# 21ST CENTURY LANGUAGE AND LITERACY IN GAMESTAR MECHANIC: MIDDLE SCHOOL STUDENTS' APPROPRIATION THROUGH PLAY OF THE DISCOURSE OF COMPUTER GAME DESIGNERS

by

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For Sarah, Arturo and Nicolas, may that all forms of knowledge be respected in your lifetime
And for mom, smile your knowing smile, wherever you are

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## PREFACE

The following dissertation is based on a collection of articles of studies resulting from a three-year design research agenda for Gamestar Mechanic, a novel game-based learning environment aimed at fostering the appropriation of 21st century language and literacy skills by instructing them on key principles of game design. Given that in some cases abridged versions of these articles have been published in conference proceedings and journals, where pertinent this dissertation will present their full versions adapted to the chapter format.

Given that in a project like Gamestar Mechanic learning theory research and the development of an educational intervention that applies such research are tightly intertwined, the central thesis in this work consists of two complementary parts. *First, Gamestar Mechanic facilitates children's learning of important language and literacy skills for the 21st century germane to a designer identity, by teaching them to become fluent in the language of games, conceived as an amalgam of multiple modes of meaning representation. Second, understanding how children communicate using this language can help instructional designers create more effective game-based learning environments and assessments.*

Gamestar Mechanic is intended to introduce children to a dialect of the specialist "language of games", with the purpose of helping them think of and express sophisticated ideas, in ways attuned to the academic, social and work demands of 21st century life. At this point however, most educators and researchers know less about how the language of games works during the interpretation and communication of meaning than many students do, given that many of these students have grown up with games as an integral part of their lives. This is an issue that we as educational researchers must address before we can harness the promise of games as effective learning environments.

The research reported in this dissertation represents a step toward understanding the nature and uses of the language of games, by exploring their use by players in the context of Gamestar Mechanic. In addition, it will be an experiment in using the insights of such exploration toward the development and assessment of a learning environment that fosters real learning outcomes for disadvantaged children. With these two goals in mind, this research consists of a series of focused studies conducted following a three-year design experiment agenda, an applied research method that relies on sequential cycles of learning environment design, implementation, and assessment aimed at producing effective learning environments supported by robust learning theories. The studies are organized in a top-down manner, beginning with an overall examination of Gamestar Mechanic as a learning environment, and its evolution across the last three years of research. It gradually narrows down the scope of the research to give multiple perspectives of the learners' experiences in the game, first at a group level and then at an individual level. Through these studies, it hopes to provide a detailed multi-perspective narrative of the overall ecology of the game at different stages of development, and a robust theory of the way in which children learn and use the language of games for meaningful communication within it.

Chapter I of the dissertation is a synthesis of two pieces entitled "Design Thinking in Gamestar Mechanic: The role of gamer experience on the appropriation of the Discourse practices of Game

Designers”, presented at the 2008 International Conference for the Learning Sciences, and “The Appropriation Through Play of an Expert Game Designer Discourse: Implications for the Development of Language and Literacy Skills by Disadvantaged Middle School Students”, presented at the 2008 Annual Meeting of the National Academy of Education. It presents an argument for game design as a set of activities that can require learners to enact language and literacy practices characterized by a designer mindset, that recruits cognitive skills such as systems-level thinking, strategic problem-solving and evidence-based reasoning, widely recognized as necessary for 21st century learners. It argues for the use of Gee´s “Big D” Discourse as a useful construct through which to understand the nuance and sophistication of the language of games, as well as to unpack the specific literacy and cognitive skills that may be learned through game play and design. It concludes by out a set of research questions that serve as the central guides for the studies reported in the rest of the chapters.

Chapter II is based on the article titled “Making Computer Games & Design Thinking: A Review of Current Software And Strategies”, that I co-wrote and published with Elisabeth Hayes in the Games and Culture Journal. This article presents a thorough review of the literature concerning research on learning environments that use game design as pedagogy, as well as on the software infrastructures that have been used as their cornerstones. The review is organized according to the main learning objectives that the learning environments were designed around. It makes the argument that in most of these cases, the goal of teaching students how to program a computer has been overemphasized, while design has only be addressed with a very limited scope (e.g.

solely as construction of software). It then makes a call for research that explore the activity of design more fully, and of the learning benefits of using it as the actual context for instruction.

Chapter III builds on a conference paper titled "Gamestar Mechanic: Reflections on the Design & Research of a Game about Game Design", presented the 2008 Meaningful Play Conference, and a book chapter with the same title as the one in here, to appear in the book Design and Implementation of Educational Games. This paper presents a design study of the instructional framework guiding the design of Gamestar Mechanic as a learning environment. The narrative in this paper presents a high-level analysis of the design research agenda that has been used to build and refine the game across three years of work. It concentrates on those high-level aspects of the language of games that have consistently been observed across different game design workshops involving the game for the last three years. It presents a thorough examination of the game itself, and describes the way the findings from each design-research cycle have shaped the design of the game as well as its supporting theory and assessment from its inception in 2006 to its final release in 2009.

Chapter IV will complement chapter III by presenting a version of the article titled "Three Dialogs: A Framework for the Analysis and Assessment of 21st Century Literacy Practices, and its use in the context of Game Design within Gamestar Mechanic." published at the journal E-Learning in 2008. The chapter presents a detailed description of a theoretical framework for assessing the Discourse of game design through the language of games, synthesized from the findings in chapter III, through a meta-analysis of the literature in game-based and design-based learning. The framework is a model consisting of three dialogs representing key interactions between players and game that show promise in leading the to conceptual change and the appropriation of the language and literacy practices of the game designer Discourse. It also describes in detail a documentation and analysis methodology relying on video, screen cast and think aloud interviews through which the framework can be applied in each cycle of the design research agenda, and provides examples the dialogs assessed during play.

Chapters V, VI and VII exemplify the use of the three-dialog framework in the assessment of language and literacy at a group level within specific instances of the game, and then at an individual level across several instances. They focus the discussion of their findings on their implications for children's learning of specific 21$^{st}$ century language and literacy skills.

Chapter V concentrates the case study analysis on a group level, using the three dialog framework on a pre and post assessment of the language and literacy progress of a multiculturally diverse group of 12 middle school students and 5 professional game designers playing the game in a 32-hour after-school game design workshop. Based on a paper currently under production for a special issue of E-Learning titled "Bug or Feature? Negotiating the Affordances and Limitations of Game Design tools in Gamestar Mechanic" it particularly concentrates the analysis on the way the language of games is used during the problem-solving activities of children as they tackle jobs that present complex design challenges. In particular the way in which participants develop the notion of what counts as a “bug” or as a “feature” in the game is of central interest, as the two concepts are sometimes opposed, sometimes related and can sometimes be carefully blended into novel designs.

Chapter VI builds upon an invited paper for Educational Technology Magazine titled “Diversity-Sensitive Design Research: Cultural Stories, Gender, and their Contribution to the Design of Gamestar Mechanic, a 21st Century Literacy Game”, and extends the case study in Chapter V by placing an explicit focus on the way in which stories help children construct experiences for their players based on an intention to make a virtual identity whose shoes they will “step into”. It examines how by ascribing semantic meaning to structures within Gamestar Mechanic, they articulate narratives not with the purpose of retelling sequences of events, but of situating player identities within game worlds. It concludes with a discussion of how this meaning production process can allow for bridges between the Discourse of games within Gamestar Mechanic and other important discourses in the 21st century.

Chapter VII concludes by focusing the analysis on the evolution of a middle school that participated in every Gamestar Mechanic workshop throughout the three years of the project. The student, for which the pseudonym Marc is used, is a boy that came to the first workshop with deficient literacy skills and a disaffiliation with school, and the changes he experienced as he played the game across several research cycles for two years. It will stress the role that game design within Gamestar Mechanic can play in eliciting a continuous commitment to learning among disadvantaged students, and the consequences that such commitment may bring to their language and literacy skills, as well as to their entry into other valuable discourses in school, academia and the professions.

As a whole, these seven chapters aim to provide a detailed description of the language and literacy practices that children engage in while playing Gamestar Mechanic in a variety of contexts. One of the central limitations of this research is that by relying on a design research approach and qualitative methods, it used convenience student sample in relative small sizes used for the analysis. Thus, it forgoes any claims to grand generalization of the findings reported here. Instead, its goal is to provide a "robust theory" (Cobb, et. al. 2003) of the learning experiences that can emerge from the interactions between learners in and with Gamestar Mechanic, letting the readers be the readers as to the worth and applicability of this work to their own practice be it research, learning environment design or instruction.

## PERSONAL ENTRY TO THIS RESEARCH

My interest in the learning benefits that computer game design can bring to young students stems from over 25 years of experience playing and making games for both learning and entertainment. Born in the late 70's, I am part of a generation that saw the advent of the fist game platforms ever conceived starting with the *Pong* and *Space War* arcade machines (an argument still exists over which of these was the first computer game). Growing up, I have seen games "grow up" as well in terms of their evolution and technological sophistication. I was fortunate to experience the expansion of videogames into the living room, and have been lucky to access to hundreds of game titles for almost every system from the rudimentary blocky dots of Atari 2600, through their expansion with the hobbyist designer community of the Commodore 64, their technological and commercial explosion in the home PC and all the way to a new paradigm of immersive gaming experience in the Nintendo Wii. Playing all these titles, I have had life altering experiences give me an appreciation for games as learning contexts. Few other media have stimulated my imagination to such a degree where I could –if for a moment- believe myself capable of doing such complex things as navigating a pirate war galleon, flying an F-14 airplane or running a railroad business, all the while exploring for fun areas of human knowledge I might not have otherwise.

This notion has accompanied me throughout my career as an educator, engineer and technology researcher. In 1995, while working as a middle school computer science teacher in Mexico, I pioneered a curriculum that relied on videogame titles to introduce young learners to solving problems with the computer. This program was so successful that at the end of three years, and for the first time in the institution's history, several of our graduates were awarded full scholastic achievement scholarships to attend high school at the Monterrey Technological Institute, one of the top private institutions in the country. Later, during my five years as an R&D software engineer for National Instruments Corporation, my work as a liaison between software designers and scientists implementing automation systems with our products kept bringing me to the realization that videogames seemed to facilitate users learning to understand the workings of complex systems in much more efficient ways than other software tools could, and led me to see the disconnect that exists between most technology designers and real world learners, a well documented issue in the field of human-computer interaction.

When I decided to start a doctoral degree focusing on Learning Science at the University of Texas in 2004, videogames as learning environments became my focus of research, and for two years I was able to refine my understanding of their theory and application by conducting a variety of research and assessment projects with university faculty. After transferring to the University of Wisconsin two years ago, my work with researchers of such caliber as the members of the Games, Learning and Society group has more than ever strengthened my commitment to this work.

# CHAPTER I: VIDEOGAME DESIGN AND 21$^{ST}$ CENTURY LANGUAGE AND LITERACY EDUCATION

The research in this dissertation focuses on the 21$^{st}$ century language and literacy practices of middle school children in Gamestar Mechanic, an online role-playing meant to teach them such skills through key principles of game design. Gamestar Mechanic is currently under development as part of the Macarthur Foundation's Digital Media Learning initiative, through a partnership between Gamelab, a New York based game studio, and the University of Wisconsin-Madison. But why would one want to explore language and literacy, of all things, in a game about game design? In the following paragraphs I present an argument based on recent research on games, game design, learning and literacy, and for the benefit to education that such research may bring.

## *Design as a Necessary 21$^{st}$ Century Mindset*

As we move toward the end of the first decade of the 21$^{st}$ century, it is becoming increasingly clear that the mindset that has dominated the public discourse of many world leaders and decision makers since last century, is coming short at helping nations address the increasingly complex challenges of a global world (Shaffer and Gee, 2006). This mindset, characterized by an uncritical deference to theories of the world produced by small groups of "experts", is best exemplified in former U.S. vice-president Cheney's statement at the National Convention of Veterans of Foreign Wars in August 2002, where he said that "Simply stated, there is no doubt that Saddam Hussein now has weapons of mass destruction." ("EYES ON IRAQ; In Cheney's Words: The Administration Case for Removing Saddam Hussein", 2002)

The main premise in this statement, which we now know was built on inaccurate intelligence information gathered from a handful of witnesses (Suskind, 2008), was nevertheless used by the administration as the core argument to justify an unnecessary invasion of Iraq to the American people, and start what has become one of the longest and most morally and physically damaging military engagements in the history of the United States. The "perfect storm" that led to this disaster however, could have been avoided if most members of senate and congress had not accepted what Gee (1996) calls a "removed theory", or a theory received from others, of the link between Saddam Hussein and the perpetrators of the 9-11 attacks. Instead, most of these legislators either voted for, or failed to oppose the invasion, for fear of being "on the wrong side" of the issue as articulated by the Bush administration's theory.

Unfortunately, the practice of adopting such removed theories without question is alive and well in our society, even after such debacles. Media broadcasts are more than ever flooded with growing numbers of "experts", who present their opinions on critical areas of people's lives as truths, often using the type of absolutist terms present in the Cheney statement. This is particularly worrisome if one considers that pressing issues such as global climate change, the depletion of natural resources and the current global economic crisis are indeed the product of very complex systems of variables that we do not fully understand, and whose solution calls for the active participation not only of decision makers, but of the population at large. I their light, it becomes clear that if we are to have a sustainable future as a country and a world, the practice of uncritically adopting removed theories for decision making is one we can no longer afford.

In response to such concerns, a growing number of scholars in disciplines ranging from engineering to education, propose a designer mindset as a necessary departure from removed theories that can help us more effectively address the challenges of 21st century life (New London Group, 1996; Papert, 1991; Kafai, 1995; Kolodner et. al, 1996; Perkins, 1995). This call is best understood by making a comparison between key aspects of school practice versus design practice today.

*Traditional School Learning Vs. Design-Based Learning*

David Perkins, one of the earliest proponents of thinking in function of design, conceives knowledge as "structures adapted to a purpose" (1995). This view brings an ontological view of knowledge as structure, that is, as a system of components that interact with each other, giving form and function to what is known. At an epistemological level, two important aspects emerge in this view. First, that knowledge emerges from the active adaptation of these structures, and second, that this adaptation is purposeful, directed toward specific goals.

By contrast, consider the average middle school classroom today. In most cases, knowledge is demonstrated by the degree a student can repeat the canonical concepts found in a textbook on a standardized test. At an ontological level, this views knowledge as conceptual objects separate from the learner and with qualities of their own. At an epistemological level, these objects are transmitted as information by a teacher, and used to "fill" the head of a passive learner.

In addition, a stark contrast exists in the views that design and school hold of the actual participants in the learning process. For Papert (1991), learning happens most effectively when the manipulation of structures takes place in a public context. This implies that for knowledge to emerge it must result of public scrutiny and feedback to the designer, in a process of negotiation of ideas, uses and objectives for the design. This places learners of all levels of expertise in the role of co-designers of the artifact at hand. This is how design works in most creative firms today, from engineering to the arts, as teams are usually involved in collaborative design efforts, with their members working on specific components that others must negotiate before articulating a full design.

In school, on the other hand, knowledge in school takes place not so much as a dialog as it does as independent streams of information transmission. This usually takes the form of a question or query to a learner about canonical knowledge, followed by a response by the learner, and an evaluative statement by the teacher, a pattern well documented under the initials I-R-E (Innitiation, Response, Evaluation; O'Connor and Michaels,1993; 1996; Mehan, 1979), and which repeats itself, in mediated form, during standardized tests. In most classrooms, the pervasive one teacher to many students distribution leads to the use of this pattern in its least dialogic way, the teacher often asking questions expecting brief "correct" answers and moving on to the next question after brief evaluations and little feedback.

In school, failure during learning is to be avoided at all costs, lest the teacher deduct the failure from the learners' grades, labeling them as underperformers to their peers and parents. In design practice (and in science), on the other hand, failure is a fundamental component of learning, the ability to iteratively improved a design by testing out hypotheses (even when they are false) a fundamental method through which knowledge is advanced. The best example of this is reflected in the philosophy of IDEO, one of the most prestigious design firms in the world, summarized in an employee's statement that one must "fail often to succeed sooner" (Kelley and Littman, 2001).

In sum, a design mindset positions teachers, learners, and peers in both productive and critical roles, requiring them to habitually question the assumptions and theories behind each other's designs. This in turn, gives learners of all levels of experience, chances to develop their own models of how world phenomena work, as opposed to just receiving them from someone else. In a world where the globalization of markets is the order of the day, and where value added results from the production of new knowledge (Gee, Hull and Lankshear, 1996), the mindset of design offers our students and our country a far better chance of success than the mindset currently promoted by traditional instruction in school does.

### *Game Design as a Context for 21st Century Learning and Literacy Practices*

While many activities in today's world bear the term design in their name (e.g. fashion design, interior design, software design), computer game design distinguishes itself from them in that it integrates four very important areas of human knowledge in the 21st century, namely: a) computer systems design, b) digital art, and c) human-computer interaction.

Computer systems are more than ever a central part of human activity whether in professional, social, academic or leisure settings. Whether to organize our flight schedules or our music, we are increasingly relying on systems run by computer technologies to take care of increasingly vital functions in our lives. However, designing such systems effectively is a highly complex and nuanced activity, which engineers and programmers to sift through and organize large amounts of information and articulate complex models of real world phenomena in software code. This often requires recruiting skills in mathematics and logic that form the foundation of most knowledge disciplines, and thinking skills that bring systems to the foreground. Designing modern computer games effectively requires developers to harness the tools of computer systems design to implement in software the rule systems that define games (Salen and Zimmerman, 2003), by following a process of critical problem-solving that follows an iterative process of improvement of the model intended. As computer technologies have made it possible to organize and process larger amounts of information effectively, they enable computer game designers to implement more complex systems of rules and components, making good games products that often push the envelope of what state-of-the-art computing technologies can accomplish.

Good computer game designers today must also learn to make critical decisions regarding using a diversity of forms of digital artistic expression. Two important ones are the use of computer graphics (Akenine-Moller, Haines and Hoffmann, 2008) and digital storytelling (Crawford, 2005). Modern 3D computer graphics algorithms and techniques now allow designers to produce rich and detailed virtual worlds that immerse players in simulations of real and fantastic spaces in our world and outside it. However, with the advent of technologies like Flash, techniques for producing stunningly beautiful two-dimensional games that may digitally represent techniques from pencil drawing to Japanese manga. Game plots and storylines have also increased in sophistication as the virtual worlds of in them become more expansive, usually framing and giving meaning to the actions that virtual characters play in the world, but at the same time being shaped by those same actions. Hence, it is possible for designers to complement aspects of a game where a graphic representation would be inappropriate or too taxing to implement with a good storyline, resulting in an experience for a player that is more than the sum of its parts.

To create such experiences, game designers must learn to think with the interaction between players and game systems at the center of their design decisions. Hence, game designers must consider and engineer into their games a variety of socio technical considerations, including their player audiences expectations, their motives, their possible interpretations, and their actions as result of the meaningful experiences presented to them in game form. Issues such as the usability of the game interface, it's learning curve and the degree to which it makes players want to come back to play again must be at the center of a good designer's thoughts during the making of a game.

Language and literacy play as crucial a role in helping learners develop and enact a game designer mindset as they do in the traditional mindset of school. Decades of research in literacy provide strong evidence for the role that language in its many forms plays in the development of higher-order mental functions (Vygotsky, 1978; Bruner, 1981; Cole and Scribner, 1981; Gee, 1992; Lakoff and Johnson, 1980). This research has shown how knowledge representations (including words) can become what the author calls “tools to think with”, which help people organize their cognition about their experiences in the world.

A central idea in this research is that as with physical tools, these representations used in context serve the function of amplifying certain cognitive and communicational functions while inhibiting others, just like a screwdriver would amplify a rotational action, and inhibit a translational one on a screw (Nelson, 1996).

These functions are highlighted in diSessa’s (2002) example that contrasts Galileo’s initial articulation of the laws of motion in prose, versus Newton’s articulation with algebraic notation. Both articulations represent the same mental model of the world, however Galileo’s version had the disadvantage that it required many pages using to explain, making it difficult to remember. In contrast, Newton’s notation took but a few lines to express the model and made it easier to remember and disseminate it, but at a price, for understanding the explanation would require knowledge of the conventional meanings and abstractions of algebraic notation, which Galileo’s did not.

With this in mind, effective communicators are also good designers, who have an awareness of the mental models and perspectives carried their knowledge representations in specific contexts, and for specific audiences (New London Group, 1996). This characteristic also gives these people an intellectual advantage, for in the degree they become aware of more ways a model can be communicated, the more people they will be able to negotiate its meanings with, and the more perspectives and tools for understanding it they will have.

In recent years, prominent coalitions formed by industry, government and academia, have identified communication using interactive technologies such as those in computer game design, and common to many design professions, as a core skill set learners need in the 21st century (Partnership for 21st Century Skills, 2008; American Library Association 2007; Federation of American Scientists, 2006). Such skills entail the ability to articulate meanings using not only printed text, but the multimodal representations native to digital media as well. These skills, they contend, are fundamental for a population that will be able to negotiate the economic, social and environmental dynamics of the globalization age.

Unfortunately, research evidence shows that to this day, literacy education in schools is failing to provide students with such important skills. One of the most concerning issues within this area is what researchers call the 4th grade slump. This is phenomenon where children, especially in underserved populations such as minorities and low SES groups, who apparently do very well in the standardized early literacy assessments, promoted by the No Child Left Behind Act of 2001, fail to do so once they reach the 4th grade. (Chall and Jacobs, 2003; Hart and Risley, 2003)

An important factor behind this problem is that in this grade, school curriculum begins to introduce content texts, that is, textbooks that use the specialized language and representations of science and other professional disciplines. Given the overt emphasis on decoding print featured in today's early literacy curricula, scholars argue that efforts to teach children reading skills have overemphasized the role of "learning to read" and undermined the equally important role of "reading to learn" (Gee, 2004).

This problem becomes compounds throughout late elementary and middle school, developing into what some have called the "eighth grade cliff", a point at which students failing complex literacy tasks such as inference, comprehension, writing, and domain-specific reading, disaffiliate and drop out of school (Chall, Jacobs, & Baldwin, 1990; Chall & Jacobs, 2003; de León & Carnegie Corporation of New York, 2002). With almost 40% of male disadvantaged students dropping out before high school graduation this is now a pressing national concern (Ewell & Wellman, 2007).

Recent lines of research identify games as venues that may help address problems like this one, by promoting a design perspective of multimodal texts (Gee, 2003; Squire, 2006). In many modern computer games, children in the same groups become exposed to a form of specialist language as complex as academic language (Gee, 2003; 2004; Games, 2008), which I term "the language of games". In many cases, the materials produced by designers to support these games (e.g. instruction manuals, magazine reviews, and literature), use terms such as challenge, rules, difficulty, goals, and mechanics, to convey complex meanings referent to the structure of the game.

This language, like other disciplinary languages, is the language of systems. This is so because the specialist terms in the language of games are construed by relationships between multiple variables that interact within a given game (e.g. the knight is able to jump other pieces in chess), and give them their meaning (Salen and Zimmerman, 2003), helping players understand language as a tool for developing a perspective of complex systems that is analogous to what specialist terms in design and the academic disciplines do.

The language used in modern computer games also presents some of the most diverse and versatile methods for communicating complex ideas to players. It is flexible, and allows designers to recruit print text, but images, movement, audio, and in some cases haptic representations as well (Games, 2008). This way, designers can complement the communicational advantages and disadvantages of one form with those of another. Hence, it is not uncommon to find games that use graphics to present information that would be difficult to express verbally (e.g. the path to follow between two locations), while using verbal descriptions to elaborate on details that graphics can't convey, (e.g. some relationships between characters or objects).

Games are also hybrid texts that recruit representations, terms and constructs from other domains, including traditionally academic domains (Gee, 2003). In role-playing games game like World of Warcraft for example, statistics and graphs play as important a role in keeping the players informed of their character's status as game graphics do, helping them think about the underlying system of relationships between their characters, the rules of the game, other characters and so on, and articulate a play strategy.

To date most of the research in the area of games, learning and literacy has concentrated on the player's experience during game play (Games, Learning and Society, 2005; Gee, 2003; Squire, 2006; Shaffer, 2006). In contrast, substantially less is known regarding the learning benefits that designing games could bring to students, even though game design is an intriguing activity for understanding the complexities of learning the language of games. Most of the emphasis of educational game design research has been placed on teaching students how to program a computer (Hayes and Games, 2008) within formalized learning environments.

However, all of the skills that I have presented in the previous paragraphs as necessary for good game design have also been identified by numerous scholars as fundamental skills that learners need in the 21st century (Partnership for 21st Century Skills, 2008). Hence, the research in this dissertation concentrates on the learning that takes place during design in Gamestar Mechanic, a game about game design, and places emphasis on the ways in which learners *make meaning and communicate* using language and knowledge representations during game design, as it occurs in informal settings that closely resemble those where children would naturally encounter games.

The tremendous growth that the videogame industry has experienced over the last two decades (20% growth from 2007 to 2008, with $22bn sales worldwide) has turned games into a predominant form of entertainment worldwide. Hence, the growing interest on the part of educators and researchers comes from a desire to harness the strong engagement they elicit from players towards learning goals (Michael and Chen, 2005; Games, Learning and Society, 2005). The research reported in this dissertation aims to contribute to this effort, by exploring an innovative learning environment like Gamestar Mechanic, in hopes that it will inform areas such as the design and assessment of game and design-based learning environments in the 21st century.

***A Proposal for Research***

Since situated language (verbal, non-verbal and symbolic) plays such a prominent role in defining game design as an activity, theories of the role of language in social communication would provide useful starting points for its analysis. Among them Gee's notion of Discourse (1996, 1999) and its associated Discourse Analysis method (2005) show promise as ways to understand the ways designers construct and communicate meanings with the language of games.

One of the powerful ideas in this framework is that it sees the meaning of language as a *situated construction.* Gee (2001) argues that language has uses that go beyond the common notion of conveying information. Language is a tool that people use to *situate action* – by giving context-specific meanings to actions and to the objects involved in those actions-, as well as to *convey perspectives* -by giving others "alternative ways to view one and the same state of affairs" (P. 716). In order to study how this works, he brings forth the notion of little "d" and big "D" discourse (Gee, 1996; 1999; 2001; 2005). With little "d" discourse, he refers to the analysis of specific instances of language-in-use such as for example, a political speech. On the other hand, big "D" Discourses can be thought of as *identity kits* (2001, P. 719), which encompass the discourse, activities, values and behaviors that demarcate an identity and exist in the social context of the groups that affiliate with such identity. This then entails a view of learning as the gradual adoption of an identity by learners, and of game design as the adoption of an identity by learning game designers.

Given that situated action and meaning play such a prominent role in Discourse theory, then we could begin to analyze the Discourse of game design within Gamestar Mechanic and its bearing on the learning of language and literacy skills useful to children in the 21st century by asking the following research questions:

> 1. - How do each of the core activities enacted by participants playing GameStar Mechanic (play testing games, making games, sharing games, and reviewing games) mediate the appropriation and use of a game designer Discourse by players, and what bearing does this have on their language and literacy skills?

In order to adequately address the complexity of this question however, one should before address five specific subordinate questions:

> 1.1. – What form does the specialist language of game design take when integrated

into the Gamestar Mechanic learning environment?

1.2. - To what degree does participation in the core Gamestar Mechanic activities mediate player appropriation and use of this specialist language, and its application in literacy practices?

1.3 - To what degree does Gamestar Mechanic encourage extended participation in the activities embedded in the game's curriculum?

1.4. –To what degree does such participation mediate the adoption by novices of strategies and beliefs about game design characteristic of expert game designer Discourse?

1.5. – To what degree do the skills and practices children learn within Gamestar Mechanic speak to other Discourses such as those of academia and the professional disciplines?

1.6. – How do different player backgrounds, such as gaming experience, gender and culture impact the players' learning experience with Gamestar Mechanic?

Together, this body of questions will guide the research agenda for this dissertation, and the chapters that follow will attempt to address them, by unpacking the nuance and complexity of the learning experiences of players, as they become more fluent with the language of games embedded in Gamestar Mechanic.

*Research Methods in this Dissertation:*

In addition to a computer game, Gamestar Mechanic is an experiment in engineering a sound pedagogy centered on game design. As with similar experiments, the studies conducted with the game over the past three years have relied on a design research methodology (Brown, 1992; Collins, Joseph & Bielaczyc, 2004; Barab and Squire, 2004) to document its ecology of learning, language and literacy, and inform its design. Also referred to as design experiments, and with a history of use in studies of game-based learning environments (Squire & Jenkins, Squire & Tan, 2004; Barab et al. 2005), this method aims to iteratively develop and refine innovative learning interventions into effective learning environments backed by sound learning theory.

While this process of design and research has just recently been adopted within educational research, for many years it has been successfully been used to advance knowledge in areas such as computer science or engineering, where the iterative improvement of products is common.

Through these iterations of design, hypothesis testing, redesign, the objective of design experiments is to gradually develop an understanding of the overall ecology of a learning intervention, its components, and systemic relationships (Cobb, et al. 2003). The insights gathered from such understanding, then help the researcher inform more adequate versions of the theory and redesign the learning environment accordingly.

The studies presented in this dissertation span a three year period, divided into three cycles or phases of design research that have completed at the time of writing. For these phases, I will use the terms pre-alpha, alpha and beta, terms widely used in software production to identify phases in the development of a software system with increasing levels of functionality, stability, and refinement (Barry & Boehm, 1988). These range from a rough prototype (pre-alpha), all the way to a stable version with most major functionality limitations addressed (beta). Accordingly, each phase of the Gamestar Mechanic project involves a learning environment built upon gradually refined versions of the game, its curriculum and its underlying learning theory.

Design research does not prescribe a specific methodology to answer every question in a specific cycle, instead leaving the responsibility to the research to choose the most adequate method to answer the questions at hand. Hence, while the studies presented in the following chapters all rely on qualitative methodologies to address the research questions, the specific methodology in each varies slightly depending on the perspective it aims to illuminate. Details on the specific methods for each study are provided in each chapter.

Gamestar Mechanic is also a *teaching experiment* (Cobb, 2000) for the role of the researcher has been in many cases to manipulate the context to achieve the desired learning goals for the students. While it might seem reasonable to see this as a limitation of this research, for such manipulation would "taint' the research context and diminish its validity, I subscribe to Cobb's argument that effective instructional methods develop as a result of such goal-oriented manipulation, and better theories of instruction can result.

*Data Analysis:* Given that D/discourse theory plays such a central role in this dissertation, the studies reported in it place a particular emphasis on language used by participants in context (verbal, non-verbal and symbol-mediated) as indicators of their play and learning experiences with Gamestar Mechanic. Hence, the coding and analyses in these studies rely heavily on a multimodal form of Discourse Analysis (Gee, 2005) to draw conclusions about the relationships about the learning that takes place as a result of the relationships between the game, its players and the activities that emerge around them. The core analysis tools provided by Discourse Analysis are what Gee terms *seven building tasks of language*, which refer to ways in which people use language to situate the meanings of activities, tools, institutions and identities, thus constructing an immediate reality for others.

The tasks are (1) *significance*, using language to make certain things more relevant than others, (2) *activities*, using language to get recognized as engaging in a certain activity, 3) *identities*, using language to get categorized as enacting a certain role or identity, 4) *relationships*, using language to signal a sort of relationship between two people, 5) *politics*, using language to convey a perspective on the distribution of social goods, 6) *connections*, using language to highlight the relationships between two incidents or concepts, and 7) *sign systems,* privileging certain ways of communicating through symbols over others. Depending on the language sample and the context where it is used, all or some of these codes become relevant to its analysis.

*Limitations of the Studies Reported in this Dissertation:*

As the chapters that follow will discuss, all of the studies reported in this dissertation belong to the same design research agenda, and rely mainly on qualitative methodologies such as case studies, ethnography and discourse analysis for the collection and analysis of data. Hence, they share a common set of assumptions and limitations imposed by their specific methodologies, as well as by pragmatic considerations. Design research is a method that has as its goal to generate "humble" yet robust theories of the ecology of specific innovative learning interventions (Cobb, et al. 2003; Brown, 1992; Collins, 2004; Barab and Squire, 2004).

Due to their innovative nature however, such interventions seldom have the benefit of the well-established bodies of research that would guide well-implemented quantitative approaches to their assessment. Thus, like other design studies, the research agenda in this dissertation has a goal of description and exploration, as a first step towards generating the sort of learning theory of the game that might later be studied using more experimental methods and larger student samples. In the meantime, the author acknowledges that while the theories generated by using design research and qualitative methods can provide highly detailed understandings to researchers and designers of learning environments such as Gamestar Mechanic, they also necessarily forfeit any claims to grand generalization. Instead, they leave it up to the readers to draw any useful inferences and conclusions from their findings, and caution them against extrapolating too far from these observations.

In addition, the choice of Gamestar Mechanic as the context for studying children's game design language and literacy practices inevitably carries with it the potential criticism that the skills being appropriated by children would be those specific to the Gamestar Mechanic context and biased to Gamelab's preferences, rather than skills used by designers in general. However, one could argue in response that just like with any other language, novice learners will begin by learning the practices of the specific dialects used in the contexts where they learn them. By delimiting the scope of their language learning in such way, instructors (or parents in the case of small children) in fact provide them with structures through which to make the complexity and variety inherent in most languages manageable, structures that once mastered serve as tools that prepare them for future learning (Bransford and Schwartz, 1999) of the nuances and applications of the language in other contexts.

A final logistic limitation of the studies was that due to the limited research resources that I had access to for this dissertation, only a few of the many design jobs available in the game could be included in the interactive design interviews. Hence, the findings may not represent other types of learning experiences that the students might have had with them. In the interviews, I dealt with this problem by designing two composite challenges that involved play, repair and design activities within one single job, paired up with questions aimed at assessing the player's use of the material, ideal and real player dialogs, and thus the findings are by no means representative of all the possible learning experiences students might have had with the game. Extending this line of research is important for it would grant us a better understanding of the caveats and potential problems that the game could present to teachers, thus presenting an important direction for future research.

### *A note on the Visual Examples provided in this Dissertation*

Any serious attempt at examining meaning negotiation using the language of games would be incomplete if it did not account as much as possible for the rich diversity of multimodal representations that constitute it. In the specific case of Gamestar Mechanic, a collection of game creatures with different representations and behaviors form a central element of the language, and thus the text is thoroughly complemented with screenshots of the games players have made, repaired, played and discussed over the evolution of the project. To help readers understand these images better, I provide as reference a Glossary of Gamestar Mechanic Creatures, which provides a visual representation of every creature available to players in these studies, together with a verbal explanation of their behavior. The glossary can be found in Appendix A, at the end of this volume.

### ***Conclusion and Implications for Learners***

In this chapter I have attempted to make an argument for pedagogies based on game design such as Gamestar Mechanic's , as an alternative that can complement some of the fundamental issues present in schools and other mainstream educational institutions today. While sometimes people ask me what the implications of learning through a pedagogy based on game design could be for students' school-based and academic performance, I believe that such a question usually comes from the commonly held assumption that whatever our children are learning in school today is what they will need in order to become effective contributors to society. However, as many scholars have argued over the years, and as research results from the public and private sector continue to show, this does not appear to be the case (Institute for a Competitive Workforce, 2007; Gee, 2004; National Commission on Excellence in Education, 1983).

Instead, I believe the question should be reframed, as "How are pedagogies such as those in

Gamestar Mechanic providing our students with the skills they need for their work, social and civic lives in the 21st century?" This is the question that my work on this dissertation sets out to answer, at least in part, by examining the sorts of language and literacy practices that students engage in with the game. As I have argued in this chapter, much evidence has emerged over the years that pedagogies that place learners in designer roles can have important benefits in terms of social, technical and mental skills for students. At the same time, while school disaffiliation leading to swelling dropout rates continues among many groups (especially minorities, lower SES groups and girls) videogames are more popular than ever among school age children and young adults, a driving condition behind many educators' interest in integrating games into their pedagogical practice. Game-based (and game design based) learning pedagogies however, are still young, and much work is still needed before we have a good understanding of the role that games can play in the development of 21st century skills. The Gamestar Mechanic project then, is a first step in the direction of understanding of game design as a 21st century learning context.

# CHAPTER II: LEARNING INTERVENTIONS BASED ON COMPUTER GAME DESIGN, A REVIEW OF CURRENT SOFTWARE AND LITERATURE

## *Introduction*

Gamestar Mechanic is an innovative learning environment that relies on game design as a central pedagogical device. Hence, any learning sciences research with the game would benefit substantially from a thorough review of the literature involving previous attempts at using game design as a context for learning. In line with the socio-cultural approach informing this research, this review should also include all software tools reported in the literature, since they are as integral a part of the game design activity, as do the people and contexts involved (Werstch, 1998; Hutchins, 1995).

This chapter provides a review of the computer software and instructional strategies that have involved “making games” or “game design” over the past two decades, to engage young people and achieve a variety of educational goals. It will describe the most popular of such programs and compare their key features, including the kinds of games that can be created with the software, the types of communities and resources that are associated with each program, claims made for learning outcomes resulting from use of the software, and the results of empirical research (if any) on the application and outcomes of the software in formal or informal educational settings. It concludes with a discussion of how the Gamestar Mechanic project builds upon and differentiates itself from these approaches in its learning assumptions and philosophy, as it attempts to be an effective learning environment based on game design.

Over the last two decades, numerous educational scholars and practitioners have explored the potential benefits of computer games for enhancing learning, in and out of formal educational settings. Research on the use of games for learning has addressed academic areas such as language and literacy (Gee, 2003), mathematics (Kafai, 1995), history (Squire, 2006) and science (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005). One of the central characteristics of good games, in the view of scholars such as Gee (2003), is that they allow their players to think about them as *designed objects* (p. 42).

The value of such a "designer mentality" has been recognized by a number of educational scholars who see such a perspective as a fundamental ability required for full participation in the knowledge economy (Gee, Hull, & Lankshear, 1996; New London Group, 1996; Perkins, 1986; Wiggins & McTighe, 2005). Corporations in today's economic landscape look for employees capable of solving problems in creative and effective ways, as well as of producing new knowledge that can help them adapt and become competitive in the global market (Nussbaum, 2005). "Design thinking" has received growing attention from business leaders who seek to improve the ability of their employees and companies to identify creative solutions to increasingly complex challenges (Hyer, 2006; Kelley & Littman, 2001; Mau, Leonard, & Institute without Boundaries, 2004). While some of this literature threatens to make design thinking into the latest educational and corporate fad, there is sound evidence that design thinking merits – and is receiving - serious attention. For example, the Hasso Plattner Design Institute at Stanford University was conceived as "a place for Stanford students and faculty in engineering, medicine, business, the humanities, and education to learn design thinking and work together to solve big problems in a human centered way" (http://www.stanford.edu/group/dschool/big_picture/our_vision.html).

***Games, Learning, and Design Thinking***

Kafai (2006) identifies two general approaches to using games for learning: *instructivism* and *constructionism*. Instructivism, the more common approach, involves the design and use of "educational" games in school or after school program curricula, based on the belief that games are inherently more motivating than traditional classroom activities (e.g., Kirriemuir & McFarlane, 2004; Rosas et al., 2003). This approach also includes the use of commercial off the shelf videogames in educational settings, for example, teaching aspects of world history through *Age of Empires* or *Civilization*. These approaches have the potential to elicit design thinking indirectly as players discover the design patterns that underlie the game (Gee, 2003).

While instructivist approaches to using games for learning have dominated the literature, constructivist efforts are growing in popularity, partly due to the increasing availability of relatively easy to use programming and design tools. In contrast with instructivism, a constructionist approach stems from Seymour Papert's (1991) proposition that learning happens "especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe." (p. 1).

As applied to the use of games for learning, a constructionist perspective underlies efforts to engage young people in making their own games, to achieve a variety of educational goals (Kafai, 2006). This approach commonly entails providing learners with a set of game development tools, such as authoring software, game engines, or programming environments and some kind of support for learning to use the tools as well as for constructing games. In this case, design thinking might be fostered through the actual experience of thinking through design problems in the course of making games.

The goal in this chapter is twofold: (a) to provide an overview of different approaches to using game-making and (b) more specifically, to identify the implications of these approaches for understanding and facilitating young people's acquisition of a "designer mentality" through game-making.

***Four Approaches to Making Games for Learning***

This review identifies four main purposes or goals for using game making in educational settings, based on the current literature. In describes examples of each overarching purpose in the following sections. By far the most common use of game creation has been for the purpose of helping students learn programming tools and concepts. A second, related approach has been to use game making in programs intended to attract girls to computer science and technical fields, with programming taking a secondary place to broader goals of confidence-building and "empowerment." A third approach has been to use game-making as a means of enhancing understanding of an academic domain, sometimes with learning programming as an additional goal or in other cases, using software that minimizes or eliminates the need to learn programming. Lastly, a fourth general approach has focused specifically on facilitating learners' understanding of and ability to make games or features of games, such as types of game rules, with software specifically designed to support making games.

For each of the four general approaches, this chapter will describe some more prominent examples of tools and educational strategies, including educational goals, features of the software, and documentation of learner outcomes. It will suggest what can be learned from each approach about how game making might be used most effectively, particularly in relationship to the goal of fostering design knowledge among learners.

The review is limited in several ways. The examples were selected based on the availability of information about the software and strategies, as well as published accounts of their use in formal or informal educational settings. Thus, some popular commercial programs, such as *3D GameMaker The Games Factory*, and *RPG Maker* ( http://www.ambrosine.com/resource.html) , are not included because examples of their use for explicitly educational purposes were not available. Other popular software programs used by educators such as *Alice* (Cooper, Dann, & Pausch, 2000) and *Scratch* (http://scratch.mit.edu/about), are not included because of a lack of examples of their application to making games in particular. Even many examples included have little research support for their claims of efficacy, an issue discussed in the final section of this chapter. The goal of this paper is to provide as complete a review of the research literature as possible, and use the findings of the studies reviewed here to illustrate key issues and insights.

Lastly, this review does not include descriptions of courses or programs intended to train professional game designers.

*Making Games as a Context to Learn Computer Programming.*

The earliest attempts at using computer game design within educational settings took place during the early 1990's. At that time, the software publishing industry was experiencing an unprecedented growth that would last nearly a decade and produce some of the most successful businesses in history (Cuban, 2001). It should come as no surprise that early attempts at using videogames for learning were heavily invested in helping students acquire the math and programming skills required for work in software production.

The Logo programming language developed by Seymour Papert, Wallace Feurzeig, and Daniel Bobrow in 1968 became a centerpiece of this line of research and educational strategies. Papert conceived Logo as an environment through which children could learn to "talk" to a computer (Papert, 1980). This conversation was carried out as children entered instructions that the computer would interpret and then enact through "turtles" on the screen (e.g. the turtle moves or draws a line). Various versions of Logo have been developed over the past several decades, with new capabilities and features. Interest in Logo waned in the late 1980s, but in the 1990s new applications were developed, spearheaded by Mitch Resnick at the MIT Media Lab, including StarLogo, a specialized version of the Logo programming language for exploring the properties of decentralized systems.

While Logo can be used for many different purposes, two versions have emphasized game construction as a core activity: *Moose Crossing* and *StarLogo TNG*.

*MOOSE Crossing: Learning to program by collaborative world-building.* In the early 1990s, Amy Bruckman, at the time a student of Mitch Resnick, set out to create a multi-user virtual environment (MUVE) that would be accessible to children. The result was *MOOSE Crossing*, a text-based virtual world designed to allow players to collaboratively construct game-like elements such as virtual spaces and non-player characters, and in the process learn reading, writing and programming skills (Bruckman, 1997). *MOOSE Crossing* was based on a new programming language called MOOSE (based on the original MOO programming language), that Bruckman designed in collaboration with some of the original Logo designers. MOOSE was intended to be easily learned and usable by children, and a key design feature was the use of English-like syntax to leverage children's existing language knowledge. There was also a client program called MacMOOSE designed to make the programming interface less awkward (ibid). For each object that users create with MOOSE, they write a combination of text and computer code to describe the properties and behaviors of the object.

The goal of *MOOSE Crossing* was to create "a context for learning through community-supported collaborative construction" (Bruckman, 1997). Bruckman conducted a two year ethnographic study of children who used *MOOSE Crossing* in an after-school program, as well as children who participated online from home. Overall, she concluded that the collaborative design and construction process that took place in *MOOSE Crossing* helped facilitate the children's acquisition of programming skills, and in turn, the opportunity to collaborate and share knowledge helped to form a supportive community. She attributes the successes of *MOOSE Crossing* to the community's ability to provide:

- Role models,
- Situated, ubiquitous project models,
- Emotional support to overcome technophobia,
- Technical support, and
- An appreciative audience for completed work. (Bruckman, 1998)

However, in a later study of 50 participants' actual scripting ability, Bruckman et al (2000) found considerable variation in participants' learning, with a small number of children who spent large amounts of time in Moose Crossing and who gained considerable programming ability, while the majority spent much less time and learned only the most basic concepts. The authors concluded that an incentive for participation, such as a "merit badge" system, might help to encourage children's achievement without spoiling the open-ended, self-motivated nature of the learning environment (Bruckman, Edwards, Elliot, & Jensen, 2000; Bruckman, 2004).

*Moose Crossing* is no longer accepting new participants and its text-based environment is now dated in comparison to the graphical virtual worlds now widely available. *Moose Crossing* did not involve children in the design of a "game" per se, though as Bruckman points out, the environment resembled a text-based adventure game (Resnick, Bruckman, & Martin, 1998), and MUDS certainly were a precursor of contemporary MMORPGs. The value of *Moose Crossing* lies primarily in Bruckman's documentation of the role of community in fostering learning, and her insights into the uneven distribution of such learning among participants. The importance of "situated, ubiquitous project models" (Bruckman, 1997, p. 126) is also worth noting. Virtually every object present in *Moose Crossing* was created by participants and thus provided inspiration for new users. In addition, the objects' creators were often readily available to answer questions and provide guidance (Bruckman, 1997; Bruckman, 2000). This approach offers one example of the value of access to peer tutors and diverse examples of digital creations, in an informal educational context, at the same time suggesting the limitations of entirely self-directed learning environments.

*StarLogo TNG: Making games to motivate novice programmers.* Over the years, Logo has undergone major changes to provide greater accessibility and functionality to learners of programming languages. One of the most fundamental changes has been the extension of the programmer's ability to issue commands to more than one turtle (the core building blocks of the system) at the same time. Newer versions of Logo such as *StarLogo* (Resnick, 1994) and *NetLogo* (Tisue & Wilensky, 2004) allow the learner to create contained simulations representing complex phenomena that can be understood by observing the interactions between the turtles at a systematic level (e.g. a model of population growth dynamics) (Tisue & Wilensky, 2004).

