Not just a dollhouse: what *The Sims2* can teach us about women's IT learning

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Abstract

Purpose – *The purpose of this paper is to describe how a popular computer game,* The Sims2*, engages players in computing practices that are foundational to information technology (IT) fluency, and to draw implications for engaging young people, particularly girls and women, in computer-related learning.*

Design/methodology/approach – *The analysis is framed within a conceptual perspective on learning as a process of acquiring situated understandings through participation in meaningful activity. The paper draws on two years of work with girls developing IT fluency through playing and modding* The Sims*. It also draws on interviews with adult women who are highly engaged in creating* Sims *content.*

Findings – *The paper identifies a set of practices inherent in* Sims *game play that are foundational to IT fluency: managing complex systems; cheating and glitching; tinkering with tools; and making, manipulating, and reasoning with spatial representations.*

Practical implications – *The paper suggests how existing practices associated with games might be leveraged for the development of IT fluencies.*

Originality/value – *This study contributes to efforts aimed at rethinking how educators might conceptualize and support the development of IT fluencies. The paper offers new perspectives on the nature of IT fluency in the context of participatory culture and productive uses of new media.*

Keywords *Computers, Indoor games, Women, Education, Communication technologies*

Paper type *Conceptual paper*

Introduction

The Sims game franchise occupies a unique and somewhat problematic place in the world of commercial entertainment games. On the one hand, *The Sims* is touted as the best selling computer game of all time, in Spring 2008 reaching a milestone of 100 million copies sold. Its creator, Will Wright, is considered one of the most brilliant minds in the game design industry today. On the other hand, *The Sims* does not really fit the definition of a game, since it has no clearly defined goals, no accumulation of points, and no clear win-loss state. Some gamers find *The Sims* silly, boring, or trivial: after all, *Sims* game play seems to consist largely of monitoring the basic needs of little digital humans who can be annoyingly hard to control. Clean up a virtual kitchen versus take down a bevy of virtual monsters? The choice seems clear – or does it? One explanation for the game's sales figures is its success in attracting female players. About 60 per cent of *Sims* players are reported to be female, leading to the common perception that *The Sims* is a ''girl's game,'' with articles in the popular press pronouncing *The Sims* to be ''the new dollhouse'' (Schiesel, 2006). Game scholars, for the most part, tend to be notably silent when it comes to *The Sims*, and existing analyses tend to emphasize critique of the game for promoting consumerism and traditional female roles.

In this paper, we argue that *The Sims* is far more than a dollhouse, and perhaps surprisingly, has much to teach us about environments that support learners of all ages – particularly girls and women – in the development of a wide range of computer-related skills and abilities, as well as laying a foundation for future learning. Our discussion draws on two years of work with girls in the TechSavvy Girls project, an innovative educational program intended to help girls develop fluency with information technology through playing and modding *The Sims*. We also draw on interviews with adult women who are highly engaged in creating *Sims* content (Hayes *et al.*, 2008).

We have found that *The Sims* engages players in core computing practices, through activities ranging from creating families and neighborhoods within the game to using digital tools to produce custom content, videos, storyboards, and modding software. Just as importantly, it offers opportunities for participation in global modding communities, with distinctive forms of collective knowledge-building, apprenticeships, and opportunities for social recognition. There are hundreds of *Sims* fan sites offering millions of user-creations that can be downloaded by other players, with one estimate suggesting that more than 90 per cent of available *Sims* content is user-created. *Sims* content creators are touted as examples of Pro-Ams:

> [. . .] amateurs who work to professional standards . . . knowledgeable, educated, committed and networked, by new technology (Leadbeater and Miller, 2004, p. 12).

Unlike other Pro-Am communities, which tend to be dominated by well-educated, affluent males (Leadbeater and Miller, 2004), many of the most prolific and recognized *Sims* modders are women, often with little prior technical education and some with few financial resources. Understanding how *The Sims* provides a starting point for girls' and women's motivation to engage in the often complex computing practices associated with modding can contribute to the development of new models of computer education in schools.

In the next section, we briefly describe some current perspectives on computer-related learning and literacies, including gender-related differences in formal and informal computer education and practices. Next, we provide examples of how *The Sims2* engages players in computing practices that are foundational to IT fluency. We conclude with some thoughts on implications for schools and educators, with particular emphasis on the need to broaden our conception of ''what counts'' as acquiring fluency with information technology.

