practice skills until they become automatic; then, those skills fail in ways that cause learners to think again and learn anew. The process starts again when they move on to a new level.
   8. Information “On Demand” and “Just in Time;” People use verbal information best when it is given “just in time” (when they can put it to use) and “on demand” (when they feel they need it).
   9. Fish Tanks: People will begin to know what to pay attention to in a simplified system that stresses a few key variables and their interactions. They are less overwhelmed and more prepared to master the real system.
10. Sandboxes: If learners are immersed in a situation that feels like the real thing, but with risks and dangers greatly mitigated, they can learn well and still feel a sense of authenticity and accomplishment.

11. Skills as Strategies: People learn and practice skills best when they see a set of related skills (in the proper context) as a strategy to accomplish goals they want to accomplish.

III. Understanding

12. System Thinking: People learn skills, strategies, and ideas best when they see how they fit into an overall larger system to which they give meaning.

13. Meaning as action image: People do not usually think through general definitions and logical principles. Instead, they think through experiences they have had and imaginative reconstructions of experience; words and concepts have their deepest meanings when they are clearly tied to perception and action in the world.

Surprisingly few of these principles can be found in most educational games. Many traditionalists are correct that learners cannot be left to their own devices; they need smart tools, and most importantly, they need good designers who guide and scaffold their learning (Kelly, 2003). For games, these designers are brilliant game designers. In education, these designers are teachers.

To be most useful in education, games must be able to deliver some key components. For instance, they need to track player behavior, assess students’ abilities, capture and report on those metrics, and make them available. Instant replay may also be necessary to analyze a player’s behaviour/decisions. Other needs might include interaction with real world data from GPS systems or other player and non-player characters. And, some games may need to conform to various government or education standards.

Creating a successful serious game requires (1) a team effort, (2) both learning design and game design expertise, and (3) the development of distinct workflows: plan of record (living document of all design decisions), a common project lexicon/vocabulary, and a process diagram that guides the team in their work and reflects the needs of the discipline(s). Most importantly, learning designs must include a plan for learning transference from the game back to the greater learning plan (objectives) and to the studio/workplace.

3 Digital Games Review

Many existing games have potential value to landscape architecture and environmental design education. Some promising games include Urban Science (epistemic game about urban planning & ecological thinking using iPlan/GIS), Civilization (serious game where a settler chooses a civilization and builds an empire through exploration, constructing cities, altering terrain, building roads and railroads, etc.), and Spore (serious game about creating & guiding a creature through stages of development, from organism to civilization to environment). More good examples are described below, including some less familiar games and visualization tools that are currently works in progress. In all examples, the
quality and variety of the potential experiences, along with their interactive & immersive characteristics, offer landscape architecture learners good opportunities to practice planning and designing environments and affecting positive change in the lives of people.

**Fig. 1:** SimCity and SimCity Societies

**SimCity and SimCity Societies** (Fig. 1) are good examples of computer games (serious and epistemic) about planning, designing, and building virtual cities. In SimCity, the player is a mayor who makes decisions or plans for zoning, taxes, transportation, energy, city enhancements, disasters, and more. SimCity Societies is less complex and challenging than SimCity, offers more room for creativity, and contributes social energy toward built forms. The city is set up to manipulate the social energies in ways that dictate quality of place. The citizens’ happiness depends on the player.

**Fig. 2:** Second Life
Second Life (Fig. 2) is a free online 3D virtual world imagined and created by its residents. Its interface and display are similar to many popular massively multiplayer online role-playing games (or MMORPGs), except for two unique differences: creativity and ownership. One can create his/her own digital persona (avatar), buy virtual land and other goods, visit millions of people from around the world, explore others’ virtual creations, and more. Many would argue that Second Life is more about exploration than gaming, but it certainly has good educational potential if designed and used wisely.

Fig. 3: Ayiti: The Cost of Life

Ayiti: The Cost of Life (Fig. 3) is a web-based, role-playing social issue [serious] game about a family living in Haiti. The player chooses a goal for her/his family – make money, achieve education, stay healthy, or maintain happiness. Unexpected events and critical choices/decisions contribute to or detract from achieving the chosen goal. Although not design focused, it does present very important opportunities to understand cultures, which all environmental designers must do.

Fig. 4: Navigating Nature

Navigating Nature (Fig. 4) is a three-part serious game prototype designed to teach second grade students about the destruction of three primary ecosystems of Indiana – wetland, forest, and prairie. The character/player learns, through travel and tasks, the value of each ecosystem, including how they can be restored to a healthier state.
Comprehensive Landform Visualization (Fig. 5) is an educational multimedia computer tool for teaching landscape architecture students to visualize a vocabulary of landforms and site structures in two and three dimensions. This prototype contains comprehensive explorations of simple ridges, valleys, and slopes, to more complex retaining walls, culverts, and roadway design & alignment. Although it is not yet in game form, it has great potential to evolve into an effective visualization and serious gaming experience.

4 Games in a Curriculum

Games are perhaps best integrated into education through students creating their own games, but also by evaluating existing games to determine their effectiveness. The examples presented in this paper highlight landform visualization, landscape ecology, site design & engineering, and some good & relevant serious and epistemic games. Of those discussed, only Comprehensive Landform Visualization was designed for and used in traditional landscape architecture classrooms. All other examples demonstrate the potential value & ability games have in affording a more immersive and fulfilling landscape architecture education. Games would be well suited to augment or teach topics such as:

- Construction Materials/Details
- Ecological/Environmental Systems
- Landscape Architecture History
- Housing & Community Design
- Park & Open Space Design
- Planting Design
- Professional Practice
- Regional Landscape Planning and Design
- Site Grading and Drainage
- Site Planning and Design
- Sustainable Site Design
- Urban Design

Students seem increasingly better equipped with the digital skills and confidence to make visualization & learning tasks easier and more effective. The challenge to good design educators and students must now be to creatively & strategically explore, design, and
implement innovative & engaging educational approaches that capitalize on the strengths of current and future generations. Innovative digital media & learning technologies/theories offer us unique opportunities to reform some of our basic educational approaches, while maintaining our commitment to achieving learning objectives. Contextualized and challenging digital game-based environments can and should transform current/traditional sustainable design and related landscape architecture pedagogies. The presented work shows nearly unlimited potential in a landscape architecture curriculum.

5 References

Osterweil, Scot (2007). Designing Learning Games that Matter. The Education Arcade: MIT
Van Eck, Richard (2006): Digital Game-Based Learning. EDUCAUSE review, March/April