*StarLogo TNG* (TNG stands for "The Next Generation"), one of Logo's latest incarnations, has a somewhat different goal than its predecessors. According to the project website (http://education.mit.edu/starlogo-tng/), while *TNG* retains the overall purpose of serving as a tool to create and understand simulations of complex systems, it has the more specific goal of making programming easier to learn and more appealing by incorporating tools to make games in 3D environments.

*TNG* differs from prior versions of *StarLogo* in adopting a visual approach to programming. *TNG* incorporates two major innovations from previous versions of *StarLogo*. Programming is accomplished with "blocks" rather than text commands, and the blocks are colored according to their function (e.g., movement, traits, interface), assisting students in understanding similarities among functions. The blocks are puzzle piece shaped, and can be put together only in meaningful ways, making it easier for students to create functional programs. The second innovation, *Spaceland*, offers a 3D world view as well as first person view (through the eyes of a turtle avatar) (Wang, McCaffrey, Wendel, & Klopfer, 2006). Work with *StarLogo TNG* is ongoing and has included an after school program intended to introduce participants to basic programming concepts (Wang et al.,2006), a set of math lessons using TNG (available at http://education.mit.edu/starlogo-tng/Math/index.htmlsite), and the design of instructional games by teachers (Klopfer & Yoon, 2005).

In a pilot project focused on gaming, Wang et al. (2006) introduced *StarLogo TNG* to a group of eight students (grades 7 to 9 with diverse backgrounds) in an after school class. The class met once a week for 90 minutes and by the end of five sessions, students were able to create an interactive maze that provided a first person view and score keeping. The researchers noted that the initial instructional approach moved from largely teacher-directed, as the instructors introduced the basic set of programming blocks, to more student directed as the participants created simple games, with new information provided as needed to scaffold the incorporation of new game elements. Preliminary findings indicated that engaging in a game making task with this authoring environment did appeal to this group and increased their interest in programming. Feedback from this and other applications is being used to modify the *StarLogo TNG* software.

Work with *StarLogo TNG* indicates the value and viability of using simplified programming tools in game making activities. The initial implementation suggests how constructionist methods can follow from a more instructionist approach. Lesson overviews (available at http://education.mit.edu/starlogo-tng/resources/) indicate how the instructors shifted from presenting information to providing guided activities to open ended game-making activity. While game design was not overtly "taught" (and even programming concepts were implicit rather than explicit in the presentation materials), design principles were inherent in how the software features were presented; for example, participants were taught to make a maze and then, to add interest to the game, the concept of bonus blocks was introduced. It would not be difficult to develop a more overt process for supporting learners' design learning around the use of *StarLogo TNG*.

*Making Games as a Way to Interest Girls in Computer Programming*

Women continue to enroll in formal computer science education courses in much smaller numbers than men (Dean, 2007). The National Science Foundation (NSF) has funded hundreds of educational projects intended to support the participation of girls and women in computer science and related fields through targeted funding such as the Program for Gender Equity in

Science, Mathematics, Engineering, and Technology. This section describes two such NSF-funded projects that used game making as a core activity: *Rapunsel,* and *Girls Creating Games.*

*Rapunsel: Programming in a girl-friendly game environment.* The goal of the *Rapunsel* Project (Real-time Applied Programming for Underrepresented Students' Early Literacy) was to help girls learn computer programming in a more "girl-friendly" environment (see http://www.rapunsel.org/about.htm). The project was funded by NSF from 2003- 2006 and was intended to be a way to ameliorate the shortage of women in technology related careers and degree programs by designing an appealing game environment that would motivate children, particularly girls, to master programming concepts (Flanagan, 2005). The designers characterize the project as "activist" given their ultimate goals of promoting "equity, empowerment, and access to technology" (Flanagan, Howe, & Nissenbaum, 2005b, p. 758).

Most available descriptions of the project focus on the development rather than use of the *Rapunsel* software, particularly how the designers attempted to make explicit their own values as well as incorporate the values of potential users into the game environment (e.g., Flanagan, Howe, & Nissenbaum, 2005a; Flanagan & Nissenbaum, 2007). Based on these analyses of values, Flanagan et. al. (2005b) report, the focus of the project shifted from "how to teach programming" to "how to create an immersive, socially oriented game environment in which programming was an important and valued activity, central to achieving goals of the game" (p. 754).

*Rapunsel* is a game in itself, different from software such as *Star Logo TNG*, which are tools for creating games (and other things). The core game mechanic in *Rapunsel* is dance; the user is assigned a central character that can be programmed to move, dance and behave in various ways. Players are introduced to the Java programming language through guided exercises that allow them to create new moves and dance sequences. The reward structure accommodates both competitive and cooperative play. Players can compete with each other in dance competitions, or they can choose to collect and swap codes, decorate their "homes" in the game, create music to accompany dances, and contribute code to a shared Library, where it can be used and rated by other players. They are rewarded for completing lessons that introduce increasingly complex programming concepts and procedures as well as for creating more sophisticated and original codes (Flanagan et al., 2005a). Thus, rather than using programming to create entire games, players are expected to learn new skills through a combination of interactive lessons and modding or creating new within-game actions and content.

Details of the project evaluation are difficult to locate. According to presentation notes from Mary Flanagan, one of the lead investigators, ninety 6th graders in an urban school voluntarily participated in a study of the game's outcomes. Pre and post surveys were used to ascertain whether playing the game affected general self-efficacy, self-esteem, computer self-efficacy, programming knowledge, and confidence level about programming knowledge. Data were also collected through interviews, program tracking and blogs.  According to Flanagan, playing *Rapunsel* increased female students' sense of self-efficacy; self-esteem and programming-related self-efficacy increased after playing the game for both boys and girls (see http://grandtextauto.gatech.edu/2007/04/25/emerging-terrain-in-games-and-simulation).

The *Rapunsel* software is not readily available and it does not seem to be currently in use. This is unfortunate, since *Rapunsel* represents an interesting variation on the notion of using game design to teach programming. Since students are not actually making games, it might seem inaccurate to characterize the focus as game design per se. However, creating new material for existing games, or modding games is frequently a preliminary step towards designing games anew and might be more appropriate for novices. In addition, the game structure provides a perhaps more clear set of goals and compelling context for learning new skills than, say, a task to construct a simulation or a game in its entirety. Lastly, using the core mechanic of dance offers a distinctive alternative to the typical emphasis on shooting or maze type game designs.

*Girls Creating Games: Programming interactive stories*. Girls Creating Games (GCG) was another three year (2002-2005) demonstration project supported by NSF and aligned with the NSF's core value of encouraging young women to build leadership and to pursue advanced education and careers in Information Technology. The more specific goals of the program were:

1. To increase girls' interest, confidence and competence in Information Technology (IT) and to encourage them to pursue educational and career paths that would keep them in the "technology pipeline"
2. To help girls develop resiliency toward gender barriers through a variety of strategies. (http://www.youthlearn.org/afterschool/GirlsCreatingGames.htm)

The rationale for using game construction as a focal activity was that games are an attractive way to developing interests and engagement in IT, and games are usually not designed for or marketed to girls and young women (Denner, Werner, Bean, & Campe, 2005).

An extensive curriculum was developed as part of GCG program, with 23 sessions, each lasting two hours. Detailed lesson plans and guides are still available on the project website (see http://programservices.etr.org/gcgweb/); clearly, how the girls were introduced to programming and game construction was as important as the actual content. There are very explicit instructions throughout the teacher's guides on how to foster a supportive, nonjudgmental environment. The instructional model was based on a model proposed by the Cognition and Technology Group at Vanderbilt University (2003), which includes the principles of learning by design, scaffolding and modeling, collaborative learning, identity formation (Denner, 2007; Denner et al., 2005). Program participants were taught to create computer games with Macromedia's Flash™ program. The concept of "game" was somewhat loosely applied; the games were actually interactive story narratives in which players select a path at key decision points in the story in order to create their own series of events. Since collaboration was stressed, the participants worked in pairs to write stories about themselves or their interests and produce Flash games to tell the stories. They also play-tested each other's games and viewed final versions in a culminating "gallery walk" in which the pairs demonstrated their games to other participants. The detailed instructional guides available on the project website offer a very structured, step-by-step approach to creating the stories and the use of Flash; for example flowcharts are provided and sequence specified for stories. Design is addressed briefly, using the metaphors of creating a movie or sculpting with clay. Examples of the participants' games are posted on the internet and reflect a relatively standard format with variations in artwork and storyline.

The GCG program was implemented in its entirety six separate times over two years, after school and during the summer, with a total of 126 middle school age girls (Denner, 2007) Extensive survey data on program outcomes was collected from 90 girls, with a comparison group of 71 students, along with qualitative data from a smaller sample. The findings indicated significant changes in participants' perceptions of their computer knowledge and computer skill level as well as in social support for using computers. However, there were no significant differences in the participants' stereotypes of computer workers, intentions to take computer courses, or confidence in their computer skills. The project directors attribute this lack of change to the girls' relatively high initial confidence levels and their lack of endorsement of gender stereotypes. When asked what they liked least about the program, participants most frequently reported the amount of direct instruction and need to work with a partner (ibid).

The GCG program is noteworthy for the extent of guidance provided to participants and teachers. While the interactive story model might seem overly narrow and prescriptive, such a structured approach can be useful for novice game makers, to reduce the number and complexity of choices available to them. Similar to the Starlogo pilot project, this instructivist approach preceded a somewhat more open-ended constructivist activity. The predetermined narrative framework allowed the participants to acquire basic skills with Flash and some opportunity for creativity in the content of their stories and their use of graphics. The use of Flash is notable for giving the girls experience with a program used by real game designers (not a program designed for ‘kids’), which has applications beyond game design. As with *Rapunsel*, the NSF program funding approach does not seem to lend itself to sustainability, though curricular materials still available online. Also funded by NSF, The Girl Game Company, an extension of GCG, is intended to involve rural, Latina, middle school girls in creating web-based digital games about life in outer space. The project will utilize the online virtual world *Whyville* combined with the SETI Institute's astrobiology curriculum.

*Making Games as a Route to Learning in Other Academic Domains*

The software and instructional approaches presented in this section are characterized by their emphasis on using game making as a way to enhance learning in content areas such as mathematics and history.

*Making games to elicit mathematical thinking.*Yasmin Kafai pioneered one of the earliest uses of computer game making in education. In *Minds in Play: Computer Game Design as a Context for Children’s Learning*, Kafai (1995) describes an educational intervention in which 16 fourth graders were introduced to Logo and over six months, given the task of producing games to teach fractions to younger students. Students who created games performed better on average than a control group on measures of fraction knowledge and Logo programming sophistication. Kafai (1996) also found some intriguing gender differences in the design of the games. For example, girls tended to locate their games in realistic places while boys tended to use fantasy spaces; girls tended to use nonviolent feedback while boys tended to have the game end and the player killed in response to an incorrect answer. She noted that the boys were far more likely to play games regularly while the girls reported less gameplay and less interest in gaming, particularly because of a dislike of their themes and violence. Not surprisingly, the boys' games more often were based on or showed the influence of popular commercial games.

While students significantly increased their understanding of fractions, Kafai and colleagues (Kafai, Franke, Ching, & Shih, 1998) later noted that almost all students created games in which the game ideas and fraction content were unrelated. Subsequently, the researchers conducted two studies that included more explicit attention to what the researchers describe as "conceptual design tools" (Kafai et al, 1998, p. 157), and their impact on the integration of mathematical content with the game design. In the first study, teams of elementary school students again designed computer games to teach fractions to younger students in a 50-minute after school session. The session included three phases: (1) sharing, (2) identification of an "emergent design tool," and (3) posing a challenge. Using fractions to describe a real-life situation in the students' games was a design parameter that emerged from students' discussion and initial game designs, In the second study, pre service teachers participated in three sessions over the course of six weeks. Each session addressed the following: (1) initial game design, (2) introduction of a conceptual design tool, and (3) extending conceptual design tools (i.e., introducing a new design tool that was used to modify prior game designs).

Conceptual design tools, as identified by the researchers, consisted of guiding questions or challenges that were intended to guide and focus the participants' thinking about design. These included using fractions to describe a real-life situation and creating a game without asking questions; with the pre service teachers, the design tools included a blank page of empty computer screen frames on which they could draw and annotate their game designs, the challenge "Can you create a game without asking questions?" and an example of a dynamic representation from the students' game designs (Kafai et al., 1998, p. 157).

A useful aspect of this research is the analytic framework that the researchers applied to the game design. They analyzed the games in relation to three broad features: (1) integration of fraction content and game design, (2) types of fraction representations available within the game, and (3) consideration of user thinking. Overall, the introduction of design tools enhanced both student and pre service teachers' games in all three areas. The researchers noted that all participants started with quite narrow conceptions of educational games (e.g., games as drill-and-practice) and did not make use of their informal knowledge. The design tools encouraged them to think more expansively about both the design of their games as well as what they wanted players to learn. One implication stressed by the researchers was the importance of discussions among the teachers and students as a means of improving the design process and outcomes.

Kafai et al.'s (1998) work demonstrates the need for explicit attention to design in educational uses of game making. Even the relatively simple conceptual design tools introduced by the facilitators made observable differences in the games designed by participants. While the analytic framework they derived from analyses of these games is specific to fractions, it can serve as a starting point for the development of similar ways of analyzing games developed in other content areas and for other educational goals.

*Learning STEM concepts through game design.* Following Kafai's seminal work, scholars have begun to explore game design as a promising context for developing skills in the domains of science, technology, engineering and mathematics (STEM). The Game Design through Mentorship and Collaboration Project (Sheridan, Clark & Peters, In Press) is a NSF-sponsored research program that implements this research in the context of an after-school game design camp for high school students from disadvantaged backgrounds. In this project, students learn to design games using a mixture of professional design tools such as the Maya 3D modeling software and the Virtools game development suites, as well as tools explicitly intended to implement game design as an educational objective (covered in this review), such as Alice and Game Maker. Two hundred participants between the ages of 8 and 18 have participated in camps totaling 80 hours of instruction, at the time of this writing.

Initial findings from this research reported by Sheridan and colleagues, suggest that in the process of designing games using these tools, students also engage in a variety of learning experiences involving concepts and practices in physics, geometry and mathematics. Even when designing games without an explicit scientific intent, students still engaged in scientific inquiry as a utilitarian process directed towards accomplishing specific design goals. The authors give the example of students designing a basketball game, and having to negotiate the laws of motion using the tools provided by the game engines in order to produce the effective physics simulation such a game would require. Because game design is an open-ended problem that inherently lends itself to a multitude of solutions, the authors make the argument that it yields a process of authentic discovery not commonly found in the science classroom.

One more learning aspect reported by the researchers involved the development of collaboration skills. Even when students were designing games individually, there were multiple instances where game design ideas were shared either through inspiration from observing others' designs or by direct inquiry through questions such as "how did you do that?" One aspect that is not completely clear in this research however, is the degree to which explicit instruction versus student inquiry were involved in the design process of children.  The researchers report the camps were heavily scaffolded, involving 3-5 technologically skilled teachers as well as 20 high school and college students who have previously participated in game design camps, which leaves open the question of to what degree such a program could be implemented in other settings, and to what degree students would have been able to produce their games with less scaffolding involved.

<u>*Learning history by game modding.*</u> One of the popular trends in commercial videgogames during the last ten years has been for game studios to license the software upon which their videogames are built to allow others to create their own modded (modified) versions of the game. This software commonly consists of a *game engine* (the core software system upon which the game runs) and a set of *mod tools* (level and graphic editors, software code libraries) that

allow modifications to the original game ranging from surface changes in appearance to deeper changes in rules and game play.

The *Civilization* games, including the most current version, *Civilization IV*, have been popular with educators due to their incorporation of historical facts and concepts associated with school history curriculum. *Civilization* is a turn-based strategy game in which the player assumes the role of a nation's leader, making strategic decisions that will affect its historical evolution from a primitive culture to an advanced civilization through the centuries. The World Builder mod tools in *Civilization IV* allow players to customize the game and create their own historical scenarios (including the countries, events, characters and rules of the game) in which the game will be played. *Civilization* has been modified by educators to teach history; a prominent example is the *History Canada Game*, a million-dollar project funded by Telefilm Canada and supported by Canada's National History Society, which is a *Civilization III* mod designed to help students learn about Canadian history.

Adopting a more constructionist approach. Squire, Giovanetto, Devane and Druga (2005) designed an after-school program around *Civilization III* in which participants moved from playing historically accurate scenarios (created by the researchers) to using mod tools to create their own scenarios. The researchers' findings indicate that, as more experienced players moved to designing mods, they were able to understand the game as a system of designed rules (particularly in the multiplayer scenario) to use sophisticated language to communicate their knowledge of these designs to other players and to use this knowledge to their advantage during play.

A contribution of this approach is the integration of game play and game making. Squire et al's findings suggest that by first playing games and reflecting on features of these games, young people can first learn to see games as what Gee (2003) calls *designed artifacts*. In addition, this type of game modding does not require any programming and builds on young people's more intrinsic interest in modifying games that are already familiar and engaging to them. However, moving from player to designer, at least in Squire's work, can take a considerable amount of time (estimates upward of 30+ hours). Still, the *Civilization* game allows for the creation of quite sophisticated and complex scenarios and thus this extended learning curve might be appropriate and necessary.

*AdventureAuthor: Narrative development through game making.* *AdventureAuthor* is a platform developed by Judy Robertson at the University of Edinburgh, based on the *Neverwinter Nights* Aurora toolkit. Taking advantage of the story-centered nature of the *Neverwinter Nights* role-playing game, *Adventure Author* was designed to promote the acquisition of literacy skills (with an emphasis on storytelling) through game design by children (Good & Robertson, 2003). With *Adventure Author*, students produce original storylines in a game form, using the Aurora toolset to modify the environments, characters and story of the game. *AdventureAuthor* removes the need for learners to learn programming in order to design their games, with the tradeoff that players can only make game genres restricted to the *Neverwinter Nights* model.

Through a series of workshops and pilot testing with children, Robertson and her colleagues have made modifications in *Adventure Author* to support the development of narrative skills (Good & Robertson, 2003; 2004). By documenting and analyzing how students design games with the authoring tool, Robertson's work yields valuable insights into the way that children produce storylines in computer games (Robertson & Good, 2005; 2006). This work also illustrates how features of the *Neverwinter Nights* interface were modified to, for example, explicitly represent a story's plot, or to encourage users to create personalities for characters. In addition, they describe how resources were integrated into workshops to support the design of narrative features; for example, a screen writer was recruited to teach participants how to write dialogue (Robertson & Nicholson, 2007).

Robertson and her colleagues' work is perhaps most notable for the iterative process she used to modify *Adventure Author* to engage learners in a more explicit design process, which now includes exploratory play, idea generation, design, implementation, evalution, and testing. In a recent paper, Robertson and Nicholson (2007) describe plans for the development of a built-in "Designer's Notebook," that will provide direct software support for design. They note that

> "Children tend towards ambitious designs which are not always easily achievable, as they not only require complex scripting and programming work beyond their abilities, but also the intellectual discipline to think through every aspect of the

> design. By providing wizards that directly scaffold specific designs tasks, we can help the user to clarify their designs until they are in a workable state."

While *Adventure Author's* focus on narrative does not encompass game design in a broader sense, the design process she has evolved certainly can be applied more generally. In addition, this focus (and perhaps the tool) is readily transferable to more traditional school-based activities, such creative writing (Robertson & Nicholson, (2007)

*Understanding Design Concepts through Making Games*

The examples in this section suggest how game making can be a basis for acquiring explicit understanding of some aspect of game design itself. The *Playground Project* investigated children's understanding of rules, while *Stagecast Creator* and *Game Maker* are software programs designed specifically to allow novices to create computer games.

*Toontalk & The Playground Project: Understanding rules.* *Toontalk*, first released in 1998, is an interactive, animated programming environment for children. Ken Kahn, its creator, was inspired by his exposure to *Logo* while he was a graduate student at MIT, and while similar in philosophy and goals - to give children "computational thinking tools" (Kahn, 2001) - Toontalk (TT) has quite different features. According to Kahn, the fundamental idea behind TT is to replace computational abstractions by concrete familiar objects. Rather than rely upon text or pictures to represent programs, in TT, programs are built in an animated virtual world.

Players construct programs in Toontalk by training robots to manipulate tangible program elements such as birds and trucks. For the user to manipulate the environment a virtual hand is used to control a number of different tools: a magic wand for copying objects, a vacuum cleaner for erasing and removing things (called sucking and spitting), a bicycle pump for changing the size of objects, and notebooks are used to store objects. Kahn suggests that TT features resemble those of a video game, and even describes it as a game in some publications, because of its graphics and animation, a virtual world to explore, animated characters to interact with and get help from (Kahn, 2004).

While ToonTalk, like Logo, can be used for many different educational purposes, including learning programming, Kahn has stressed repeatedly that although learning programming is valuable, the process of building, running, and debugging programs is central to TT. The TT website (http://www.toontalk.com/english/adultask.htm) likens this process to playing an adventure game, suggesting that TT makes it fun for kids to build things, not just to play with the resulting creation. The site elaborates five types of thinking that TT can foster, including problem decomposition, component composition, explicit representation, abstraction, and thinking about thinking (http://www.toontalk.com/english/think.htm).

In addition to describing TT as a game, Kahn (2001) argues that TT is a better tool than Logo for making most kinds of games and simulations due to TT's underlying concurrency (multiple processes can be executed simultaneously) and its extensive support for giving behaviors to pictures. Perhaps the most extensive application of TT to game making in education was the Playground Project. The Playground Project was funded through an EU initiative from 1998 to 2001, and involved a partnership among schools and universities in the UK, Sweden, Portugal, and Slovakia. The project's goal was the design and evaluation of a computational "playground" where children aged 4-8 could play and create their own games. This space contained game-building tools, games already built by children or developers, and sub-elements of a game, such as game objects, rules, parts of rules and scenery. TT was one of two programming languages used in the project; the other was *Imagine*, a graphical version of *Logo*. Researchers partnered with local schools to develop playgrounds and study children's games, the game creation process, and learning outcomes. A core objective for the project was to have children learn, through game design, about rules, the different ways they can be expressed, how they can be changed and the implications of modifications (see the Playground Project proposal at http://www.ioe.ac.uk/playground/proposal/proposal1.pdf).

The Playground Project generated a number of studies (e.g., Adamson, Hoyles, Tholander, & Noss, 2002; Goldstein & Pratt, 2001; Goldstein, Noss, Kalas, & Pratt, 2001; Hoyles, Noss, Adamson, & Lowe, 2001; Tholander, 2002) in the form of detailed case studies of how children of different ages create, talk about, and change rules in the process of making games. The Project's final report provides a detailed overview of these studies and their findings (http://www.ioe.ac.uk/playground/RESEARCH/reports/finalreport/index.htm). One useful observation from these studies is that rules function at different levels in games and must be understood in relation to their purposes.

For example, there are rules for player behavior and rules that define conditions and actions in the game system. (Adamson et al., 2002). The researchers found that children were most likely to describe player rules or constraints, and had difficulty articulating system rules, or those that defined, for example, the core mechanic or the game environment. Overall, the researchers were able to document an increase in the children's ability to create and describe more system-related rules. However, the children were not always able to describe a rule they might have programmed correctly, or predict the implied consequences of a formal rule they have programmed (Hoyles et al., 2001) Increased ability to identify rules did not result from unstructured game making and discussion; the participants were engaged in highly scaffolded activities, for example, modifying only one or two rules and predicting the consequences.

The Playground Project is well documented and provides very concrete examples of how young children make and talk about rules in games. The young age of the children limited the sophistication of the games they created, and most of the games used in the research were relatively simple; however, they were discernable as games, unlike what children created in some projects in this review. Tholander (2002) points out that the concrete nature of the programming environment offered a crucial affordance in allowing the children to "talk" about programming elements without having developed the verbal skills of speaking about these elements.. However, the language and actions they learned to use were perhaps too specific to the TT environment, potentially limiting transfer to other contexts and tools. The researchers also noted that their involvement played a key role in prompting and supporting the participants' learning, in ways that cannot be built into software alone and that integrating use of the software with adult and peer support is crucial for learning (Tholander, 2002).

<u>*StageCast Creator: Making Games to Enrich Instruction.*</u> A direct evolution of Apple's *Cocoa/KidSim* (Cyper & Smith, 1995) programming-by-example environment, *Stagecast* is a commercial software environment that lets kids develop simple games and simulations without programming. Creating a game in *Stagecast* involves the use of *agents*. These agents are characters that can be edited and animated to have interactions with each other and with their surrounding microworld. In order to get agents to engage in certain behaviors (e.g. moving 3 pixels to the left if no other character is present), a set of visual rules can be assigned to them through a rule editor. *Stagecast* was conceived as a way to introduce children to programming without requiring them to understand any complex syntax. Instead, the visual rules used to define agent behaviors rely on concrete visual representations that were presumed to be easier for novices to grasp. The finished products can be uploaded onto a web page and played over the Internet (Smith & Cypher, 1998; Smith, Cypher, & Tesler, 2000). Of the software reviewed in this article, *Stagecast* appears to be the easiest to learn and use but at the expense of flexibility and power, letting learners create only a very limited variety of games.

The principal avenue for learning how to make games in *Stagecast* is following a set of tutorials. The tutorials aim to facilitate learning to use the *Stagecast* tool set as well as some fundamental concepts, such as associating character actions with rules. The tutorials consist of screens with some "broken" features that must be fixed to make them functional and built-in step-by-step instructions. *Stagecast* allows even young children to produce interactions between agents very easily; Habgood, Ainsworth and Benford (2005) had forty children between 7 and 11 years develop their own games using *Stagecast*, and showed evidence that even the youngest were able to create some form of computer game.

Stagecast Software, the company behind *Stagecast*, has actively promoted it to educators as a means of achieving a wide range of educational goals, ranging from higher order thinking skills to deeper understanding of content across the curriculum (http://www.stagecast.com/school.html).

A variety of sample lessons are accessible through the *Stagecast* website and related sites, some of which include explicit attention to elements of game design, For example, the materials developed and used by Habgood et al, available at http://www.gamelearning.net/, include lesson plans along with simple templates for technical, level and style design.

The visual rule definition system in *Stagecast* makes it a tool with a relatively shallow learning curve for novice designers. The tutorial is an excellent example of how to support users in mastering not only the tools but also the concepts underlying them. However, Habgood, Ainsworth and Benford (2005) observed that even after six weeks of instruction on the use of *Stagecast*, young learners could only achieve a low level of sophistication in the design of their games. When given the task of developing a game aimed at teaching some form of academic concept through game play, most of the games children made replicated rule systems and mechanics from entertainment games, and the learning content was only integrated as an afterthought, similar to Kafai et al.'s (1998) findings. *Stagecast*, while actively promoted as a game-making tool, still lacks sufficient attention to fostering an understanding of design principles that might improve the quality of user-created games.

<u>*Game Maker*: *Making games as the goal*.</u> *Game Maker* is a programming tool designed to facilitate the creation of 2D and 3D games by novices. The *Game Maker* interface follows the Microsoft Windows interface design style, and its look and feel is very similar to Microsoft development environments such as *Visual Studio*. Reflecting object oriented software design, *Game Maker* allows users to make games by defining objects such as rooms (game screens), backgrounds, sprites (animated characters or objects) and sounds which can be combined into game levels. These objects have properties (e.g. the color of a background) and behaviors (e.g. a sprite's ability to move) that can be customized by users. *Game Maker* uses an event-driven approach to the production of games, where events are "important things that happen in a game, such as when objects collide or a player presses a key on the keyboard" (Habgood & Overmars, 2006, p. 11). In *Game Maker*, users can give objects actions in response to these events and thus create a complex set of interactions. Basic games can be developed in *Game Maker* without any programming through a point and click interface and elements such as selection menus and check boxes for different game attributes. For more advanced users, a scripting language similar to the C programming language is available within *Game Maker* as well (Overmars, 2004).

A robust community has evolved around the use of Game Maker and the GameMaker site (http://gmc.yoyogames.com/) has an extensive set of very active forums along with many games, a wiki, additional resources, and tutorials. While the forums seem to be dominated by novice or aspiring professional game designers, technical information and support could be a resource for educators and students alike. The tutorials address making various game genres, ranging from maze games to first person shooters, though the more sophisticated game tutorials require programming. However, the content of the tutorials focuses primarily on technical strategies, such as how to create a chat system for multiplayer games, rather than the overall design of each genre. The wiki includes a section with information for teachers, including course materials for primary through postsecondary education. There are active teacher communities around the use of *Game Maker,* particularly in Australia (see http://www.gamelearning.edu.au).

Habgood and Overmars (2000) have encouraged educators to think broadly about potential applications, arguing that *Game Maker* allows students to concentrate more on game design rather than the technical aspects of getting the game to work. However, little published research is readily available on how *Game Maker* has been used by educators; a scan of the online forums and posted materials suggest that teachers have primarily used it in the context of computer science education.

*Game Maker* embodies a number of important design principles used by game designers. The object oriented approach is one of the most popular software development approaches in the industry, especially for 3D games where languages such as C++ or C# are in many ways the standard for game engines. The companion textbook *The Game Maker's Apprentice* nicely complements *Game Maker* by addressing at a basic level, design principles such as rules, mechanics, challenges and player goals. Perhaps most significant is the active user community, which supports considerable informal learning and might serve as a model for more deliberately educational efforts to use game making for learning.

### *Discussion*

This review makes it clear that the majority of efforts to incorporate game making into education have emphasized learning computer programming as a rationale for using game making as well as the design of specialized software, an area where Gamestar Mechanic clearly differentiates itself, by placing its emphasis on helping players learn to think as designers. Given the emphasis on programming, most software tools reviewed here were created to simplify programming concepts and methods without explicit consideration of how such tools would scaffold game *design* in particular. Even *Game Maker* as a stand-alone tool implements an interface incorporating a substantial amount of abstractions, which assume a previous degree of programming and software design experience on the part of users. These assumptions limit its possible user base significantly, as it obscures the game design process to those people who have been players but not designers previously, and fail to scaffold their thinking through specific aspects of game design. Robertson and her colleagues (Robertson & Good, 2005, 2006; Robertson & Nicholson, 2007), with their plans to create of a virtual Design Notebook, seem to have given the most attention to integrating support for a design process into the tool itself.

While there have been efforts to support design thinking through activities around the software, such efforts tend to be rather narrow in focus.

This stress on programming is not surprising given the history of (digital) game making in education. The impetus behind the original versions of *Logo*, for example, was to give children the opportunity to understand and interact with computers at a time when computers were not widely accessible and when mastery of programming concepts was essential for even basic applications. Moreover, driving this research was the notion that learning how to program would provide students with strategic thinking and problem solving skills that would extend to other domains, a claim that has been strongly disputed over the years (Pea, Kurland and Hawkins, 1985; Pea and Kurland, 1985) However, even now this emphasis on learning programming reflects broader efforts to make computer science education more appealing to young people, a challenge with even more urgency given the decline in computer science enrollments at the postsecondary level. It is also not surprising that the teachers most likely to be interested in and feel competent in using the available software programs would be in computer science.

Design might also have been more intentionally left unaddressed. One can infer that at least some of the past approaches have assumed that design is an intuitive, creative act, an assumption that gives little or no attention to the very explicit approaches to game design that are now readily available (e.g., Adams & Rollins, 2006; Fullerton, Swain, & Hoffman, 2004; Salen & Zimmerman, 2003). In many cases, even the concept of a "game" was very loosely defined and applied to a wide variety of digital constructions. It is perhaps not surprising then that examples of what students created using these approaches often seem to reflect a limited sense of good (game) design.

Another assumption may be that design requires more sophisticated ways of thinking than most young people (or teachers) are prepared to undertake, or alternatively, that game design thinking specifically is not particularly relevant or valuable for anyone aside from game designers. However, the author believes there is plenty of evidence to the contrary in regard to the first point, though current understanding of how young people think about design in general, and game design in particular, is quite limited and a topic sorely in need of further research. This is especially true when one considers the extensive research on design thinking in professions where it plays a prominent role, such as architecture, engineering, and the sciences (Schon, 1983; Kolodner, et al, 1988; Perkins, 1986). Such research may offer important insights regarding the more general value of "thinking like a designer" in the context of game design, for those who have no aspirations to design games as a career.

While learning computer programming is no doubt an important goal, other arguments in favor of design-based pedagogies underscore the notion that design should also play a key role within educational game making. The first argument concerns student motivation. Assuming that game making is what motivates students to learn programming, educators have used games as the "carrot" to be obtained after going through a sometimes arduous process of mastering programming tools. Yet if the games they ultimately create are not very good, the students may not have much motivation to continue making games, or using their newly acquired programming skills. Indeed, the literature lacks any data on whether young people who have participated in game making activities continue on to acquire more advanced skills or even sustain the skills they have already developed.

An alternative approach, and the one taken in Gamestar Mechanic, is to provide tools and strategies that enable learners to make games quickly and then support a transition to using programming tools to go beyond limitations of the game-making software. In contrast with the "program to make games" approach, this approach begins with the assumption that computer games are culturally valued and motivating artifacts of their own right in children's culture (Squire, 2006; Cassell and Jenkins, 1998). It also assumes that players are commonly exposed to many of the design principles involved in games in the commercial titles they voluntarily play, though the degree to which players reflect on these principles is largely unknown (Gee, 2003).

If participants are not given enough guidance to create games that are fun – or even playable – it's likely that they are not going to be motivated to take the next step into learning programming. *Game Maker* and some other commercial tools can support this approach, but even these tools tend to focus on game components rather than design and have a considerable learning curve. If game making is fore grounded, it becomes crucial that principles of game design be explicitly addressed.

Moreover like with game play, good game design has a history as an activity that great designers engage in mostly voluntarily. Legendary game designers such as Will Wright and Sid Meier have commonly told stories of how for them the fun of games is not so much in playing them as it is in making them (Wright, 2007; Meier and Falstein, 2008). However, most of the research and interventions involving game design as a learning activity reported here, have explored it in the context of learning settings that in many cases are foreign to those spaces where children would naturally encounter games, in an attempt to make them educationally relevant (e.g. in schools).

This approach, in the my view, risks producing the sorts of learning experiences that Ann Brown has called "lethal mutations" which are neither gaming experiences, nor school experiences, but ineffective hybrids of both that end up alienating players (Brown & Campione, 1996). Especially when dealing with populations that are increasingly disaffiliated with a school identity, creating an environment where games feel like school is the surest way to having students that boycott the learning intervention, skewing the research data as a result. Gamestar Mechanic attempts to address this challenge by implementing a design-based pedagogy as the central mechanic of a game, and by making the game available to students online and in informal after-school workshops that more closely mimic the naturally occurring environments of games.

A second argument for game design as a pedagogy is that learning to plan how an intended system will work is a fundamental step necessary for good programming (Pea, Midian and Hawkins, 1985). Design allows students who acquire an understanding of systems by emphasizing the modification of structures toward specific purposes (Perkins, 1985). Students gain an appreciation of how programming accomplishes its goals when they learn about the design of a program. As Denning & Martell (2007) put it, great designers can "see" large systems at all levels of detail in their heads and can transform their vision into working code very quickly. Designing software involves concepts and strategies like levels, prototyping, understanding user interests and contexts, and understanding systems – all of which may be illustrated and practiced in the context of making games (Denning, 2007; Denning & Martell, 2007)

With these points in mind, students who learn the principles of design before they learn to program may well learn to do so more rapidly and more effectively because they have a context in which to understand coding issues (Claypool & Claypool, 2005). As the coming chapters will discuss in detail, the design-based approach in Gamestar Mechanic emphasizes such planning and understanding, and gives an entryway into programming through the process of game component configurations.

A third argument is that design skills and knowledge are increasingly recognized as crucial to software engineering and other computer science/programming-related work, professions recognized as crucial for economic success in the 21st century. More than twenty years ago, software pioneer Fred Brooks argued that cultivating great designers was essential for the development of reliable software, though perhaps the most difficult task for educators and employers (Denning, 2004). Teaching game design, as an instance of software design, would result in a broader introduction to computer science (Claypool & Claypool, 2005).

The fourth argument hinges on the value of learning to engage in professional practice, in particular learning to think like a professional. Shaffer (2006) has argued for the value of what he calls “epistemic games” - games that introduce young people to the ways of thinking of creative professionals. Shaffer states that:

> “Creative professionals learn innovative thinking through training that is very different from traditional academic classrooms because innovative thinking means more than just knowing the right answers on a test. It also means having real-world skills, high standards and professional values, and a particular way of thinking about problems and justifying solutions.”

This stance does not imply that game-making be approached as vocational training for budding game designers. It does point to the potential value of attending to not only the technical aspects of game design (i.e., learning to use tools such as programming or even discrete concepts such as rules) but also to broader dimensions of “thinking like a game designer.” These dimensions would include understanding the specialist language of game design, understanding ways of evaluating games through the lens of a particular value system, and broadly speaking, taking on the kind of identity of a game designer that Gamestar Mechanic intends to foster.

Fifth, and perhaps most importantly, as noted in the introduction, “design thinking” is increasingly viewed as a foundational capacity for engagement in professional practice beyond more obvious examples such as software engineering. Indeed, as Gee argues, design thinking can be viewed as a way of viewing the world:

> “Games designers have to think about how objects and actions (their nouns and verbs) combine to get effects from players when specific goals are assumed or given. In this sense, game design is a core way of thinking about the world . . . . Indeed, in our daily lives, when we are thinking proactively, we look at the world as if we could design the objects and actions around us to achieve certain goals—we “game” it. Game design is, thus, akin to the design of social life. (Gee, 2007)”

Design thinking, as the ability to think about – and influence – social systems, can thus be a precursor to learning how to negotiate the complexities of modern life (New London Group, 1996).

So how can we shift from a focus on game making to game design in education?
Educators need to start by becoming more familiar with theories of design, and game design in particular. There are multiple perspectives on game design (see Salen & Zimmerman, 2003, for an overview) and clarifying the particular stance towards design that will inform educational strategies is an important first step.

Second is the development or selection of tools such as Gamestar Mechanic, and strategies to use them to support students’ engagement in design activities. Fischer and Lemke (1987-88) make a distinction between construction kits and design environments that can be useful in this process. As he suggests, construction kits are not sufficient; learners need to be immersed in environments that assist in the design process through features such as models, critics, and suggestions, an approach that Gamestar Mechanic implements in its design-based pedagogy. Furthermore, there are many courses intended to prepare professional game designers and, while their content may not be appropriate for young students or more general student population, they offer useful examples of content and instructional strategies. In addition, examples of instruction based on more general design, such as the learning-by-design approach (e.g., Kolodner et al., 2003) could inform more game-specific curricula.

Third is the mapping of design knowledge and skills to other valued domains in school and beyond. While the research in this review includes some useful suggestions of how game making might address academic skills, a focus on game design opens up a wealth of potential applications. However, as Tholander (2002) notes, there is evidence that without explicit scaffolding, children do not transfer what they have learned from one learning domain to another and such scaffolding needs to be incorporated into activities intended to promote connections to other domains. As later chapters demonstrate, Gamestar Mechanic facilitates the design of learning experiences for players in the form of game design jobs, that show much promise in helping educators make such connections explicit for learners.

Lastly, to inform these efforts, there needs to be a better understanding of design thinking itself, how novices think about game design, and how they develop more sophisticated and useful understandings and practices. There may be different types of learning trajectories, based on students' prior experience with games, their gaming preferences, and the contexts of their learning. This research aims to contribute to this area by exploring the way in which students lear to think as designers in the context of Gamestar Mechanic, by mapping the trajectories of different groups throughout extended periods of game play.

Kafai (2006) calls for educators to investigate all potential ways to use games for learning, both playing and making games. We would add that educators should explore the full educational potential of making games for learning, which includes explicit attention to a design midnset. Why continue to overlook such a rich and valuable aspect of game-based learning?

## CHAPTER III: DESIGN-RESEARCHING GAMESTAR MECHANIC: INTEGRATING SOUND LEARNING THEORY INTO A GAME ABOUT GAME DESIGN

### *Introduction*

This chapter presents a design study of the first two years of the *Gamestar Mechanic* project. The goal of the project has been to produce, deploy and assess a game-based learning environment that fosters middle school children's 21$^{st}$ century language and literacy skills, through an online multiplayer role-playing game experience that places learners in the role of game designers (Games and Squire, 2008; Salen, 2007). The development of the game has been funded by the John D. and Catherine T. Macarthur Foundation's Digital Media Initiative, an effort to promote research that deepens our understanding of the ways in which digital technologies are impacting the social, civic and academic lives of today's youth.

### *About Gamestar Mechanic: Theoretical & Instructional Frameworks Guiding the Design of a Game about Making Games*

One of the core objectives since the inception of Gamestar Mechanic, was to produce a game-based learning intervention that would effectively blend sound and evidence-backed learning science theory with good game design. Traditionally, the disconnect between game play and education has been such, that historically many of the so-called "edutainment" titles engender what Brown and Campione (1996) call "lethal mutations", that are neither good games, nor good learning environments, but ineffective hybrids of both (Soloway, 1998).

To address this issue, Gamestar Mechanic has been produced in collaboration between the Games, Learning and Society group at the University of Wisconsin-Madison, which the author represents, and professional game designers Eric Zimmerman and Katie Salen from Gamelab in New York. The author's role has been to contribute his software engineering and learning science experience to the design and research of the game, and to help the communication between the research and development teams for the game.

Gamestar Mechanic is, in a nutshell, a game about making games, where players learn to think and communicate like designers, by playing, building and sharing computer games in a flash-based online environment. The game is set within a narrative that places players in the role of *game mechanics,* in a fantasy world where people discovered how to encapsulate well-designed games and harness their energy to fuel the systems that support their lives. However, over time different philosophies and approaches to making the "best games" emerged, and groups specialized in specific game types –schools of gaming- formed. Different philosophies brought with them arguments between members of different schools, and people got so involved in defending their own game preferences that knowledge of how to make high yield games was lost.

As a consequence, the factories that once produced high-energy games have fallen into disrepair, the games they made yielding less and less energy, causing a crisis that radicalizes the postures of schools. Players enter the world by choosing avatars, characters that represent new recruits of one of the schools of gaming, and who strive to become true mechanics by learning the core principles of game design espoused by their school (Figure 3-1).

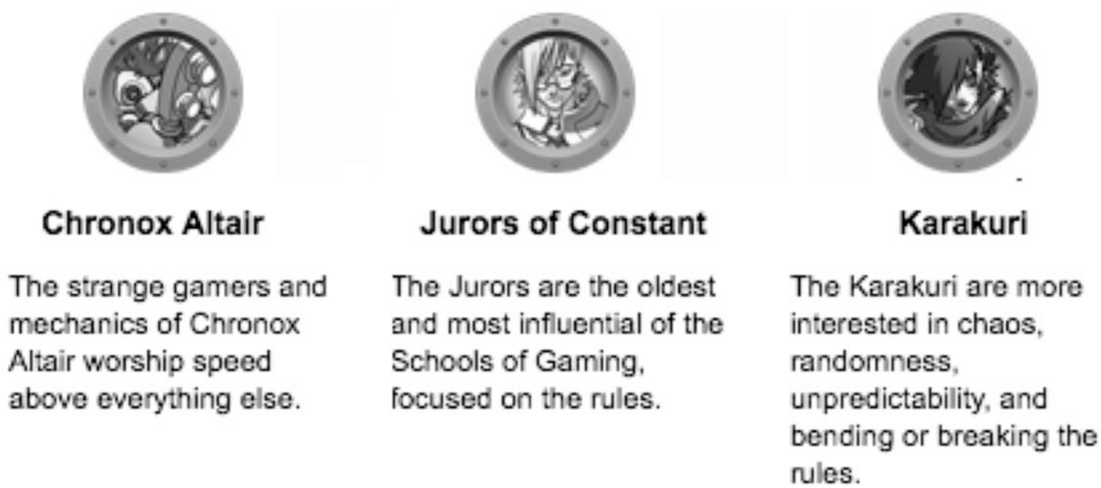
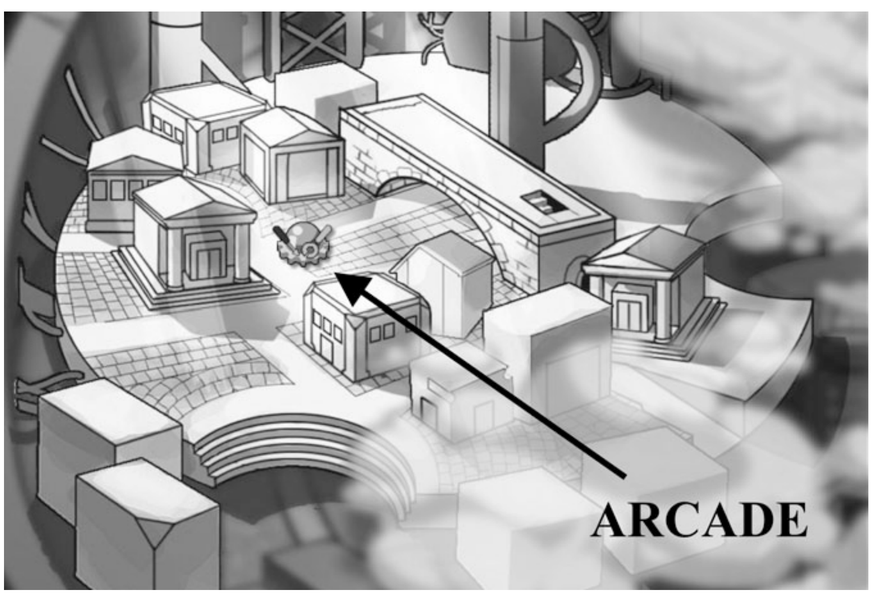
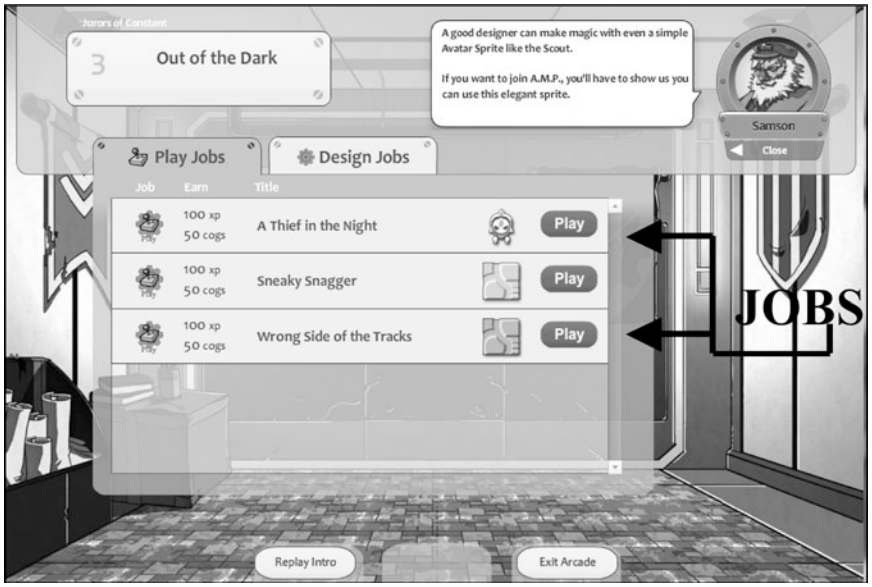



Figure 3-1. Examples of Gamestar Mechanic Avatars

According to James Paul Gee's *What Videogames Have to Teach us About Learning and Literacy* (Gee, 2003), one of the central ways in which games can encourage powerful learning experiences for players is by allowing them to take on and play with different *identities*, and explore their possibilities within the virtual world of the game. In the case of Gamestar Mechanic, the narrative serves precisely this purpose, as its goal is to situate the players' decisions in ways that encourage the negotiation between their *real world identity*—and the *virtual identity* of their avatar, with the goal of generating a *projective identity,* -a hybrid identity where the player learns to think and act like the virtual identity he is role-playing-, and where the powerful learning germane to modern videogames often occurs., As they advance towards restoring the broken factories, players also move towards membership in an elite underground organization called the *Allied Mechanic Project,* whose members are represented by game characters but which can also be impersonated by live players. To do so, they must visit numerous *arcades* throughout the factory and in them complete an curriculum consisting of *game jobs* that involve playing, designing, documenting and repairing games (Table 3-1).