A note on terminology is important. We use ''*The Sims*'' as a general term for *The Sims*, and ''*The Sims2''* to refer to the specific version of the game. Specific examples of game features are drawn from *The Sims2*.

Computer literacy and beyond

There has been a flurry of reform efforts directed at redefining what young people should know about computing as well as how computing should be taught. Computer literacy has been reconceptualized as ''fluency with information technology'' (National Research Council, 1999), a collection of twenty-first century skills that includes using technology for visualization and complex problem-solving (NCREL, 2003), and a set of core abilities and attitudes that include making productive use of computing (ACM K-12 Task Force Curriculum Committee, 2003). These new frameworks, while different in certain respects, share a common concern with moving beyond simple understanding and use of basic hardware and software to using computing for problem-solving, innovation, and knowledge creation.

Sadly, schools from kindergarten through universities have been slow to adopt these new perspectives, in practice if not in principle. Many emphasize courses on basic computer skills such as word processing, and treat more advanced topics, such as computer programming, as special electives open to only the most motivated or talented students, if they are available at all. Perhaps, not surprisingly, enrollment in formal computer science degree programs has dropped precipitously, particularly among women (National Center for Women and Information Technology, 2005). While this drop has been attributed in part to the IT industry crash in the early years of this century, many educators admit that much computer science instruction is vastly ineffective and outdated, with prerequisites such as advanced mathematics courses that are no longer relevant.

At the same time, that educators and policy makers bemoan a drop in enrollments in formal computer science courses, particularly among women, young people are engaging in increasingly sophisticated computing practices outside of school. Girls use computers as much as boys; recent studies show that their participation exceeds that of boys in certain productive practices such as blogging (Lenhardt and Madden, 2005). Somewhat ironically, given the prevalence of computing in current society, the crisis in computer education is partly one of relevance. Computing practices emphasized in school often do not recruit abilities and knowledge that young people might develop outside of school, and do not prepare them to participate fully in a networked, participatory culture (Jenkins *et al.*, 2006). Girls in particular, according to many studies (see, for example, Anderson *et al.*, 2008; Gasmo, 2004; Margolis and Fisher, 2002; Nordli, 1998), do not perceive courses on topics such as programming as relevant and interesting, and likely for good reason, since course content rarely is tied to their own pursuits and existing uses of computing (Nordli, 1998). In interviews with teen girls, Gasmo (2004) found that they described school computing as related to future education in or jobs within ICT, yet also as boring and trivial. In contrast, they tended to identify leisure computing as fun, somewhat useful, or perhaps most striking as not really computing; in other words, what the girls did at home, such as playing online games, surfing the internet or chatting was not perceived as legitimate computer use. To some extent, the girls were simply reiterating dominant discourse on computing: ''real'' computing is programming, or something ''serious'' rather than fun.

As Gasmo points out, the problem is two-fold. It is not just that school computing is boring, current conceptions of computing in school do not encourage girls to recognize the computing skills that they already may have. Strategies for recruiting women into computer science translate women's perceived need for ''relevance'' into the use of applied and ''socially useful'' activities, which may not be of interest to individual women. (No one seems to have found it odd that women would have a greater need for relevance than men.) While such activities may be worthwhile and an improvement over decontextualized and routine learning exercises, this approach ignores what may be the primary reasons that people develop a deep interest in learning a complex set of ideas or practices, such as those associated with computing: a sense of personal engagement, discovery, and pleasure in learning. For example, Nordli (1998, p. 13) discovered that Nordic girls who were highly engaged and interested in computers:

> . . . spent time in front of the screen and wanted to learn more because it was fun, not because it was useful. Even though they of course, saw that computing was a smart thing to know, their fascination for computers came from their excitement about all the things they did not know and the pleasure they got from playing with it. They regarded the computer as an advanced toy that also happened to be a useful tool.