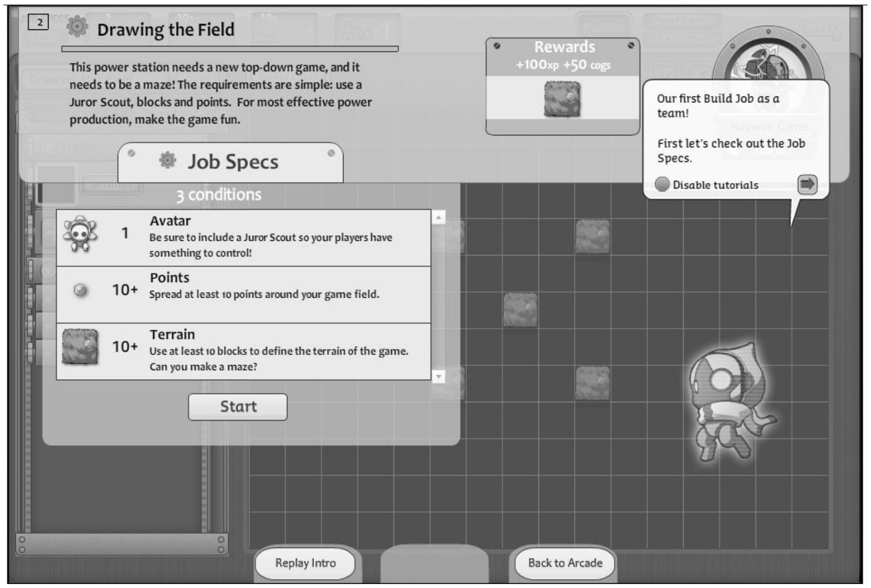

a)




b)

Table 3-1. Factory screenshot, Arcade screenshot

Players are free to choose the types of jobs they want to specialize in, thus giving players with different learning strengths, skills and preferences, multiple paths to advancement in their learning process (Gee, 2003 P. 108). As they successfully complete these jobs, mechanics must collect a series of *sprites* (e.g. heroes and enemies), creatures pre-designed with specific qualities and behaviors. A mechanic's sprites are stored within his/her *toolbox*, a web-based game editor where sprites can be dragged from a palette into a play area, and as players become more familiar with their individual behaviors, combine them into new and gradually more complex games (Table 3-2).




a)

b)

<u>Table 3-2. Job requirements screenshot, toolbox screenshot</u>

The jobs that constitute the Gamestar Mechanic curriculum are built on a learning-through-design approach, informed by a broad body of literature on design-based pedagogies, that have been especially fruitful in areas such as computer science and engineering education (Papert, 1991; Kafai, 1995; Kolodner, et. al. 1996).

In design-based pedgogies learning takes place through the intentional modification of structures by learners (Perkins, 1995), and their subsequent refinement through a series of cycles of refinement and redesign (Kolodner et. al, 1998). But the design activity produces its most effective learning results when its products are subject to public scrutiny (Papert and Harel, 1991), which transforms them into contributions to an ongoing dialog with a community that shares their interest in design.

Gamestar Mechanic implements this by framing the players' activities within a robust community of mechanics, in order to promote players development of a game designer identity. Participants with a variety of levels of experience constitute the community, including not only middle school students, but professional game designers working for Gamelab and independently as well. The goal of this community is to let the schools of gaming emerge as true *affinity groups* (Gee, 2003), groups of mechanics sharing a common appreciation for certain aspects of game design. The narrative of the schools creates an initial set of parameters that propose initial appreciative systems (Schon, 1983), value systems through which group members give relative validity to specific design features (Figure 3-1, this chapter).

In the professional disciplines, similar groups are referred to as communities of learners (Brown and Campione, 1996) or communities of practice (Lave, 1993), and can expose their members to powerful learning experiences through a shared discussion and negotiation of the meanings and knowledge within their appreciative systems (Scardamalia and Bereiter, 2003). Gamestar Mechanic encourages such discussions in two ways. First, every game that a mechanic produces in the toolbox can be published at the press of a button, and made visible to all mechanics logged into the game server at any point, for commentary and critique (Table 3-3 screen a).


a)


b)

Table 3-3. The game alley and a game rating and comments forum

Others cannot only play these public games, but they can rate and comment on them in a discussion forum that Gamestar Mechanic attaches to all public games, as screenshot b) shows. Second, the game narrative brings the player in touch with an elite group called “Allied Mechanic Project”, an underground group attempting to restore balance to the factories by going beyond the boundaries of the schools, and letting its members complete jobs that explore the advantages and disadvantages of all design approaches (Figure 3-2).

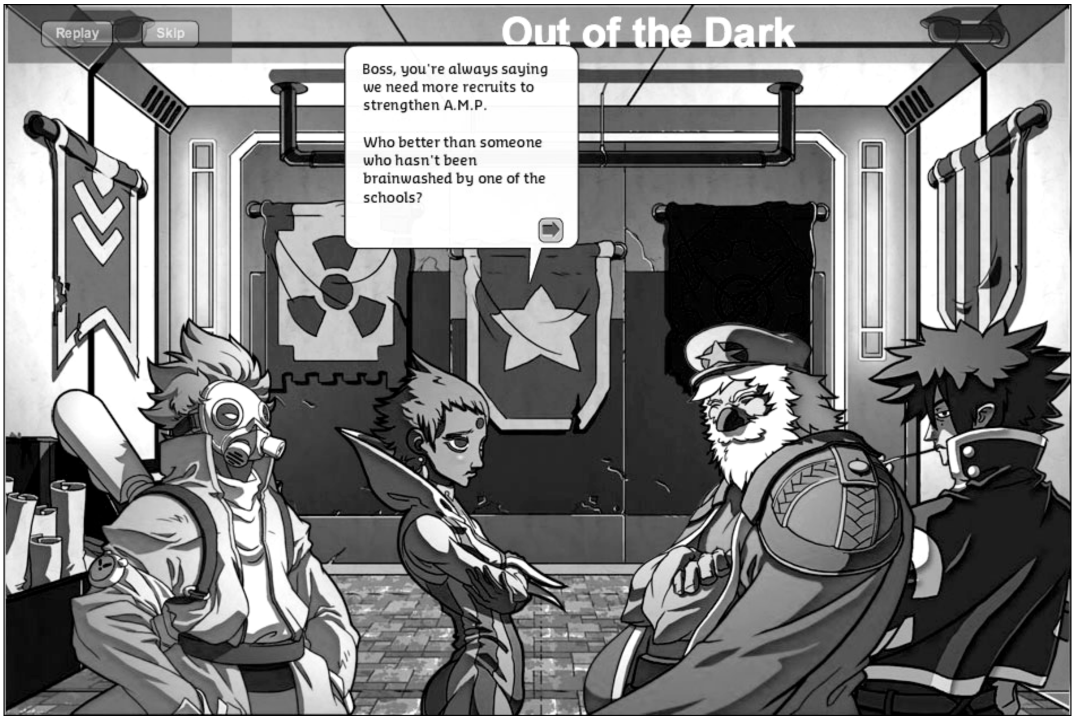



Figure 3-2. Meeting the Allied Mechanic Project

In conjunction, the system of components and activities that constitute Gamestar Mechanic (playing, constructing, repairing and sharing games), are set up with the specific intention of promoting the appropriation by learners of a game designer Discourse (Gee, 1996; 2005). D/discourse theory (or big and small d, discourse theory), construes the notion of *Discourse* as a term that builds upon Wittgenstein's "lifeworld" (1953), to encapsulate the ways of doing, being, thinking, talking and participating that define a person's identity as a member of a specific community, in this case a community of designers. People demarcate these identities for others through instances of language used in context, or *discourse*, through which they situate the meaning of identities, activities, tools and institutions, construcing an immediate reality for others in communication.

While Gamestar Mechanic is a game intended to promote a game designer Discourse, its central purpose as a learning tool is not to train professional game designers. Rather, by immersing students in key activities and practices of game design, it is intended to act as an *epistemic game* (Shaffer, 2006) that encourages learners to think and communicate like game designers do. According to Gee (2007) "In epistemic games, learners do things that have meaning to them and to society. Such games are *knowledge games*. They are meant to teach learners both how to navigate complex linguistic, cognitive, and symbolic domains and to innovate".

Avoiding the production of lethal mutations in the design and research of a learning environment like Gamestar Mechanic requires careful consideration of the differences in learner expectations between design-based learning in games and school. Game play is an activity that players naturally engage in a voluntary fashion. Videogames are today a valued and predominant form of entertainment among youth worldwide (Palmer and Finilla, 2005), and videogame play is an activity that has been consistently attracting new participants from almost every age and gender for over a decade (Entertainment Software Association, 2008). It is precisely the ability of games to recruit extended player engagement in active and critical thinking about complex subjects that makes them such effective learning contexts (Gee, 2003; 2004). However, until recently, games have seldom been designed to have explicit curricular goals to them, and those who did often failed to be either good games or good learning environments (Soloway, 1998).

On the other hand, design-based pedagogies have often been aimed at achieving similar forms of learning than games do, but with explicit academic concepts in classroom environments

(Kolodner, et al. 1998). A growing body of literature documents the relationship between learner motivation and outcomes, and suggests that learning is most effective when it is valued, and driven by learner goals (Ames and Archer, 1988; Wigfield, Eccles and Rodriguez, 1998; Pintrich and De Groot, 1990). However, as much research has also shown, schools are systems of activity that so systemically undermine those self-motivated aspects required for design pedagogies to succeed, that their effectiveness in these contexts is always limited (Papert, 1997).

To add to the woes of school-based design pedagogies, in recent years a disturbing trend in school identity disaffiliation has emerged among many students within those populations Gamestar mechanic aims to serve, that feeds into swelling high-school dropout rates in the U.S. (National Center for Education Statistics, 2007).

Therefore, in terms of maximizing the potential benefit that Gamestar Mechanic could bring to students, a potential pitfall leading to lethal mutations would be to frame game-based learning environment in a way that resembles school too much. In fact, Gamestar Mechanic's goals should in no case be for the skills to be learned in it to transfer to school, but rather, to transfer to those areas of civic, social and economic life that school is failing to prepare our students for today.

In order to minimize the risk of a lethal mutation, the game has been designed to strike a delicate balance between game and curriculum design, and has been framed in the context of informal after-school game design workshops, where the students gather weekly with an "instructor" that takes the role of just one more player, albeit a more experienced one. The, workshop, formats resemble closely those of summer camps and after-school programs, contexts where children more naturally encounter games.

### ***Research Methods: Designing, Researching and Assessing the Game***

For the study reported in this chapter I relied on a method I term discourse-based design ethnography. This method mixes design ethnography (Barab, et. al. 2004), and discourse-based ethnography (Steinkuehler, 2005), with the goal of constructing a narrative that provides a "thick description" (Geertz, 1976) of the overall language and literacy learning ecology of the game, through the lens of participants' communication practices over time.

#### *Participants, Contexts and Data Sources*

The narrative in this study presents a high-level perspective that spans three different instances of the Gamestar Mechanic workshops, each corresponding to an individual phase of design research (pre-alpha, alpha and beta), as explained in Chapter I (see Research Methods in this Dissertation). Table 3-4 presents a summary of the participants, sources and methods used in each study.

| Cycle | Pre-alpha (Fall 2006-Spring 2007) | Alpha (Summer 2007-Fall 2007) | Beta (Spring 2008-Summer 2008) |
|---|---|---|---|
| Workshop Context and Format | • Early prototype consisting of a rudimentary online version of the toolbox with a limited creature set, and a paper-based version of the game design curriculum.<br>• Two 6-hour mini-workshop focus groups during the fall.<br>• 15-hour after-school workshop format gathering 2 1/2 hours a week for 7 weeks during the spring. | • Alpha version of the toolbox implementing more polished artwork, elements of the storyline, an extended creature set and the ability to modify creature behaviors, level rules, level look and feel, as well as digital documentation for games through player messages and a game label form.<br>• Extended version of the game design curriculum implementing best practices and lessons learned from the pre-alpha cycle.<br>• Two 15-hour after-school workshop formats, gathering 5 hours daily for 3 days in the Summer, and 2 1/2 hours a week for 7 weeks during the fall. | • Beta version of the game including an extended creature set for the toolbox, adds an online version of the curriculum in the form of game jobs inside the factory, complemented by paper-based jobs, and provides the web infrastructure to make games public in order to share and discuss game designs with other users.<br>• Paper versions of teacher-driven game jobs available for flexibly adaptable curriculum.<br>• Two 15-hour workshop formats, gathering for 2 1/2 hours a week for 7 weeks in the spring, and 3 hours a day for 5 days in the summer. |
| Participants | • Participants recruited through flyers at public libraries and after-school programs in the Madison, WI area. No compensation provided.<br>• All participants and their parents signed consent forms and completed gaming literacy background interviews.<br>• For the focus groups, 6 males and 6 females between 5th and 8th grades, mostly from lower SES backgrounds. Ethnicities included African American, Asian American, Caucasian, and Hispanic.<br>• For the workshop 2 males and 3 females between 6th and 8th grades, some from low and some middle SES. Caucasian ethnicity. | • Participants recruited through flyers at public libraries and after-school programs in the Madison, WI area. No compensation provided.<br>• All participants and their parents signed consent forms and completed gaming literacy background interviews.<br>• For the summer workshop, 15 participants, all male between 6th and 9th grades, half from lower SES and half middle class backgrounds. Ethnicities included mainly African-American, Caucasian students.<br>• For the fall workshop, 20 participants were involved, between 5th and 8th grade, mostly from lower SES | • Participants recruited through flyers at public libraries and after-school programs in the Madison, WI area. No compensation provided.<br>• Expert designer participants recruited in person at professional conferences.<br>• All participants and the children's parents signed consent forms and completed gaming literacy background interviews.<br>• For the spring workshop, 10 participants, 5 male 5 female between 6th and 8th grade, mostly from low SES. |

| | | | |
|---|---|---|---|
| | | backgrounds.<br>• Multicultural group including African American, Asian American, Caucasian and Hispanic participants. | • For the summer workshop, 6 participants, all female between 6th and 9th grade.<br>• Both multicultural groups including African American, Asian American, Caucasian and Hispanic participants. |
| Data Sources and Collection Methods | • Participant observation<br>• Field notes,<br>• Participant interviews,<br>• Digital audio and video recordings,<br>• Paper-based documents (e.g. participant game stories and instruction sets),<br>• Digital documents such as screen casts of game play sessions. | • Interactive Design Interview digital videos to document and assess game design Discourse. Conducted pre and post workshop for 10 participants in the summer, and 10 in the fall.<br>• Other sources still used including participant observation, session audio and video recordings, participant interviews, paper documents, and digital documents (game labels, game designs) | • Interactive Design Interviews conducted pre and post workshop for 6 of the participants in the spring workshop and 3 in the summer workshop.<br>• Other sources include participant observation, field notes, session audio and video recordings, interviews, and digital documents (game designs, labels, online game discussions).<br>• |

Table 3-4. Summary of Methods and Data Sources in the Cycles of Design Research

Following the format suggested by Collins, Joseph and Bielazyc (2004) for reporting design research, I organize the narrative according to these phases, and I report specific information on the learning environment's goals and components, the context, participants, and the insights obtained, within that specific cycle's specific section. In order to articulate trends in participant thinking, language and literacy practices germane to a game designer Discourse across the different versions of Gamestar Mechanic, the narrative in each section places emphasis upon two types of insights: a) insights about participants' thinking and communication about and with the knowledge representations provided by Gamestar Mechanic, across the different game design workshops, and b) insights on the implications of these changes for the redesign and gradual improvement of the subsequent phase's version of the game, its curriculum, and its supporting learning theory.

Given the prominent role that discourse (i.e. language used in context), plays in the examination of the thinking, language and literacy practices of a Discourse like game design, I relied on several methods of documentation in the different phases that yielded a rich collection of language samples. In order to capture the communicative richness of the specialist language of games and game design, these data sources are multimodal in nature as well, and include: a) participant observations I conducted while in the role of a player of the game, b) field notes I collected during the workshop sessions, c) transcripts of digital video and audio recorded participant semi-structured interviews, d) digital videos and screen casts of participants' design activities with the game, and e) digital and paper copies of participants' games and associated texts stored on the game server. The section belonging to each design research cycle in the narrative provides specific details on the methods I used to collect these sources.

*Data Analysis*

For the analysis of the language samples collected throughout the workshops, I relied on a Discourse Analysis methodology (Gee, 2005), which is detailed in Chapter I (see Data Analysis, Research Methods in this Dissertation Section). Preliminary to the analysis I transcribed the language samples collected in the digital video and audio documents using Transana (Woods, 2003), a video analysis tool that synchronizes the video and audio tracks of a recording with a transcript, thus facilitating the analysis substantially (see Figure 3-3).

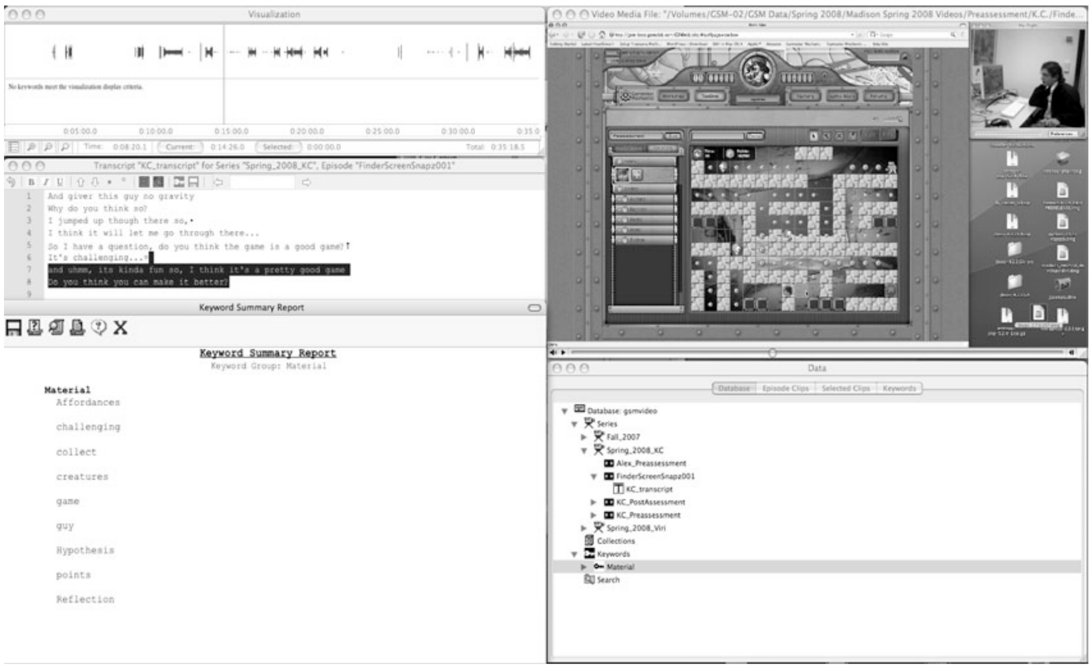



Figure 3-3. Coding a design think aloud video using Transana

I then coded the transcripts using Gee's seven building tasks of language (Gee, 2005), which categorize utterances according to the ways people use language to situate the meanings of activities, tools, institutions and identities, thus constructing an immediate reality for others. These are (1) *significance*, using language to make certain things more relevant than others, (2) *activities*, using language to get recognized as engaging in a certain activity, 3) *identities*, using language to get categorized as enacting a certain role or identity, 4) *relationships*, using language to signal a sort of relationship between two people, 5) *politics*, using language to convey a perspective on the distribution of social goods, 6) *connections*, using language to highlight the relationships between two incidents or concepts, and 7) *sign systems,* privileging certain ways of communicating through symbols over others. Depending on the language sample and the context where it is used, all or some of these codes emerged as relevant its analysis.

Using the codes generated, I then constructed categories of interactions denoting trends in the use and sophistication of language during design by the workshop participants, and shared them with other researchers to maximize their validity, before constructing the study narrative presented here.

### *Limitations of the Study*

For details on the limitations of the studies in this agenda, see the *Limitations of the Studies Reported in this Dissertation* section in Chapter I.

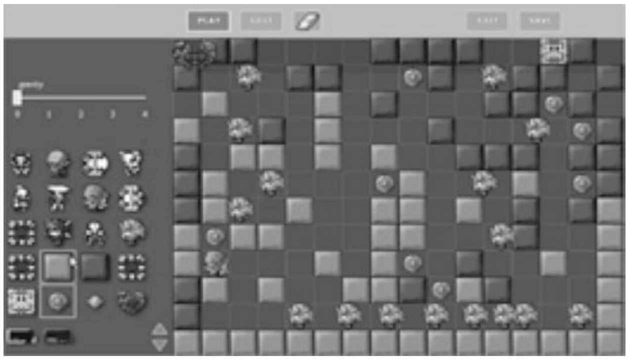
### *Fieldwork and Results*

Three years of intensive design research have produced important findings regarding the learning ecology of Gamestar Mechanic, and in particular regarding the forms of language and literacy practices enacted by players in interaction with the game. This chapter reportins these findings at a project level, concentrating on (a) those constructs that emerged from each cycle and that were consistent across different workshops, and (b) how these findings informed changes to the game and its supporting theory on subsequent cycles. Following chapters concentrate the analysis on specific cycles, and provide insight into how the general findings reported here produced specific forms of learning, language and literacy practices, important to learners today.

*The Pre-Alpha Phase an the Grammar of the Language of Games*

The initial phase of research into the educational effectiveness of Gametar Mechanic took place between December 2006 and May 2007. During this phase, two central interests guided the research. The first was to identify whether the main idea guiding the design of the game (a game one plays by making games) would lead or not to a lethal mutation, whether it would be perceived too much as school by adolescents in the populations it aims to serve (middle school children from disadvantaged backgrounds, minorities and girls), and whether it would engage their interest over an extended play period. The second was to perform an initial assessment of the kinds of language and literacy that would emerge from the interactions between participants and an early prototype (pre-alpha) version of the game.

*Pre-Alpha Phase Goals and Game Components:* The prototype consisted of a) an early version of the *toolbox* with a limited set of sprites and fixed behaviors, b) paper based *sprite profiles* that would allow the players to compare sprite descriptions and make decisions as to which to use in their games, c) a rudimentary version of the *game design curriculum* within the narrative and jobs in the form of paper-based narrative storyboards, and d) a *game label* format where players would write the description and instructions for their games. Table 3-5 shows an example of each of these components. Their purpose was to simulate as completely as possible the overall experience of playing Gamestar Mechanic. Because the game in meant to be a reification of learning theory, this prototype would allow us to conduct initial empirical tests of some key theoretical questions.




a) Toolbox


b) Sprite Profile


c) Narrative Storyboard


d) Game Label Form

Table 3-5: Components of the Gamestar Mechanic Prototype.

In order to structure the workshop around jobs, I used a set of job templates provided by Gamelab with the prototype storyboards. These templates were short texts that described the requirements of the specific job the children needed to complete. They organized jobs according to three categories: a) *play jobs* –where players needed to win a game previously designed, b) *repair jobs* –where they had to identify and fix a problem with a dysfunctional game-, and c) *design jobs* – where they had to design a game from scratch within constraints specific to the Discourse. Design requirements would typically look like the following:

> "A core mechanic represents the essential moment-to-moment activity of the player, what the players will do over and over in order to reach a win condition in the game. For this challenge, make a game where the core mechanic is to *collect things.* When you're done, write the instructions for your game so that others can play it."

*Pre-Alpha Phase Settings, Participants and Documentation Methods:* This phase of the research took place between at a computer lab in the University of Wisconsin-Madison. To answer the initial question of whether the game would turn into a lethal mutation or not, members on the Gamestar Mechanic research team and I conducted a seven-week, fifteen-hour workshop at a university computer lab. Previous to this workshop, two preliminary six-hour focus group sessions had been conducted with sixteen children playing the game, with encouraging results, which gave me reason to believe that an extended workshop with a curriculum prototype could be successful. For this I recruited participants from the Madison-Milwaukee Wisconsin area through flyers announcing a mini game design workshop for children.

I posted the flyers in public libraries, after-school program facilities and community centers where children commonly gather. The participants were six children ranging in age from 6th to 8th grade from diverse ethnic backgrounds. Three of the children were girls and two were boys, and only the two boys and one girl identified themselves as regular gamers, and reported substantially more time a week dedicated to game play and game related activities (e.g. reading game magazines, or watching game T.V. shows) than their peers.

One of the girls had a visual impairment that required her to do her work very slowly, but otherwise did not stop her from participating. The girls knew each other and the boys knew each other, but there were no cross gender acquaintances. The children came from a various socioeconomic backgrounds, and all of them were Caucasian.  Attendance to the sessions was voluntary, and during the whole workshop the children had the option of leaving the computer room and going to the game room to play with a library of commercial games and consoles.

During the workshop, digital video recordings and screencasts (digital video captures of computer screen activity) played a central role in the documentation of children's design activities. I used the *Camtasia Studio ©*, a screencasting software to generate digital videos of they play or design process in the computer screen in parallel with video of the participants themselves to provide a rich documentation of their design process for the Discourse analysis. During this phase, I designed a protocol consisting of a think aloud interview conducted with participants as the completed individual and group design jobs, aimed at documenting their meaning-making processes during design. I discuss this method in detail in Chapter IV. Throughout the workshop, I conducted a series of these interviews with the participants, to document the changes in the ways they thought and communicated about and with Gamestar Mechanic over time.

*Pre-Alpha Phase Findings:* Two main insights about Gamestar Mechanic and its function as a learning environment emerged from this phase of research. The first one concerning student engagement and lethal mutations, showed that even a rudimentary prototype of the game was able to keep students interested in designing, playing and sharing games with other for the extended duration of the workshop. Particularly insightful was to see that even for those participants who declared themselves non-gamers, the social component of the game (being able to play with their friends) provided a strong enough motivation to keep bringing them back throughout the workshop's duration, and for some, throughout the three years of the project.

The second insight that was emphasized in this phase, and became pervasive in the rest has to do with the forms of language and literacy used by participants interacting with Gamestar Mechanic. Throughout all the phases, it became evident that, as expected, the language and literacy practices enacted by students were multimodal in nature. Children used specialized forms of verbal language to communicate with each about their games, with phrases such as "this game is too difficult" or "my game is not challenging enough", commonly dominating their verbal discourse. For boys in particular, the notion of a "good game" at this point had a strong association with its level of difficulty, with games in the shoot 'em up genre where the a player avatar had to face many enemies in a gun battle being considered better.

As I will discuss in later phases, this notion change over time, and it became evident that especially for inexperienced players, the language served at first a fundamentally mathetic function during all the phases. Mathetic is a term that refers to the use of language by people with the central purpose of learning the function of some of its structures and components (Halliday, 1973; Papert, 1996), as opposed to exerting a communicative function. Young children commonly display this behavior when they use certain utterances they have heard from others in contexts where they apparently make no sense, to test the results of making such an utterance in that context. That students were using terms such as challenge and difficulty in this form was evident because when I asked them questions such as "what would make the game more challenging?" responses such as "I don't know, it just needs to be more challenging" have been typical among new players.

The mathetic function of language also became evident in the players' interactions with Gamestar Mechanic, and in this first phase in relation to learning of what Gee (2003) terms the design grammar of games. In Gee's view one of the main ways in which games can foster good learning experiences for players is by letting them manipulate complex systems. Teaching students to solve problems by thinking in terms of systems has been identified as a core 21st century skill for learners (Partnership for 21st Century Skills, 2002).

An observation that was consistent among most students in this phase was that even with the prototype, the creatures and tools provided in Gamestar Mecanic helped children learn to think of their games in terms of systems, by becoming familiar with the possible relationships and interactions between creatures available in the mechanic toolbox. How does Gamestar Mechanic promote this? The answer is best explained using Gibson's notion of affordances, discussed in detail in Chapter I (Gibson, 1977; Norman, 2002), and that refers to those characteristics designed into language and objects that facilitate some meaning articulations in certain contexts, while inhibiting others.

In Gamestar Mechanic, affordances have played a particularly important role in helping players understand the systemic relationships between components that define the design grammar of the language of games. The creatures collected by players in their mechanic toolboxes embody these affordances at one level, being purposefully pre-designed with capabilities and limitations. Affordances also play a role as job requirements, delimiting a problem space where players must use limited creature combinations to produce grammatically valid designs that satisfy them.

A clear example of this comes from a screen recording of a design job completed by Catherine (her Gamestar Mechanic avatar name), a female participant in a workshop during the prototype phase. The game at this phase was little more than a barebones version of the editor, with a limited collection of creatures available for players to design with.

The job presented with only two requirements: 1) make a game using a maximum of four different creatures from the toolbox, and 2) write down a game label stating the goal of the game. A game label is a brief text where players articulate a description of their game, as well as the instructions that a player would have to follow to play it. During the early prototype the labels were commonly written either in paper or in a word processor, and in later versions they were integrated into the mechanic toolbox as a text entry available for edition upon saving a game.

During her process of design, Catherine used the thinking tools provided by Gamestar Mechanic's language of games as aides to guide her thinking and design strategy in very important ways. First, she began her process by articulating an initial design, accompanied by the game label required by the job. The statement read "what you do in my game is try to get to the bottom right corner without getting hit". Table 3-6 presents her initial design followed by descriptions of the creatures she used to construct it.

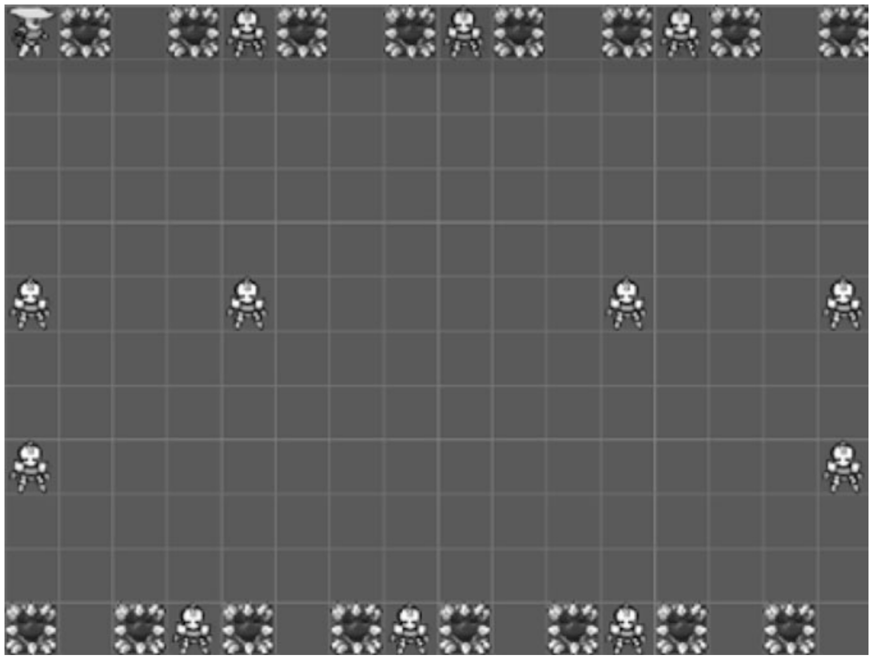
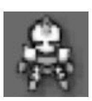
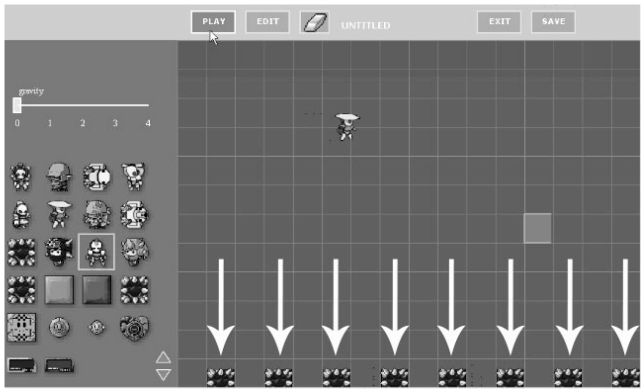
| | |
|---|---|
|  | |
|  | Weak Enemy: Damages the avatar on touch, it moves up and down, dies on one avatar shot. |
|  | Veritcal Damage Block: Destroys the avatar on touch, it moves downward or upward until it hits another creature, then reverses it’s direction. Cannot be destroyed. |
|  | Shooting avatar: Moves horizontally and vertically, shoots bullets that can destroy weak enemies in one shot. Can withstand three hits from weak enemies and is destroyed by damage blocks. |

Table 3-6. Initial design and components of Catherine’s game

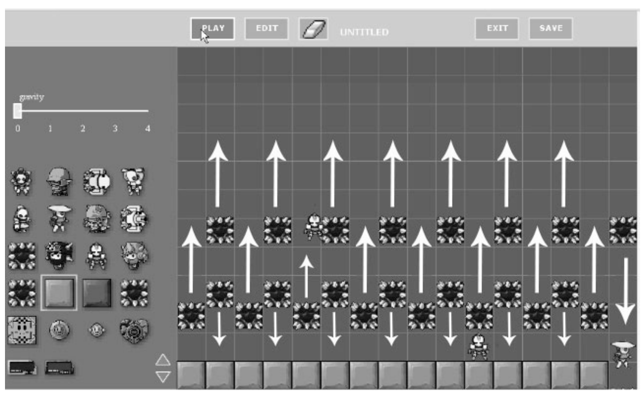
These two articulations put in context, provide important insight into how learning the grammar of the language of games facilitated her thinking of games in function of systemic relationships. In her label statement, she is articulating a model of what she conceives a solution for the design task to be. To do so, she uses the concept of game goal as a cognitive reference around which to build her design, as denoted by the "what you do in my game is trying to get to the bottom right" part of the statement. The design itself corroborates that this was her model because she deliberately placed the avatar creature on the top right of the screen, maximizing the distance from her goal.

The second part of her statement "without getting hit", is to frame the "game" as an opposition, a contest for dominance of the game space that is commonly found in many good games (Jenkins and Squire, 2002), which at the same time defines the main rule defining appropriate player action, to avoid having the avatar hit on the way to the goal. Hence, this statement formulates her hypothesis of what professional designers commonly call the mechanics of the game, a term which refers to its form and function, defined as a system of rules and interactions.

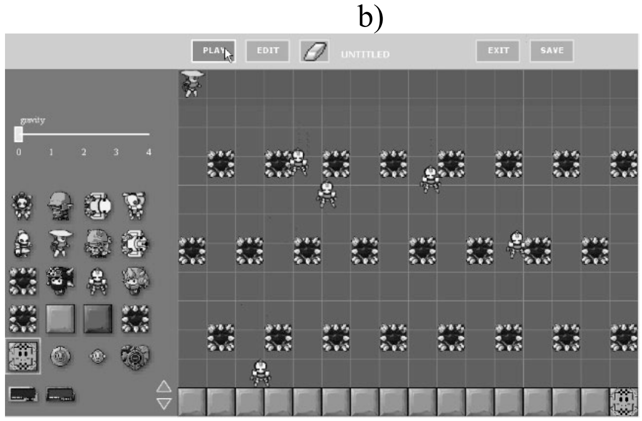
Her initial design would, at face value appear to support the model of mechanics she is verbally articulating, since she places the moving damage blocks in the space between the avatar and the area she has defined as the goal for her game. However, the screenshots in Table 3-7 shows how up to this point her understanding of the grammar specific to Gamestar Mechanic does not support her initial mental model once she activates the game hitting the play button (white arrows indicate direction of motion for the damage blocks).




a)




b)




c)

<u>Table 3-7. Catherine’s design sequence</u>

Screenshot a) of this table shows how the damage blocks, designed to move downward and reverse upon hitting another creature, move as designed. However, when reaching the bottom of the screen they exit the play area, eliminating the challenge to the player, even if the player makes no move at all. She had not realized that the edge of the play area did not represent a real boundary in the game model, even when it does in the real world.

Screenshots b and c in Table 3-7 demonstrate this point. In b) Catherine placed concrete block creatures along the bottom of the level, effectively forcing them to reverse their direction and at the same time forcing the avatar to move lest it be hit. However, in Gamestar Mechanic, reaching a spatial goal such as the one defined by Catherine can only be achieved using a goal block creature, which demarcates a win condition upon touch by an avatar. Even though she succeeds in reaching the goal in screen b), she realizes the game is not winnable at this point due to the lack of this block, which she places in the goal area in screenshot c), finally accomplishing a design that matches her label.

*Pre-Alpha Stage Implications for Redesign:* The observations I conducted during the pre-alpha also led me to revise the game's original theoretical framework to make it more adequate at explaining the learning interactions taking place in the game (see Figure 3-4). While Discourse theory was still a very useful framework to understand the language and literacy practices of players, interactions such as the examples above, suggested that a more specific version of the theory would better convey how learning with and about the grammar of Gamestar Mechanic took place. In addition, Discourse theory places an emphasis on people demarcating (Gee, 2005) situated meanings, as opposed to negotiating them. However, interactions like the ones in this section clearly emphasised the role of dialog in meaning production and learning. As such, I built upon Discourse theory to construct a theoretical model of the designer-game interaction leading to learning the grammar of Gamestar Mechanic, as a tool to guide future designs of the game. Figure 4 presents a diagram of this model, where a designer negotiates the meaning of the grammar of Gamestar Mechanic by engaging in a dialog with a game produced in the toolbox.

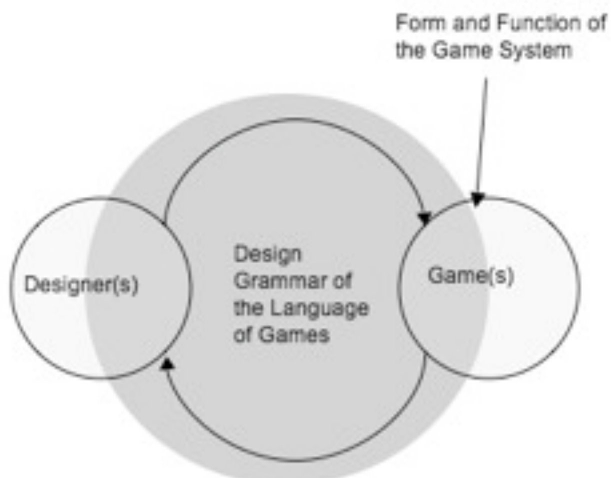



Figure 3-4. The material dialog and the design grammar of the language of games

In addition, one of the concerns about the game that arose from this phase was Gamestar Mechanic's ability to elicit sophisticated game ideas from players. This was especially strue considering that most of the players' written texts, whether they were game instructions or small stories, were facile and sine qua non, even when it was evident from their verbal articulations and discussions that they had much more sophisticated ideas about their games A good game designer must recruit effective writing skills to communicate as much as any other knowledge profession.

Its possible that this was due to the fact that up to this point the game had not tied the jobs in the game to the overall narrative, and thus writing was not seen as something valuable by the players. However, numerous comments by students regarding the small number of creatures in the toolbox suggested that if given more of a variety, more sophisticated games and texts would follow. If one makes an analogy between a game and a composed text (Gee, 2003), then the creatures provided in the toolbox would be analogous components, that is, to its words. Hence, we hoped that a broader collection of creatures then, would amount to providing players with a broader lexicon with which to express a wider variety of game ideas, and more complex texts as a result.

*The Alpha Phase and the Semantics of the Language of Games*

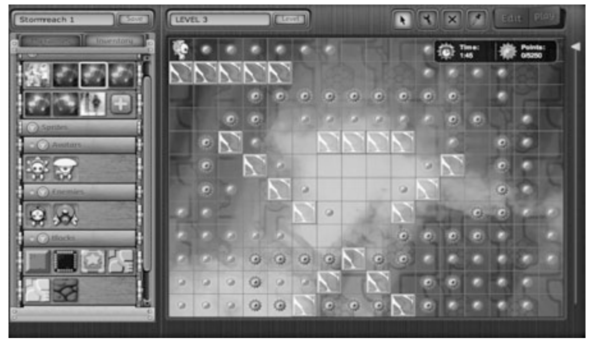
In the summer of 2007, the game design team at Gamelab released the alpha version of Gamestar Mechanic, which implemented improvements based on the insights and subsequent feedback I provided during the pre-alpha phase. In this version, the game job curriculum was still paper-based, however, it addressed the issue of creature variety with five important features, as the following section explains.

*Alpha Phase Goals and Game Components:* Table 3-8 shows screenshots that demonstrate the alpha toolbox features. First, it made sixty-two creatures available to players for use in their designs, as opposed to the twenty-two available in the prototype (screenshot a). Second, These creatures presented an enhanced set of skins, a term that in game design refers to the appearance of game components, and in Gamestar Mechanic specifically to the look and feel of the toolbox and creatures (screenshot b).

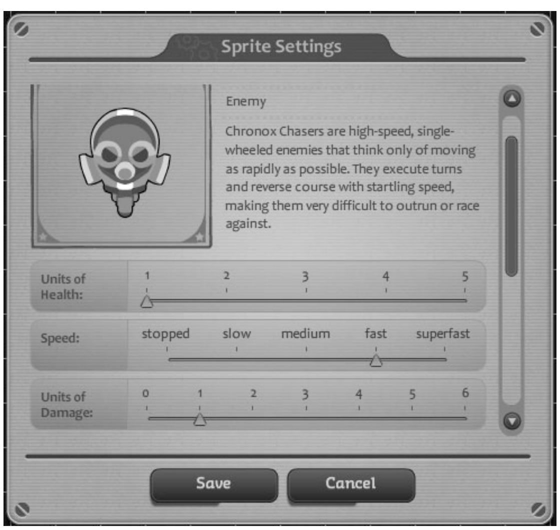
Third, creatures not only had default behaviors that differentiated them from each other, but the new toolbox introduced the ability to modify these behaviors through a configuration panel, thus expanding the players' ability to express game ideas with an exponentially larger variety of interactions (screenshot c). Fourth, for the first time the toolbox made it possible to modify the appearance of the play area (screenshot d), and to create games with multiple levels connected inside one game. With this feature, players could now modify this area to have different properties such as larger horizontal and vertical dimensions spanning more than one computer screen, as well as different backgrounds and even musical scores.

Fifth, to facilitate the articulation of games as multimodal texts, the alpha toolbox integrated a semi-structured game label format that every game made would display at the beginning of play (screenshot e). The intention, was to make it easier for players to integrate not only textual information about game rules, goals and mechanics for other players, but also to allow them to integrate complex texts such as narratives into their games.

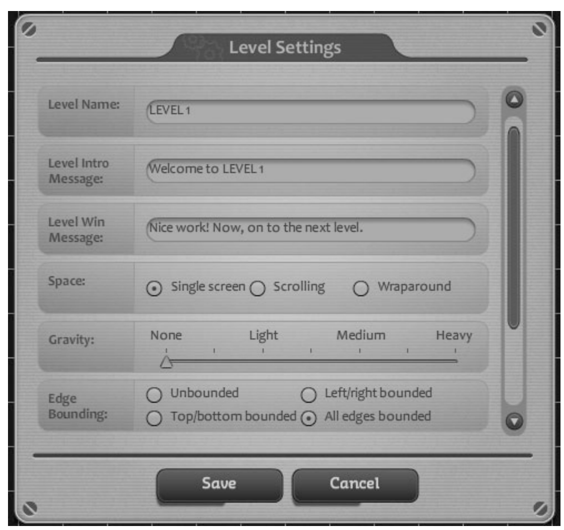

a) Extended set of characters.




b) Enhanced toolbox and character skins




c) sprite profile and behaviors




d) level properties


e) A game label

<u>Table 3-8. Components of the Gamestar Mechanic Alpha Build.</u>

<u>*Alpha Stage Settings, Participants and Documentation Methods:*</u> The alpha phase took place in the period spanning the period from June to December of 2007. Two groups of children participated on instances of the Gamestar Mechanic Workshop during this time. The first group consisted of fifteen males from diverse socioeconomic and ethnic backgrounds, participating in a summer technology camp at a high-school library computer lab in a suburb of Milwaukee, Wisconsin. The design job curriculum spanned 15 hours, and involved both individual and collaborative designs. The second group, conformed by 20 middle school children, half males and half females from diverse ethnic and socioeconomic backgrounds recruited from after-school programs in the Madison, Wisconsin area, gathered for a 16 hour workshop in the Spring at a university computer lab.

In addition to the documentation methods involved in the pre-alpha version of the game, the Gamestar Mechanic research group (James Gee, Elisabeth Hayes, and myself) made a decision to conduct a more detailed assessment of a subgroup of 10 students in this phase. I conducted the assessment pre and post workshop, and it involved the following documentation methods:

a) Concepts about Game Design Interview: This interview consisted of a set of questions about games and game design as an activity. Typical questions included “What do you think a game designer does?”, and were aimed at getting students to elaborate on their conceptions of what the goals of a game are and what kinds of activities comprise game design as an enterprise.

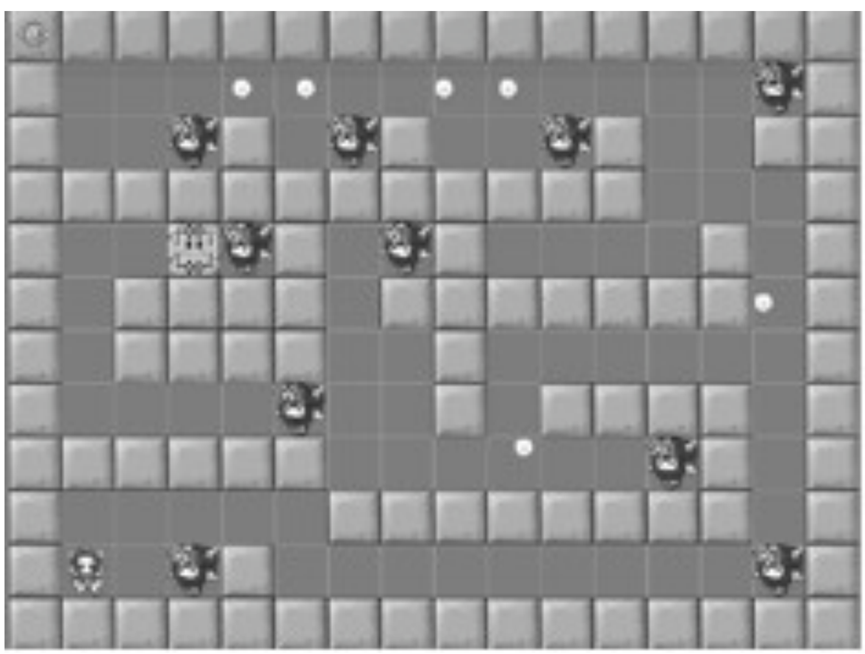
b) Paper-based game design job: Since at pre-test most of the participants would not have familiarity with the toolbox, I wanted to assess their process of thinking about game design at a more general level. This task simulated a game design job and consisted of having participants design a game using a variety of materials including colored pens, paper, dice, chips and tokens. Participants had 15 minutes, to design the game, including its rule set and a description for players.
c) Think aloud interview: To assess changes in their use of the toolbox over time, this task presented to participants a game design job with fairly open-ended requirements. They had to design a game around the idea of “save the lakes”. We also gave them a brief instructional tour of the toolbox features, and throughout the design process conducted an interactive design interview to assess their

meaning making practices during the process. Questions in this interview were open ended, with typical examples being “Why did you decide to use x creature?” and “Is your game behaving as you expected it to?” aimed at assessing changes in player mastery with the design grammar of games in the new toolbox.

d) Concepts about Systems Interview: This interview was intended to continue the assessment of changes in the thinking and communication practices about games and systems of players as they mastered the design grammar of games using the extended creature lexicon provided by the alpha toolbox. The questions in this section were aimed to assess changes in their understanding of systems at a more general level as a result of playing Gamestar Mechanic. These questions included: “What is a system?” “Could a game be considered a system? Why?” and “What other systems besides games do you experience in daily life?”

*Alpha Stage Findings:* As expected, the introduction of a larger lexicon of the language of games through an extended creature set led to more sophisticated and complex player game designs. However, not all students progressed at the same rate. An examination of students’ designs in this phase over time showed that in general, girls tended to approach their designs in a more analytical way than boys did. When put in context with a re-analysis of the designs by boys versus those of girls during the pre-alpha phase, it became evident that in both phases there was a clear trend showing that boys would begin their experimentation with designs in Gamesttar Mechanic with simple designs that fell into the shoot’em up genre, typically consisting of simple open spaces where an avatar would have to overcome large amounts of enemies. In contrast, the designs made by girls were characterized by a lot more consideration of how a player would interact with the game at a tactical or strategic level, hence presenting designs where puzzles and mazes without immediately evident solutions were more common (Table 3-9).


a)



b)

Table 3-9. Screenshots comparing boys' a) and girls' b) early designs across different phases

Part of the explanation for these differences became evident from a trend I consistently observed across workshops and participant groups in the three phases, with regard to the amount of individual design time versus social design time enacted by each gender. Females consistently spent more time engaged in conversations during their process of design than males did, and many of these conversations revolved on ‘how to make the game better”. They spent more time designing new games using the toolbox even with limited creatures, and working towards interesting interactions with these limited sets. These discussions commonly involved aesthetic comments such as  “a different background would look better”, but they also involved discussions about game mechanics, such as “there’s too many enemies and they move all over the place, slow them down”. These conversations fore grounded the role of player perceptions and actions over other considerations, placing the girls as co-designers of their games, and framing their designers’ perspectives in sophisticated ways.

Boys on the other hand, displayed more extended cycles of individual work with the game jobs and thus experienced different creatures behaviors sooner. Hence, their shooter designs commonly involved a broader variety of avatar-enemy combinations than girls’ designs did. This suggests that while boys’ designs might appear less sophisticated at first, boys and girls entered sophistication in different ways. Among the commercial game titles that companies target towards young males, first and third-person shooter games are undoubtedly one of the most widely available and popular.

Years of research in cognitive psychology suggest that one of the main ways in which people make sense of the world around them is by attempting to organize it into familiar and predictable patterns (Pinker, 1999). For boys playing Gamestar Mechanic for the first time, the shooter game genre a fast and familiar way to create systems that behaved like what they knew as “games”. However, what also became evident toward the end of the alpha workshops was that while girls’ early designs implemented more sophisticated mechanics, ultimately the boys’ designs caught up in terms of sophistication and variety, as boys integrated different creatures into their initial designs.

Regardless of whether the players showed a preference over a certain design pattern or another, a key finding stemming from the prototype and alpha phases of the project was that players developed sophisticated design strategies and understandings of their games by attempting to communicate interaction goals to an idealized player (Games, 2008a). These expressions were commonly guided by attempts to construct models of what Gee (2003) calls a *projective idenitity* for an ideal player, that is, an interaction between an ideal player and a virtual identity such player would “step into”. Professional designers commonly foster the negotiation of a projective identity by framing the possible actions players can take in the game in ways that make them meaningful, and which lead to an increased investment and engagement in the game on the player’s part (Freeman, 2004).

This became especially evident in player’s conversations about designs they had completed either after completing design jobs or making their own games in the toolbox during the alpha and beta phases, where the toolbox provided a much larger collection of creatures than the prototype did.  In these conversations, two pervasive ways in which connections between game creatures and player identities guided design strategy were evident, and in both the designer had to "step into the shoes" of a player playing the game.

The first way was by the designer's attribution of semantic interpretation, and a communicational intent to the relationships between creatures organized into patterns. A simple example of this is exemplified in Figure 3-5, which depicts a section of a game designed by Tec, the mechanic name for a male Gamestar Mechanic player during the pre-alpha phase. During an interactive design interview, he described the structure as a trap. When the researcher asked him to clarify what he meant by trap, he said "The whole point is to get the coin, but there is someone guarding the coin".

Figure 3-5. A structure identified by Tec as a "trap"

For Tec, this structure is more than just a system of (1) an area delimited by concrete blocks, (2) that holds a coin character, and (3) an enemy character who navigates it. It is a trap, and a trap for someone, that is, for a player. As such, his understanding how this subsystem works in the game is based on an important prediction on Tec's part, that an idealized player would be one to interpret "the point" of this structure to be a trap, thus giving meaning to a player's action of deciding to attempt getting the coin while not being killed by the enemy in such constrained space, thus creating an interesting opportunity for a projective identity to emerge.

A think aloud I conducted him toward the end of the alpha phase shows how his ability to step into the shoes of the player had not only increased in sophistication, but drove a strategic approach to the design of more complex interactions in games. This semantic activity was particularly evident when players engaged in “post-mortems”, activities of reflection about designs they had previously completed.

In this sample, Tec explained his favorite part of a game he had previously designed. The questions I posed were aimed at leading him to reflect on his game design process. One of the key aspects that differentiated his explanation of design strategy at this stage versus during the pre-alpha phase was that as Transcript 3-1 suggests, instead of being guided by predictions of the form and function of the game, the the actions that conformed his strategy were guided by predictions of the possible actions that the player would or would not take during play.

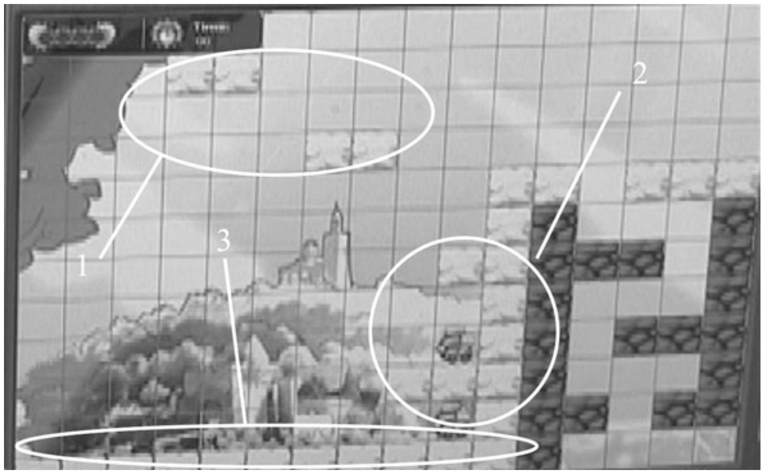



Figure 3-6. Marc's level section during the ideal player dialog interview

(R= Researcher's Utterance; M= Marc's Utterance)
Stanza 1
R1: So what was your favorite part when you made this game?
M1: Umm…all the ideas, putting them into one (scrolls the level to a particular section where the avatar can jump from cloud to cloud across the sky, below is a platform of clouds for the avatar to fall into as shown in Figure 4)
Stanza 2
M2: …and since I don't wanna make the gamer too mad at me
M3: so that's why I put those down there (points to the platform of clouds labeled 1)
M4: so in case he falls they got this (points to a cloud just above the platform labeled 2)
M5: and they can get back up there.
R2: Ok, so instead of just having to just float through those clouds
R3: they can actually fall down there (points to the long platform of clouds at the bottom of the screen labeled 3) and don't have to go all the way down to the bottom of the level?
M6: Yeah (.) cause when I played this I fell down a lot
M7: and was like ugh, I don't really want to play this anymore.

Transcript 3-1. Marc articulates his ideal vision of player interaction by reflecting out loud on a completed design.

What is most interesting during this analysis is found in lines M2-M5. In them, Tec articulated a theory of the way he would expect the player to react to the particular design decisions he implemented in this level (a specialist language term that denotes a section of a game bounded by spatial or temporal limits) of his game.

Since in Gamestar Mechanic it is possible to make levels that span an area larger than the computer screen, Figure 6 shows the particular section of the level he was referring to during this reflection. The way he designed this section, the player character would enter this screen through the bottom right section of the screen (the vertical tunnel-like section surrounded by rocky blocks), and then attempt to get to the next level section by making his character jump from cloud to cloud in the section indicated with the number 1. In line M2 Marc's utterance predicts that if "the player" were to fall bellow the line of clouds at the bottom of figure 4, he or she would experience an undesirable level of frustration by falling to the bottom of the level, which is several screens below this section.

What these utterances show is that Tec was beginning to think self-critically about his design, and about the possible ways in which a player might interpret it. This critical view of his game is not based on simple conjecture, but rather is the result of a dialogic interaction with himself as lines M6 and M7 indicate, in the form of a semantic negotiation of meaning with an idealized player

Also important in this transcript is the fact that Tec is relying on another important tool within the game designer Discourse to situate the meaning of his design and think about it, and that is *player engagement* (Rollings and Adams, 2003 P. 6; Rouse, 2001 P.6; Salen and Zimmerman, 2003 P. 312). Gee (2003) has argued that it is precisely their ability to elicit extended player engagement that makes games powerful learning platforms. In lines M6 and M7, Tec takes advantage of the organizational function of this concept, and uses it to structure his thinking about design strategy in terms of the emotional responses of a player with his design.

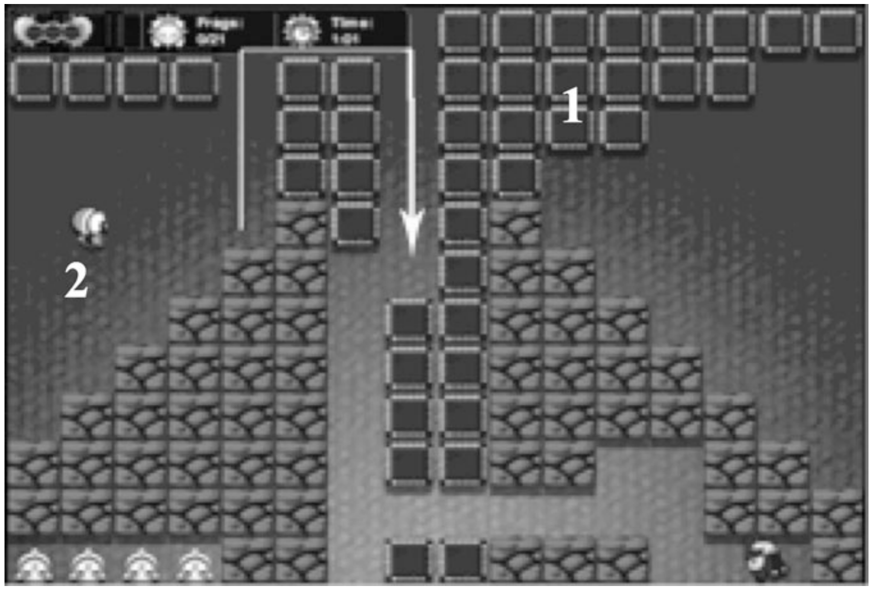
Mental exercises of stepping into a hypothetical player's projective identity, provided players throughout the workshops with two important literacy skills that apply to either print or digital media: First, thinking in function of an "audience" for their games, allowed them to maintain coherence in a design process involving many variables (e.g. the creatures, the space they formed, possible player actions and reactions, multiple screens not visible all at once), by structuring a mental model that reconciles the  game structure with a possible interpretation of that structure delimited by possible player actions, as in the example above. Included in this negotiation was the notion of game genre, as in many of the interviews and discussions, statements such as "I'm designing for people who like shooter games" or "mine is a puzzle game" were common during reflection tasks.

Second, thinking in terms of possible projective identities allowed them to think about the affordances and limitations of the tools provided by the grammar of Gamestar Mechanic with regard to the possible ideas they could communicative to players. In doing so, the creatures and tools provided by the game became a collection of expressive tools through which they were able to structure, understand and convey their real world experiences to potential players. As a result, many hybrid productions that combined the expressive aspects of text with those of game components began to appear in the workshops, and have exploded into a large collection over the three phases of research.

An example of this is a game called "the BIG Volcano" by a mechanic called tranform. In this game, he used the affordances of text to situate the meaning of player activities through the following introductory message:

"OH NO! the enemies toke[sic] the goal block away from me. Goal: the enemies toke[sic] the goal block and put it in the volcano so it would burn[sic] you have 1:20 seconds to get it out. Its getting hot."

Table 3-10 screenshot a below shows the initial screen the player finds in the game (screenshot a). Using the dirt and damage block creatures at the center of the screen, tranform created a shape that looks like the cone of a volcano, with "lava" (represented by the damage blocks, marked 1 which in color screens are red) that hurts the avatar (marked 2) on touch. The arrow shows the only path that the avatar can follow to enter the volcano, through its rim.




a)


b)

Table 3-10. Tranform's BIG Volcano Game

As the player descends through the volcanic chimney, several caves and rooms become evident, full of enemy characters attempting to stop the player from "taking" the goal blocks at the bottom (screenshot b). Notice that the goal blocks (marked 3) in the game appear translucent, which in the grammar of Gamestar Mechanic indicates they are not accessible until certain conditions are met. To communicate these conditions, tranform relies on two system rules, provided by the Frag, and Time counter creatures (marked 4 and 5). In combining of these two creatures and a goal block is present, the message the designer is articulating is that the game can only be won if a number of enemies are destroyed (21 in this case) within a certain time period (1 minute 20 seconds for this game). If the player can satisfy the two conditions, the goal blocks become opaque again, indicating they are active and will yield a win condition upon an avatar touch.

*Alpha Stage Implications for Redesign:*

Consistent with the observations that led me to articulate the interaction model for learning Gamestar Mechanic's game design grammar, the discourse of participants in this phase also suggested a dialogic interaction through which players could develop sophisticated game design language and literacy practices. In the samples above however, this interaction would help players learn understand their designs through semantic representations that are in function not only of the structure of the game, but of an interaction with a hypothetical player. I present the model I developed for this interaction in Figure 3-7, to guide the design and research of the game in future versions.

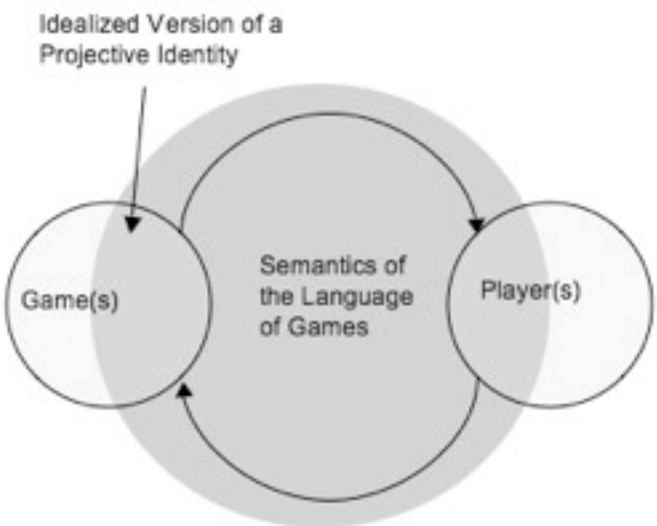



Figure 3-7. The Ideal Player Dialog

Three aspects arising from this phase also became important drivers of change as the project moved into the beta phase. First, even though in this workshop we saw more writing than in the two previous ones, in general the writing samples we could collect from students tended to be very succinct and did not reflect the sophistication the same players verbally articulated in their discussions and interviews. This also made it evident that up to the alpha stage, the game was not providing females with much support in terms of the social approach to design they seemed to prefer. Hence, providing a mechanism built into the beta game that would facilitate these discussions took on new importance.

Second, a the game was placing most of it emphasis in rewarding players for completing game jobs, and not those players who spent more time designing new games, also, some of the jobs that required designing games from scratch provided too little guidance for players regarding what good games were, and placed too much emphasis on grammatical correctness (having all the creatures required in place). Hence, many games at this point presented the creatures they required, but their designers would not create effective game mechanics with them. This problem was compounded by the fact that during the alpha, the behaviors of creatures could be configured with such flexibility that it was possible to have two completely different creatures acting the same way, even when they looked very different.

While this was not a problem with experienced gamers, for novice gamers this could lead to a lot of confusion in terms of how to complete jobs and discuss games. Hence, many times feedback from more experienced gamers regarding best design practices that would have improved a novice's game went disregarded or implemented ineffectively because of lack of grammatical rule clarity among the creatures. Hence, for the beta version it would be necessary to implement mechanisms not only to clearly differentiate between creatures, but to provide guidelines upon which to critically assess "good' game designs.

Third, during the pre-alpha phase, some of my observations had suggested that the different levels of previous gaming experience of participants would make a difference in their response to Gamestar Mechanic games. By the alpha phase, it became evident that for those participants with extensive gaming experience, advancement through the design jobs was a faster process than for those without it, and that their expectations of the game would be different than for novices. For these players, access to the full collection of creatures in the toolbox came quickly, and with this access came much more sophisticated games.

What happened after this was particularly important, for several of the advanced players decided to focus on one or two different game design patterns as their favorite, and then work towards refining games in this genre to a high level of nuance. For example, one of the players decided to stay with the shooter game format, and toward the end of the beta workshop his games involved mechanics that would make shooting enemies more difficult, such as introducing level bosses or traps involving complex enemy movement.

During their interviews, several of these players expressed that the game no longer seemed to provide any specific form of reward in terms of game advancement, and yet their experience and knowledge would be a valuable asset for others, an asset which the game risked losing due to a perceived lack of incentives. Hence, introducing mechanisms into the game that would still validate their game refinement activity became an important issue to address in the beta.

*The Beta Phase and the Pragmatics of the Language of Games.*

For the beta phase of design research, a substantial overhaul of the game took place on Gamelab´s part. This phase brought a much stronger emphasis on the “multiplayer role-playing” aspect of the game, by integrating the extended version of the editor into a website where that made it possible for players outside specific workshop contexts to participate in the game. This new version also implemented substantial feature changes that addressed key concerns from previous iterations.

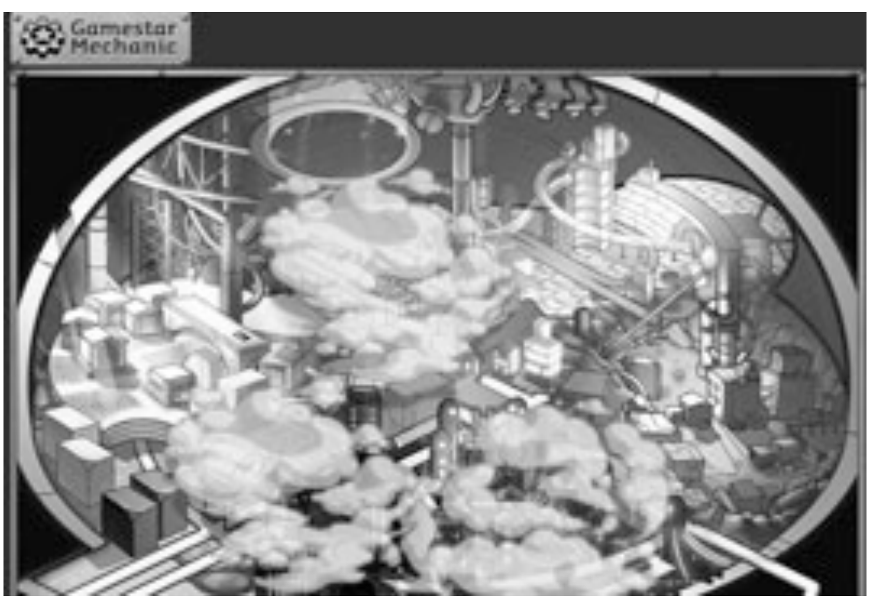
*Beta Phase Goals and Game Components*

A common principle behind the arguments of Discourse theory, Game-based learning theory and theories of learning through design, is that learning happens best when it takes place in the context of public practice (Gee, 2003; Gee, 2005; Papert, 1991). In professional design practice, public scrutiny and discussion of designers' creations serve the purpose of making the design better, by virtue of its ability to solve problems and fulfill desires of larger numbers of members of communities with a common interest in it. While as a team, the whole Gamestar Mechanic teams were aware of the importance of social interaction in learning, the mechanisms by which these interactions should be facilitated had to balance carefully the expectations of players with different gaming and design skills, by providing them valid paths of advancement and status in the mechanic community (Gee, 2003).

The beta version of the game addressed this issue by implementing the role-playing aspect of the game through a web-based community model resembling spaces such as facebook or myspace. The community is framed in the context of the overall game narrative, where players must choose an avatar that enters the virtual world as a member of one of the six available "schools of gaming". In the beta version and up to the time of writing, the Gamestar Mechanic design team and I have put a strong emphasis in enriching the narrative so that all the play and design activities that take place in the game are framed within it. Through the schools of gaming narrative, all players begin with a proposed virtual identity that has an associated set of values through which its affinity group (Gee, 2003) judges the relative worth of games.

In the web community model, every player's mechanic has access to three areas that represent his or her presence in the virtual world, as Table 3-11 illustrates.


a)




b)


c)

Table 3-11. Components of the web-based community model in the beta phase

First, upon choosing a mechanic, every player was assigned a workshop by the game. This is a profile page where players can customize their description of the mechanic's personality and preferences, to give it their personal touch (screenshot a). The workshop is also the site where every game designed and job completed by a mechanic is featured, helping them organize their designs according to the dates when they last worked on them.

Second, the beta version of the game integrated the jobs and the narrative into a flash-based virtual world called the factory. The factory is divided into six different sections that the narrative describes as being the turf of individual schools of gaming. When the game begins, most of these areas are covered in steam and inaccessible to the player, the result of machines that, while once producing energy, now fail to do so due to poorly designed games (screenshot b). It is in those areas not covered by steam that players find the areas called arcades with their available jobs discussed at the beginning of this chapter. In the latest version of the game, choosing a job ties the decision into the game narrative, where the Allied Mechanic Project gives meaning to player's successes not only through creature rewards, but also through recognition of their status in the community of designers (screenshot c).

Third, the game beta first provided a space where mechanics could engage in discussions about games and game design previously unavailable. For every game designed in their toolboxes, mechanics now had the option to publish their games into the Game Alley, a public website within the Gamestar Mechanic community where any other mechanics logged into the game can play published games. In the Game Alley, each public game has an associated commentary and discussion forum, where players can leave feedback and critique for its author, as discussed at the beginning of this chapter (see Table 3-3).

The beta version of the game implemented a rating system for each game. Players can rate games from one to five stars, with five being the best rating. Those games with the best ratings are now featured more prominently in the game alley page, and their authors featured as exemplary mechanics, giving an incentive for more advanced players, and those whose preference is to make new games versus completing jobs, to keep producing games.

*Beta Phase Settings, Participants and Documentation Methods:*

The beta phase of Gamestar Mechanic design research began in the Spring of 2008. Groups of twelve children participated in each of the two workshops that took place during the period between January and July 2008, recruited using the same methods and with the same composition than the alpha phase (middle school ages, diverse ethnicities, approximately equally divided in gender, and belonging to the game's target groups).

In addition, the release of the Gamestar Mechanic beta in a website format allowed for the workshop participants to interact with a community that went well beyond the boundaries of their local group. To provide incentives for advanced players and stimulate a community of mechanics with a variety of levels of experience, I recruited five professional game designers both from Gamelab and external companies to become players who would interact with students through the game discussions. Hence, players of all levels of experience had the added incentive of receiving social recognition for good designs in addition to the rewards provided by the factory jobs.

I documented the workshop using the same methods as the alpha phase, with the key exception being that the data sources now included the text-based discussions between players associated to game alley games, and the interactive design interviews also documented the designs of the participating professional designers, to provide points of comparison for the pre and post workshop design language and literacy practices of children.

*Phase Findings:* With the introduction of richer storyline and the community tools in the game, the workshops now placed a stronger emphasis on the role of social exchange in game design. With this shift, there was also a shift in the discourse of players and the ways in which they used design patterns not only to think about their games, but also to communicate through them.

This move in pattern use from a representational to a communicational function translated into a more extensive use of written language on the part of players, as the game labels gained new importance as ways to convey core game aspects to player, and comment on other's games became a more common activity for players (see Figure 3-8).

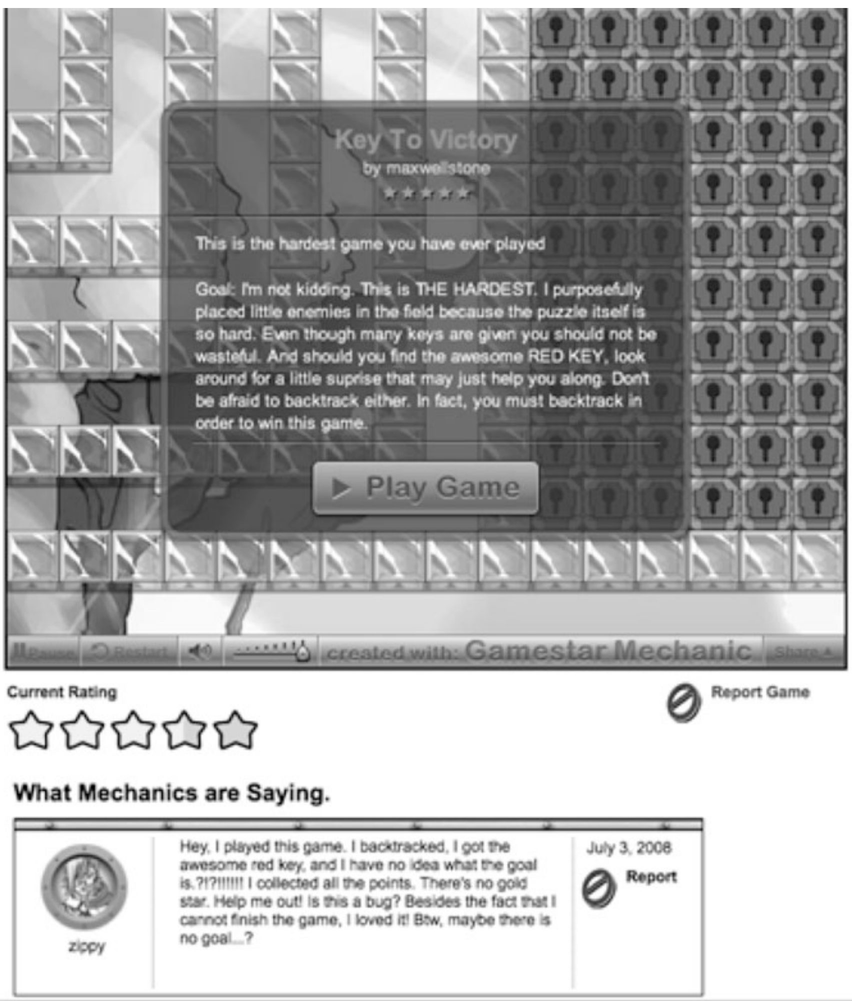



Figure 3-8. Discussion forum for a mechanic's published game

With this increase in discussions with real players, not only were designers' hypotheses and mental models of player interactions tested, but they were also shaped into new and refined forms. A particularly powerful strategy to negotiate and refine game ideas in these discussions was through the use of widely spread design patterns with proven cultural value, a strategy well documented in the learning sciences and also widely used in the Discourses of academia and science (Wertsch, 1993).

The left column on Table 3-12 presents a sequence of three screenshots that illustrate this point, representing three stages of refinement of a published game design by village29, a player in the beta version of Gamestar Mechanic. The right column presents a comment left by different players after experiencing each version, and which led to the designer making the changes that produced the next version. The game, titled Mech-Pacman, began with the author attempting to replicate with Gamestar Mechanic creatures, the type of interaction that a player would experience in Pac-man, one of the best known game titles of all time (Pac-Man, 2009), a screenshot of which is presented for reference in Figure 3-9.

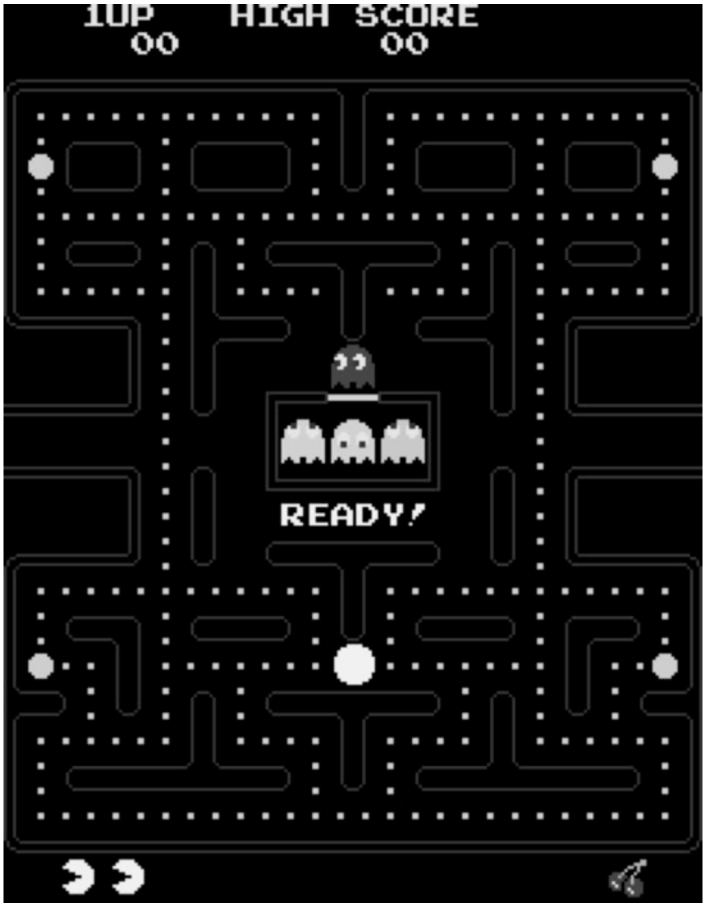



Figure 3-9. A screenshot of the original pac-man game

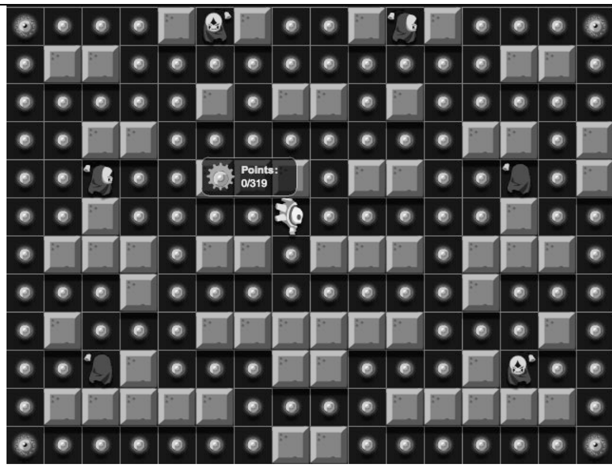
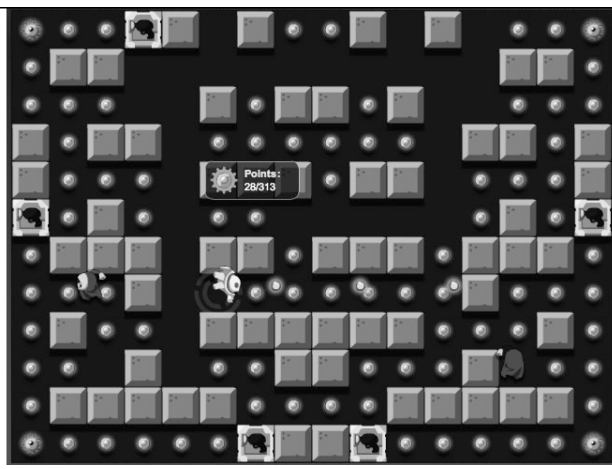
| | |
|---|---|
|   (a.1) | Commenter 1: I love this game! But it's too hard, now if you add some blasters it would be like pac-man eating those monster dudes. (a.2) |
|   (b.1) | Commenter 2: That made the game much better! Now give the guns a time limit and it will be just like pac-man! (b.2) |

Table 3-12. Three stages of Mech-pacman's design.

Using the game Pac-man in the game title, immediately evokes on potential players not only the look of the game, but the actual experience of playing it (Games, 2008), the designer attempted to fulfil this expectation was complemented in screenshot (a.1) by (1) organizing the play space in a maze similar to pac-man's using concrete blocks, (2) using coin characters to replicate the pac-dots that pac-man would collect, (3) placing a scout creature that can be controlled by the player in the middle of the level, (4) ghosts to prevent the scout from collecting the coins and kill the scout on touch, and (5) a score creature to indicate the number of points collected, which also presents a win message when all coins are collected.

Comment (a.2) is interesting, because it is the result of a critical examination of this initial game version as compared to the original Pac-man. The commenter notices that even though the mechanics are reminiscent of the original, a key mechanic is missing from the game that could bring it closer to the original pac-man experience using the creature lexicon available in Gamestar Mechanic. In Pac-man, a player can not only eat pac-dots and earn score, but there are larger dots that when eaten, give pac-man the ability to eat the ghosts confronting him as well. The player's suggestion of the gun creature is intended to reproduce a similar mechanic in Mech-Pacman, since it gives the scout avatar the ability to shoot bullets and destroy the ghosts when collected. This sort of suggestion not only challenged the original hypothesis of player interaction articulated by village29, but also shaped a new one as the second version of the game in screenshot (b.1) shows, where gun characters were placed in the four corners of the level, as in Pac-man's design.

While this change approximated the experience in the original, an important component was missing in this new mechanic. In Pac-man, when a large pac-dot is collected, the ability to eat ghosts is temporary, while in the (b.1) game the ability to shoot became permanent once a gun was collected, making the game too easy to play.  The player leaving comment (b.2) identifies this problem, and makes the suggestion that the ability to shoot time-limited, which the designer implemented by configuring the gun character's behaviour using the panel in Figure 3-10 below, bringing the interaction much closer to the sophistication village29's title intended to convey in the first place.

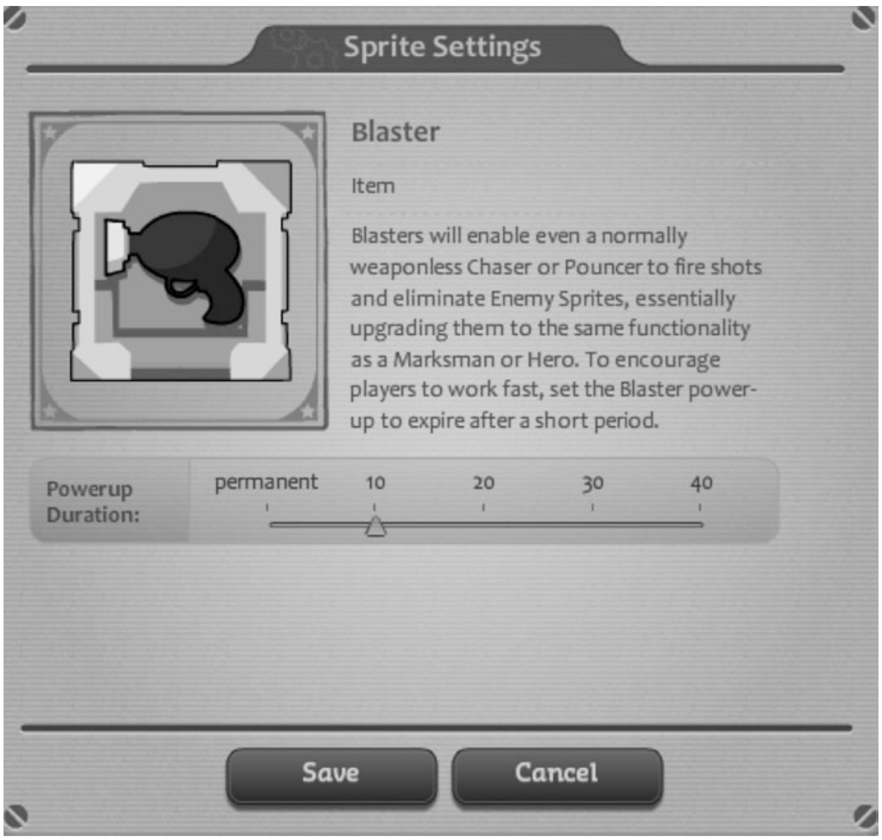


Figure 3-10. The blaster character behavior configuration panel

This example shows how in the Discourse of games and game design, the pragmatic value of the language of games is represented in design patterns regarded as "good games" can play an important a role in moderating a dialog between designers and players which leads to "smarter" design communities, just as "good ideas" or "good experiments" refined though peer review and public scrutiny can do so in activities such as science.  By sharing a common model representing a shared experience, the pragmatics of the language of games allowed all the participants in this interaction to distribute cognition of the model represented in the game (Hutchins, 1995). This distribution allowed specific participants to concentrate on the details of specific aspects of the model, while relying on others to concentrate on other aspects, and through communication create a product that is more than the sum of its parts.

*Phase Implications for Redesign:* As in the previous iterations, the observations in this one explicitly show the importance that dialogic interactions play in shaping Gamestar Mechanic's players understanding not only of their games and game design, but also of those other important actors in the process of play: the players. While learning the semantics of the language of games in the alpha cycle helped players develop sophisticated mental representations of their games in function of an ideal player, the interactions with real players facilitated by the community model allowed for mechanisms to enrich and refine these models and beliefs through direct feedback. As such, these interactions helped players become familiar with the pragmatics of the language of games, through a dialog with players mediated through their productions. Hence a theoretical model for guiding the learning theory behind Gamestar Mechanic, as well as its redesign, should take into consideration this important interaction (see Figure 3-11).

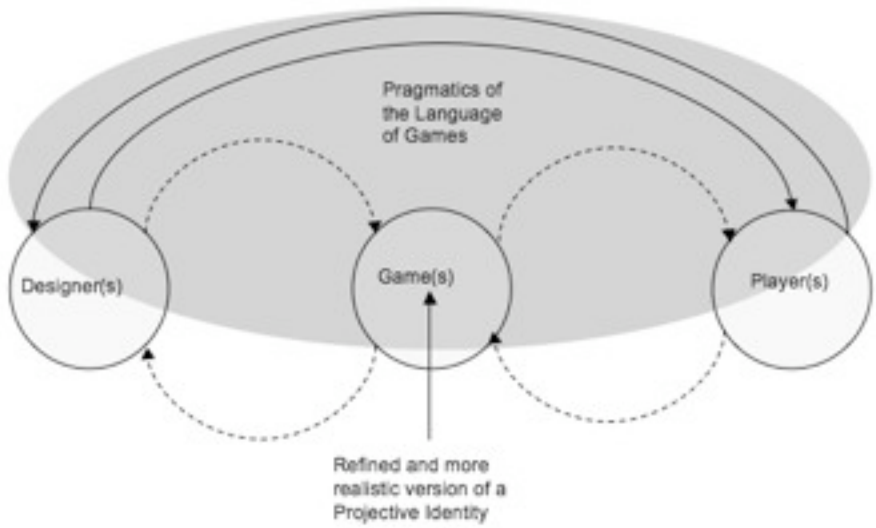



Figure 3-11. The Real Player Dialog of the Language of Games

During this phase, two important observations suggest areas of concern and opportunity that future refinement of the game and its learning environment should take into consideration. First, while the storyline of the game suggests virtual identities to mechanics that are associated to specific systems for critical analysis of games, the game alley in no way ties these systems to the public games produced. Hence, most of the discussions, even when critical, are guided by emergent value systems that give no advantage to players who stay within the value systems of their schools. For novice players, this value system could prove a valuable framework to enter a critical thinking about their games that the community cold benefit from if the game alley were more tightly linked to the narrative.

Second, the new communication modes made available by the community model, gave way for numerous opportunities for players to introduce content outside of game design into their discussions, this shows promise for transforming Gamestar Mechanic into a framework for flexibly adaptive instructional design (Schwartz, Lin, Brophy & Bransford, 1999), a term that refers to a framework that allows for academic concepts to be presented in effective ways in different contexts. As some of the following chapters discuss, the flexible nature of the toolbox makes it possible for players to design jobs for others, jobs that could specify requirements involving valuable representations and understandings in other learning fields. Future versions of the game-based learning environment could include such jobs, allowing the language of games provided in the game to adopt concepts that would give it more communicational power.

### *Conclusion*

The purpose of this chapter was to document at the overall project level the evolution of the game-based learning environment and its learning theory over the last three years, as well as to demonstrate the way in which Gamestar Mechanic may help students develop core communication skills regarded as necessary for learners in the 21st century, by helping them develop communicational competence with the specialist language of games and game design.

The findings shown here represent those general trends that emerged from an analysis (and in later phases re-analysis) of data across the different phases of the project, regarding those aspects of the game designer Discourse that players appropriated as a result of playing the game. These findings suggest that through games made in Gamestar Mechanic, players can learn to think about and with complex systems, by learning the grammatical relationships between creatures through the solution of design problems. Using these systems as tools to think with, players can learn not only to analyze designs articulated by others, but also to articulate their own versions of problems and solutions, a skill deemed fundamental to participating in the joint effort to address today's complex issues (Partnership for $21^{st}$ Century Skills, 2002).

They also suggest that through the construction of patterns of creatures, players can express increasingly complex ideas, and understand these systems as a function of interactions with other people developing a sense of "audience" as an active participant in the meaning-making process of design, that is fundamental in activities such as academic writing (Bereiter and Scardamalia, 1987), and other forms of professional communication.

The findings also show how the community features of Gamestar Mechanic can place players in the sort of active, critical roles necessitated by most knowledge communities and so seldom taught in schools today (Gee, 2004). Using the systems they construct as communicational tools, students can finally recruit aspects of their previous experience formerly considered as trivial, in authentic activities of peer review, knowledge negotiation and critique that resemble in many ways those enacted by scientists and academics in many "serious settings".

Perhaps more importantly, these findings echo Gee's (2003) notion that the sort of learning practices taking place in out of school contexts are now more in tune with the needs of work and life in the $21^{st}$ century than those practiced in most schools today. Nevertheless, the extensive use of traditional literacy within Gamestar Mechanic also shows that the sort of knowledge being constructed in game design still necessitates basic skills such as reading and writing, currently emphasized in schools. With this in mind, a starting a conversation between the Discourses of learning activities in and out of school might be the timely thing to do, as it could lead to beneficial outcomes to educators and learners alike.

# CHAPTER IV: THREE DIALOGS, A TEORETICAL AND METHODOLOGICAL FRAMEWORK TO STUDY 21st CENTURY LANGUAGE AND LITERACY IN GAMESTAR MECHANIC

## *Introduction*

This chapter builds upon the theoretical changes that took place with Gamestar Mechanic during three cycles of design research presented in Chapter III. It synthesizes these changes into a model for the analysis and assessment of language and literacy practices that occur during videogame design. The framework identifies three dialogs that occur during good game design and within good design in other new literacy contexts. I argue that these dialogs play a crucial role in learning grammatical, semantic and pragmatic aspects of the specialist language of games and game design that are fundamental to appropriating and enacting good language and literacy practices within their Discourse. Furthermore, I argue that analyzing learning environments based on the design of games and interactive media in terms of these dialogs may help us pinpoint crucial moments where interactions between learner and learning environment can lead to conceptual change and the appropriation of important meaning production practices.

I exemplify the framework applied the context of interactions that have taken place during the course of the *Gamestar Mechanic* project, an online role-playing game intended to teach middle school students 21st century language and literacy skills through instruction on key game design principles (Games & Squire, 2008; Salen, 2007). I use the three-dialog model – which emerged from two years of researching the design activities of children and professional designers in the context of the game – to examine the thinking, language and literacy learning of students during after-school game design workshops using Gamestar Mechanic. I examine three representative transcripts of language from interviews conducted with participants during game play and design, that exemplify each of the dialogs in action within Gamestar Mechanic, and discuss the implications of this analysis for instruction and assessment with game-based learning environments.

***About Gamestar Mechanic***

In *Gamestar Mechanic*, players take on the role of *"game mechanics"*, characters in a fantasy world called *the factory* where the economy, culture and lifestyle are fueled by well-functioning games. In the plot of the game, a catastrophe has taken place resulting in that the overall system upon which the world operates malfunctioning. Its once well made games have fallen into disrepair. Instead of energy, the factory's machines now produce huge amounts of steam, making life almost intolerable for its inhabitants.