Nordli goes on to note the minimal role of schooling, as compared to the home, as a location for the girls' IT learning, and points in particular to the significance of popular culture in providing incentives for learning. Notably, in her study as well as others, gaming figures prominently as a starting point for boys' interest in computer science, but not for girls. Gaming seems to offer boys a means of developing technology-oriented peer social networks, something that even more tech-oriented girls seem to lack (Goode *et al.*, 2006). These networks are crucial for sharing knowledge, resources (such as hardware and software), and social reinforcement for an interest in computing.

Girls face a host of other barriers to formal study; for adolescent girls in particular, the image of the computer nerd still seems pervasive as an inhibiting factor for enrollment in certain kinds of computing courses, particularly programming. Girls construct their female identity using the images and ideas of being female and a woman in their society, which still rarely combine intensive interest in computing and femininity. The popular television show *Beauty and the Geek* aptly depicts the dichotomy. However, girls and women do enroll in certain kinds of computer courses, such as graphic design, in almost equal numbers as men (Rasmussen, 2001). Notably, school courses rarely connect graphic design and programming, which might be a way to enhance more girls' interest in the latter. Games can be a way to do just that.

Gaming, modding and learning

Why might gaming be a promising starting point for IT learning? Gaming is the first encounter that many children, both boys and girls, now have with computers, and often is the most memorable. Games can offer incredibly immersive, rich, challenging and emotionally charged experiences, along with the ability to take on new and compelling identities. These experiences are what can prompt players' desire to document their gaming through screenshots, machinima, and story-telling; to extend gameplay through creating new levels and scenarios, to further improve on their gameplay by modding everything from interface designs to the eye color of an avatar, and to enhance the visual effects of the game by figuring out how to install the latest graphics card.

Modding has been associated with computer game culture from its outset when games were created by college students playing with mainframes (Herz, 2002). Current game companies take advantage of this tradition by offering built-in tools such as character and level editors that allow a wide fan community to engage in modding. Extensive online communities develop around games and particularly around mods and modding, as players share and critique tools and player creations, as well as collaborate on creating new modding tools. These communities allow players to fully leverage these tools and drive continued learning. Such online communities are, as Herz (2002, p. 173) describes them, ''networked models for learning and teaching'' that allow players to learn with and through each other. Steinkuehler and Johnson's (in press) account of the collaborative development of a mod for *World of Warcraft* illustrates how participants engaged in a wide range of computational literacy practices, and suggests a model of development as gamers progress from consumption (of mods) to critique, to revision of existing artifacts to full-scale production.

Participation in game modding, the desire to understand how games work and to create games of their own are often described as motivations to learn computer science by teen boys (Margolis and Fisher, 2002; Tillberg and Cohoon, 2005), but not girls. Part of the discrepancy can be attributed to differences in the kinds of games that girls and boys tend to play, as well as the culture of gaming. While girls now play games as much as boys, they tend to play more ''casual games'' – games that are shorter, less graphically sophisticated, and less computational complex than games favored by many boys. The culture of gaming still is dominated by males and reflects masculine attitudes and behaviors. Women continue to report harassment and a generally unwelcoming environment in many fan communities (see, for example, http://blog.shrub.com/archives/tekanji/2007-04-06_564). While comprehensive data on the demographics of modders is not available, the more visible high end modders tend to be young men. Notably, all of the modders in Steinkuehler and Johnson's study were male and had prior programming experience.

The Sims is one of the few games popular among women which offers an extensive range of modding opportunities, and women are prominent among the content creators in *Sims* fan communities. Thus, *The Sims* and its communities offer a unique opportunity to understand not only the game features that engage girls and women in IT learning, but also the nature of fan communities that support and encourage women to engage in this learning.

Situating IT learning within *The Sims2*

The Sims has been described as a ''household simulator,'' a game with the objective of fulfilling needs and wants of virtual families through strategies that reflect rather blatantly consumerist and hedonistic values: buying and decorating houses, earning lots of money, partying, falling in love, and developing ''skills'' ranging from cooking to charisma. The fun of such a game premise seems dubious, and players flock to the game largely because they can subvert the game's overt goal structure and play in ways of their own choosing. Various ''cheats'' – codes remaining from play testing – allow players to acquire endless amounts of money, maximize their aspirations, fulfill sim wants, eliminate certain constraints on building, and otherwise opt out of the established route to success within the game. The game becomes for many players a sort of playground where they can use sims to act out narratives of daily life, build realistic or fantasy environments, and even engage in forms of social or political critique.