To fix this situation, mechanics must complete a series of *jobs* -which involve playing, fixing, designing and sharing games – highlighting important aspects of game design that must be addressed, using tools and components provided by the game. To complete these jobs, mechanics must collect *sprites* (e.g. heroes and enemies). These are creatures pre-designed with specific capabilities and limitations they can enact in any given game, and that can be modified to make them behave in different ways. Sprites owned by a player are contained in the player's *toolbox* (see Figure 4-1), a web-based editor where sprites can be composed into new game designs or used to modify and repair dysfunctional games (Salen, 2007).

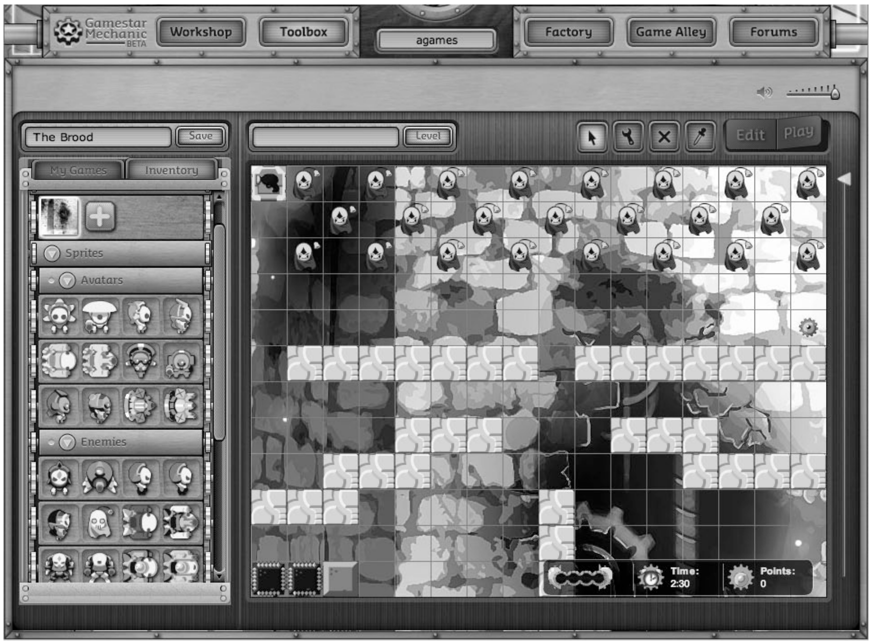



Figure 4-1. Completing a Job with the Gamestar Mechanic Toolbox.

The game's instructional framework borrows elements from constructionist approaches aimed at facilitating computing as a form of literacy (diSessa, 2002; Kafai, 2006; Resnick, 1994), as well as from learning-through-design interventions aimed at fostering learning through problem-based scenarios (Kolodner, et. al, 1996; Perkins, 1986). It diverges from them in that these approaches have commonly taken an "if you build it, they will come" view of the learner, with the instructional designer providing the tools and standards for design that learners should appropriate, in hope that they will appropriate skills like programming by accepting the goals or values designed into the tools (Hayes, and Games, 2008).

Gamestar Mechanic, by contrast, begins by considering computer game play as an activity socially valued by millions of people, that provides them with tools and skills necessary to design their own games by teaching what James Gee calls the *Discourse* of game design. By Discourse Gee (2005) refers to the ways of doing, talking, thinking and using tools that game designers enact in professional practice. Participants can then appropriate this Discourse in the context of a familiar game play activity, which Gee has argued fosters a safe space for self-expression and early learning success (Gee, 2003). More sophisticated and abstract practices like programming may be pursued once specific goals emerge from the players themselves.

To give the game this emphasis, design challenges within it are framed in the context of a *metagame,* defined by the overarching narrative and rule system that help define player characters' identities, goals, and paths of advancement and status within an online community of game mechanics. Players participate in the community by storing games in their *Workshop*, a website containing the mechanic's profile and a list of jobs completed, and any original games created. Second, each game produced can become a public artifact for display within another website called the *Game Alley*. Other mechanics can play any games for display in the alley, and have the opportunity to rate them and leave feedback in a discussion forum associated to them. Gamestar Mechanic can be thought of as an online role-playing game that features a careful balance of videogame elements with elements of social networking spaces like MySpace or Facebook, defining what Gee calls an *affinity space* (2004, p. 77) around game design.

### ***The Three-Dialog Model of Game Design Literacy***

*Theoretical Foundation of the Model*

To make sense of the language and literacy practices that occur as children participate in Gamestar Mechanic, and the ways in which they use them to enact a game designer Discourse, it was necessary to articulate an appropriate theoretical framework. Such a framework would be able to account for interactions between the game and the learner that could potentially lead to the production of meaningful artifacts in ways that would approximate those of authentic game designers. To this end I reviewed three main bodies of literature.

The first comprises existing works that articulate the thinking and meaning production practices of professional game designers (e.g. Salen & Zimmerman, 2003; 2006; Gee, 2003; Crawford, 1984; 2007, Rollins and Adams, 2003; Robison, 2006). This includes the literature on learning environments that rely on the design of games (Hayes and Games, 2008; Shaffer, 2006).

The second comprises an extended body of works on the so-called new literacies (Lankshear and Knobel, 2006) – a term that refers to literacy practices using forms of expression outside of the traditional printed word, with an emphasis on those forms mediated by computers – such as digital literacy (diSessa, 2002), and design literacy (New London Group, 1996).

Because game design shares so much with other domains of design, and given the relative youth of the research involving the literacy practices of game designers, I also included a third body of literature that articulates thinking and meaning production practices in other professional design domains (Alexander, Ishikawa, & Silverstein, 1977; Schon, 1983; Norman, 2002).

From this review three main theoretical approaches emerged as representing common themes addressed in the literature: namely, the notion of *Discourse* proposed by Gee (1996; 1999; 2005), Bakhtin's notion of *dialogism* (Bakhtin, 1976), and DiSessa's *three pillars of literacy* (P.6). In the following paragraphs I lay out the key ideas from each of these approaches, and then elaborate on how they blend into the framework itself.

According to the socio-cultural view of mind proposed by Gee (1992), learning and literacy can be conceived as the gradual appropriation of what he calls a big "D" Discourse (1996; 1999; 2005). This refers to constellations of practices that include ways of knowing, doing, being, talking and believing that define people as members of particular culturally defined groups and communities of practice (Lave, 1991; Lave & Wenger, 1991).

Language (verbal, nonverbal and symbol-mediated) plays a crucial role in understanding a Discourse, for through small "d" discourse - referring to specific instances of language-in-use - members of a community demarcate their identities to others, and situate the meaning of language, actions, objects, symbols, practices, and thus aim at constructing a situated reality through which others can understand their intended message. Game design literacy in this view, is learned and demonstrated as the gradual appropriation of practices (language and otherwise) recognized as authentic by game designers. The notion of Discourse also tells us something about *why* learners would appropriate or not certain practices, depending on the degree that they wish to be recognized as "legitimate" members of a community of game designers (Gee, 1996).

But meaning making through communication is never just an act of one-way demarcation. When we communicate with others they have as much of a role in the active interpretation of our language as we do. Hence, meaning emerges as the result of a dialogic negotiation between two or more parties (which can be people, designed objects or ideas, as I discuss below), a view of meaning that Bakhtin refers to as *dialogism* (Bakhtin, 1982). In this view, all meaning, and thus knowledge and identity, are socially constructed as a function of an interaction between self and other, aimed at reconciling situated meanings between two entities occupying simultaneous but different spaces (Holquist, 2002 P.21). Consciousness and knowledge emerge as a gradual awareness not only of self, but also of self-in-relation to other.

Language is the fundamental tool through which this negotiation takes place. In recent years, a similar argument has been made about the way knowledge is negotiated and transformed in knowledge communities such as science (Bereiter and Scardamalia, 2005), where the findings of specific studies must be brought to bear in the larger discourse of the members of the community to contribute to the advancement of its communal knowledge.

At first the idea of text as dialog might seem counterintuitive, since the notion of dialog commonly carries a connotation of greater immediacy. The highly interactive nature of the digital technologies that mediate textual communication today, however, have led many researchers to revisit this idea, given that many digital texts such as email messages, blog entries and text chat allow for immediate responses to them. Digital technologies have also allowed for more collaborative text structures to emerge (e.g. wikis) that require a constant dialog between their contributors as they attempt to articulate common messages.

The central role of these technologies in mediating the communications and meaning-production processes of today's knowledge communities, have led researchers to propose the notion of *dialogic literacy* (Bereiter and Scardamalia, 2005) as a necessary theoretical framework for the adequate research and instruction of 21$^{st}$ century literacies. Thinking of game design as a dialogic literacy serves an additional purpose. In telling us *how* meaning is constructed in literacy practices, it can help us identify those experiences and contexts within a learning environment that offer most promise in leading a learner to appropriate the practices germane to game design.

diSessa (2002) identifies three domains or *pillars of literacy* that provide some insight into these contexts. In his view, for any literacy to be considered as such its meaning production practices must occur in an interaction between elements of *the material*, *the cognitive and the social* domains (P. 6). The material pillar highlights those tools and artifacts and materials that can be used to create inscriptions that mediate meaning making in the practices of a specific literacy. Whether the paper, ink and words used in print literacy, or the screen, electrons and multimodal representations of computing literacy, this pillar highlights those sensory components that the literate person can use to interpret and produce meaningful inscriptions.

The cognitive pillar refers to the individual mental models that the literate person holds and uses during the acts of meaning interpretation and meaning production. These models are theories of the relationship between self and other, and their function is to help us predict the possible future outcomes of events and actions. These models can be more or less fluid, as they are maintained, revised and/or refined as take action and reflect on it.

The social pillar refers to those conventions that define socially accepted ways of articulating meanings – or in this case designs – in the context of the literacy practices of specific communities. Communication through language –in its broadest sense to include oral and written texts, as well as artifacts produced by specific design grammars- is the modus operandi in this pillar, and the role of dialog is more overt to its participants than in others. At this level, real people are involved in articulating and interpretating meaning, bringing their own intentions and experiences to bear in it (Holquist, 2002 p. 67).

diSessa's theory highlights one more aspect that is crucial to understanding game design as a form of literacy. The three pillars, present in all forms of literacy are independent of the forms that characterize meaning representation and interpretation in any specific literacy, be they computational, mathematical, musical or artistic representations. As such, they become identifiers –beacons of sorts- that can help guide our analysis and assessment of game design and other literacies, and identify those contexts within specific learning environments in which meaning making practices – and their learning- can be found.

*The framework explained*

The resulting framework is a synthesis of the key ideas of the theories described above, and identifies three specific dialogs that learners should gain awareness of and participate in during the game design process, as they become more literate in the Discourse of game design. I call these three specific interactions the *material dialog*, the *ideal player dialog* and the *real player dialog*, which correspond to interactions where players learn the design grammar, semantics and pragmatics germane to the specialist language of games and game design (Chapter III, this volume). In the following paragraphs I explain each one, in terms of its participants and its function towards the appropriation of a game design Discourse by learners.

Figure 4-2 presents a visual representation of these dialogs and their interrelationships. The small circles represent each of the actors in the game design activity, and the larger circles with arrows represent each dialog and how it influences others. Table 4-1, below, presents a summary of the actors, goals and 21st century literacy outcomes involved in each dialog. While the dialogs themselves are somewhat independent instances of meaning negotiation identifiable as specific sub activities of game design, their meanings permeate and influence each other. Games produced at the intersections of these dialogs would be more desirable, since this would mean that designers would be incorporating aspects of these crucial interactions into their design strategies and activities. Games produced at the intersection of the three dialogs would have a higher chance of being of good quality than those incorporating only two, and so on. As a consequence, the framework doesn't give hegemony to any one dialog. Rather, it is enactment of the system as a whole that leads to the production of good game designs.

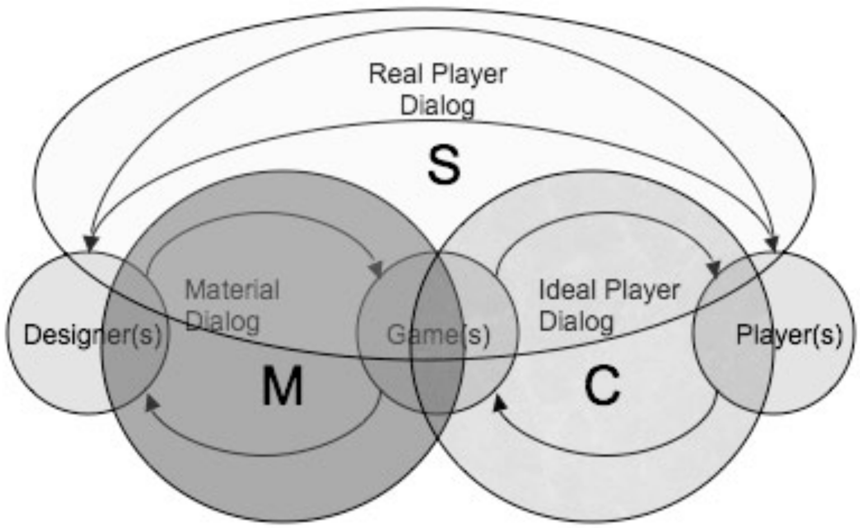



Figure 4-2. The three-dialog model of Game Design Literacy

| Dialog | Literacy Pillar Emphasis | Possible Dialog Actors beside the designer. | Dialog Goal for the Designer | Emergent Knowledge (Learning Outcomes) |
|---|---|---|---|---|
| Material | Material | Tools, Components, Symbol Systems & Representations . | To articulate a theory -a mental model- about the form and function of the game system, by confronting existing beliefs about the outcome of mixing tools and materials, with the actual outcome of mixing tools and materials. | Knowledge about game system form and function. Knowledge about material and tool affordances and limitations. Knowledge about the design grammar of the game. Knowledge of the importance of reflection in action. |
| Real Player | Social | Players, Designers, Critics, Users. | To reconcile the designer's belief about the identities and actions of an ideal player with the identities and actions denoted by real players in order to make the real player more like the ideal and vice versa. | Knowledge about the emergence of the virtual, real and projective identities. Knowledge about appreciative systems Knowledge about real uses and ways of playing. |
| Ideal Player | Cognitive | Designers, Game System & Subsystems. | To articulate a theory -a mental model - of the real , virtual and projective identities and actions of an ideal player that is closer to those of a real player. | Knowledge about game system behavior and possible player interaction results. Intuitive Knowledge about appreciative systems. Knowledge of the importance of reflection-on action. |

Table 4-1. A Summary of the three-dialog framework

*The Material Dialog:* Among the different texts that could emerge from a digital literacy, games are undoubtedly among the most complex. To make a modern videogame, a designer (commonly a *group* of designers) must negotiate the meaning making process involved by using a variety of material components. By "material" I mean any element that can be perceived by any the senses. These components include media (e.g. images, video, animation and text), information sources (databases, data files), and tools (game engines, programming languages).

Within videogame design literacy all of these components belong within diSessa's material domain. They are perceptual means through which meaning can be articulated in games. Through direct interaction with them in the *material dialog* designers can have multiple opportunities to refine their knowledge about these components. But is this interaction with the materials really a dialogic one? Several ideas emerging from the learning sciences and from research on design suggest that it is. Numerous researchers have used the notion of affordances (Gibson, 1977; Norman, 2002; Pea, 1997) to denote the ways in which a designer can "download" intelligence into an artifact that communicates to a user his/her mental model of the possible actions that could be taken on the artifact. Shaffer and Clinton (2006) extend this idea by arguing that the use of artifacts isn't just a matter of simple "transmission" of the designer's mental model through the artifact. Rather it is an active negotiation of the meaning that the designer intended for the artifact to convey and the actual interpretation of these meanings by the user. Consequently, the tools that a designer would use to put a game together will most probably have been designed by someone else, and thus carry with them the "voice" of the previous designer: a notion Bakhtin clearly articulates for text when he says that all texts are subject to *heterglossia*. This denotes the multiple voices at play within any meaningful communication (Bakhtin, 1982 P. 263).

Scholars of professional design activity have also come to see the usefulness of viewing design as dialog. Donald Schön, for example, argues that professionals engage in design as a process of *reflective conversation* (Schön, 1982). This is a complex process where "there are more variables-kinds of possible moves, norms, and interrelationships between these- that can be represented in a finite model. Because of this complexity the designer's moves tend, happily or unhappily, to produce consequences other than those intended. When this happens, the designer may take account of the unintended changes he has made in the situation by forming new appreciations and understandings and by making new moves. He shapes the situation, in accordance with his initial appreciation of it, the situation "talks-back," and he responds to the situation's talk-back" (P.79).

Schön's description is insightful in that it highlights details about the dialog that might occur between designer and design during the design of good games. By engaging the material dialog, the designer develops a gradual awareness of the relationship between him/her *self* and the *game, by* a process of experimentation with the different components that constitute a specific design. In his view such awareness emerges from the *iterative revision* of one's own beliefs about two important aspects of any given game, its *form* and its *function* (diSessa, 2002: 125). Interestingly, these elements play important roles in contemporary theories and methods of print literacy assessment (Clay, 1993; Goodman, 1987).

*The Ideal Player Dialog:* In his discussion of the learning that takes place when learners play well-designed videogames, Gee (2003) argues that these interactions lead players to negotiate three identities that require them to think critically and problem-solve to move forward in the game (P. 59). He calls these identities *virtual, real, and projective*. They refer to the identity proposed by the game for the player to adopt while in play, the identity the player actually adopts during play, and an emergent hybrid identity that results from the player infusing the virtual identity with aspects of his/her own. During game play, the emergence of the projective identity is crucial because in the degree that a player can reconcile it from the other two is the degree that he/she will be able to make sense and take action within the virtual world of the game, and engage in the learning experiences it could offer.

By contrast, during game design the objective for the designer is to infuse the game with those elements that will articulate the virtual identity to the player in a way that will facilitate the emergence of the hybrid identity. Given that in most instances of game play the designer will never be physically present, the pragmatic choice is for designers to engage in a dialog with the game. During this dialog, the negotiation of meaning takes place between the designer's idealized version of the player (enacted by the designer) and the virtual identity initially proposed in the design. The goal of this dialog then is to gradually refine the designer's mental model of what the hybrid identity would look like during player-game interaction, so that it approximates what this identity would be in a real interaction between a real player and the game. As designers become more literate, this dialog involves metacognitive considerations, since the player learns to reflect on previously taken action (Schön, 1983) and thus becomes aware of what he knew and didn't before, and what he knows after the design. The designer's strategy is guided by a view of the game as system (or subsystem), instead of a view of individual component relationships that guides the material dialog.

Designers commonly engage in this dialog by playing their own games, but it its also possible for them to articulate it to others while explaining their design decisions relative to what the player “would do”. This implies that the designer’s participation in one dialog critically influences the outcome of the others. Developing a notion of who “the player” is, and what he/she would do in a given situation, requires the designer to reflect on previous interactions at a social level (to be discussed below). By engaging in this dialog the designer can articulate a gradually more sophisticated theory of *interactivity* in games, a theory that should look more and more like how real people would play the game (Crawford, 1984; Crawford, 2003).

*The Real Player Dialog:* None of the previous dialogs would lead to the design of good games unless they had as their central goal the production of games considered “good” by real players. In addition to being aware of the nuances of the material and ideal player dialogs, the good designer must also gradually become aware of an emerging meta-dialog, a conversation between him/herself and the community of people who will actually play the game either directly or mediated by the game design itself. I call this the *real player* dialog.

For good game designers, the activity of play testing embodies this dialog at its most authentic level (Salen and Zimmerman, 2003). Its purpose is for real people to play the game and provide direct feedback from the experience, to help reconcile the designers’ beliefs about the emergence of the projective identity with how it emerges during real instances of play. In many modern commercial games, this dialog is mediated by a series of mechanisms such as support forums, blogs and discussion boards. These let the players directly express their interpretation of the game to the designer and the overall design community (Steinkuehler, 2005).

The awareness about audience that emerges from this dialog is a crucial differentiating factor between traditional literacy and 21st century literacies like game design. To date the text production practices of academia and the professions have emphasized a view of audience that conceives the hypothetical "reader" as identical to the "writer" (Gee, 2004, P. 91). In other words, the way that literacy is taught to this day in most schools emphasizes a view of literacy practice that limits itself to the equivalents of the first two dialogs, making them look almost monologic.

A further reason the designer-player dialog is important goes beyond the fact that designer and player both refine their knowledge about the specific instance of design. Rather, its purpose is for the designer to participate in the broader discussion about what a "good game" is that is taking place for game designers, players and other members of the community, and in doing so contribute to the advancement and transformation of the communal understanding in this regard (Bereiter and Scardamalia, 2005; Gee, 2004). One of the ways in which this takes place is by helping designers and community negotiate an *appreciative system* (Gee, 2003 P. 96) for good games. The notion of appreciative system is a powerful one, for it encapsulates those design practices and products valued and accepted by the design community. At the same time, during this dialog core practices and elements of the game designer Discourse can be tested and learned by designers, allowing them to gradually master a *specialist language,* through which to articulate sophisticated meanings germane to game design (Gee, 2003: 104) and contribute to its evolution.

### ***Documenting The Three Dialogs at Play within Gamestar Mechanic:***

*Methods*

A core goal of Gamestar Mechanic since its inception has been to facilitate research into the language and literacy practices of middle-school players of the game. Accordingly, the first two years of research involving prototypes and early versions of the game aimed to test it in a variety of learning contexts. To achieve this goal, the Gamestar Mechanic research team and I decided to use a Design Research approach (Brown, 1992; Collins, Joseph, and Bielaczyc, 2004; Barab and Squire, 2004). In this form of research, a theoretically based educational intervention is tested in a series of iterations within authentic learning settings. During each cycle, an initial set of questions about the intervention is posed and empirically tested *in-situ* within an authentic educational implementation. The findings of each cycle are then used to refine both the theoretical model, and the intervention itself during subsequent iterations. The research that informs the theoretical framework reported here draws on two years of work with several versions of Gamestar Mechanic, implemented as after-school game design workshops for middle-school children in the Madison, Wisconsin area. To date six different implementations of the workshop have been conducted. More than 60 middle school students have played the game in a variety of formats, ranging from two-day structured intensive design workshops, to twelve week loosely structured after school implementations. On average, implementations required participants to engage in 15 to 30 hours of play.

<u>Design Interviews:</u> Given the wide range of activities that players can enact in the context of Gamestar Mechanic, providing adequate methods for documenting the players' game design

literacy practices posed a complex challenge. To tackle this complexity while at the same time producing useful data for analysis, I relied on a system of documentation with specific methods to assess both individual and social interactions with the game.

This methodology began with a background semi-structured interview (Stake, 1995) of the participant's existing notions of videogames and videogame design conducted before players begin to design. The interview includes questions such as "how would you recognize something as a game if you saw it?" and "what steps would you take if you had to make a new game for others?"

The second step consisted of a set of semi-structured think aloud interviews video recorded in parallel with a screencast (a digital video) of the players' design processes in the computer screen, as interacted with Gamestar Mechanic. Questions in this interview are deliberately open-ended. The goal of the interview isn't to assess the players' cognitive processes as in traditional think aloud methods (Ericsson and Simon, 1993) but to get the participants to articulate in depth their own meaning making processes at a meta-level as they play the game. To this and the interview nonetheless shares with traditional think aloud the practice of asking questions like "why did you decide to use that component?" or "why did you make that change?" as frequently as possible, especially when a significant change has occurred or when a player becomes quiet.

This think aloud format can be conducted both on a one-to-one basis between the researcher and an individual participant, and during interactions with other players online, or during public presentations to other participants in the design workshops. The resulting data is an hour-long digital video documenting the meaning making and interpretation activities of participants as they play different parts of the game either alone or interacting with others during the workshops (see figure 4-3). This video is then processed for analysis using Transana (Woods, 2003) qualitative video analysis software. In Transana, the video is then be divided into episodes (clips), which can be associated to transcripts and then coded for further analysis.

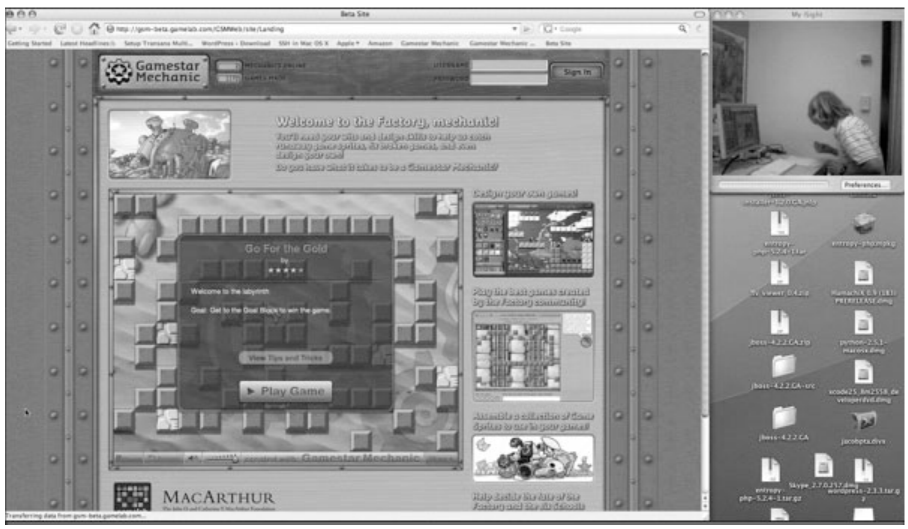



Figure 4-3. Documenting a design interview.

I complemented the interviews using various ethnographic methods such as participant observation, field notes, and video recordings of participant activities during the workshops, to form a narrative of the context for the transcripts. Because Gamestar Mechanic is a server-based game, a permanent record of every game designed by participants is stored and can be reexamined at any time by researchers, along with any texts created by the player in this context.

<u>Data Analysis:</u> The resulting documentation places primacy on the role of language used in context to provide a rich description of players' in-game activities. For this reason, analysis of the videos and their associated transcripts is done using a Discourse Analysis methodology (Gee, 1996; 1999; 2005) that focuses on the situated meaning making practices that people enact through language used in context to produce a description of what people are "doing" with it. The method relies on seven building tasks of language, seven categories of utterances that Gee argues people use to situate the meanings of identities, activities, tools, and institutions, hence constructing an immediate reality for others, as analytical tools to code individual samples of language.

These tasks are (1) *significance*, using language to make certain things more relevant than others, (2) *activities*, using language to get recognized as engaging in a certain activity, 3) *identities*, using language to get categorized as enacting a certain role or identity, 4) *relationships*, using language to signal a sort of relationship between two people, 5) *politics*, using language to convey a perspective on the distribution of social goods, 6) *connections*, using language to highlight the relationships between two incidents or concepts, and 7) *sign systems,* privileging certain ways of communicating through symbols over others.

Discourse analysis does not have as its goal to prescribe a specific approach to the "correct" analysis of a specific language sample, but rather, it expects that tools such as the seven building tasks will be used, transformed and adapted by the researcher according to the type of analysis at hand (P. 6). The Three Dialog Framework is such an adaptation. Based on Discourse theory, just like Discourse analysis, it does so by focusing the analytical tools on the specific language that happens during interactions between people, tools and contexts fundamental to effective game design that have emerged over the three years of research in Gamestar Mechanic. Hence, while in samples that take place in the material dialog tasks such as significance, connections and sign systems might figure more prominently for their explanatory strength, in real player dialog samples, relationships and politics might take precedence instead.

Moreover, the three dialogs extend the traditional language base that Discourse Analysis has been used with to include the multimodal representations of the language of games. Hence, while I have used the seven building tasks within the dialogs to code the verbal components of one interaction, I have used them in others to examine the visual components of the same, or the relationships between both modes.

***Results***

The following are two Discourse analyses of language sample data collected by a researcher during the 2007-2008 Gamestar Mechanic workshops. While the framework comprises three dialogs, for reasons of space I have decided to present only two data samples that, while highlighting the material and real player dialogs, also make it evident how the ideal player dialog influences game design over time. As the analysis shows, in both of these dialogs it is possible to see utterances articulating the designer's ideal player dialog, and their influence on the learner's participation in the other two, as well as on their outcomes. By this means it is possible to provide the reader with a sense of how this dialog plays out during design, even though no sample is specifically dedicated to it.

The participants in these samples were, for the material dialog, a middle school Caucasian male, and for the player dialog three middle school females of Middle-eastern and African-american ethnicities. All are from low socioeconomic backgrounds in the Madison, Wisconsin area. I use the pseudonyms Marc, Miriam, Ashante and Lakeesha respectively to refer to these players. Each sample begins with a brief description of the specific context and game activities where it took place, followed by a transcript coded in Jeffersonian notation (Jefferson, 1984) of the specific dialog of interest. To complement the multimodal analysis and clarify some of the insights from the transcripts presented here, relevant screenshots from the video associated with each transcript accompany the analysis.

*The Material Dialog: Marc Interacts with the Gamestar Mechanic Toolbox to articulate a form and function for his game design*

This sample focuses on the Marc's participation in the material dialog as he worked toward completing a game design job in an early version of the Gamestar Mechanic toolbox (see figure 1). The goal of this job was for him to use a subset of the 22 *sprites* he had available in his palette and make a game out of them. The definition of "game" was deliberately left open-ended, for the purpose was to assess Marc's understanding of the meaning of this term. Table 4-2 presents a summary of the sprites he chose; their names, and their functionality once placed in the toolbox play area.

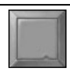
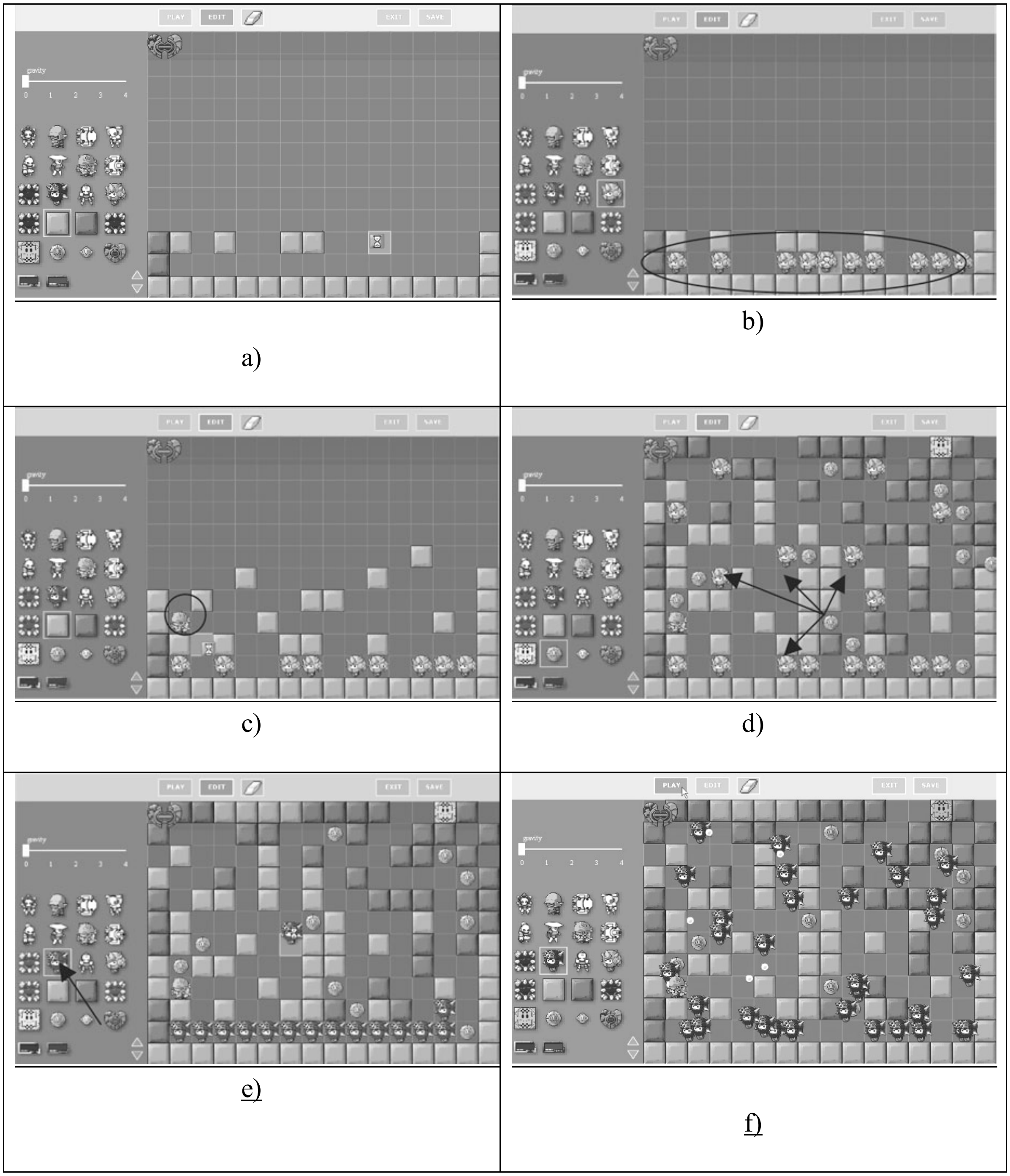
| Creature | Name | Description |
|---|---|---|
|  | Shooting Hero | This sprite is a character that the player can control directly during the game. It is designed to move fast and shoot bullets in four directions (up, down, left and right). |
|  | Goal Block | The goal block gives the player a win condition upon touch by a hero. |
|  | Concrete Block | Concrete blocks are static entities that serve to delimit the movement of other creatures in the game. |
|  | Strong Enemy | Slow but hardy and deadly, this enemy sprite is designed to move left and right. It cannot shoot, but it can deal a lot of damage to a hero upon touch, and withstand numerous shots before being destroyed. |
|  | Health Meter | This sprite tells the player the amount of "life" left in his avatar When a player avatar is damaged, a circle is removed; the avatar dies when the meter is empty. |
|  | Coin | This sprite is a static entity that gives the player 1 point when it is collected, it role is to serve as a reward. |

Table 4-2. Marc's sprite choices.

Marc's choice of sprites is interesting in the context of the framework, for it already begins to hint at the way that he is conceiving the notion of "a game", and how he believes it should be articulated with the design grammar of Gamestar Mechanic. If one agrees with the idea that some form of "intelligence" can be downloaded by a designer into a design in the form of "affordances" (the possible uses that a designed object can be put to), then Marc's selection of sprites shows how the affordances of sprites provided in the game enable him to articulate a nuanced understanding of the form and function aspects necessary to constitute a game (Gibson, 1977; Pea, 1997; Norman, 1995). This seems especially apparent in light of an influential view of an integral quality of the nature of games that Jenkins and Squire refer to as *contested spaces* (Jenkins & Squire, 2002). This metaphor explains the key design pattern present in most games, and defined by a state of affairs in which two or more competing forces vie for a shared space.

Marc's selection of sprites highlights his intention to establish relationships between sprites that he could use to construct such opposition, nd underscores his understanding of the affordances of the shooting hero, of enemies, and of the relationship between them, which in conjunction creates a play system where advancement is participation in a series of oppositional interactions towards a goal.

But how would we know whether Marc's choices were made following an intentional strategy or purely at random? The three-dialog framework becomes a useful tool to answer this question. Consider the following two documents acquired during Marc's interactive game design interview. Table 4-3 shows four screenshots displaying different versions of the game as Marc progressed with his design. Transcript 4-1 shows the dialog that took place between Marc and a researcher during this process coded in lines and stanzas in line with the format suggested by Gee (2005).



a) b) c) d) e) f)

Table 4-3. Six stages of Marc's design

(M= Marc's Utterance; R= Researcher's Utterance)
Stanza 1
R1: So why, why did you decide to make them that way? (Referring to the block characters on screen a)

M1: Well, since I'm gonna pick one bad, evil person
M2: I'll put like (.) as many as I want (places more blocks, and adds enemy creatures to design indicated at the bottom of screen b)
Stanza 2
M3: Like (.) the Hades, or something, like I play God of War
M4: Aand one of the levels that you're going
M5: that you're going (.) you're going to Hades and
M6: all the bad people, and all the creatures you killed…
R2: are in there? Are in Hades?
M7: Yeah. And we have a little (.) the shooter (places the shooter character indicated in screen c)
Stanza 3:
M8: Then it just becomes a puzzle
M9: Find your way out (referring to the goal block creature on the top right of all screens)
M10: As these characters are able to get out of there (referring to enemy characters in c)

Transcript 4-1. Marc Articulates His Theory of Game Form and Function

In the screenshots and the transcript, it is possible to see how Marc took advantage of both the material dialog and the ideal player dialog to articulate an intentional design strategy for his game. Having chosen creatures capable of creating a game based on opposition, he visually highlighted the relationship that exists between the enemy characters he placed at the bottom of screenshot b) and the overall space he defined for the game with the concrete blocks. However, the nature of this relationship does not become apparent until one examines his utterance in line M3. In this utterance, Marc was engaging in an activity that is analogous to academia's notion of citation. That is, he was using a previous work (the game God of War) to express the complex system of relationships that exist between the enemies and the space.

In particular, Marc referred to a specific section of God of War, the Hades level. In this level, the hero, who plays a Spartan warrior condemned to the underworld by the Greek gods. Must attempt to escape Hades by climbing from rock to rock towards an exit that will bring him back to the world of the living, all the while being attacked by foes attempting to bring him back down to his death. The role of enemies in his game, under the God of War pattern, should be to stop a hero character from climbing to the surface. Notice how in line M7 he completed the researcher's question with an assertion and by placing a shooting hero at the lower left corner of the level (screenshot c), he did so immediately after his articulation of the role of enemies (to stop the hero), and in doing so, represented a mental model that highlighted the oppositional relationship he believed to be important in the Hades. In doing this, he demonstrated the ability to examine a game as complex as God of War, not at a surface level, but at a structural one, defined by systemic interactions between components, precisely the kind of learning that can emerge from the material dialog.

However, Marc's discourse and design served more than a cognitive/representational function, they also served a communicative one. In particular, they denoted his intention for a hypothetical player to interact with his game in a similar way that he or she would with the Hades level. This hypothetical interaction, between his game and a player "like himself" (the ideal player dialog) was in fact the model guiding his design decisions, and showed how both dialogs interact at points during the design to guide an overall design strategy.

But why choose God of War instead of another game with similar mechanics to serve as a model for his design?  The answer can be found in the practices of many design professions. Whether we examine science or game design, a common practice through which to legitimize a work or a claim is to draw an analogy to a prominent work in the field. In the Gamestar Mechanic workshops, practices like these are a common trend I have observed as students become more comfortable with their knowledge of the grammar of game design. The design for *God of War* for the Playstation 2 is certainly within this category, having received numerous acclaims, awards and recognitions in the videogame industry. Here, one more time we can see Marc's ideal player dialog permeate the material one, with an assumption that whoever plays the game will value this design as well.

So far however, the transcript has only shown the Marc's contribution to the dialog, which would hardly make this a dialogic interaction. However, as the following transcript (4-2), which shows an immediate continuation of the first one shows, Gamestar Mechanic's design is such that it allows the game to respond to this contribution in a way that can foster powerful conceptual change.

(M= Marc's Utterance; R= Researcher's Utterance)
Stanza 1:
M1: Wanna see if it (.) works (presses the play button on the toolbox, game system begins to work).
M2: Not how I planned it
M3: I thought they were gonna move all over (points at some of the enemies, as indicated on screen d, who are just moving back and forth on a horizontal pattern in screenshot d)
R1: What do you think happened here?
M4: I think…
R2: What sprite would you trade those guys for I guess?
M5: I guess I'll trade them for the red characters (referring to the shooter enemy sprite indicated on screen e)
M6: so that I make it (.) a little more challenging
M7: But I'd have to put more, like times(.) times two since these go away so easily (referring to the shooter enemy sprite)
M8: So now I have to get rid of all these guys I just put (deletes all the old enemies and replaces them with shooter enemies)
M9: So, 16 (.) hmmm, 32, am I right?

M10: And now (presses play and the game begins, with the new enemies now shooing and moving all over the screen as shown in screen f)
M11: Oh my god! They're going so fast! And I'm not moving at all!

<u>Transcript 4-2. Gamestar Mechanic Responds with Feedback and Marc's Conception Changes</u>

This excerpt shows the second component of the dialog, in this case in the form of a response given by Gamestar Mechanic to the player, but it also shows how this dialog can lead players to important changes in their understanding of the systemic relations that conform the grammar of games and game design. This is evident in lines M1 and M2, where Marc articulated his experience of what professional design practice scholar Donald Schön calls receiving *talkback* from the design. Interactions like this are what makes Gamestar Mechanic a powerful tool to foster an interactive literacy.

For Schön, the talkback from Gamestar Mechaic is a powerful learning device that can lead the designer to reflect on the actions taken previously. In this way Gamestar Mechanic helps the players learn to engage in a series of processes of reflection-on-action, which provide them with opportunities to accomplish conceptual change. In line M3 Marc showed this reflection, by drawing a connection between his existing hypothesis of the form and function of the game model, and the actual observation he made in screenshot d). By drawing this comparison, Marc identified a problem with his system, as the behavior observed in the enemies did not confirm his mental model.

In the utterances exchanged in lines R2, M5 and M6 however, the researcher probed further for this conceptual change by asking what changes he would make to the behaviors of the characters he has identified as problematic, thus situating the game itself as a problem to be solved (line R2).

Marc interpreted the researcher's utterance in the same way, and proposed a solution in return (line M5), which entailed a replacement character that can move in many directions (Line M5, screenshot e), and justified the reason for his replacement as well (line M6). For this justification, he relies on a specialist design term, challenge. Here, once more the ideal player dialog plays a central role in guiding the material one, for Marc's utterance denoted an assumption that for a player to find the game good, it needed to be challenging.

This was an important appropriation of the Discourse of game design, for balancing the challenge in a game plays a prominent role in most professional and academic game design discussions (Salen and Zimmerman, 2003; 2006), and at the same time is a concept that is inherently systemic, becoming a tool to think with, around which Marc can organize his cognition about the game and set a design strategy. In this way, Gamestar Mechanic, like other well designed games, is a learning tool that provides players with opportunities to learn to use these tools to solve complex problems, by engaging in what Gee (2003) terms the *probe-hypothesize-reprobe-rethink* cycle (2003: 87), a practice analogous to the hypothesis testing cycle that is so central to scientific inquiry.

But this transcript does not by any means suggest that the language and literacy skills Marc was learning while he played Gamestar Mechanic would be limited to the field of games itself. Lines

M7, M8 and M9 provide evidence of how in his attempt to solve a design problem within the Discourse of game design, resulted in recruiting and practicing literacy practices that are valued in other discourses, particularly in traditionally academic disciplines. Line M8 is particularly interesting, because it shows him recruiting a mathematical calculation in his attempt to balance his game design. In this utterance, he brings up the connection between the number of enemies in the play area and the total amount of damage that an enemy can sustain from the player before being destroyed.

He relied on his knowledge of the grammar of game design to come to the conclusion that since the strong enemies he placed in the initial design could take double the damage than the ones he wanted to replace them for, balancing the challenge in his game to what it would have initially been would require the player to shoot enemies at least as many times in the second version. Hence, he proposed that duplicating the number of enemies (from 16 to 32, line M9) would balance the overall form and function of his game, in relation to the skill of the same hypothetical player.

A final insight from this transcript is that it shows the way the designers' knowledge is continuously refined so long as they participate in the dialog. In this case, the new dialogic interaction started by Marc with the materials of the game resulted in a new insight (line M7) that then translated into further changes to the game, and to conceptual changes on his part, as he approximated his mental model of the game closer to what could really be produced using the Gamestar Mechanic toolbox.

*The Real Player Dialog: Mita, Ashante and Lakeesha negotiate elements of the appreciative system of games during a game label discussion*

In Gamestar Mechanic, the types of jobs that learners have to tackle during play fall into three categories: playing games, repairing existing but broken games, and designing games from scratch. One of the requirements of the design jobs is that once they feel ready to design a public game for others to play in the game alley, they must complete a form called a *game label (*see Figure 4-4). This involves providing a description of their game, instructions, and tips and tricks on how the game should be played.

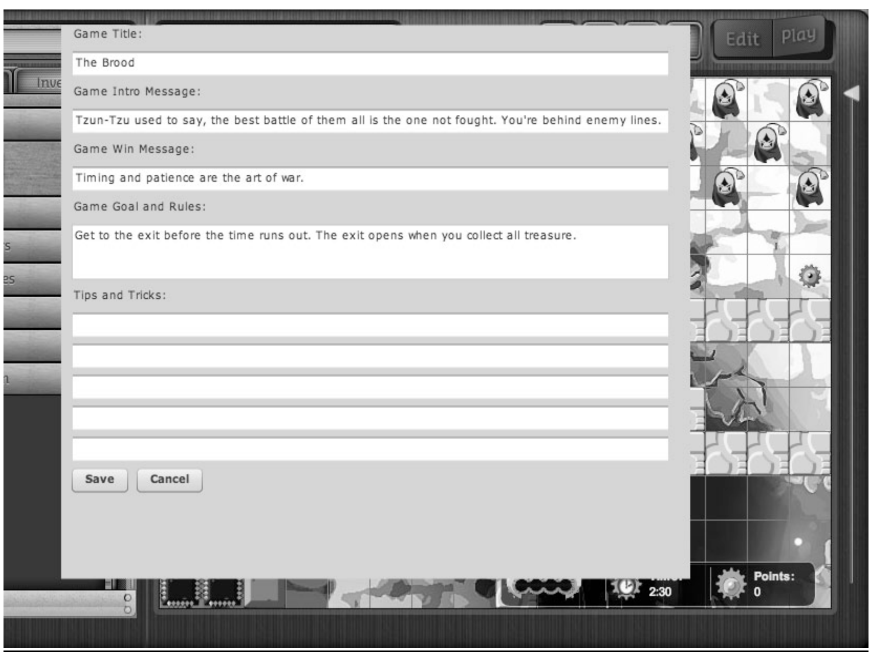



Figure 4-4. The Game Label and Game Comment Board

In this sample, the researcher conducted a public interactive interview with Mita, a participant in the Summer 2008 Gamestar Mechanic workshop, regarding the content that she was going to include in the label of a game she had just completed. To support her description of the game, she played through it as she responded to the researcher's questions. Transcript 4-3 shows how this sharing activity within Gamestar Mechanic facilitates the emergence of the real player dialog between Mita and two other participants, Ashante and Lakeesha, commenting on her game. Throughout the workshop the three girls had shown very competitive attitudes towards each other, often challenging each other's views on design. In this sample, Mita's presentation put her in a role where she had to negotiate her identity as a game designer by using the Discourse to effectively communicate and argue her design decisions to others as follows:

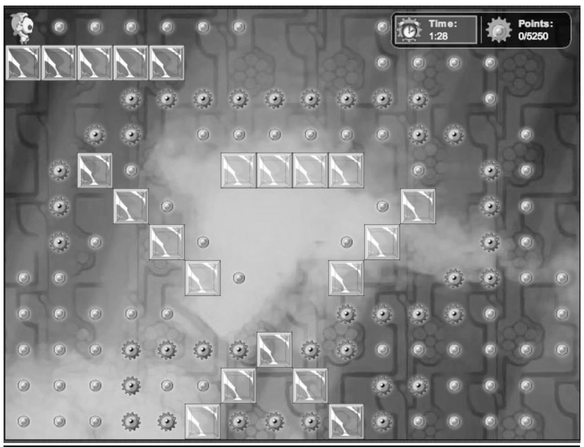
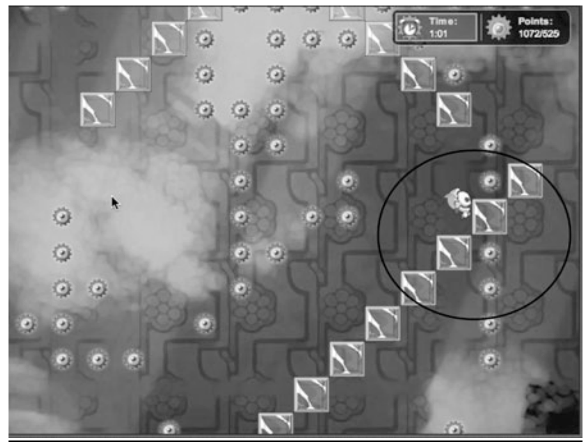
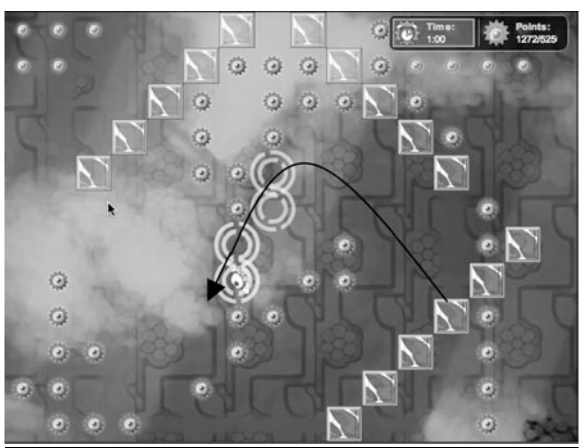
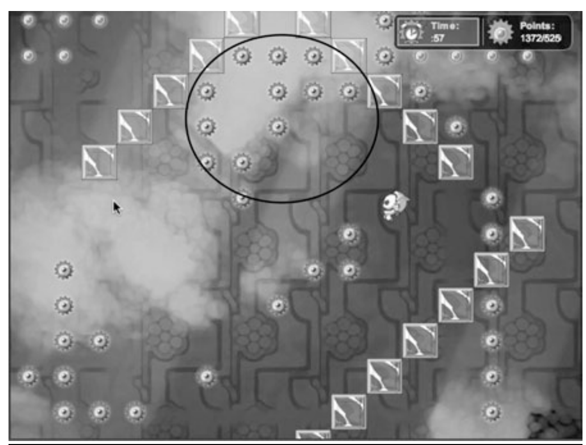
| | |
|---|---|
|  a) |  b) |
|  c) |  d) |

Table 4-4. Four screenshots of Mita's game during the label discussion

(M= Mita's Utterance; A=Ashante's Utterance; L=Lakeesha's Utterance; R= Researcher's)
R1: Ok, So what is this level about?
M1:You have to get, 5250 points

R2: So does that mean you have to collect all the coins? (referring to the circular sprites in screen 1a)=
M2: =No, just (.) the majority of them.
M3: It's impossible to get all the coins you don't (inaudible)
A1: No it ain't
M4: Yes it its=
A2:=No, last time I (inaudible)=
M5:=I've tried to get all the points=
M6:=You can't, because there's no way to get what you can't jump to.[
A3: Yes you can.]
L1:=Them points? I'm gonna jump get'em.
L2:=There jump off the top of that thing there (pointing at the top of a stair-like block structure indicated on screen 1b).
M7: I did.[ (makes the avatar jump for the coins , but can't reach them as it follows the trajectory indicated on screen 1c)
M8 You can't get those right there.

<u>Transcript 4-3. Mita, Ashante and Lakeesha discuss Mita's game</u>

The central purpose of the real world dialog is to help designers refine their theory of the player's identity and bring it closer to the actual identities enacted by players with the game. One way designers commonly organize their thoughts about the three identities is by thinking about the possible actions that the player-as-avatar can enact in a given game. Shigeru Miyamoto, CEO of Nintendo and considered by many the father of modern videogames, refers to these actions that the *verbs* that he organizes his game design activities around (Jenkins, 2005).

To know whether a certain set of actions will be interpreted and enacted in the expected way by the players, it is necessary for the designer to learn how to communicate the way they work in the game system as clearly as possible to them. Here again, the use of a specialist language can provide a powerful set of tools to articulate meaning. In this case it serves a distinctive communicative function whereby symbolic elements that are particular to games and define them as a semiotic domain can be used to share ideas, in the same way that the specialized language forms that define the domains of science and math can be used to share knowledge within them.

This section shows how articulating knowledge with the specialist language of games can be done using multimodal representations in very sophisticated ways. Game designer Raph Koster gives us some insight to how this happens his *theory of fun* (Koster, 2005), He argues that what attracts most players to games is the challenge they pose toward discovering the hidden "pattern" that lies behind their surface look. As several learning scientists have argued over the years, one capability that makes humans powerful learners is that we make sense of the world by organizing it into patterns (Gee, 2003; Pinker, 1999; Chi, 1978). The communicative power of a literacy lies in the degree to which its systemic components can help people produce such patterns to create conventions, share and build upon ideas, and ultimately advance their communal knowledge in increasingly sophisticated ways. These *design patterns* encapsulate complex ideas, problem solutions and aesthetic considerations in ways that permit their efficient dissemination.

As this dialog shows, the patterns that compose the specialist language of games involve ways of talking about games as well as the multimodal representations available within games. Images, sounds, movement, behaviors and their relationships all play crucial roles in defining the 'words' and 'sentences' of this language. Just as with verbal language they do so by providing a context for each other and through that context situate their meaning (Gee, 1996; 2003).

Kress and Van Leeuwen (1996) began to articulate some of these concepts for *static* images in what they called a *visual grammar* defined by their constitutive elements and their relative positions within the image. What this sample shows, however, is that the grammar of games goes beyond the visual and is instead *experiential*. This is partly because it incorporates a verbal or visual grammar (it also includes auditory and movement-based representations), but also because the meaningful patterns produced in it are as much a function of the design of the game as they are of the perception and *interaction* of the players with it. In other words, when players ‘read’ a game it is not just whether the game ‘looks’ like a certain pattern or ‘sounds’ like a certain pattern that reminds them of others, but also whether it ‘plays’ like that pattern.

In this dialog we see how Mita articulated an answer to the researcher’s question using this multimodal approach. First, in line M1 she verbally laid out the goal of the game, a specialist term that on its own encapsulates two things: a) the game win condition (collecing 5250 points), and b) some of the mechanics of the game (collecting points). Second, she complemented her articulation by presenting an example of her own game play to the public. By making this move she hoped to convey the *core mechanics* – a game design term referring to the main actions a player must enact to play (Salen, 2007) – of her game. In this case, a core mechanic of her game is that to collect the points one has to make the avatar jump from block to block.

What Mita hadn’t taken into account, however, is the fact that this design shares many common elements with widely disseminated game titles like the *Super Mario Bros.* series or the *Sonic the Hedgehog* series. Both have sold many millions of copies worldwide and use the core mechanic of jumping and collecting coins (the equivalent of the points in this game). In these games, however, the pattern generally implemented by designers is such that whenever there is a point (usually represented by a coin) present in the play area, it will be reachable, even when if it requires the player to use a non-intuitive or unconventional strategy to reach it. But in Mita's design the function of some coins is to distract the player from the real goal, which is to collect a number of them before a timer runs out (something she fails to mention to the others). This pattern is present in some games but they are not as widely disseminated.

Verbally Mita only expressed partially the key elements of this mechanic. She never mentioned that a timer was present, which would require the points to be collected before its expiration. Instead, she left this part to be "read" by others directly from the visual representations in the game. The result was a conflict with the interpretation that Ashante and Lakeesha were ascribing to the pattern they saw on screen (Lines A1, L1), which did not cohere with claim (Line M2).

Regarding Gamestar Mechanic's goal of fostering the appropriation of the Discourse of game designers (and an identity as game designers) by its players, Mita's contribution to the real player dialog in this claim illustrates how it mediated her game designer identity. Claiming an identity is only valid when one is recognized as such by others (Gee, 1996), and in stating that it is impossible to collect all the coins, Mita was implicitly laying a claim to authority as a game designer. This would require others to trust that what she was saying had a basis on knowledge of the design grammar of Gamestar Mechanic. Up to line M2 this wasn't the case. Hence, Ashante's challenge required Mita to figure out a way to either prove that her articulation of the game's goal indeed reflected the actual mechanics she wanted to articulate (and assert her identity as a game designer this way), or to reevaluate her understanding of the design.

Her first response strategy was to back up her claim verbally by an appeal to logic (line M6), trying to convey (unsuccessfully) that the avatar she chose for the game wasn't designed to jump as high as would be required for some points to be collected. This utterance also shows how using a single language mode (verbal articulation) could fall short of conveying her point. Consequently, her explanation wasn't sufficient to make the challengers revise their view. At this point Mita was assuming that what others were interpreting in the game was the same as what she had negotiated in her ideal player dialog (herself). This statement did, however, provide the opportunity for Lakeesha to contribute to the dialog in a way that revealed that her reading of the game was following the more popular pattern described above, as her suggestion for Mita to make the avatar jump for the coins from a sideways angle (screen b) indicates. This contribution became crucial to the dialog. It required Mita to revise the existing theory that emerged from her ideal player dialog regarding Lakeesha's interpretation of her game, and to find a different strategy to articulate her response such that the other two students would understand and accept it.

To this end, she took advantage of a powerful literacy practice in game design. This was to use the design grammar of Gamestar Mechanic itself to back her claim. She decided to use Lakeesha's request to demonstrate her point by making the avatar jump in the direction of the inverted v, showing that the parabola formed by this jump wasn't high enough to reach the coins underneath (screen c, line M7). With this move, she used the language of games in a way that would speak to the discourse of players, highlighting the common experience of play as evidence for her design argument (particularly regarding jumping in games), and successfully countering the challenge in a way analogous to how professionals in knowledge communities do so (Goodwin, 1994).

***Conclusion and Implications for Game Design-Based Research and Assessment:***

My aim has been to provide a useful framework for the analysis and assessment of what many consider an example of 21$^{st}$ century Literacies: namely, the type of literacy present in game design. As the framework shows, the core epistemology underlying expression and understanding through games is dialogic, for without interaction a game isn't a game. Producing good games requires that players not only think in terms of what they want to articulate, but rather in terms of self-and-other: in other words, in terms of the dynamic relationships that exists between designer, player and game. Gamestar Mechanic facilitates thinking in these terms by allowing players to engage in activities that require doing this for successful participation (playing, making and sharing games with others). As a consequence, it is possible to observe the ways in which their sophistication with the game designer Discourse evolves over time, even over very short periods, as in the case of Marc's material dialog. More importantly, analyzing the activities of players in the game makes it possible to see how good players must engage in the three dialogs simultaneously. They have taken into account the material, the social and the mental aspects integral to 21$^{st}$ century literacy practices.

The analysis makes it very clear that the process of becoming more literate (or more knowledgeable) in the Discourse of game design is a function of multiple cycles of iterative refinement of knowledge, as the continuous back-and-forth communication between the participants in each dialog shows. This iterative refinement is consistent with the observations done by other researchers using learning interventions based on design, such as the STAR LEGACY cycle (Schwartz, Lin, Brophy, & Bransford, 1999), which requires players to "test their mettle" in front of others, in a form similar to Mita's case, or the Learning by Design cycles (Kolodner et al, 1998), which require learners to test and revise hypotheses as they change their conception of a designed system, as in Marc's case.

Gamestar Mechanic extends these interventions by relying on a design grammar that acknowledges that players bring with them a variety of motivations and understandings that play a key role in the way conceptual change takes place. In Mita's case, she was unable at first to articulate fully why collecting all the coins was impossible. Nonetheless, she had what DiSessa calls an *intuitive knowledge* (2002: 66) of the interactions made possible by the way she had designed the avatar and space and components of her game. While this intuitive knowledge caused some communicative problems for Mita, it also provided an opportunity for her to revise her knowledge about the way other players would "read" her game. While indeed Gamestar Mechanic provides facilities that enable a community of game designers to emerge that allow such interactions to emerge, it is the fact that it allows it to happen in a dialogic form that makes this possible.

The common endeavor all these frameworks have in common is that one of their central goals is to promote innovative thinking that balances the rigorous standards of the knowledge professions, like engineering or science. Thus far the Discourse of game design promoted by Gamestar Mechanic seems to provide opportunities for players to think innovatively by solving problems of design. Whether this approach will yield more sophisticated knowledge than one where the standards are designed into the learning environment beforehand is beyond the scope of this paper. It is, however, an important issue to be addressed by further research.

The samples of Discourse presented here provide us with insights into practices germane to Gee's specialist language (2004) of game design. Observing how students interact with Gamestar Mechanic we can see such language as a method for organizing thinking practices, for interpreting the products of this literacy, and for communicating knowledge with others. These samples also show that communicating in sophisticated ways through the language of games involves much more than just verbal representations. In Gamestar Mechanic it involves recruiting a variety of modes of representation like the sprites, the structures built with them, and the types of play interactions that players will experience. At this point it remains unclear to what degree this "language" will benefit students' participation in other discourses, and further inquiry is needed here. Nonetheless, examples like Marc's use of *God of War* as a way to represent a complex systemic interaction evoke key practices in disciplines like math, where the ability to understand a concept through multiple representations (isomorphism) can be crucial for successful understanding.

What seems clear is that in appropriating this specialist language in the game, the students enacted moves that are very similar to those involved in scientific and professional discourses, where the ability to communicate using their conventions and values and accepted practices is absolutely integral to success.

Games are among the most complex productions that can emerge with the current tools available to 21st century Literacies. By articulating a framework to analyze games I have thereby provided a framework for analyzing the practices of those 21st century literacy productions that use subsets of the design grammar of games in their compositions, as well as for other literacy practices involving design. Hence, other interactive design activities of design, such as blogging or web page production, could benefit from such a framework. All that would be required to use the framework to research such contexts would be to change the identities of the actors participating in them.

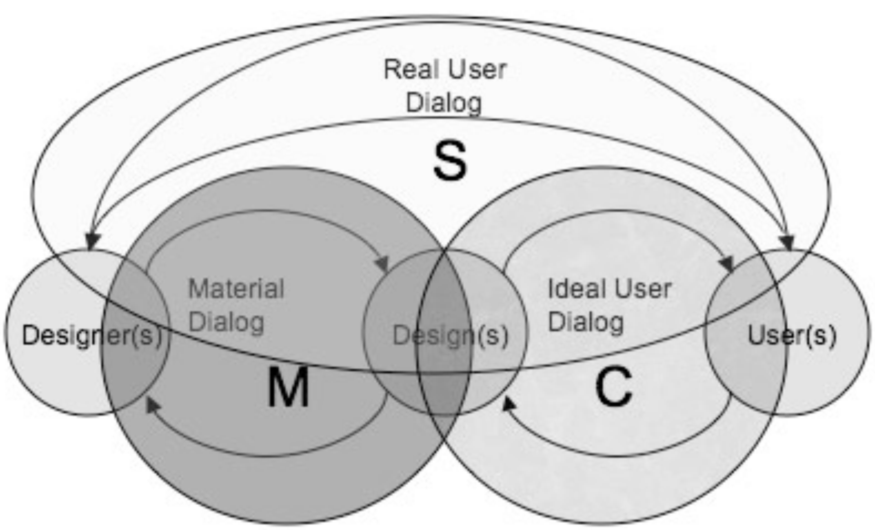



Figure 4-5. A general version of the three-dialog framework

Hence, any literacy activities based on design could be characterized this way by replacing the ideal player and the real player dialogs for an ideal user and real learner user dialog (see figure 4-5). Alternatively, in the case of classroom-based literacies these two dialogs could be replaced for the ideal learner and the real learner dialog, transforming the framework into a powerful analytic tool through which teachers can think about their lesson designs.

# CHAPTER V: BUG OR FEATURE? COMPLEX DESIGN PROBLEM SOLVING AND SYSTEMIC MEANING ARTICULATION THROUGH A MATERIAL DIALOG WITH GAMESTAR MECHANIC

## *Introduction*

This chapter presents a case study of middle school children in an after-school computer game design workshop constructed around Gamestar Mechanic, an online multiplayer game-based learning environment where they learn to appropriate the mindset, language and literacy practices of designers, through a built-in curriculum that teaches key principles of game design.

In it, I examine the role that players' adoption of the specialist language of games (Games, 2008) has had in facilitating changes in their strategies for addressing design problems, in the context of the sophisticated form of literacy constituted by computer games (Gee, 2003; Squire, 2008; Lankshear and Knobel, 2006). I begin by articulating the theoretical framework that guides the study, building upon contemporary socio-cultural perspectives of literacy and intelligence (Gee, 1992; Lave, 1988; Cole and Scribner, 1981). I discuss the notion of material dialog (Games, 2008), as a perspective that can help us situate the way problem solving and literacy interact in Gamestar Mechanic. I then present the study narrative, beginning with the context and methodology I used in order to document changes in the problem-solving strategies of children throughout the workshop. I present the analysis, concentrating on exemplary episodes of children addressing design problems in the context of play. Finally, I conclude with a discussion of the implications of the insights garnered from the study for future educational uses of Gamestar Mechanic.

*Complex Problem Solving and Setting Activity within the Discourse of Game Design*

Perspectives that conceive literacy as a problem-solving activity are not new. Prominent reading scholar Mary Clay, for example, defines reading as:

> "A message-getting, problem-solving activity that increases in power and flexibility the more it is practiced. .,.within the directional constraints of the printer's code, language and visual perception responses are directed by the reader in some integrated way to the problem of extracting meaning from cues in text, in sequence, so that the reader brings a maximum of understanding from the author's message" (Clay, 1991)

Indeed, both reading and writing are activities where the literate person must harness language in order to either interpret (read) or articulate (write) meaningful constructions. But language is never used in a vacuum, for in order to determine what the solution for the meaning-making problem is, people must be able to determine the context in which the message being constructed will function, as well as what the communicational intention should be. D/discourse theory (Gee, 2005) sees such language used in context (discourse) as the fundamental tool through which people solve meaning-making problems, by construing them in function of identities (Discourses) as members of specific communities.

But the language tools used by diverse Discourse communities to make meaning is not limited to the verbal meaning representations we call oral language or printed text. Indeed, recently a growing body of scholarly work has begun to acknowledge the view that representations within diverse fields such as mathematics and science (Lemke, 2004), computer software and game development (diSessa, 2002; Gee, 2003), and even graphic design (Kress and Van Leewen, 1996) constitute unique forms of literacy that while as sophisticated as print, are qualitatively different in the sorts of meanings they can convey.

The ability to effectively identify, analyze and develop a strategy to solve complex problems using this constellation of representations has and continues to be a core skill that most professional disciplines demand for their workers (Gee, Hull and Lankshear, 1996). Fundamental analytical tools such as mathematics, which today provide the cornerstones of most scientific, engineering and knowledge production disciplines, place a substantial emphasis on problem analysis and resolution in their practices.

But focusing only on solving pre-established problems is not enough, given that in the practice of most knowledge disciplines seldom do practitioners encounter well-defined problems, and is a limited view of literacy that fails to produce truly literate learners. Instead, for most practitioners, the process of successfully solving a problem in areas like engineering or science begins with the ability to articulate what the problem using the community's valued meaning representations is in the first place, by organizing complex, ill-defined and sometimes ambiguous information (Schon, 1983).

As we move into the 21st century, serious challenges characterized by complexity and ambiguity such as climate change and the global economic crisis, are likely to call for solutions requiring extensive public participation. This makes it evident that the need to provide larger segments of the population with effective problem setting and solving skills using representations across different fields of knowledge is indeed great.

In the last few decades, educational researchers have identified the design of computer games as a promising activity to develop sophisticated skills in areas characterized by complexity. I her seminal work with the Logo programming language, Kafai (1995) for example, designed a learning environment where children learned about mathematical fractions while designing computer games for their younger peers. Hayes and Games (2008) on other hand, provide an extensive review of a broad set of learning interventions involving game design, that over the years have been used to teach children concepts and practices involving articulating and solving problems in computer science, and physics, among other areas.

This interest appears justified when one considers the sophisticated skills involved in producing modern computer games. Among the artifacts that can be constructed using interactive media, games are certainly some of the most complex. And this is not only because games recruit components from different representation modes such as images, video and audio, but more importantly because in order to be games, these representations must be articulated within rule systems that are coherent and engaging to players (Robison, 2008).

To design quality computer games today, designers must be able to recruit knowledge from diverse fields including computer programming, systems design, and art. Games also present designers with challenges and problems where they must recruit complex knowledge from fields such as mathematics and statistics, whether it is with the purpose of including physics simulation into their games, or to calculate the outcomes of player actions with respect to complex rule systems. These problems involve thinking about games in terms of relationships between components, as well as of the processes that those relationships are involved in (e.g. stochastic vs. deterministic, algorithms vs. heuristics, open vs. closed loop cycles, see Salen and Zimmerman, 2003; 2006).

Good designers must also be able to effectively deal with the ambiguity of player perceptions when setting up game problems, puzzles or challenges for players, as the predictability of their responses to specific designs can involve many variables such as demographics, interests and so on. Thus, designers must give these variables careful consideration as they choose the representations through which they will communicate their ideas in game form.

With the growing interest in the so-called serious games, these problems have become even more complex. In these games, designers must be able to negotiate content knowledge from areas as diverse as medicine and history, in order to produce engaging-yet-educationally valuable player experiences (Michael and Chen, 2006).

*The Role of Distributed Intelligence in Addressing Complex Game Design Problems*

The cognitive revolution of the 1950's pushed the dominant paradigm in psychology away from behaviorism, and into a view of mind as a separate entity residing in the individual's head. In recent years, a similar shift has emerged, with perspectives of mind as a function of complex relationships between individuals and their surrounding contexts (Lave and Wenger, 1991; Cole and Engeström, 1993). A prominent perspective among these views is the notion of distributed intelligence, which identifies two dimensions that play a role in a person's ability to think, strategize and make decisions in the context of activity, a social dimension and a material one (Pea, 1993).

The social dimension presents a view of knowledge as emergent in the interaction between people. This dimension becomes particularly prominent in activities where group member coordination is fundamental to their successful performance. In his studies on how cognition happens "in the wild" for example, Hutchins (1995) examined the activities of quartermasters navigating a navy aircraft carrier – an activity a single individual could never carry alone- and demonstrated how by distributing different aspects of the mental model for the activity, the overall crew could develop a shared model that allowed them to carry it out successfully. In this dimension, language and other representations serve as tools to think with (Gee, 1992; Vygostky, 1978; Bruner, 1991) that help organize not only the individual mind, but also the collective minds communities carrying out the activities around specific mental and cultural models resulting in knowledge that is more than the sum of its parts.

The material dimension, on the other hand, concentrates the analysis on the way in which material contexts, tools and physical representations (such as symbols), shape mental activity and as a consequence physical activity as well. Norman (2002) for example, writes extensively on the role that the design of every day objects such as teapots carries with it a form of intelligence that exists "in the world" to guide their decisions through affordances (qualities, such as the location of the handle on a teapot, which indicate possible actions with the tool, such as the direction where pouring should happen). Lave (1988) on the other hand, gives examples of how people use the intelligence previously embedded in objects such as measuring cups to easily carry out calculations that mentally would be very hard to complete. Whether to help do calculations or facilitate decision-making, the work on distributed cognition parts from the notion that when people use tools or objects in different activity contexts, they rely on meanings previously articulated in them in order to free up mental resources, thus allowing themselves to use these resources to accomplish tasks that are more than the sum of the person and the tool alone. These meanings are also a function of the cultural models carried by the Discourses that the activities the tools were intended for belong to.

*Material and Social Distributed Intelligence in Game Design*

The two dimensions play important roles within game design. In the social dimension, the tool par excel lance is language, whether verbal or symbol-mediated, as it is used to negotiate game ideas with players, other designers. In *homo ludens,* philosopher Johann Huizinga presents a detailed explanation of the many roles that games and play have in enriching human life (Huizinga, 1998). For Huizinga, their central function is a *significant* that allows us to temporarily enter states of affairs where "real world" judgment is suspended, and where we can celebrate our humanity, explore it and extend it in ways that push culture and knowledge forward, just as ritual play provides primitive communities with the forms of government from which ours emerge.

As Huizinga's own attempts at defining the act of play indicate however (P. 29), for games to act as signifiers they must be constituted by meaningful patterns through which they can express the ideas and experiences their authors aim to convey, patterns that define them and differentiate them from other sophisticated human activities.

The language of games differs from other (e.g. verbal and visual) forms of language in that it encompasses and exceeds them by recruiting a wide variety of modes to represent knowledge. Not only do modern videogames incorporate graphics, video and audio to convey the designers' intended meaning to the player. More importantly perhaps, they rely on a designer's concept of the players themselves as co-designers of the overall experience, to generate what one would call "the game" (Games, 2008).

Hence, a literate and competent articulation of a good game requires that designers address not only whether it looks and sounds certain ways, but also whether it *plays* in certain ways, and such articulation is in itself an act of setting up a problem for a player to address within certain rule boundaries (Salen and Zimmerman, 2003; Church, 2006). Articulating a good game then is at the same time a problem posing and problem solving activity, for it only works if the result of mixing materials, rules, and goals into a game system translates into a coherent, interesting, and challenging experience for the player.

Like in other disciplines that deal with complexity, the Discourse of game design has over the years developed a set of specialist language terms that allow designers to organize their thoughts and form strategies as they work on design problems. Terms such as *rules, goals, mechanics* (possible player interactions with the game), *level of challenge* (difficulty to overcome obstacles toward the game goal), and *space* (the play area) are some examples of this language. Perhaps as importantly, these terms serve not only a representational function as tools for designers to think with, they also serve the role of distributing cognition in social ways through communication, as designers use them to articulate complex design ideas for and with others (Salen and Zimmerman, 2003; Church, 2006; Salen, 2007).

In the material dimension, to construct a modern computer game, designers must negotiate the perceived capacities and limitations (the affordances) of the material components they will use to do so, and of the tools they have at hand. In computer games the materials are digital representations (graphics, sounds, videos and so on), and I classify the material tools into two categories: a) programming and construction tools, b) art and assets tools. Though in practice these tools interact and even share functions (e.g. art tools can be part of programming tools and vice versa), these categories will be useful for the analysis, in helping understand the way in which game designers rely on tools to organize their minds and construct games.

*a) Programming and Construction Tools:* Programming languages have been a part of computer game development since its inception. Whether built using the BASIC programming language during the early days of the Atari home console, or the many versions of the C/C++ languages that are part of most modern computer games, programming tools are fundamental to translating a game design into code a computer can translate into a game experience. However, if designers had to rely just on these languages to develop a new game from scratch every time, much of the sophistication and availability of game titles today would not be possible.

Part of what has enabled modern videogames to reach their current level of complexity is the availability of game engines. In recent years, whole frameworks of software components made of programming code (e.g. functions, objects, variables and so on), have been compiled by game development companies and offered for sale as packages that designers can use as the foundation upon which to build new games. In this way, designers and developers can reuse program code in new designs, and concentrate on creating novel and interesting interactions instead of having to create new code every time. The Torque game engine and UNITY, are two frameworks that fall into this category. Sometimes game studios will also bundle engines with commercial titles, letting other designers create their own modifications (or mods, for short), of the games. The famous game Civilization IV, includes its own modding kit, which lets people who buy the game create their own scenarios of world history using the same mechanics embedded in the original game.

<u>*b) Art and Assets Tools:*</u> In order to design the complex game experiences that form modern computer games, designers commonly rely on digital art creations such as images, music and sounds, as well as 2d and 3d models of objects and characters to simulate rich virtual worlds. All these creations are commonly termed "assets" by professional game designers. And the tools involved in their creation (e.g. 3d modeling and animation software, image and sound editors and digital movie editors) provide certain functionality and limitations that play an important role in design decision-making. An example of this is what game designers call the "pipeline" between a 3d modeling package and a game engine. By choosing tools that are most compatible with each other (e.g. the 3D Studio Max editor and the Torque game engine), design teams can dedicate cognitive resources to tasks more critical to the game experience.

*Addressing Game Design Problems in Gamestar Mechanic*

As I have discussed previously (Games, 2008), literacy practices within Gamestar Mechanic take place in the context of three dialogs or levels of interaction that are systemically intertwined. This three dialog system consists of (a) the material dialog, (b) the ideal player dialog, and (c) the real player dialog, which help designers understand and effectively the grammatical, semantic, and pragmatic functions of the language of games to construct and negotiate meaning.

The dialogs do not take place independently, as Figure 5-1 shows. Rather, they're inherently intertwined in the act of meaning negotiation, and if designers fail to keep any of them in mind in their process of communication, their literacy practices will be suboptimal. However, each dialog emphasizes different thinking practices that help players learn to think like good designers, and to simplify their analysis, it is useful to emphasize the function or one or another depending on the thinking practies one wishes to study. To simplify the analysis, this case study emphasizes the material dialog, and where pertinent will make references to the other dialogs, as they help designers become more competent with it.

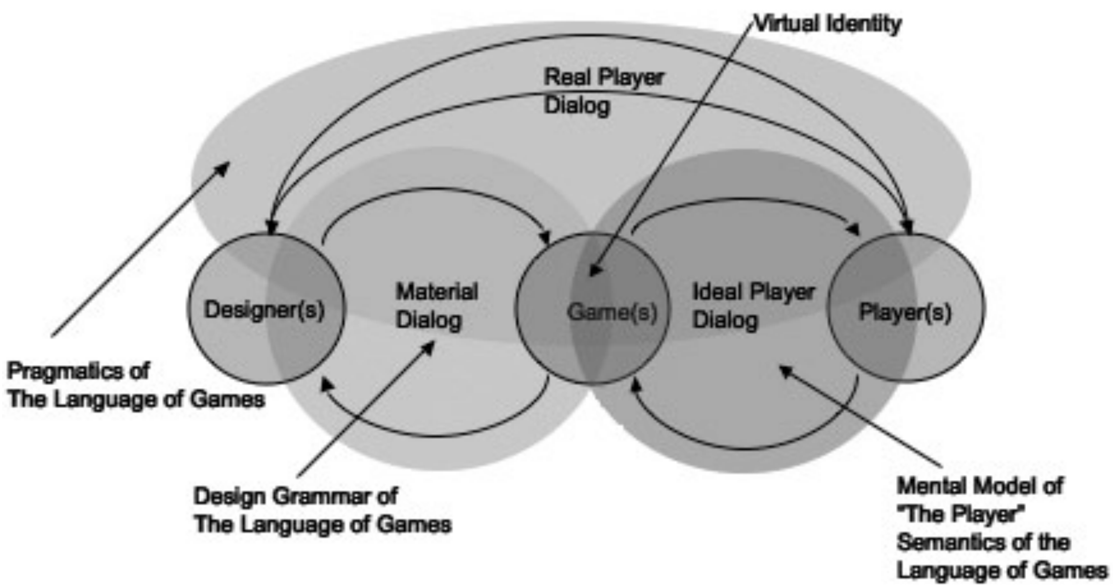



Figure 5-1. The Three Dialog Framework

As its name suggests, the material dialog represents the interactions that designers engages in with the tools and materials available to them during the process of design. In Gamestar Mechanic, these materials are tools are contained within the mechanic's toolbox (Figure 5-2), a game editor integrated in the game, where mechanics can make games by dragging creatures from a palette (labeled 1) to a play area (labeled 2). The toolbox also provides players with tools that allow them to move creatures in the play area, delete them, configure their behaviors and switch from edit to play mode, in which they enact the behaviors configured for them.

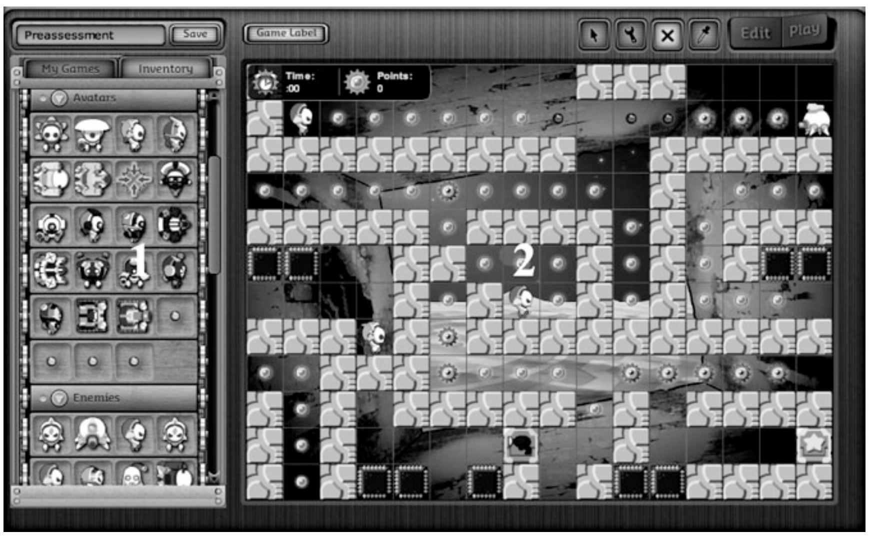



Figure 5-2. The Mechanic’s Toolbox

In Gamestar Mecahnic, players are exposed to the literacy practices of in the material dialog through a series of design jobs they must complete using the toolbox. These jobs may involve playing games, repairing dysfunctional games, or designing games for others from scratch. When mechanics choose a job, they are given a set of design specifications they must adhere to in order to complete it successfully. In play and repair jobs, these specifications are meant to scaffold players by constraining the possible solutions to the design problems presented in them, while in the design jobs the specifications are more loosely defined, in order to give players more freedom to create original games (Figure 5-3).


Figure 5-3. Job Selection in the Game Arcades

***Research Methods***

For this study I relied on a discourse-based case study methodology, which shares with regular case studies the intention of identifying a unit of analysis of interest (Stake, 1995) and articulating it's "thick description" (Geertz, 1978), however, it complements the narrative by placing emphasis on the analysis of participants' discourse (Gee, 2005; Steinkuehler, 2005) through samples of language used in context. In this way, it aims to document the evolution of participant identities and meaning making practices such as problem solving and setting over time, through the lens of their language and literacy activities during play.

The context of this study was an after-school game design workshop for middle school students that took place during the Spring of 2008. Twelve middle school children, six boys and six girls, gathered weekly, to play through the game job curriculum embedded with Gamestar Mechanic. In addition, five professional designers participated in the study, in order to serve as a reference of how people experienced in the game designer Discourse would interact and make meaning with Gamestar Mechanic.

_Data Sources:_ In order to construct the rich ethnographic narrative and collect the language samples for the discourse analyses, this study relies on a method involving multiple data sources, listed as follows:

a) _Interactive Design Thinkaoud Interviews:_ To document the changes in participants' conceptions, language use, and literacy practices within the game design Discourse, I conducted a pre and post workshop assessment protocol (Games, 2008). The protocol began with an enthnographic interview focusing on notions of game design. Sample questions of this interview include "What are the minimum parts something should have to be considered a game?" and "What, in your opinion, are the main activities of a game designer does in making a game?" The interview was followed by a think aloud interview, where the interviewer asked the player to complete three Gamestar Mechanic game design jobs incorporating requirements of the play, repair and design jobs embedded in the game's curriculum. The interviewer also asked that the player explain his/her design decisions during the process, and if at any point the participant became silent, the interviewer would ask questions aimed at eliciting participant explanations using the specialist language of game design at semantic, grammatical and pragmatic levels. Relatively open-ended questions such as "Why did you select that specific creature?" or "What is the core mechanic of your game?" were typical during this activity, with the goal of maximizing the participant's elaboration of the meanings made during design. As the reader may notice, unlike traditional cognitive studies that strictly define think aloud protocols as assessments of mental processes (Ericsson and Simon, 1993), the think aloud interviews in this study have the objective of assessing meaning making by participants at a meta cognitive level, an activity that is core to good literacy practices. During these interviews, parallel digital video captures are conducted focusing on the participant, and the computer monitor, resulting in a digital video file of the overall verbal and non-verbal communication by the participant during a Gamestar Mechanic job.

b) *Ethnographic documents:* To corroborate potential findings during the interviews and support the construction of a rich narrative of the overall workshops learning ecology, the I conducted participant observations taking the role of one more player completing the curriculum, albeit an advanced one. In this way, I documented the activities of participants during workshop time through field notes, as well as by conducting informal interviews with all of the participants over time, and bringing in other researchers to conduct session audio and video digital recordings.

c) *Digital documents:* A key factor in tracking the change in sophistication of player Discourse practices was to keep a systematic record of their actual productions in the game. Following the software architecture of many multiplayer online role-playing ganes (MORPG's), Gamestar Mechanic relies on a server-run database system to retrieve all of the content presented to the players in the web browser, as well as to store all the games played, repaired and designed by them in a persistent form. Using this server-based model, all games and their associated digital texts such as game instruction labels and stories, as well as the comments from other players associated to them, were (and are) available for me to access at any point afterwards.

Data Analysis: Given the substantial reliance on digital video of my data sources, I used the Transana (Woods, 2003) qualitative video analysis software, to organize and integrate the video with audio data synchronously. Using Transana, I organized this data into smaller episodes, and then transcribed using Jeffersonian notation (Jefferson, 1984) into text files. Transana also allowed me to use the transcripts synchronously with the video and audio in the coding process.

I coded the resulting transcripts using a Discourse Analysis methodology (Gee, 2005), which examines language used in context as an ideologically charged means to accomplish specific action by situating meaning and constructing a shared reality (Gee, 1996). Discourse analysis examines these properties of language through the lens of *seven building tasks*. These are (1) *significance*, using language to make certain things more relevant than others, (2) *activities*, using language to get recognized as engaging in a certain activity, 3) *identities*, using language to get categorized as enacting a certain role or identity, 4) *relationships*, using language to signal a sort of relationship between two people, 5) *politics*, using language to convey a perspective on the distribution of social goods, 6) *connections*, using language to highlight the relationships between two incidents or concepts, and 7) *sign systems,* privileging certain ways of communicating through symbols over others. Depending on the language sample, some tasks might bear more relevance to the analysis than others.

In order to validate the insights from this analysis, I used the other documentation as a way to triangulate the codes and categories I generated, and shared them with other researchers, with participants and with Gamelab designers to verify their verisimilitude.

***Fieldwork***

The Spring 2008 workshop took place over a period of 15 weeks at a computer lab of the Univeristy of Wisconsin-Madison. During this time, participants gathered for 2 hours once a week during 15 weeks at a university computer lab. I recruited them by posting flyers at public spaces and after-school programs frequented by minority and low socioeconomic status children in the Madison, Wisconsin Area. Six males and six females between 6$^{th}$ and 8$^{th}$ grade, mostly from low socioeconomic backgrounds participated, and the overall ethnic makeup of the groups was highly diverse, with students from African American, Asian American, Caucasian and Hispanic backgrounds represented.

Five professional game designers representing a variety of different approaches and philosophies of game design also participated in the study.  Due to professional and legal obligations to their employers, as well as to ensure their privacy, the pseudonyms Alicia, David, Edgar, George, and John will be used to refer to them. Alicia is lead game designer at a mid-sized educational software and games studio in the east coast; she has worked for more than 15 years in the industry and has been playing games for 25. David is co-founder and lead designer at a small games studio in the Midwest, concentrating primarily on the design of educational and the so-called serious games, which are games with purposes other than entertainment. David has been designing games for the last 5 years and has over two decades of experience as a gamer.

George and Edgar are senior designers at a game studio that focuses on the design of *casual games,* a genre of games designed to target audiences that will commit to playing them for short durations at a time. Casual games are characterized by having simpler rule sets and mechanics than those that characterize other modern computer game genres such as role-playing games or first person shooters. George has nearly a decade of experience playing and designing games, and Edgar has over two decades as a professional game designer.

John is a professional game designer working for a large Japanese videogame company. He has over a decade of experience designing multimillion-dollar game titles for game consoles, many of which have been critically acclaimed worldwide.

Before the workshop, I created an individual game account for each participant using pseudonyms only I can associate to an individual's identity. I also asked participants not to reveal their online identity to others, and only I had full access to their account throughout the study.

*Adopting Metacognitive Strategies with Gamestar Mechanic*

James Paul Gee (2003) argues that one of the ways in which videogames facilitate players understanding such mental models is by presenting them with activities that facilitate their thinking of the impact of their actions in the game at a metacognitive level. While the term metacognition has been used to refer to a variety of areas from self-regulation (Pintrich and De Groot, 1990) to study strategies (Zimmerman, 1989), what they all share in common is that thinking at a meta level requires learners to develop strategies for organizing their knowledge in order to formulate a plan or mental model that will help them understand a phenomenon at hand.

My observations during the workshops and the participants' language during the interviews, suggest that over time, the appropriation by players of the language of games provided by Gamestar Mechanic, translated into increasingly more sophisticated metacognitive strategies for design, and that distributed intelligence built into Gamestar Mechanic played a fundamental role in this. The evolution of the strategies became particularly evident in those situations where players had to addressing bugs in games, whether by identifying them, repairing them, or, as I explain later, using them deliberately within their games.

<u>*From Player-centered to System-based Strategies:*</u> What defines a bug in a system? The term bug has been used in the language of science and engineering since as early as Thomas Edison's inventions (Edison, 1878), to represent functions or behavior of systems unintended by their designers. As such, identifying a bug requires the ability to examine not only the actual system components, but also to be able to understand the intentions and rules behind its design. In

games, as in other systems, whether a function is a bug or a feature is also a matter of delineating those contexts where "undesirable" behaviors occur. In Gamestar Mechanic games, these skills play important job within game repair jobs, which require players to identify and correct malfunctions in games according to a set of specifications. The participants' pre and post workshop interviews included an assessment consisting of a repair job, in order to examine the relationship of such tasks the changes in their thinking, language and literacy practices over time.

The job requirements were for the participant to play and repair a dysfunctional game as shown by the screenshot in Figure 5-4. Like with all Gamestar Mechanic games, the goal was to restore the game to the form and function specifed by its game label, a text containing a brief description and play instructions, which I asked them to read before seeing the game. It read: "*the objective is simple, collect all the points and reach the exit before the timer runs out. Watch out for those shooters, pacers and pouncers, they will stop you if they can!"* This statement indicates the intention of the designer for the game's form and function was initially.


Figure 5-4. The pre and post workshop game.

I designed the game to contain three different bugs, each of which presented an increasing level of difficulty to be found, as each had an increasing level of abstraction and was less directly observable that the previous one. The first bug (identified by the number 1 in Figure 4) was an area containing four coins surrounded by concrete blocks, making it impossible to collect all coins and thus win the game. The second bug, a bit more subtle (marked 2), was a shooter enemy configured with an extremely high rate of fire and maximum damage capability, making the top area of the screen inaccessible to a player, whose avatar would die upon the contact of bullets (the darker dots next to the lighter point dots) impossible to avoid.  The third bug, and the least evident, had to do with a timer creature (marked 3), configured to never run out of time, making the rule outlined by the label irrelevant.

The Discourses of gamers and of game designers share many aspects. Gamer culture is flooded with ideas and discussions that emerge from game design circles, disseminated through media channels such as gaming magazines, websites, and TV shows. However, before the workshops, the interactive design interviews with players and designers showed a clear difference between the strategies that each would use to analyze a game and make sense of it, which in turn would impact their strategies for bug identification and solution during this job.

On one hand, in the pre-workshop interviews, I asked players the question "Can you identify any problems with this game?" in two occasions, once during their first play cycle –defined as the period between pressing the play button and going back to edit mode by either winning the game or having their avatar destroyed-, and after three to five cycles of play.

During this phase, no players were able identify the three bugs previous to their first play cycle, and only one (a very experienced gamer) was able to identify bug number one at the outset, while most players were only able to identify this issue after several cycles of play. This was typical after their avatar had come into an interaction with the blocked area around the points. In this phase, the significance, connections and sign systems tasks of language were particularly revealing of the way they made meaning with the game. Their discourse at this point suggested that perspectives on bugs were mostly based on how a function of the game failed to enable their immediate play strategy, as suggested by typical utterances such as "I think there's a problem because my character can't break the blocks and get to the coins in there", given by players as answers to the question between their third and fifth play cycle.

In contrast, the statements of designers during their first play cycle, relied on hypotheses of game form and function based on the language in the label, and that considered possible systemic relationships between game elements. The following interview transcript (5-1) by Edgar before play presents a typical example of this:

> (E = Edgar’s Utterance; R= Researcher’s Utterance)
> R1: Do you see any problems with the game at this point?
> E1: The instructions say the goal is to collect points
> E2: So there might be a problem winning the game
> E3: if the values of the points outside these blocks (signaling to the area labeled 1) [
> E4: ] don’t add up to 582 the point counter needs (signaling to the point counter labeled 4)
> R2: What makes you think that there’s a point requirement?
> E5: The point counter is marked 0/582,
> E6: but unless the point creatures are worth more than one point each
> E7: I don’t see 582 points in the screen

<u>Transcript 5-1. Edgar’s design interview</u>

Several differences become evident in the nuance of Edgar’s discourse and the inexperienced players’ discourses. Just like them, Edgar articulated a hypothesis of a possible problem with the game at the outset, however, instead of waiting after the first round of play to do so, he relied on the actual language of the label, using the notion *game goal* (and its preconditions) articulated in it to construct the hypothesis (E1). Another key difference between his problem statement and those of inexperienced players at this point was that he *qualified his hypothesis* by making explicit his assumption of a relationship between the point creatures and the point counter (Lines E3 and E4). When the researcher asked him to clarify where this hypothesis came from (R2), he used the language of games once more, but not on the label. Instead, he relied on the intelligence built into the graphic representation in the point counter creature (marked 0/582, Line E5), to establish another qualified hypothesis, but this time based on the assumption that a systemic relationship must exist between the actual point creatures, and the game goal requirements (Line E6). His assumption then, was that for this game to match what the requirements established by the label, not only must the coins inside the blocks become available to the player, but the actual point creatures should likely be worth more than one point.