The Sims'*s* focus on the seemingly mundane is what makes it readily accessible to so many players, especially women, who might eschew the abundant crop of game worlds populated by elves, soldiers, hitmen, and football players. It offers players a familiar suburban world, in which everyday life stories can be told and retold, parodied, perfected – and in which the player is in charge, at least to some extent. Players get emotionally involved in their sims' lives, worrying about their happiness, their careers, and their futures. They devote huge amounts of time to creating painstakingly accurate historical architecture, following families through ten generations, producing chapter after chapter of Sims novellas. What makes *The Sims* a powerful – yet easily overlooked – starting point for acquiring IT fluency is that such learning is couched in a familiar and personally meaningful domain. As we will see, information and skills associated with IT fluencies are mastered much more readily when they are integral to the player-learner's own purposes and goals in a technological space, or as Gee says, when they are part of '''playing the game' the learner wants to play'' (Gee, 2004, pp. 19-20).

Learning as situated understanding and activity

While formal education associated with computer science or even general computer literacy tends to emphasize skills, tools or abstract concepts, gaining IT fluency with games such as *The Sims* is rooted in acquiring situated understandings (Gee, 2004) through engagement in computer-based activities. As a simple example, rather than being introduced to the abstract concepts of objects and classes, fundamental to object-oriented programming, the player learns to navigate the *Sims* interface by associating specific objects with different classes; i.e. a coffee table is an object within the class of table, or a particular garden border is a specific instance of fence, all of which share similar properties. Situated understanding in relation to computing is based on tacit knowledge of practices that may be difficult even for professionals to articulate. This knowledge is embodied as ''know-how,'' in contrast to the ''know-what'' that comprises more abstract understanding of concepts and principles (Denning, 2004). In its broadest sense, this know-how is reflected in the ability to engage in practices such as programming; however, the building blocks of such practices are certain ways of thinking and acting – habits of mind and hand – that evolve from experience with tools and communities.

The Sims is designed in such a way that supports player engagement in practices that are integral to a situated understanding of computing more broadly. While the player may not be able to articulate what she is doing in terms of programming concepts, or fully understand the underlying architecture of the game, she is building a set of experience-based intuitions about how computer simulations work, which can make it much easier for her to understand relevant concepts and tools if she encounters them later, in a classroom or textbook (e.g., Gee, 2007; Shaffer, 2004). Furthermore, she is exposed to and begins to engage in practices associated with fields like software design, such as identifying bugs in computer programs, designing workarounds, and so forth. The player takes on the implicit identity of ''programmer,'' by choosing cheat codes to modify game parameters relative to what she wants to accomplish within the game. In other words, she has the experience of being capable and successful in modifying software to achieve particular ends, potentially enhancing her confidence and commitment to such an identity in the future. She will be better able to understand why specific sorts of technical knowledge are important, how this knowledge applies to meaningful problems, and will have a sense of her own capacity to fully understand and use that knowledge (Gee, 2004).

This kind of situated understanding of computing is difficult to capture in a set of standards or curriculum objectives. The set of ten intellectual capabilities outlined in the National Research Council's (1999) framework of ''fluency with information technology'' are pertinent, but they are so broadly defined (an example is ''expect the unexpected'') that their connection to actual practices can be obscured. Indeed, the term ''intellectual'' is somewhat misleading, since such capabilities are only evident in actual practice. Through our work with *The Sims*, we have begun to identify a somewhat more specific set of practices inherent in *Sims* game play, that are foundational to fluency with IT in a broader sense. In the following section we briefly describe a selective number of these practices: managing complex systems; cheating and glitching; tinkering with tools; and making, manipulating, and reasoning with spatial representations.

Managing complex systems. Wing (2006) argues that computational thinking includes ''having the confidence we can safely use, modify, and influence a large complex system without understanding its every detail.'' Such confidence is essential for *Sims* players. From the very start, *The Sims* engages players as designers or co-creators of their game play (Gee, 2007). Players are offered myriad choices, including selecting or creating neighborhoods, houses, families and individual sims. These options mean that there is no clear path of skill development for players: some players might spend hours learning to design custom homes without ever creating a family, while others might focus entirely on managing the lives of multiple sims. Unlike more linear games, problems in *The Sims* are not well-ordered (Gee, 2007) and the player has considerable control over her own learning trajectory.

However, the player is never in complete control of the *Sims* world, and things happen in unanticipated ways. One of the first tasks a player confronts is how to understand and limit the game's complexity in order to avoid catastrophes such as burning down a house, having the children taken away by social services, or furnishing a home without essential features such as toilets and fire detectors. Of course, *The Sims* is a simplified system, that is, it does not model the full complexity of human behavior and needs. People do not get sick or disabled; furniture does not wear out; until the expansion pack *Seasons*, the weather never changed. Still the number of variables left to the player's control are significant, unlike the more restricted options open to players in many other types of games. To manage this complexity, the player must begin to develop an awareness of how game functions as a system; to do so, she plays with the game world, not simply within it. In doing so, the player comes to understand (implicitly or explicitly) that the game is governed by a set of underlying rules, and how those rules operate in the game. For example, new players may happily create large sim families, only to discover that keeping all family members healthy and content is far too challenging. The player can modify her game by creating a smaller family, or she can modify the rules by using cheats to keep the family's needs satisfied more easily. Players also learn the limitations of the simulation; they may look in vain for washing machines (sims clothes do not seem to get dirty, although sims themselves do) and cell phones (there is a cheat to obtain cell phones, but sims cannot make real phone calls with them). An embodied understanding of rules, or ''feeling for the system'' through immersion in this world, lays the foundation and motivation for further learning about how software programs function, as well as for understanding the limitations of computing as a representational and problem-solving tool.

Cheating and glitching. In *The Sims*, similar to many other games, some of the underlying rules become visible to players in the form of cheat codes. The player can use a set of keystrokes to open a console window, and then enter one or more command lines that affect parameters of the game. These codes, presumably used by the developers for debugging, range from relatively simple commands affecting single parameters, such as ''aging off/on,'' to codes with more global effects, such as ''boolProp TestingCheatsEnabled true,'' which enables a host of new actions and modifications to the game. A different form of cheat is ''glitching,'' taking advantage of bugs in the game, to do or build things that are otherwise impossible. A popular cheat of this type is creating a floating house by building it on a set of columns, and then deleting the columns.

Cheating and glitching are foundational to IT learning. First, the player begins to understand that what happens in the game can be modified through the use of a particular ''language,'' which is crucial for understanding how software functions. For the cheat codes to work, she needs to become aware of important features of this language, such as case and syntax, and that the language functions at different levels (neighborhood or household). She learns the importance of accuracy: one letter out of place will render the code uninterpretable. While the player is exposed to only a selective set of codes, removed from the context of the entire program, she is gaining an intuitive grasp of how the language works, which could make actual programming more easily learned in the future.

Second, using cheat codes and glitching gives the player a sense of the range and specificity of rules underlying the game. The player is introduced to the idea that the game can be broken down into discrete elements, invisible to users, which together comprise a complex system. In addition, she begins to see how even carefully constructed programs can contain gaps in logic that lead to unexpected consequences. This ability to deconstruct a complex system is crucial to work with IT, in tasks ranging from software design to program debugging.

Tinkering with tools. Myriad software tools can be used to create and modify content in *The Sims*. The game itself offers players the ability to choose from among a diverse array of furnishings, building features and landscaping options. The game comes with Body Shop, a tool that allows players to design custom sims using a predetermined set of physical attributes and personality traits. EA offers two programs for players who wish to create custom content. Homecrafter Plus is intended to be used in conjunction with any paint software program and allows players to custom home features such as flooring and wall coverings. A second EA tool, Content Manager, allows players to view modified content they have created or downloaded, and enable, disable or delete the content using this tool.

Just as notable is how the game incorporates player-designed custom content created with a wide range of other software tools. For example, players can use Photoshop to create clothing from digital photos and import it into the game, create new objects with Milkshape 3D, a low polygon modeler, or design a new neighborhood terrain map with *SimCity*. Players themselves have created tools that can be used for everything from importing MP3s into *The Sims 2*, to making object textures look ''dirty.'' Many of these tools require the player to deconstruct a task into discrete steps; for example, even the most simple task of recoloring a piece of clothing requires creating a new file in BodyShop, exporting the clothing folder, opening it in Photoshop, finding the correct file, modifying the desired parameters, saving the file as the appropriate file type, moving back to BodyShop to preview the item and then importing it into the game.