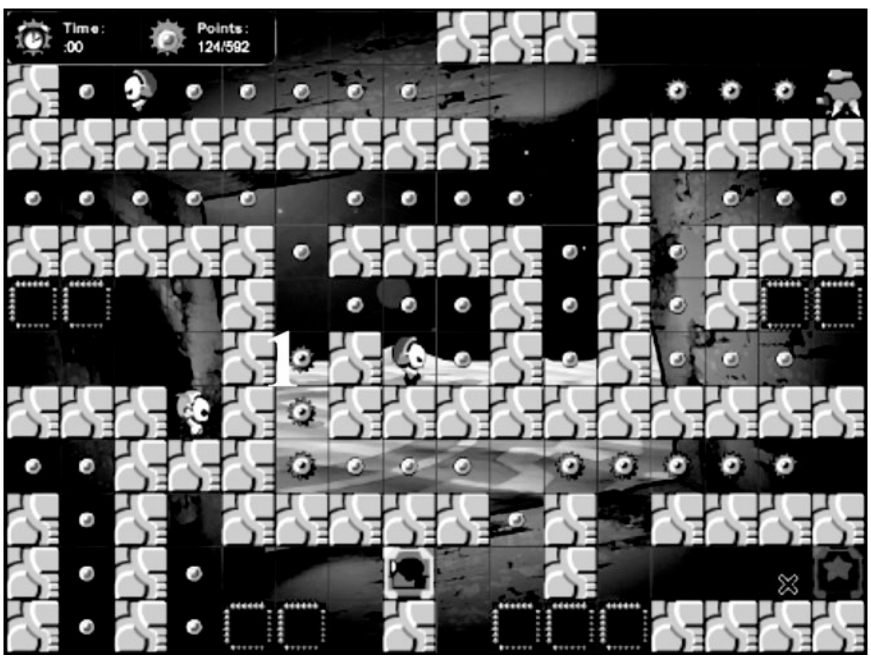
However, my observations during the different player design activities suggested that as they tackled different jobs with the toolbox, they gradually appropriated the discourse of game design in similar ways than professionals, with regards to examining games for possible problems. At post workshop interviews, this translated into more nuanced strategies for identification of bugs, and the use of the language in the label as a guide as well during their first play cycle. For example, consider the response to the bug identification question in this cycle by maxwellstone, a participant who completed the whole game curriculum, and a prolific designer (with over 40 games made in Gamestar Mechanic). He said:

“I think there’s a problem with the coins inside the blocked area (pointing at the area labeled 1). Because one of the rules in the label says that to win you must collect all the points, and those are blocked. However, I also think there may be a problem with the shooter on top (labeled 2), cause I think he may be shooting too fast and will make it impossible to enter that area (pointing at the space right under 3 and 4) to get the points without getting killed”

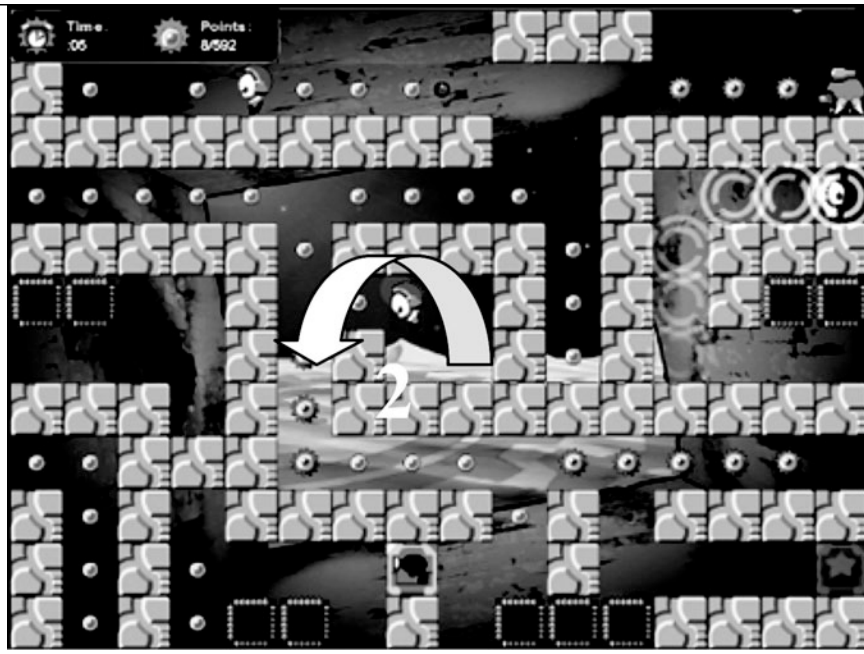
How did this happen? As I have discussed previously (Games, 2008), my observations with most participants over three years suggest that it was through repeated engagement in the material dialog, a back and forth interaction between player and toolbox where systematically trying different combinations of creatures in the play area. This dialog highlighted for the players not only the differences in the individual behaviors of each creature, but also of the possible interactions that could emerge between creatures when placed together in context. In addition, it made specialist language terms such as game rules, meaningful in the game context, making them become thinking tools, tools with distributed intelligence, around which to organize their cognition of the systemic relationships between game elements.

*Fixing Bugs in Games: From Component-based solutions to Systemic Solutions:* The changes in participants' bug identification strategies became further evident in their articulation of solutions to the bugs they identified. Here again, their recruitment of the specialist language of games and of the distributed intelligence built into the toolbox components played central roles in differentiating the strategies of novice and experienced players with respect to professional designers. In particular, the main trend I observed among players was a move from strategies that relied strongly on repeated manipulations of a few components to more nuanced ones where the solution to the observed bug involved manipulating systemic relationships between components.

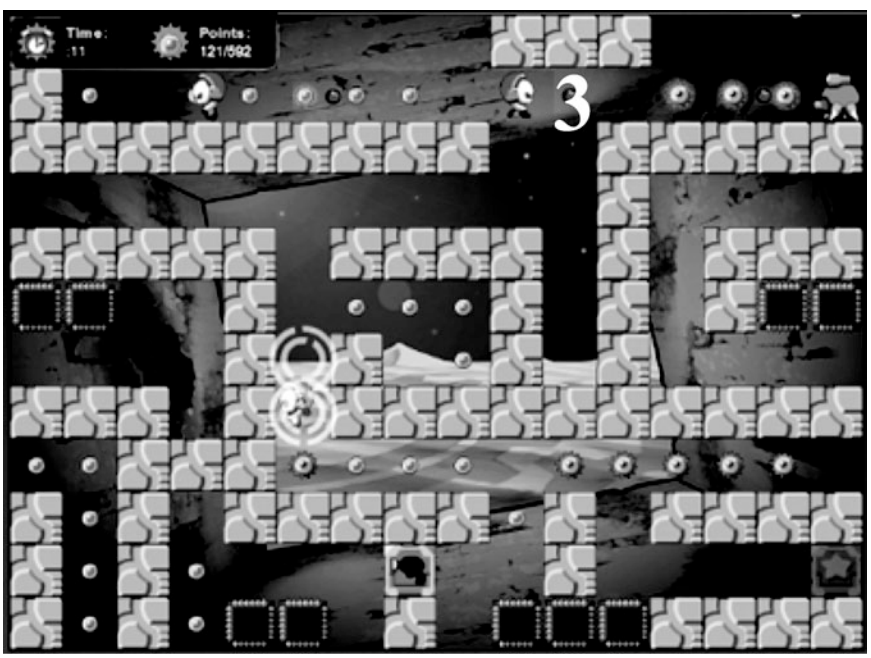
A very typical example of the first strategy was the tendency of novice designers to deal with perceived bugs by removing the offending components. In the case of the pre and post think aloud interviews, a common strategy for dealing with the blocked points bug was to delete the block in the passageway just to the left of the structure (Labeled 1 in Table 5-1, screenshot a). However, I designed the level with this in mind, and designers taking this simplistic approach would find themselves encountering the unpleasant surprise of a pouncer creature (Labeled 2 in screenshot b, the arrow reflects its escape trajectory) configured to jump very fast and in random directions, who would easily escape this area, and substantially increase the difficulty of the level (Labeled 3 in screenshot c), especially if the shooter rate of fire bug was not corrected first, as the bullets over the coins in this area show.




a)




b)



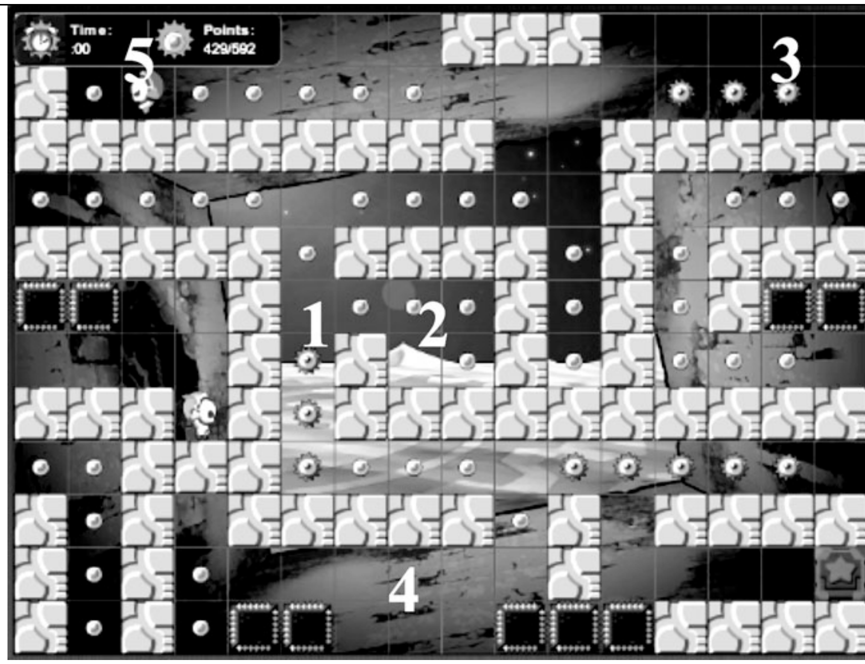

c)

Table 5-1. Simple Block-removal Strategy for the Blocked Points bug

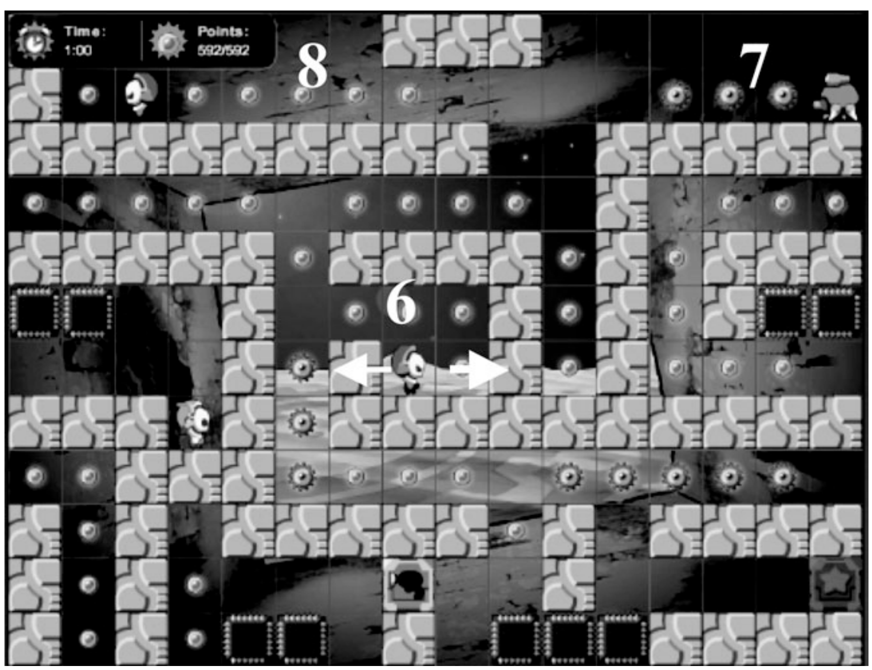
However, as Table 5-2 shows, the removal strategy of Helee, a male participant at pre-workshop interview, was an easy way for him to deal with components stopping him from winning the game, one removal at a time. This strategy however, ended sacrificing nuance and challenge in the game. As screenshot a shows, the resulting in design was a more simplistic version of the original.

Like Helee, at pre-workshop most players used the repeated removal strategy, gradually taking of components as they moved closer to winning their games in the material dialog. In the first play cycle, Helee removed the block corralling the points (marked 1), and moved the point creatures around to make a passage. Second, when he encountered the problem with the escaped enemy, he deleted it (marked 2), and third, when he found a problem with the rate of fire of the shooter, he also deleted it (marked 3).

When players attempted this strategy repeatedly, they very often ended deleting creatures that were not problematic in the first place, as in screenshot a, where Helee removed in the bottom of the screen (marked 4) in an attempt to give the player more moving space, but eliminated the gun creature as well, a component that would have given the player an advantage. Typical of players at pre-workshop, the more nuanced bug with the timer was not spotted or fixed in this game, as shown by a timer that starts at zero, and then counts up (marked 5).




a)




b)

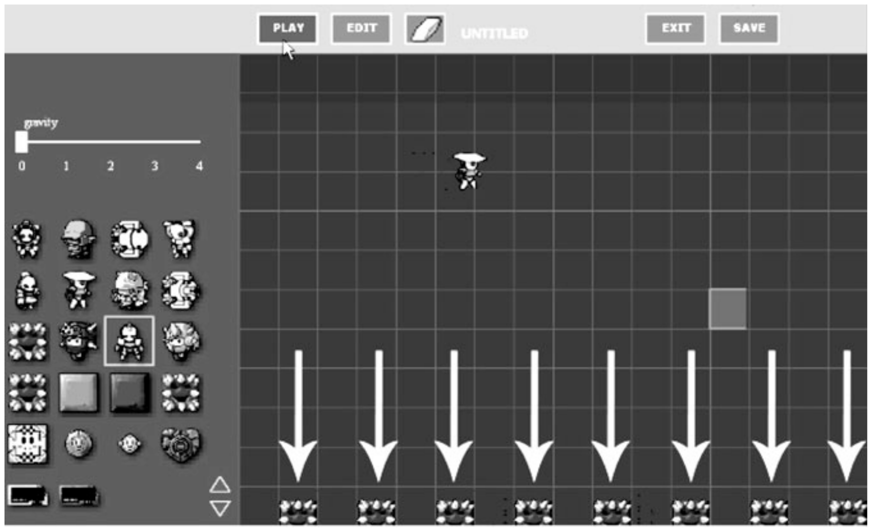
Table 5-2. Helee's pre and post workshop interview solutions to the bug-fixing question

In contrast, Helee's strategy during the post workshop interview produced the game in screenshot b). The clear difference between this strategy and his first one is the variety of changes that he made to different game components to change relationships between them, transforming the overall game system into a winnable and nuanced game. In this second solution, he began by removing the block left of the enclosed points, but also modified the behavior of the pouncer inside to remove his ability to jump (marked 6 screenshot b, the arrows reflect its trajectory), effectively containing it for the rest of the game.

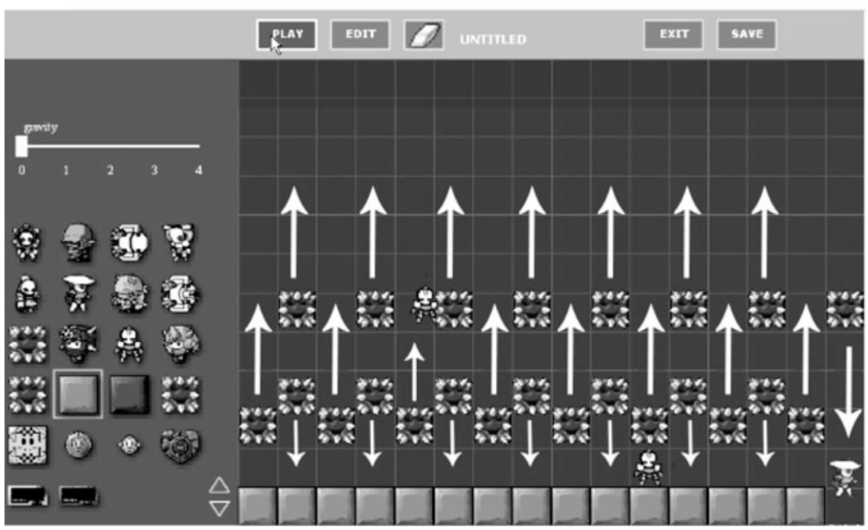
In addition, he identified the problem with the shooter enemy's firing rate and reduced it substantially through its behavior panel, making it possible for players to get the coins on top (marked 7). Finally, the player also edited the timer, so that it would now start counting down from 1 minute to zero, hence making it a precondition to playing the game together with collecting all points, consistent with the game label (marked 8).

*Transforming Bugs into Features:* One of the most interesting ways in which players displayed a changes in their perspectives of bugs from component-based views to systemic ones was when they recruited creature behaviors and interactions that had previously considered dysfunctional as features of their games, that is, as intentional functions intended to facilitate a certain play experience.

Since early in the three year period of Gamestar Mechanic's development, a common aspect that players had considered a bug was when the edges of a single-screen game were unbounded, meaning that any character moving in a single direction could leave the screen and might never get back into the play area (Table 5-3, screen a, arrows mark the creatures' trajectory). During most workshops, it was a rule of thumb that games presenting this behavior must block the edges either by placing blocks to bind player movement, or in later versions of the editor, to use the level configuration panel to explicitly set the edges of the game as bounded (Table 5-3, screen b).




a)




b)

Table 5-3. The unbounded screen edges “bug” in an early toolbox version

However, during the 2008 workshop, a player came up with a design that used unbounded edges in an innovative way that effectively gave a value added to the game play experience. The player, nicknamed commando, designed a game he called “The War (To The Core)”, where the central goal and mechanics were for an avatar cross a narrowly defined path from the bottom to the top of a multi-screen level that scrolls down as the player advances. To win, they must also destroy all the enemies who would patrol the corridors.

As the screenshot of Commando's level map in Figure 5-5 shows however, traversing the corridor begins to increase in difficulty as the player progresses, first because of the tight quarters where the avatar must fight the enemies (marked 1), then because one enters an area where traps spring shooting bullets that are very difficult to avoid (marked 2, arrow shows the bullet trajectories), and later because one enters a maze of damage blocks, where in addition to the bullet traps, touching the maze walls also damages the players' avatar, forcing them to look for health packs to restore their lives back in dangerous parts of the level (marked 3).

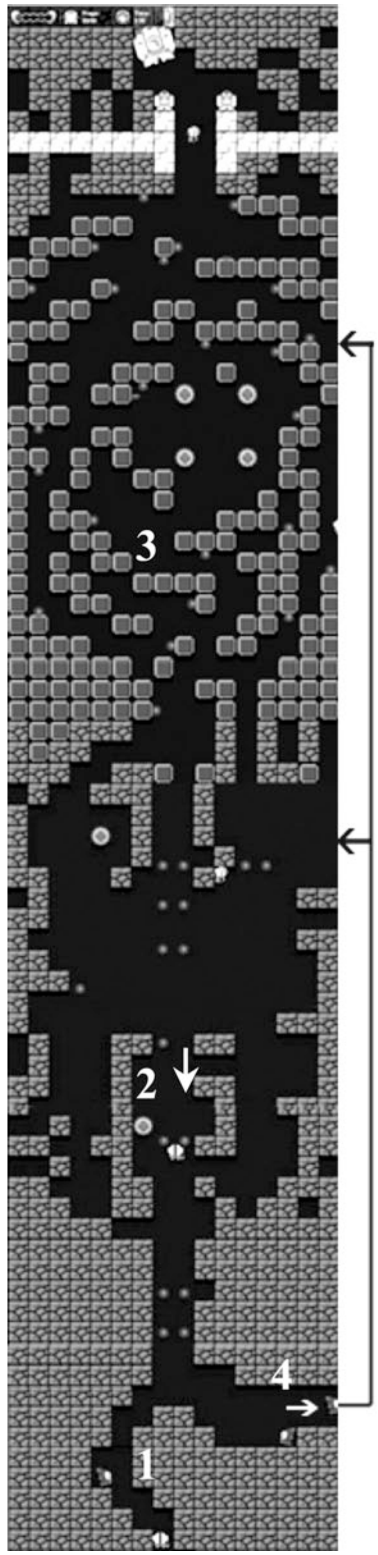



Figure 5-5. Commando's game map

While this combination of creatures makes the game nearly impossible to win for all but very experienced players, Commando gave players two hints at a "secret route" that would even the odds out. First, he concluded his game label with the sentence "look for unexpected things", indicating to the player that the level mechanics would be more than meets the eye. Second, as he mentioned during the interviews and the section marked 4 in the map shows, he deliberately configured some enemy creatures to leave the play area (what would have been a bug in other games, marked with an arrow) as a suggestion that more play area might be beyond the screen.

Why? Commando knew that gamers learn in games by exploring in depth the limits of their levels, constantly testing their boundaries and action possibilities (Gee, 2003). As the arrows on the right of the level show, he provided a way around the high difficulty problems in his game, by using the affordances of unbounded space to give the players a secret passageway not through the corridor, but around it. In this way, players could walk outside the play area while still scrolling it, thus springing all the bullet traps safely, and then come back into the play area in one of two locations depending on how much challenge they are willing to take on.

Thinking of using a known bug in this way required Commando to carefully consider the way in which the affordances of this issue could interact in valid ways with other components, in the context of the rules of the game. Hence, identifying the contexts where players leaving the play area would be valid, expresses his ability to systematically think of games in terms not only of the individual distributed intelligence of components, but of the affordances generated by systems conformed by creatures, rules, play areas, and players as well. Professional designers have used this strategy to create mechanics of "secret passages" to special game content in prominent game titles, notably in the famous Super Mario Bros. franchise (Figure 5-6).

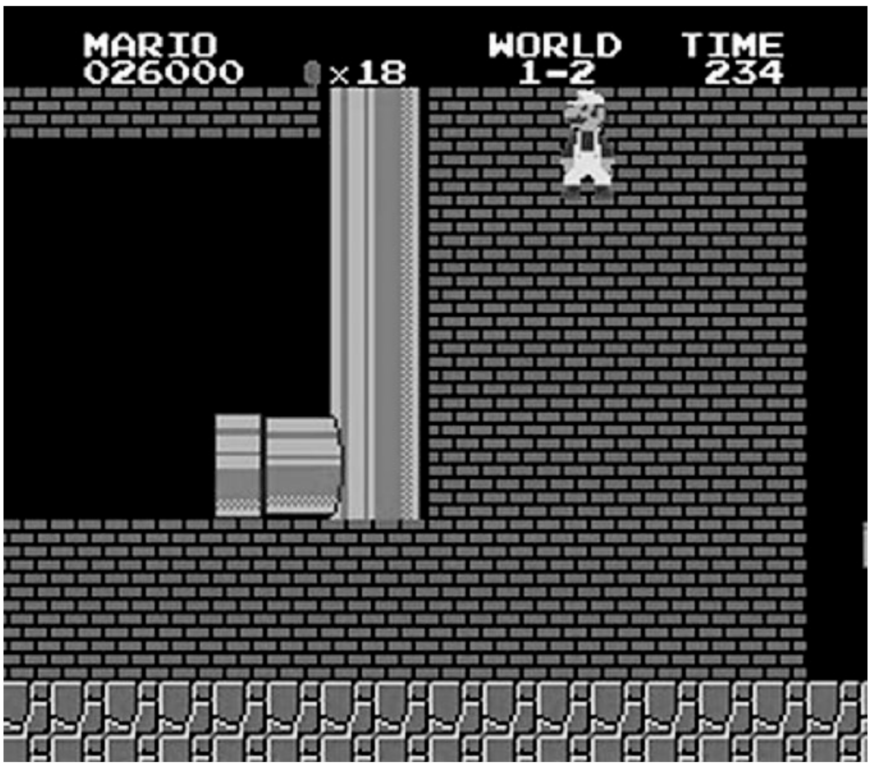



Figure 5-6. Leaving the Screen Boundaries to Advance in Super Mario Bros

***Discussion***

The findings in this study suggest that, if one subscribes to the view that intelligence and cognitive sophistication are not the result of the individual mind, but rather of the individual's ability to recruit the tools and representations available in a context to articulate complex ideas, Gamestar Mechanic is an effective tool to teach students effective distributed intelligence practices.

This view echoes Pea's notion that education should shift its focus towards teaching for distributed cognitions, as the ability to organize one's mental models in function of the tools and materials available, and to form strategies with them, is a fundamental skill demanded by today's world of work.

Through these findings one can also see why diSessa argues that the sorts of mental activities that take place using computer-based representations such as videogames would better be classified as literacy practices, for as they show, it neither the person nor the tools that plays the most prominent role in effectively addressing nuanced design problems such as bug identification and repair, but rather it is the dialog between both that gives rise to an intelligence that is more than the sum of its parts. On one hand, the tools at hand allow the learner to think in function of systemic interactions and establish metacognitive strategies. On the other, these strategies allow the learner to configure the tools into complex game designs.

Finally, these findings suggest that through the material dialog, players begin to use these metacognitive strategies to think of their games at gradually more systemic levels. It begs the question for future research, to identify whether and how such systematic could be facilitated in order to help learners bring tools to think with from other discourses into their game designs and vice versa.

# CHAPTER VI: TELLING STORIES THROUGH GAME DESIGN: FROM NARRATIVE TO IDENTITY PLAY THROUGH AN IDEAL PLAYER DIALOG WITH GAMESTAR MECHANIC

## *Introduction*

Any serious study of the role that language and literacy play on children's learning would be incomplete without addressing the issue of meaning. At the core of any literacy activity lies the articulation and interpretation of meanings using those material, semantic and grammatical aspects that define authentic practice in specific communities, whether they rely on print or on new media to communicate (diSessa, 2000; Gee, 1996, 2003). Hence, a central goal of the last two years of research in Gamestar Mechanic have concentrated on meaning-making as a way to understand how students think of and appropriate the "language of games" in their designs.

Chapter IV introduced the three-dialog framework as a lens through which to examine the language and literacy practices of game design that students learn in the context of Gamestar Mechanic. The framework identifies three dialogic interactions that game designers must organize their thinking and practice around during the construction of good games, and that Gamestar Mechanic's play activities can facilitate (Chapter IV). Chapter V explored the first of these dialogs -the material dialog- and the way that children negotiate the form and function of the creatures provided in the toolbox to make a functional game. This chapter in turn explores the language, literacy and thinking practices involved in the ideal player dialog, an interaction between the player and a game that results in the construction by the designer of an idealized model of game-player interaction. Developing this construct is crucial for thinking like a game designer, for it is the first step towards thinking of the game as an *interactive system,* as opposed to a self-contained artifact.

***Theoretical Framework: The Ideal Player Dialog, Narrative and Game Design***

Over the last twenty years, an increasing number of scholars have argued that one of the main (if not *the* main) ways in which human beings make meaning from the world around them is through narrative (Gee, 1991; Bruner, 1991; Mishler, 1986). People use narrative to make sense of experience, and thus the interpretations (and thus the decisions) that they make about current and future events are conditional to the stories they build around the past (Gee, 1991). Memory, Discourse and narrative then are inextricably linked to each other, as narrative serves the role of structuring the experiences in these memories, to situate the meaning of language, and to reduce complexity into a manageable form (Bruner, 1991; Gee, 1996).

Scholars have also studied multiple ways in which narrative serves a sense-making function for humans. Grand narratives or *big stories* have allowed cultures since ancient times to make sense of life not so much as a linear sequence of events, but rather as patterns of relationships of themes that characterize the human condition. Contrary to some common conceptions of narrative today, these stories facilitate sense making not through a chronological order, but rather by juxtaposing the themes that compose these patterns. Gee (1991) for example, compares the bible story of Abraham and Issaac (Genesis 22.1-19) versus that of Jephthah and his daughter (Judges 12.29-40), and points out how even when the sequences of events they depict are polar opposites, their "messages" are organized around defining themes of Judaism such as the relationship of God and man, kin and non-kin, the role of sacrifice and so on. These stories then, can be though of as "puzzles that fit together in different ways" (P.7), but regardless of the order of the pieces end up producing a coherent picture of an enduring aspect of human life (Levi-Strauss, 1963, 1964-1971, 1966, 1979).

Bamberg (2006) instead focuses his analysis on *little stories,* those that individuals recall in autobiographies or memoirs, or even on day-to-day anecdotes. Aside from serving as cognitive structures through which to understand the world, he subscribes to the view that narratives are also *actions,* and people use language and rhetoric moves in them to accomplish very specific objectives, as for example eliciting empathy from their audience. Moreover, while the scope of these stories may give chronological order a stronger role in their meaning, such small narratives when situated in the socio-cultural contexts (and thus within the big stories) where they naturally occur can help people make sense of and denote aspects of their authors' own *identities*, for the language used to articulate them commonly carries the cultural milieu of their authors.

Narrative plays a very similar role in the Discourse of game design. Thinking of games in terms of narrative requires game designers to practice presenting meanings in ways that certain audiences will be receptive to, a fundamental literacy skill in most 21st century knowledge professions. In good games, an effective narrative can play a fundamental role helping potential players become more receptive to the kinds of virtual identities being offered to them by the game designers. This sort of identity "buy in", is fundamental to what some call "suspension of disbelief" (Frasca, 2003), a phenomenon whereby players relax their own real world identities and immerse themselves in the roles the game offers them, thus allowing for the emergence of a projective identity that guides player decisions, critical learning and meaning negotiation with the game (Gee, 2003).

One of the key notions a game designer must develop in order to make good games (and good game narratives) is the concept of “the player”. That is, an ideal model of how a player would interact with a game, the choices he or she would have to make, and the effects of these choices on the overall game experience. Thinking of the game in narrative terms is a useful way of developing this notion, for when designers play their own games; they get to gradually experience the decisions that a player (even if a player like them) would make and negotiate the representation of the virtual identity they propose the player will take in the game. Thinking in narrative terms can help designers build episodic representations (simulations) of the possible outcomes that those decisions would have over time, and how they might shape the emergence of a projective identity (Gee, 2003), that is, the player’s construed model of his or her play experience in the game, and a powerful guide for design strategy.

In order for this to happen however, the play process must be a *reflective*, where the designers habitually and consciously ponder the consequences of their design decisions in light of the results on the game experience they are creating, and use the insights to guide new action. This reflective back and forth negotiation of meanings between designer in the shoes of a player, and game system, is the essence of the ideal player dialog. Through this dialog, designers learn to see game design patterns (the language of games) beyond mere assembled structures, and instead see them as semantic representations that have meaning in relationship to another person's interpretation (Figure 6-1).

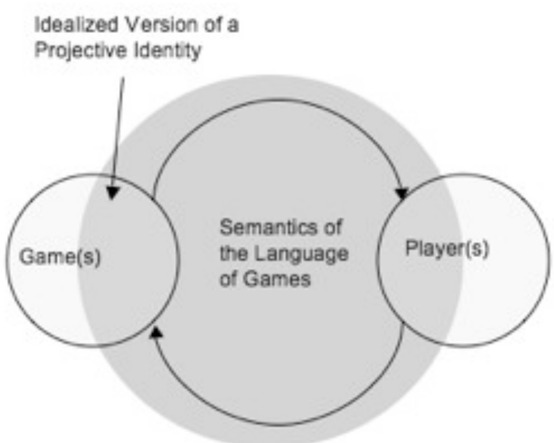



Figure 6-1. The Real Player Dialog

Constructing stories by designing games has recently begun to attract the attention of educational researchers for other reasons as well (Hayes and Games, 2008). One of the arguments in favor of using game design as a storytelling medium concerns the motivational benefits for children with poor skills with print literacy. Robertson and Good (2005) for example, argue that while many of these children have a wealth of creative story ideas, their limited writing ability and attitude towards writing can prove a barrier to their expression. They further argue that the multiple modes of expression allowed by the language of games could allow these students an entry into narrative that could positively affect their motivation to produce text.

Given that Gamestar Mechanic is a game that has as its core objective to teach children 21st century language and literacy skills, arguments such as these make it an intriguing space within which to study the production of narrative through game design and its possible literacy learning benefits for children.

*Methods*

<u>Context and Participants:</u> The study reported in this chapter took place during an instance of the Gamestar Mechanic workshop, using the beta version of Gamestar Mechanic during the spring of 2008 (see chapter III for a description of the beta). The study relied on a discourse-based case study methodology, which mixes case studies (Stake, 1995) with Discourse Analysis (Gee, 2005) to produce a "thick description" of Gamestar Mechanic's learning ecology through the lens of language used in the context of play activity. The goal of this was to identify a context that would provide the most insight into the ways in which through stories constructed in and around their games, children would appropriate the game designer Discourse in Gamestar Mechanic. The specific workshop addressed here was structured as a 15-hour after-school program where children would gather for 2 1/2 hours a day for seven weeks during the semester, to play through the game design curriculum embedded with Gamestar Mechanic with the help of a facilitator. When not in session, students were encouraged to work independently, playing the game and constructing their own games at home or in any Internet-enabled public space.

I recruited participants through flyers at public spaces and after-school programs frequented by minority and low socioeconomic status children in the Madison, Wisconsin Area. 12 middle school students participated in the Spring 2008 workshop, 6 males and 6 females between 6th and 8th grade, mostly from low socioeconomic backgrounds. Overall the ethnic makeup of the groups was highly diverse, with students from African American, Asian American, Caucasian and Hispanic backgrounds represented. I created an individual game account for each participant using an anonymous user id that only I can associate to an individual's identity. I asked participants not to reveal their online identity to others to ensure their privacy.

Data Collection: The workshop discussed here took place at a computer lab of the Univeristy of Wisconsin-Madison. In the same way than the study in the previous chapter, an ethnographic account is used to document this case study, complemented by a Discourse Analysis methodology (Gee, 2005) to examine the way in which participants used the language of games to construct game narratives. Given that Discourse Analysis is inextricably linked to Discourse Theory (Gee, 1996), as a method it relies on an examination of *language-in-use* to understand the way people make meaning in the context of specialist activities such as game design. It does so by placing the attention on the way people use verbal, non-verbal and symbol-mediated forms of language to construe the meanings of identities, tools, activities and the contexts in which they occur. Hence, the data sources required for such an analysis would need to reflect this diversity of communication modes and methods.

To collect these sources, I relied substantially on participant observation, taking on the role of Samson, a game character that acts as both player and facilitator for other players in the game (see Methods section in Chapter V for a detailed description). In this role, I was able to follow participants as they completed game design jobs part of the game curriculum, as well as independent design activities. I placed particular attention on documenting those jobs and activities where the construction of game narrative played a central role. To examine these jobs in detail, I relied on two data sources:

a) *Design Reflection Interviews:* Before the workshop began, I thoroughly examined the literature on game and computer game design, and engaged in numerous conversations with professional game designers at game conferences, to identify authentic design activities involving narrative, that I could then implement as design jobs within Gamestar Mechanic. The activities I identified were a) designing games around narrative ideas, b) writing stories around preexistent game designs, and c) using narrative to explain their game design choices. During the workshop, I documented these activities using video recorder think aloud interviews (see Chapter IV for a thorough description of this method) in parallel with screencasts of their computer screens during design, to examine the meaning making process of players as they make their games. During these interviews, a whole set of questions were devoted to assessing players' understanding of games and their components, some of which directly addressed their beliefs of the role of narrative in games. Questions such as, "What are the minimum parts something must have to be a game?" "Do you think games are similar or different to stories?" and "What does a game designer do?" are examples of these questions. During workshop activities I also conducted interviews directly addressing the role of stories in games. Questions such as "tell me the story of your game", or "what is the central theme of your game?" were typical in these sessions. In my player role, I was able to monitor on a daily the progress of participants in these jobs conducting several interviews with each participant. I conducted some interviews one-on-one in a separate room from the main computer lab, and some in public during workshop time. I digitally video-recorded all interviews in parallel with a screencast of any game play that the participants would have decided to enact during their jobs.

b) *Digital documents:* In order to complement the videos from the interviews, I also relied on the games themselves, as well as on the digital documentation associated with them. Gamestar Mechanic relies on a server-based software architecture that is commonly used in multiplayer online games. Such games are *persistent*, meaning that any changes that take place in a player's account such as completing a job or saving a new game design are permanently registered on the remote game server. In the beta version, games could be documented using *game labels*, electronic text documents that players can create by completing a form available in the save menu for any game (figure 2). Using the labels, participants can document the rules, goals and instructions for the game, as well as write down narratives and messages that players can see in each level of multilevel games. Given that I had full access to the login credentials for each player, as well as to the server database where the game stored their data, I was able to come back to all these documents and reexamine my findings as necessary.

<u>Data Analysis:</u> As in the study reported in Chapter VI, I organized and coded the videos and documents in this study using Transana (Woods, 2003), a video analysis tool that allows the researcher to organize and integrate digital video, audio and text files associated with any data sample of interest. Using Transana, I transcribed all the video data collected, and coded it using a Discourse Analysis methodology (Gee, 2005) that examines the way people situate the meaning of language (verbal, non-verbal, and symbol mediated), through seven building tasks of language (see the *Research Methods in this Dissertation* section in Chapter I, for details on the tasks). Among these tasks two of them became particularly useful in examining players' perspectives on the relationships between stories and games. The first one *significance,* examines the way in which people make certain things more relevant than others in their discourse. Hence, examining the way in which players made narrative more salient when discussing games allowed me to see changes in their conceptions over time. The second one, *connections*, examines the way in which people bring to fore certain relationships between concepts or incidents. Examining the way in which players connected narrative to other aspects of games and game design, allowed me to reach conclusions regarding conceptual changes in their understanding and appropriation of stories in the context of game design.

### *Results: Implications of Game Narrative on Children's Game Design Discourse*

Even since the earliest versions of the workshop involving only the prototype, it became clear that narratives played a very central role in how players made sense of the games they played outside of Gamestar Mechanic, and that this was a practice they carried over into their Gamestar Mechanic games as well. However, throughout the evolution of the workshops, it also became evident that their interactions with Gamestar Mechanic helped shape the way they thought and communicated with and about narrative in their games. In this section, I focus on three areas that were particularly salient in this regard.

*The Specialist Language of Game Design and Changing Narrative Practice and Conceptions*

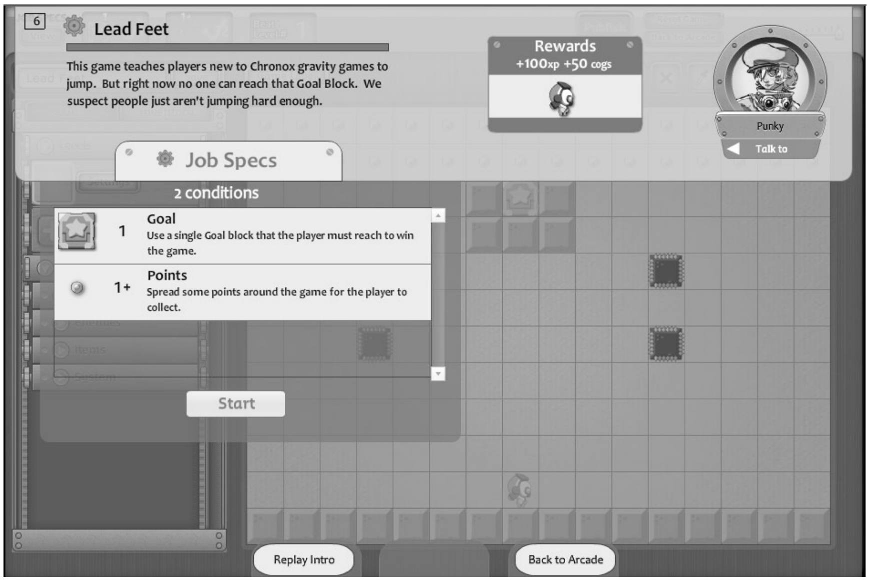
During the pre-workshop interviews, stories and narrative, and in particular narratives related to characters, figured much more prominently in the answers of players, than did other game components. However, by the post-workshop interviews their discourse presented quite a different picture, with other game concepts such as rules, goals, interactivity and challenge featured more prominently than before. Table 6-1 presents three pairs of questions with their typical answers, as given by 80% of the participants in each phase:

| Pre-Workshop | Post-Workshop |
|---|---|
| Q: What are the minimum parts something needs to be a game?<br><br>A: They need a character, something for the character to do, and somewhere for the character to go | Q: What are the minimum parts something needs to be a game?<br><br>A: It needs an objective, and things to overcome in order to accomplish that objective, and rules |
| Q: What does a game designer do? | Q: What does a game designer do? |

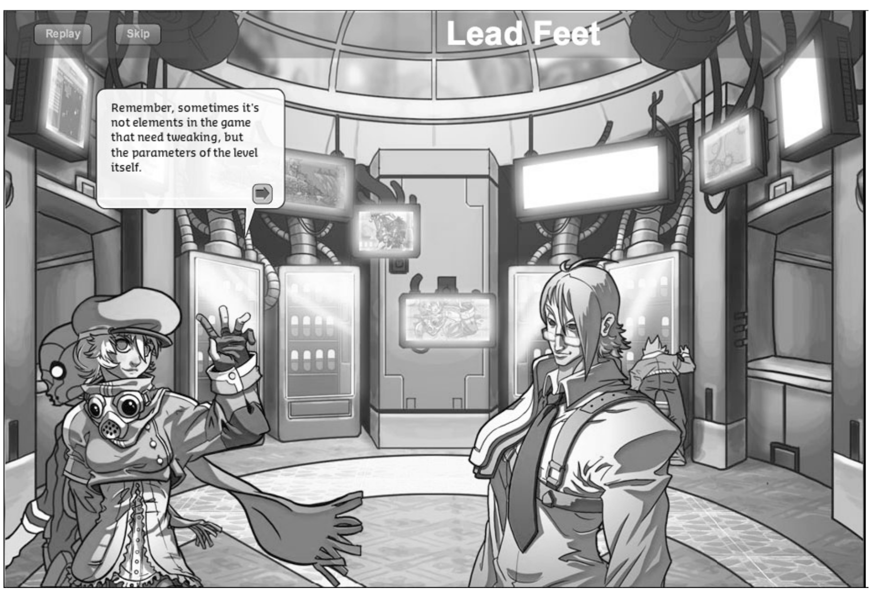
| | |
|---|---|
| A: They create the story for the game, the characters, locations and so on | A: He things of a game, and makes it. He comes up with the verbs of the game (the actions of the player), and a good space for them to happen, and the characters and enemies in it |
| Q: Are games the same or different than stories? How?<br><br>A: I think games are like stories. You have a character and you play their story, and you fight the battles that they went through. | Q: Are games the same or different than stories? How?<br>A: It can be, as many games are based on stories like movies. But players can do things in a game you can't in movies, like take the story in different directions or do unexpected things |

Table 6-1. Pre and Post workshop answers to Game Design and Narrative questions

My observations suggest that Gamestar Mechanic promoted these changes through the contextual use of specialist game design Discourse terms in its game job curriculum and throughout its overall game narrative. Table 6-2 shows examples of this:




a)




b)

Table 6-2. The specialist discourse of game design used in Gamestar Mechanic

Screenshot a) shows the specifications screen for a game job requiring a player to modify a game in order to allow an avatar to reach a goal block (a specialist term in the discourse of games), highlighting the importance of establishing a reachable win condition in games (the concept that the goal block conveys). Screenshot b) shows the game narrative that serves as an introduction to this job, with a game character highlighting the role of game rules (parameters, a specialist term), and how sometimes they and not game components (another specialist term, referring to the actual creatures forming the game) need to be modified in order to make a game functional.

As I argued in Chapter V, the specialist terms of the language of game design are tools to think with, which once appropriated into the discourse of players, can help organize their cognition about games and game design. An extended specialist lexicon in turn, leads to more nuance in their mental models and hence more nuanced designs. This became evident in the actual narratives that players constructed for games they designed.

Narratives constructed by players pre-workshop tended to have very little connection to the design of the game they were describing, and with scant or no use the specialist terms commonly used to describe the actual mechanics by which one would play them, instead relying more on vernacular forms of language. The following sample by a player nicknamed Akumishi shows a story representative of those written students for a game early in the workshops:

> <u>The portal</u>
>
> My game is about these 4 construction workers that come across a portal that shows the future [sic] and there are these monsters that are attacking people [sic] and the workers go back to the present time and they try to stop the monsters from taking over.

In contrast, the narratives associated to players' games toward the end of the workshop were much richer and tied to the actual design of the game, they appropriated more on specialist terms or on their vernacular equivalents as integral parts of the story, like in the following example, of where his game story highlights this change:

> <u>Battle</u>
>
> You and your companion go on a journey[sic] then your companion gets captured. Now it's up to you to get him back go through lot's[sic] of mazes and obstacles, fight in battles and go on a [sic] journey of a life time to save your fellow companion.

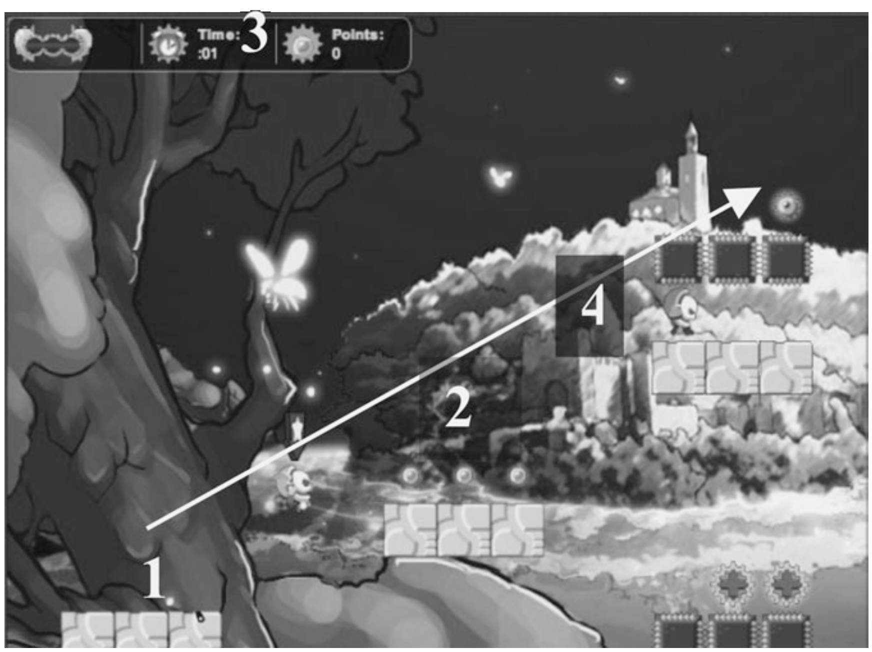
While the spelling in the story was evidently poor, it was also evident that after participating in the workshop, participants like Akumishi were beginning to integrate game design concepts more into their narratives. Elements such as the goal of the game (saving a friend), and its mechanics (traversing mazes and fighting enemies), became evident in numerous game label narratives in such as this one at post-workshop. With the recruitment of these specialist language components into their discourse and literacy practices, the grammatical structure of their stories showed some improvement, as players shifted the focus from describing a vaguely connected theme in the game, to a more cohesive and focused description of how the identity taken on by an ideal player, would play out through the possible actions that the game would make available.