While players have created step-by-step tutorials for specific actions using these tools, much learning also involves ''tinkering:'' playing with the tool, seeing how it works, and developing goals incrementally (Papert, 1993; Turkle, 1995). While tinkering is often associated with computer hardware, it is also an important part of creating software as well as learning to use it. Programming, and software design more broadly, while often described and taught as a linear, top-down process, in practice combines structure and improvisation, through an iterative process of planning and experimentation (Papert, 1993; Turkle, 1995). Tinkering seems to be a way of engaging with technology that boys adopt more readily than girls, potentially due to greater prior experience with IT (Jones *et al.*, 2000). However, studies have examined this behavior primarily within formal school settings, where gender differences may be a consequence of the social context and the particular tasks at hand. The editing and customization tools used with *The Sims* require no programming, so they allow relatively inexperienced computer users to have the experience of tinkering without extensive prior knowledge. In addition, they allow players to develop their capacity to engage in forms of spatial reasoning, such as those described below, which are crucial for the use of more advanced tools.

In addition, through the process of tinkering, the player gains factual information that comes ''for free'' (Gee, 2004). An understanding of file type and structure, the elements of graphical content (such as textures, layering, hue and saturation), how to import and export files, packaging files for uploading and downloading, and much more are part of learning to make and use even relatively simple content modifications.

Making, manipulating, and reasoning with spatial representations. Computing is increasingly used to solve problems in science, engineering, and mathematics that are inherently spatial in nature. Goodchild (2001) argues that in general, digitally-based problem solving will take place within spatial frameworks. In computer education, studies suggest that students with stronger spatial reasoning abilities are more likely to be successful in introductory programming classes (Jones and Burnett, 2008). Gender differences in spatial ability have been found in a number of studies, with females appearing to underperform on measures such as mental rotation (Voyer *et al.*, 2000). Interestingly enough, one explanation for this gender difference is that boys may develop stronger spatial skills through playing video games, and one study found that repeated practice with games actually enhanced girls' spatial skills (Subrahmanyam *et al.*, 2001). A growing number of visual and graphical programming languages have been developed, often (somewhat ironically) with the goal of making learning to program easier, thus making spatial reasoning skills even more central to computing.

Simply navigating the *Sims* world requires a heightened sense of spatial awareness, since the player is not taken down a linear route but rather must each time choose a starting location and orient him or herself within a spatial environment. Building within the *Sims* world, as well as utilizing many design tools supporting content creation, requires the ability to manipulate and to reason with and about 2D and 3D images. *Sims* architecture is based on a two-dimensional grid and requires players to rotate objects, estimate length and width, anticipate relative positioning of objects, and so forth. Various tools require shifting from 3D to 2D representations, such as folding and unfolding clothing for recoloring or cropping. Finally, communicating with other players about content creation can require creating new representations, ranging from screen shots to diagrams that illustrate problems and solutions.

Implications

While a growing number of educators are exploring the value of making games as a means of introducing young people to programming (Hayes and Games, 2008), *The Sims* shows us how existing practices associated with games might be leveraged for the development of IT fluencies in a broader sense. In addition, a closer examination of practices associated with gaming and fan communities can offer new perspectives on the nature of IT fluency in the context of participatory culture and productive uses of new media. For example, one of the intellectual capabilities in the NRC framework is ''managing problems in faulty solutions,'' which is typically interpreted as identifying and fixing bugs in software programs. For *Sims* players and other gamers, bugs become opportunities for creative problem solving and innovation, to be taken advantage of, not just managed. *The Sims* also suggests how computing skills that are typically treated separately in school can be introduced in a more integrated manner if grounded in actual practices around complex computing tools. In TechSavvy Girls, we are developing strategies for using *The Sims* as a starting point for engaging girls in further learning about programming, 3D design, and behavior modeling.

While we can learn much from *The Sims* about new approaches to fostering IT fluencies, we are not advocating that *The Sims* or other games be simply inserted into formal education. Our argument is a broader one that stresses rethinking how we conceptualize and support the development of IT fluencies. In our own work, we have found that associating games with any school-like activity can quickly lead to resistance and loss of interest on the part of learners. Retaining a sense of free choice, experimentation, and most of all, play, remains crucial for authentic game-based learning. Yet we have also found that simple access to *The Sims* is not sufficient to ensure that all player-learners engage in practices that contribute to the kinds of learning we have discussed, and herein lies a role for educators. For example, without access to the tools, resources, and examples offered by fan communities, players may never even become aware of the possibilities for content creation. In our experience, teen girls often face greater restrictions on their internet access, and thus to fan communities, than teen boys, typically due to parental concerns over their safety. Even when such access is available, we have discovered that teen girls may need the additional support of adult or peer mentors to guide them through a new practice before they feel confident enough to practice it on their own. In addition, as Gee (2004) points out, situated understandings do not necessarily lead to abstract verbal understandings, and educators may play an important role in prompting young people to talk about what they are learning and introducing specialist language that enables them to participate in a wider community associated with IT. In other words, educators may help to create contexts that push computing ''know-how'' to computing ''know-what.''

The Sims also offers particular insights into girls' computing practices and preferences. We have argued that while it may be easy to dismiss *The Sims* as simply playing with dolls, in reality players engage with fundamental computing practices through *Sims* gameplay. This is not to say that the content of *The Sims* is trivial or unimportant, a form of packaging computing in ''pink.'' Rather, *The Sims* offers girls and women (and many male players) the chance to play with socially acceptable and powerful identities, just as games that feature swordplay or football offer such identity play, though appealing more often to boys. Rather than dismissing these interests, or trying to impose our own conceptions of appropriate content, we might acknowledge this attraction, however problematic, and seek to better understand how *The Sims* affords quite complex and often transgressive play with societal norms and values. Indeed, rather than forcing players to adopt a static set of norms and identities, *The Sims* allows players, though cheats and mods, to construct a seemingly endless array of new identities, social relationships, and storylines. We have observed the same girl take pleasure in creating a standard romantic storyboard, using a cheat to have men get pregnant, and constructing an elaborate sweatshop complete with ''Exile Island'' for misbehaving sim workers. As Papert (1993, p. 123) writes:

> Knowing that one can exercise choice in shaping and reshaping one's intellectual identity may be the most empowering idea one can ever achieve.

References

ACM K-12 Task Force Curriculum Committee (2003), *A Model Curriculum for K-12 Computer Science: Final Report*, Association for Computing Machinery, New York, NY.

Anderson, N., Lankshear, C., Timms, C. and Courtney, L. (2008), '''Because it's boring, irrelevant and I don't like computers': why high school girls avoid professionally-oriented ICT subjects'', *Computers and Education*, Vol. 50 No. 4, pp. 1304-18.

Denning, P.J. (2004), ''The field of programmers myth'', *Communications of the ACM*, Vol. 47 No. 7, pp. 15-20.

Gasmo, H. (2004), ''Computing: excludingly boring at school, includingly cool at home'', available at: www.sigis-ist.org

Gee, J.P. (2004), ''Game-like learning: an example of situated learning and implications for opportunity to learn'', available at: www.academiccolab.org/resources/documents/Game-Like%20Learning.rev.pdf (accessed June 15, 2008).

Gee, J.P. (2007), *What Video Games Have to Teach Us about Learning and Literacy*, 2nd ed., Palgrave/Macmillan, New York, NY.

Goodchild, M.F. (2001), ''A geographer looks at spatial information theory'', *Lecture Notes in Computer Science*, Nos 2205/2001, pp. 1-13.

Goode, J., Estrella, R. and Margolis, J. (2006), ''Lost in translation: gender and high school computer science'', in Cohoon, J.M. and Aspray, W. (Eds), *Women in Information Technology: Research on Under-representation*, MIT Press, Cambridge, MA.

Hayes, E. and Games, I. (2008), ''Learning through game design: a review of current software and research'', *Games and Culture*, Vol. 3 Nos 3-4, pp. 309-32.

Hayes, E., King, E.M. and Lammers, J. (2008), ''The Sims2 and women's IT learning'', *Proceedings of the Adult Education Research Conference, St Louis, MO, May*.

Herz, J.C. (2002), ''Gaming the system: what higher education can learn from multiplayer online worlds'', available at: http://connect.educause.edu/ (accessed June 25, 2008).

Jenkins, H., Purushotma, R., Clinton, K., Weigel, M. and Robison, A. (2006), *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century*, The MacArthur Foundation, Chicago, IL, available at: www.digitallearning.macfound.org (accessed June 1, 2008).

Jones, M.G., Brader-Araje, L., Carboni, L.W., Carter, G., Rua, M.J., Banilower, E. and Hatch, H. (2000), ''Tool time: gender and students' use of tools, control, and authority'', *Journal of Research in Science Teaching*, Vol. 37 No. 8, pp. 760-83.

Jones, S. and Burnett, G. (2008), ''Spatial ability and learning to program'', *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*, Vol. 4 No. 1, pp. 47-61.

Leadbeater, C. and Miller, P. (2004), ''The Pro-Am revolution: how enthusiasts are changing our economy and society'', available at: www.demos.co.uk/publications/proameconomy (June 9, 2008).

Lenhardt, A. and Madden, M. (2005), *Teen Content Creators and Consumers*, Pew, Washington, DC.

Margolis, J. and Fisher, A. (2002), *Unlocking the Clubhouse: Women in Computing*, The MIT Press, Boston, MA.

National Center for Women and Information Technology (2005), *Women and Information Technology: By the Numbers*, National Center for Women and Information Technology, Washington, DC.

National Research Council (1999), *Being Fluent with Information Technology*, National Academy Press, Washington, DC.

Nordli, H. (1998), *From Spice Girls to Cyber Girls? The Role of Educational Strategies in the Construction of Computer-enthusiastic Girls in Norway*, Centre for Technology and Society, Norwegian University of Science and Technology (NTNU), Trondheim, available at: www.ntnu.no/sts/SLIM/ (accessed June 20, 2008).

North Central Regional Educational Laboratory (NCREL) (2003), *enGauge 21st Century Skills: Literacy in the Digital Age*, NCREL, Naperville, IL.

Papert, S. (1993), *The Children's Machine: Rethinking School in the Age of the Computer*, Basic Books, New York, NY.

Rasmussen, B. (2001), ''Cultures and generations: young women and their relation to computers'', paper presented at the Itech Women: Meeting Tomorrow International Conference, Vienna, Austria, October, available at: www.europaforum.or.at/site/HomepageITECHwomen/documents/Rasmussen.pdf (accessed June 20, 2008).

Schiesel, S. (2006), ''Welcome to the new dollhouse'', *The New York Times*, May 7, available at: www.nytimes.com/2006/05/07/arts/07schi.html?_r = 1andoref = slogin

Shaffer, D.W. (2004), ''Pedagogical praxis: the professions as models for post-industrial education'', *Teachers College Record*, Vol. 106 No. 7, pp. 1401-21.

Steinkuehler, C. and Johnson, B.Z. (in press), ''Computational literacy in online games: the social life of a mod'', *International Journal of Gaming and Computer Mediated Simulations*.

Subrahmanyam, K., Greenfield, P.M., Kraut, R. and Gross, E. (2001), ''The impact of computer use on children's and adolescents' development'', *Applied Developmental Psychology*, Vol. 22 No. 1, pp. 7-30.

Tillberg, H.K. and Cohoon, J.M. (2005), ''Attracting women to the CS major'', *Frontiers: A Journal of Women Studies*, Vol. 26 No. 1, pp. 126-40.

Turkle, S. (1995), *Life on the Screen*, Simon and Schuster, New York, NY.

Voyer, D., Nolan, C. and Voyer, S. (2000), ''The relation between experience and spatial performance in men and women'', *Sex Roles: A Journal of Research*, Vol. 43 Nos 11/12, pp. 891-915.

Wing, J.M. (2006), ''Computational thinking'', *Communications of the ACM*, Vol. 49 No. 3, pp. 33-5.

Further reading

Internet and American Life Project (n.d.), available at: www.pewInternet.org.

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