*Second-person narratives as guides to the design of projective player identities in games*

The influence of the specialist language of game design within Gamestar Mechanic on game narratives was not unidirectional, since besides influencing the way players articulated their stories, in numerous occasions I observed how the improved narratives served a design planning function, helping players select visual elements of the language of games in the toolbox, and guide their design strategy during the game jobs. These guiding stories were particularly evident because of their intensive use of the second-person perspective in their telling, as in Akumishi's post-workshop narrative above. Second person is a perspective seldom used in traditional narrative genres because of the difficulty it presents for authors trying to articulate a sequence of events (e.g. McInerney, 1984), but more common in storytelling genres that presuppose active participation by the reader, such as the Choose Your Own Adventure interactive books (Packard, 1979) or Interactive Fiction (Montfort, 2005; Crawford, 2005). The second person perspective however, is more commonly used in many writing genres within the professional disciplines such as tutorials, guidebooks and technical manuals.

Using this voice, players placed an emphasis on a hypothetical player's actions and their consequences on a sequence of events, rather than on the sequence of events itself. Taking this perspective, they situated the meaning of the different structures they constructed with game creatures, by placing them within the context of player activities, which gave them semantic value within the particular episode they wanted to represent. Thus, the narrative served a scaffolding function, helping players remember which creature functionalities and combinations would best fit a particular game section, by drawing analogies between their behaviors in the editor and the behaviors their narrative roles would expect.

An excerpt from a design interview with a participant nicknamed maxwellstone, which I conducted as he completed a game design job with a game he called “The backstage pass”, effectively exemplifies this point. In this job, the requirements stipulated that the designer make a game for another player of the same age, but opposite gender. Table 6-3 shows three screenshots of his game design, followed by a transcript of an excerpt of the interview questions I asked as he was designing the game.



a)


b)


c)

Table 6-3. Three screenshots of Maxwellstone's "The Backstage Pass" game

(R = Researcher's Utterance; M=Maxwellstone's Utterance)
R1: What is your game about?
M1: In my game you have to try to get a backstage pass to get into a concert.
R2: Where did you get that idea?
M2: Because I'm thinking of all my friends who are girls,
M3: and are really into grunge music and they tell me the concerts there are wild.
M4: So this is your starting block (places blocks and avatar marked 1 in screen a)(.)
M5: and points are the pieces of a ripped up backstage pass (marked 2).
M6: And there should be a time limit, because the concert starts eventually (marked 3)(.)
M7: and there will be bouncers (marked 4 screen a and b).
M8: And then you need to pass the bouncers,
M9: before getting into the stage (places goal block marked 5).

Transcript 6-1. Maxwellstone's Post-workshop interview

This transcript (6-1) shows how a narrative emergent from the ideal player dialog became both drove and was driven by maxwellstone's design decisions in this job. First, his use of the second-person perspective in lines M1, M4 and M10, denotes his intent to use his game ideas as a somewhat intimate communication channel to an ideal player. Line M1 also serves to articulate the virtual identity he is proposing for the player to take in the microcosm of the game, through the activities that such an identity would enact. Lines M2 and M3 show how constructing the game narrative required maxwellstone to form a mental model of who an ideal player would need to be if they were to buy into the proposed virtual identity. In his model, it would have to be girl his age, fond of music concerts. The model of a player identity guiding his design would be a hybrid of the previous two, what Gee (2003) calls the projective identity.

Lines M5, M6, M7, and M9 served a dual purpose. First, they indicated the three main events that take place in maxwellstone's narrative sequence (collecting the pieces of the pass, getting past the bouncers, and reaching the stage). Second, they helped maxwellstone describe the central game design concepts around which to construct the game system.

Using the concert narrative and that of the ticket being scattered in pieces outside the concert hall helped him establish analogies to game creatures that would be construed by an ideal player as a point collection mechanic. He accomplished this through the design step he described in line M5, using the point creatures to represent the scattered pieces of the pass. He then used the notion that since in the real world concerts usually begin right at a certain time, that then it would make sense for the collection activity to be time limited, a mechanic that he accomplished in the game using the timer creature configured to yield a loss condition if the stage wasn't reached before time ran out (Line M6).

In his narrative, the character in the story would only be able to enter the concert if he or she had a ticket and reached the stage area in time for it to begin. However, for this to happen, the character would have to get past concert bouncers that in real concerts have the role of keeping people without tickets out. Once more, maxwellstone used an analogy between the role of these two elements (the concert stage and the bouncers) to guide his game design process. He accomplished these two roles in the game using enemy creatures (Line M7) throughout the play area hat would place a challenge by standing between the player's initial position (Line M4) and some point creatures (the distance and direction the avatar needs to cover to reach it is marked by the arrow in screen a), and placing the goal block (which only became active upon collecting all points) in the stage area constructed from concrete block creatures, at the rightmost end of the level (Line M9).

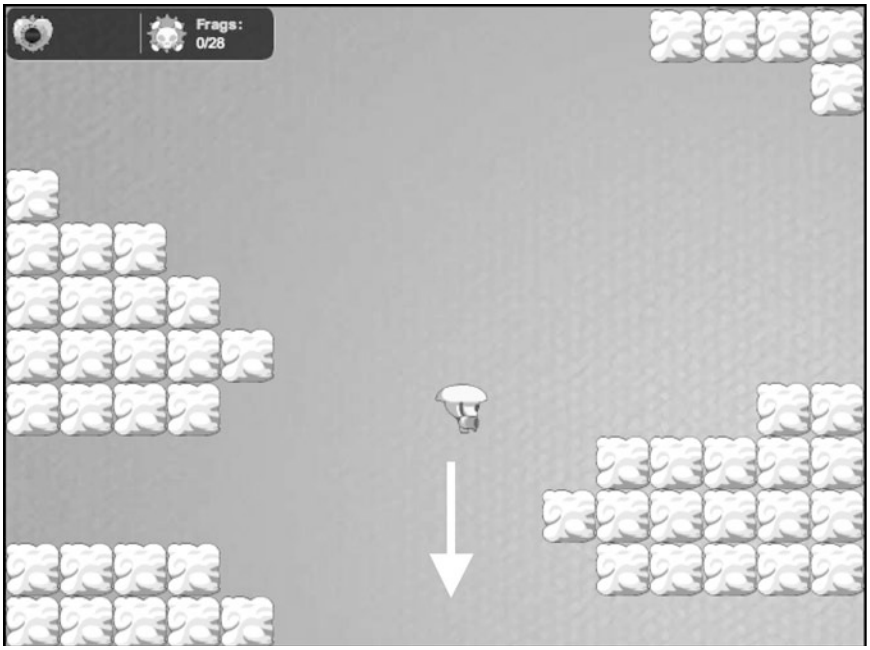
As one can see, while maxwellstone's narrative articulated a sequence of events, once put in the context of his design strategy it becomes evident that communicating such a sequence of events was not his main goal. Instead, the narrative served the goal of helping him situate the meaning of different game creatures, structures and relationships as analogous to a real world activity (going to a concert). In doing so, he was attempting to communicate to his ideal player the characteristics not so much of the story, but of the activities that would define the virtual identity whose shoes the player was to step into. What the transcript also shows is that maxwellstone's choice of a virtual identity was not random, but based on a hypothesis of the player's real world identity, in hopes that by creating a virtual identity relevant to it, better conditions for the emergence of an engaging projective identity would be set.

*Narratives as metaphors and reflection devices for real world identities and experiences*

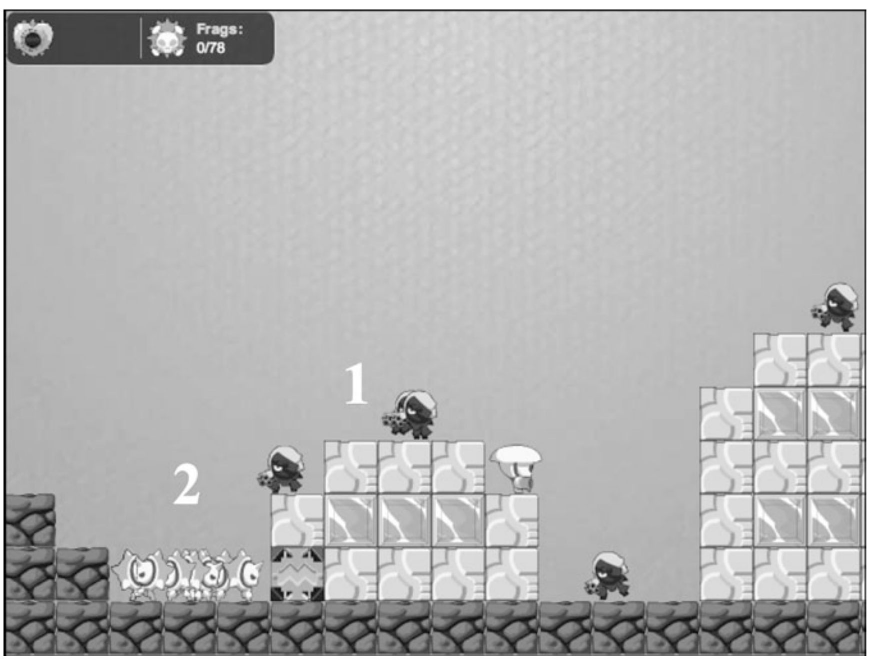
Once I began to think of students' game narratives as aimed toward the production of virtual and projective identities (as I discussed in the previous section), I was able to make sense of how towards the end of the workshop, this identity play allowed participants to think in more sophisticated ways about their games, but also about Gamestar Mechanic and their own world and experiences. Thinking of their game representations at a semantic level allowed players to imagine games that served as metaphors for important aspects of their own identities. While much debate exists on whether games are artistic representations (Jenkins, 2005), what is certain is that in the workshops the language of games within Gamestar Mechanic became a true vehicle of self-expression for players. With this in mind, I created a game job, which yielded some of the most interesting designs in the three years of the project. The job instructions read:

> "Design a game that tells your player something important about your life, or about a news headline you think is important. Make sure to explain in your game label what your game is about"

Several of the designs that players made to complete this job were interesting not only because of the games themselves, but because of the level of depth with which the authors thought about the identities they were trying to represent. An example of this was a game called "Assassinate Bin Laden", by a male player nicknamed *commando.* During an interview, he explained that the game was meant to represent the wars in Iraq and Afghanistan. The player took the role of an American trooper being parachuted into the Afghan Mountains with the mission of finding and killing the terrorist Osama Bin Laden. Table 6-4 shows two screenshots of his game. As in the game discussed in the previous section, the virtual identity that commando wanted to articulate served as the guide for designing game structures and mechanics, as the character falling amid the clouds to the battlefield in screenshot one shows (screenshot a).




a)




b)

Table 6-4. Two screenshots of commando's game

At first glance the game might look like a traditional shoot'em up genre, however in this game commando introduced a very interesting mechanic that differentiated it from many other designs like this one. In the enemy palette, some of the enemies present very different colors than those of the avatar (marked 1, screenshot b), while others do not, even when their looks make them appear like enemies (marked 2, screenshot b). In the battlefield area, he mixed a large number of enemies of both colors, but configured the enemies of the same color as the avatar to do no damage to the player when touched. When I asked commando about this, he mentioned he intentionally designed them this way because they played the role of all those people in the wars who even when they looked like the enemy, were really not enemies, and who very often became casualties of war.

Hence, in his game rules he wanted players to win the game by killing bin laden and his supporters, but to avoid killing innocents in the field. For a player like commando, the sometimes blurry, sometimes deadly relationship between innocents and combatants in the field of war became a central idea to explore different player and non-player character identities through Gamestar Mechanic's language of games.

This complication of game character identities had important learning consequences for participants throughout the workshops, since in becoming designers of these identities, they began to see them in a more critical and reflective light. This critical stance however, did not end within the boundaries of Gamestar Mechanic, but its consequences are summarized in a statement by a female player called meridian who said that now she " can't play other games like I used to, I keep wanting to examine them every time!"

Indeed, on several occasions players brought into the workshop sessions discussions and conversations about the games they were playing, but with analytical perspectives borrowed from the issues they had experienced in Gamestar Mechanic. An example of this came once more from maxwellstone, a second generation Iraqi American, who liking commando's use of harmless enemies as innocent bystanders went on to design a number of games using this mechanic. After one of our design sessions, he sent me an email telling me how much he had been thinking about the importance of stories and non-player characters in games, especially in the context of how games represented issues like the Iraq War where there were no clear friends or enemies.

He then described how thinking about this he had looked up and found a New York Times article covering heated online discussion that had been taking place between the editors of two prominent gaming blogs 1UP and Kotaku, over the role of story in the game Metal Gear Solid IV (Itzkoff, 2008). Metal Gear Solid IV is one of the best selling game franchises in history, and is a game that integrates a mechanic of avoidance similar to that in commando's and maxwell's games. In the game, this mechanic is deeply integrated with a story that depicts a fictitious battleground where private war contractors wage war for business instead of patriotism or ideals.

The graphics in the game are designed in such way that they replicate images from Iraq and Afghanistan widely broadcast through news media during the last decade, making the game a clear commentary on the many abuses that have been committed by private contractors such as Blackwater during the armed conflict. Figure two shows an image comparing a game screen to actual conflict images, as it appeared in the original article (Figure 6-2).

Figure 6-2. Left, an image from an Iraqi battlefield. Right, an image from Metal Gear Solid IV

The discussion between the two editors in the article concentrated on whether using narrative content within a game made the game better or not, with each one supporting a side in the debate. At this point, what became interesting to me was to find out how maxwellstone thought about this issue. When I asked him, he responded:

> “I like games with good stories and characters like Metal Gear Solid IV, even though many people say they use too much story. I like that a designer can put a point across using the game story, because it make your actions meaningful, unlike Halo, where you spend your time shooting at others because they don’t look like you, it makes it kind of a racist game”

For players like commando and maxwellstone, designing games within Gamestar Mechanic also became an important context in which to think and reflect more deeply about the media they consume, and to get involved in discussions about its relationship to some of today's most important issues.

***Conclusion***

This chapter explored the way in which narrative can contribute to Gamestar Mechanic player's development of the Discourse of game designers as a function of a reflective ideal player dialog. It showed how the multimodal tools to think with provided in Gamestar Mechanic's language of games, not only developed player's narrative-writing skills by organizing their cognition, but also how the narratives, enhanced with the concepts presented in the game, allowed players to construct sophisticated game experiences driven by hypotheses on player real, virtual and projective identities.

As the chapter showed, it is precisely that player identities and actions lie at the center of game narratives that seems to have made the stories told through and with the language of games interesting, and qualitatively different from those more traditional genres. As with professionally designed games, the game narratives in Gamestar Mechanic highlighted the players' growing adoption of the Discourse of game design by shifting their perspective from events to interactions, and this shift allowed them to understand and express real world situations in novel ways, as in the case of commando's game.

But why would developing such narrative skills be important? As I mentioned before, the types of narratives that place the audience at the center of the message being conveyed play a central role in many genres of written communication within the professional disciplines. Product guides, instruction manuals and how-to documents have been in widespread use in technical disciplines such as engineering for a couple of decades, as they play very important roles in disseminating information not only about concepts, but about procedures as well, across members of organizations. Because many of the products that engineers produce end up being used widely in communities ranging from science (e.g. the oscilloscope) to popular culture (the ipod) in the 21st century, these documents tend to have a wider scope and impact that one would think at first.

In addition, the narrative modes players learned to use in game labels, shared in common with these other technical documents the effective use of specialist language and concepts as structural elements behind their messages. Hence, the practice of creating a narrative that relays instructions for a player on how to play a game, is not completely alien to the practice of instructing a user to use designed artifacts in other important domains of 21st century life.

The findings suggest that Gamestar Mechanic's language of games provided these middle school children with a system for expressing meanings relevant to their own lives in a medium they were familiar and engaged with. In this way, they found a set of tools and contexts where they could think in deeper and more critical ways about games as media they consume that one would expect them to have at first, as in the cases of commando and maxwellstone. Such critical examination of the meanings within the media they consume has been considered a fundamental literacy skill in the $21^{st}$ century, and exploring the possible connections between Gamestar Mechanic's design jobs and critical literacy approaches to media certainly merits extensive examination beyond this research (American Library Association, 2008).

However, for al the potential that narrative-driven game design could bring to players' discourse, if their design process ended here and only took into account the designer's model of the ideal player, their designs would come short of their potential effectiveness. The three dialog framework highlights the importance of having real players test out these designs in order to corroborate, and if necessary redesign, the initial game system. While it is beyond the scope of this chapter to discuss this real player dialog in detail, one must keep in mind that only with the participation of other people in the process of design, can the narrative skills discussed here achieve their full potential. The following chapter discusses this in detail.

# CHAPTER VII: ENTERING FLUENCY WITH THE DISCOURSE OF GAME DESIGN THROUGH A REAL PLAYER DIALOG WITHIN GAMESTAR MECHANIC

### *Introduction*

This chapter presents a discourse-based case study to documenting the way in which a teenager under the pseudonym Marc evolved in his thinking about games and the Discourse of game design across two years of participation in the Gamestar Mechanic project. It focuses in particular on the way in which Marc's dialog with other real players became an entry point that gradually led him to think and communicate more effectively using the language of games. It examines the way in which this process helped him develop language and literacy skills important to 21st century learners (New London Group, 1996), and their impact on his learning experiences beyond the game.

### *The Real Player Dialog in Gamestar Mechanic:*

At the point of this writing, the Gamestar Mechanic project has just concluded its third year as a collaborative effort between educational researchers at the University of Wisconsin-Madison and professional game designers at Gamelab in New York, to produce a game-based learning environment intended to teach middle school children from disadvantage backgrounds the Discourse of game designers. By Discourse, I refer to James Paul Gee's notion of the ways of doing, being, using language (referred to as discourse), and believing which define a person as a member of a community of game designers (Gee, 2005).

Throughout the three years of design and research that comprise the Gamestar Mechanic project, one of the central theoretical insights that have emerged, is a model of the thinking and meaning negotiation practices enacted by good game designers using meaning representation in games as a form of language (the language of games). I call this model the three-dialog framework (Figure 7-1, for details see Games, 2008).

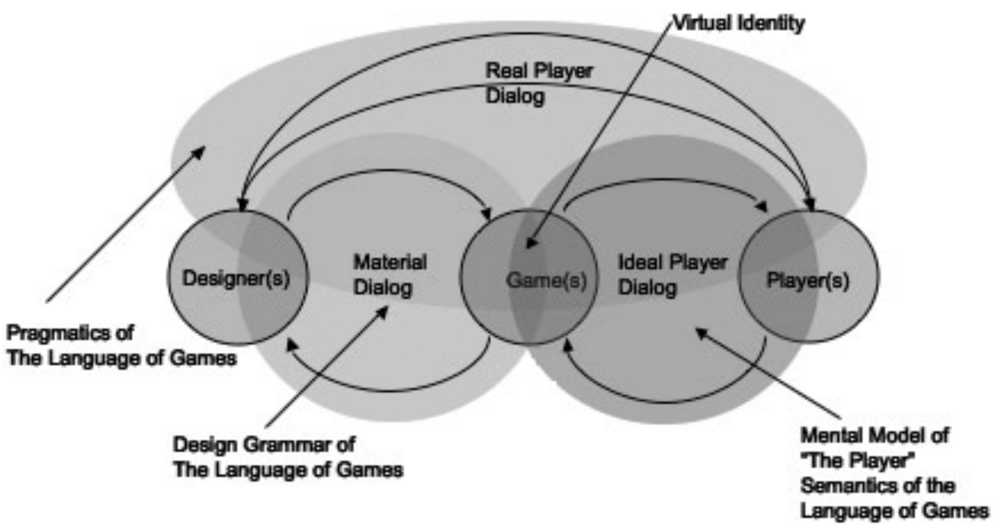



Figure 7-1. The Three Dialog Framework of the Language of Games.

The framework describes the system of communication and meaning negotiation necessary to produce good games, and it is comprised by interactions between designers, the games they produce, and the players that will play them. I call these three levels of interaction the material, ideal player and real player dialogs, and each of them serve the purpose of bringing into the designer's awareness the grammatical, semantic and pragmatic functions of meaning representations within games as a system of communication where they play interdependent roles.

Chapters V and VI concentrated their analyses on the material and ideal player dialogs respectively, examining the way in which children playing Gamestar Mechanic changed their conceptions and practices regarding game design over time. This chapter concentrates its analysis on the ways in which a player's real player dialog shaped his competence with the Discourse of game design across three different instantiations of Gamestar Mechanic, over a period of three years.

The real player dialog is an interaction that brings to fore the pragmatic role that meaning representations can serve, in helping players negotiate common meanings regarding what constitutes a good Gamestar Mechanic game. It does so by situating the meaning and value of language and other meaningful representations (images, characters, design patterns and so on), in within the boundaries of the Discourse historically used by a specific community. In other words, it helps community members distinguish from forms of expression that "work in the world", from those that don't. The real player dialog serves a crucial meaning negotiation role in multiple activities within game design. It takes a particularly important role in those activities designers engage with real players (including other design team members in the role of players) for a variety of reasons including discussing their games, getting feedback on the experiences they provide, and to get a sense of player preferences, as showing in Figure 7-2 Below.

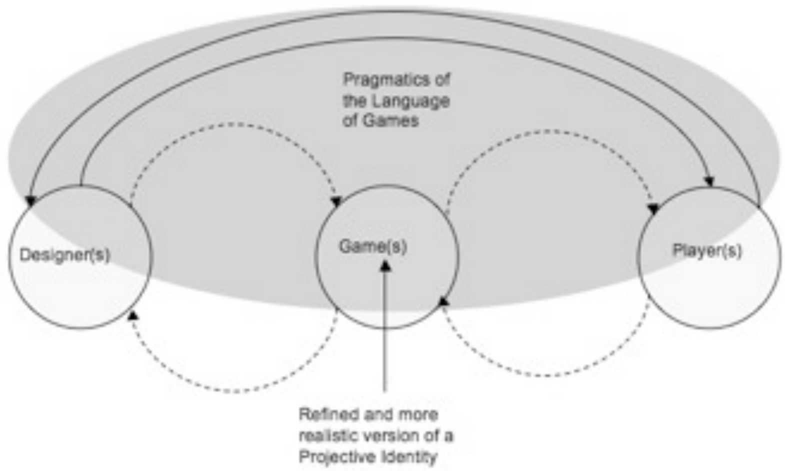



Figure 7-2. The Real Player Dialog

As the diagram shows, the dialog can happen either directly between a designer and a player in the same room during a play test session, or it can take place indirectly, though observations done via video of players playing a game or through electronic discussion forums such about a game, like in the case of the popular World of Warcraft community, where players discuss and leave feedback for the game's designers (Table 7-1).


a)


b)

Table 7-1. a) A screenshot from World of Warcraft. b) The WoW discusson forums

Through extended engagement in these activities, designers learn to use the conventions, aesthetic values and practical concerns of real players when designing their games; in other words, they learn the pragmatics of the language of games.

In most forms of language, learning the pragmatics is crucial for a person to effectively negotiate meanings with others (Bruner, 1981). In writing for example, Scardamalia and Bereiter argue that writing that does not take into account the conventions and pragmatic interpretations of readers in the audience it is intended for is just *knowledge telling*, a one way process that seldom produces texts capable of transforming the knowledge of communities (1987). On the other hand, writing that takes into consideration that it is part of an ongoing community conversation can accomplish *knowledge building*, a gradual process of refinement of the writer's own knowledge and that of the community as a whole (2003).

Conversely, when pragmatics are not taken into account in game design, the designer risks ending with a game that only he or her will think is fun and worth playing, ultimately dooming it to failure. Examples of this abound in the commercial videogame industry, as in the case of the recent title "Too Human" (Sterling, 2008). When this game was presented to critics at the E3 conference, prestigious games magazines such as Electronic Games Monthly gave it terrible reviews. In response, lead designer Denis Dyack blamed the many critics of his game design on the fact that it was too innovative for them to "get it". What Dyack failed to see in the reviews is that in his design, he broke many of the common conventions and pragmatic rules that the design patterns he used in the game indicated to players, while ignoring some key conventions needed to effectively interpreting how to play the game. The ultimate result was a confusing and boring experience. The importance of the designer's awareness of such conventions extends to many fields of design beyond games, and has been extensively documented in areas such as usability and human-computer interaction (Norman, 2002).

One of the most effective practices that game designers can engage in to learn the pragmatics of the language of games is play-testing (Salen and Zimmerman, 2003). These practices allow game designers to present a game in various stages of development to real players in order to get valuable feedback on their play experiences. In these contexts, the language exchanged serves a *mathetic* function as well as a pragmatic one, this means that aside from being meaning negotiation contexts, these activities also serve as meaning learning contexts in a similar way that a child learns pragmatics by trying out language patterns with more experienced others (Papert, 1996; Halliday, 1975; Bruner, 1981).

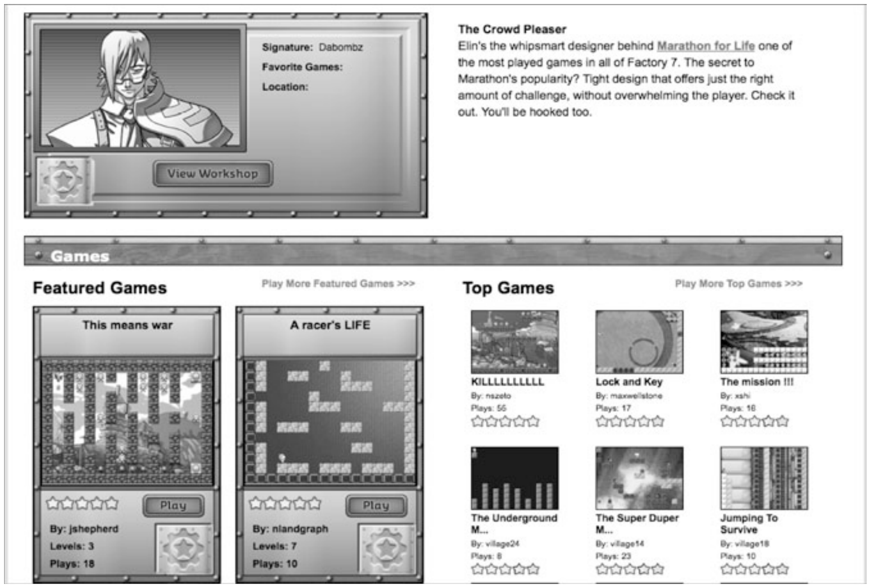
Like other languages, through its pragmatics, the language of games gains a flexibility that allows it to recruit knowledge representations from a multitude of discourse into its own system of meaning expression. The language of games is characterized by *hybridity* –it can incorporate meanings and forms from a variety of Discourses - and *multimodality* – it relies on multiple mediums of representation such as images, video and audio to convey meanings-. These two characteristics fill the pragmatics of this language with opportunities for designers to experiment with a wide variety of forms of knowledge representation within as well as outside the Discourse of games, helping them understand their uses in context and if possible integrate them into their own games.

Through hybridity, modern games can recruit representations that are highly valued in other domains such as the academic and professional disciplines. For example, Railroad Tycoon 2 is a game where the player takes on the role of a robber baron trying to build a rail empire in the early 20th century America. In this role, the player must make decisions about what and how much track to build, the types of locomotives to develop and so on. In order to make these decisions, the player must interpret a variety of representations that range from geographical maps, to budgetary reports to math graphs (Figure 7-2).

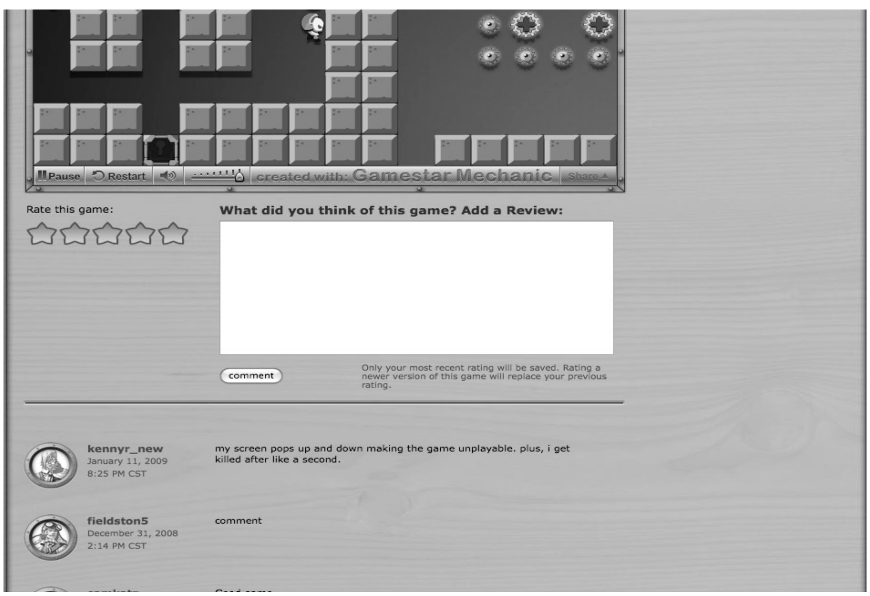

<u>Figure 7-3. Two screenshots from Railroad Tycoon 2</u>

Given that they are an eminently computational product, modern videogames rely on multimodality to complement the shortcomings of some representations regarding conveying certain ideas, with the strengths of others. As in diSessa's example of Galileo's versus Newton's explanations of the laws of motion (2002, p. 13), different forms of representation can allow some people to express and understand some ideas in much more efficient and sophisticated ways than other representations, but in the process obscure other ideas, making them more complex to understand and express for others. Hence, learning the pragmatics of the language of games can help designers gain a wider array of tools through which to communicate with broader audiences.

In Gamestar Mechanic, the real player dialog is most prominently featured in the context of those design contexts involving its online community of players. These are mainly represented in a community website called the Game Alley, where every game made by a player can be published and shared with every other player who has a game account (Table 7-2 screen a). As I discussed in Chapter III, while this feature was not always available in its fullest form in the early prototypes of the game, activities that involve social participation in a community of designers have been an integral part of every instantiation of the game since its inception. An activity that has remained central in all these instantiations has been that of sharing, play testing and critiquing games with others. In the latest version of Gamestar Mechanic, every game that gets published becomes associated with a rating and comments form, where other players can leave feedback for their makers.  Through the ratings, players gain status in the community of game designers as games that have the highest average rankings (with five stars being the highest rank) featured more prominently in the Game Alley (Table 7-2 screen b).



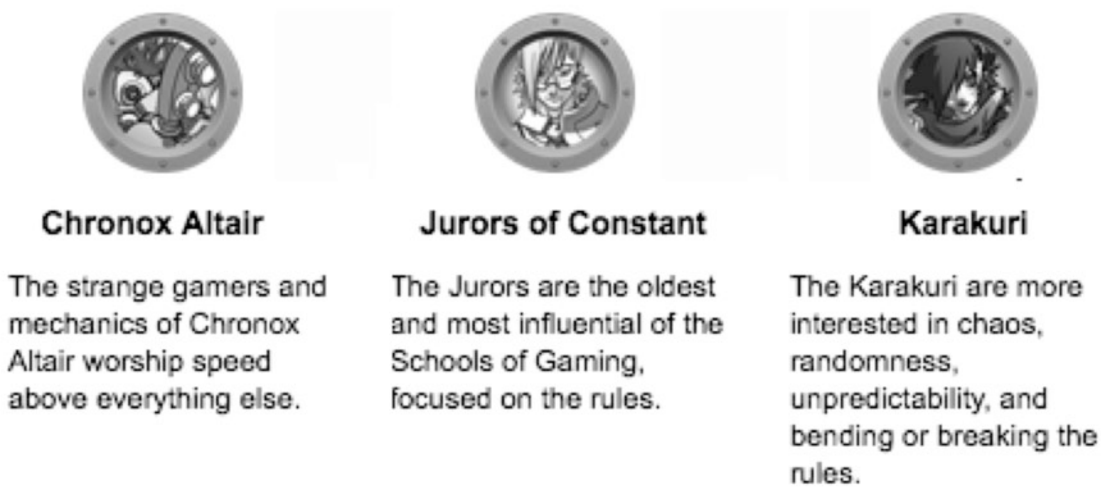

a)




b)

Table 7-2. The Game Alley Site and Game Comments and Rating Form

A second way in which the pragmatics of the language of games are presented to players by the game, is through Gamestar Mechanic's role playing component. When a player first logs into the game, they must choose an avatar, a character that will represent them in the virtual world of the game and in the online community. In the game narrative, avatars belong to one of six different schools of gaming, groups that espouse different philosophies of game design with specific value systems through which the quality of their games is judged (Figure 7-4). In this way, players can choose multiple paths to advance in the game, either by choosing to stay within the boundaries of their school philosophy, or by extending their Discourse to include the perspectives of other schools.




<u>Figure 7-4. Examples of Gamestar Mechanic Avatars in different Schools of Gaming</u>

***Methods:***

*<u>Context and Participants:</u>* When children learn their first language, their initial experiences with it serve as much of a mathetic role (helping them learn the language itself) as they do a pragmatic one (helping them accomplish a specific communicative goal). It is only after an extended period of interaction with the communicative tools provided by the language (words, grammatical structures and so on), as well as with other people using them, that a semblance of sophistication emerges in children's utterances (Bruner, 1981; Halliday, 1975). In older children and adults,

becoming proficient in new languages such as that of games also necessitate an extended effort and engagement that diSessa terms *committed learning* (diSessa, 2002).

Working under the assumption that learning the pragmatics of the language of games follow a similar evolution, the case study reported here concentrates on an individual player named Marc (a pseudonym) who continuously participated in all the Gamestar Mechanic workshops in all cycles of design research for the last two years of the project. Not only was Marc's case interesting to me as the researcher, but also to all members of the Gamestar Mechanic research team, because his background as a low SES middle school student was representative exactly the type of disadvantaged population that the game was designed to serve. Marc was a 13 year-old middle school male student when he began participation in the game. He belongs to a low SES family in a medium-sized Midwestern city. His mother is unemployed due to health reasons, and his father works as a house painter. The family has a history of economic and educational struggle, and the parents have had several instances of trouble with the law in the past. During a preliminary interview in 2006, Marc expressed disaffiliation with school, saying he would prefer to have less homework and more time to do other things. However, he expressed a desire to pursue a career as a designer, doing either football or something related to design, and he was aware that he needed to succeed in school-based tasks in order to achieve that, though it was not clear to him what he needed to study to do this. In contrast he expressed a strong affiliation to videogame play, and considered himself a gamer, playing for nearly 40 hours a week.

_Data Collection and Analysis:_ In order to document this study, I relied on several ethnographic methods throughout the three years of Marc's participation. The overall purpose of each of these is outlined below:

a) _Participant Observation:_ In order to make the observations of Marc's activities as naturalistic as possible, I took on the role of Samson, a character in Gamestar Mechanic representing an experienced game mechanic whose role is to serve not only as a player in the community, but as a guide and mentor to new mechanics as well. In this role, I was able to develop a good rapport with Marc, which helped maintain his interest in coming back to the workshops throughout the two years. I also kept a systematic log of field notes on his interactions with the participant during this time in computer text files. I digitally recorded every workshop session, and stored and catalogued the videos in a password-protected university computer for later access.

b) _Ethnographic Interviews:_ Over the last three years, the Gamestar Mechanic project has followed a design agenda comprised by three phases termed prototype, alpha and beta representing different degrees of development of the game. On numerous occasions during the three phases, I conducted ethnographic interviews with Marc and other members of his family regarding their views on the usefulness and value of the workshop in other areas of his life such as his life goals and academic activities. Questions such as "What is the most important thing you learned during this workshop?" and "Have you found anything you learned here useful in other parts of your life?" were common in these interviews. Some of these interviews were conducted in face-to-face settings, some over telephone and some over email. I then transcribed and stored the interviews in digital format on a password protected university computer.

c) *Pre and Post Workshop Design Interviews:* At the beginning and end of each workshop, I conducted a design interview intended to assess the changes in Marc's use of the material, ideal player and real player dialog while completing Gamestar Mechanic jobs. This protocol consisted of a sequence of play, repair and design jobs similar to the ones presented by the game, where Marc was asked to do a think aloud of the meaning-making processes guiding his design. I documented these interviews recording two parallel digital videos, one of Marc, and a screencast of this activity on the computer screen. Like other videos, I also catalogued and stored these on a password-protected university computer.

*d)* *Digital and Paper Documents:* As in previous studies, all of Marc's games and its associated digital texts (e.g. game labels and reviews) are permanently stored in the Gamestar Mechanic server at Gamelab. I had full access to these documents for later review and analysis. In some cases, Marc also produced narratives and drawings for his games in paper-based format. I filed and stored copies of these in locked university cabinets.

Using this collection of documents, I constructed a “thick description” (Geertz, 1976) of Marc’s learning experiences throughout the Gamestar Mechanic project, and documented the changes I observed in his use of the material, ideal and player dialog during play. This collection of documents also served the purpose of triangulating my observations for validity purposes, together with sharing my observations and data with other members of the Gamestar Mechanic team for independent analysis. I collected and coded transcripts of all digital video and audio data using Transana (Woods, 2003) a video analysis tool where transcripts, audio and video can be simultaneously catalogued and stored for analysis. Where language samples were involved, I encoded the transcripts using Jeffersonian notation and examined them using a multimodal Discourse Analysis methodology (Gee, 1999; 2005) specifically focused on instances of Marc’s discourse during the ideal player dialog.

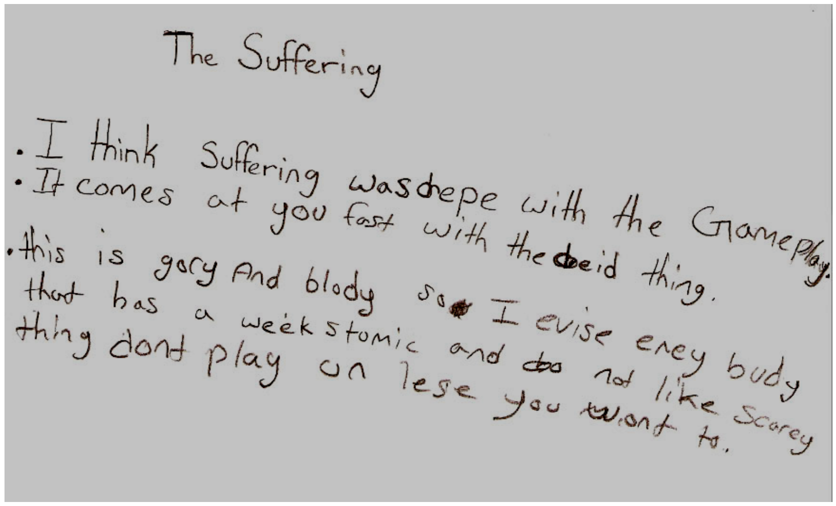
***Fieldwork***

I now turn my attention to the specific research question guiding this chapter, namely, how did the real player dialog impact Marc’s language and literacy practices over his participation with the game? To answer the question within a reasonable amount of space, I begin the narrative with a brief description on his background and his entry into the project and then concentrates on four specific areas where the ideal player dialog’s influence on his language and literacy practice changes were most noticeable.

*Marc's background and entry into the Gamestar Mechanic Project*

Marc's relationship to the Gamestar Mechanic project began in the second week of February 2007, when I received an email from his uncle, whom I will refer to as Joe, asking for an opportunity to get his nephew involved in a game design project he had heard about at the University of Wisconsin. During our initial interview it became clear to me that Marc came from a troubled background in working class home, and a dysfunctional family. His uncle explained that his mother was trying to "get her act together", and find a job as a waitress after having experienced problems with drugs. Marc's father was also struggling to make ends meet, working on several jobs as a painter, and having been in trouble with the law on several occasions before. He also explained that Marc was a great kid, but he had recently been having trouble at school because he particularly in the language arts areas, but he had a very strong interest in games, which he spent a substantial amount of time on during the week. I asked to have an interview with both of them and we set it up at the end of that week.

Early in this workshop, it was evident that Marc's attitudes toward school versus games could not be more different. He displayed a particular aversion to reading and writing, and his print literacy skills were deficient, as the example of a review for a game he liked to play (which I asked him to do during the first session) in Table 7-3 screenshot a shows. Instead, he showed a strong preference for drawing and other forms of visual expression (screenshot b). However, he also expressed a very strong interest in game design as a possible professional path. During his first day, he brought to the workshop a set of pictures he had drawn representing the story of a game he dreamed of making.



The Suffering

- I think Suffering waschepe with the Gameplay.
- It comes at you fast with the deid thing.
- this is gory And blody so I evise eney budy that has a week stomic and do not like Scorey thing dont play un lese you wont to.

a)

b)

Table 7-3. Marc's early writing sample and game art sketches

In addition, it also became evident in his discourse about games early on that Marc displayed a more extensive experience with videogames than most of the other workshop participants, even when they considered themselves gamers. However, his experience did not come from any formal game design program, it came from his voluntary exposure to the medium and the discourse of games, by playing them for over forty hours a week, visiting gaming websites, and watching a popular gaming TV channel G4 (www.g4tv.com).

As I have mentioned elsewhere (Games, 2008), adopting a three-dialog perspective, and its associated practices, during game design, does not need to follow one prescribed route (e.g. starting with the material dialog, then the ideal player and then the real player dialog). Instead, the three dialogs work as a system of communication, and influence each other in various degrees at every point. Hence, it is possible to become better at them by entering the Discourse of game design through any of them, and in the case of Marc, this entry point was his exposure to material being discussed by other designers and players directly. In fact, during his three year experience, Marc tended to prefer direct dialog with other players over other forms of interaction with the game as his way to learn, asking others' questions about creatures or engaging in discussions about games and game design.  I observed four ways in which this had a direct impact on his progress with the Discourse during this time, as the following sections discuss.

*Imitating socially valued designs: Entering the three dialogs from a real player perspective*

One of the main ways in which the real player dialog had an impact on Marc's design practices was by making him aware of game design patterns that, being perceived as highly valuable in the gamer community, would serve as guides for his own learning about Gamestar Mechanic designs. In this way, he harnessed his embodied experience playing games to establish analogies between the ways certain mechanics worked in professionally designed titles and the creatures available in the toolbox. During the prototype stage, an example of his use of the real player dialog came during a game job that I gave the players, requiring them to make a game using only five creatures from a palette of twenty-two available in that early version of the game (Marked 1 in Figure 7-5 below).

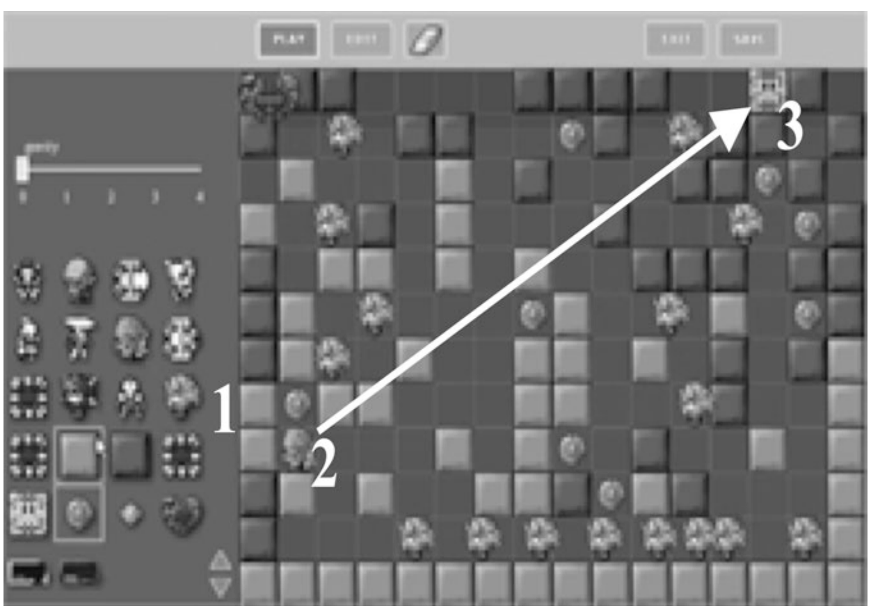



Figure 7-5. Marc's prototype phase design.

During his design process for this game, I conducted a think aloud interview throughout which I asked him to think aloud about his design decisions. I have previously discussed an extended segment of this interview in Chapter IV, however, for this chapter I would like to concentrate the reader's attention on a specific excerpt. As follows:

(R= Researcher's Utterance; M= Mark's Utterance)
Stanza 1
R1: So why, why did you decide to make them that way? (Referring to the maze-like space of his game design)
M1: Well, since I'm gonna pick one bad, evil person (selects the strong enemy creature, marked 1 in Figure 5)
M2: I'll put like (.) as many as I want (places copies of enemy creatures all over the screen)
Stanza 2
M3: Like (.) the Hades, or something, like I play God of War II
M4: And one of the levels that you're going
M5: that you're going (.) you're going to Hades and
M6: all the bad people, and all the creatures you killed…
R2: are in there? Are in Hades?
M7: Yeah. And we have a little (.) the shooter (marked 2)
Stanza 3:
M8: Then it just becomes a puzzle
M9: Find your way out (referring to the goal block creature, marked 3)
M10: As these characters are able to get out of there (referring to the enemy creatures)

Transcript 7-1. Marc's description of the mechanics for his game

Transcript 7-1 shows how the real player dialog influenced Marc's design strategy in this game. At the center of his design lay the analogy he drew to the game God of War II, specifically to the Hades level (Line M3). In the section of God of War II he refers to, the player, in the role of a Spartan warrior, must climb his way out of Hades, the greek mythological underground (marked 1 Figure 7-6) to the surface of the earth, but he must do so by climbing up a maze of rock blocks while avoiding being dragged back down or killed by numerous enemy creatures which he must either evade or destroy (Marked 2). While on the surface both games are dramatically different in terms of their looks, at a structural level they share what professional designer Katie Salen calls the core mechanic of the game, that is, the central activity that a player must enact in order to play (Salen and Zimmerman, 2006), which in the case of both God of War II and Marc's game is to climb to the level exit while avoiding enemies.


Figure 7-6. The Hades Level in God of War II

This example shows how the real player dialog worked for Marc. God of War II is one of the most popular games ever produced, obtaining numerous industry awards and critical praise in popular media the year it was released (God of War II, 2009). Marc's discourse in this excerpt it denotes that he was aware of what Gee's Discourse theory refers to as the politics (2005, P.12) of meaning situated using a particular form of the language of games. It makes it evident he was aware of the fact that high social status is given to the interactive experience given to God of War II, and thus aimed to emulate it to the degree possible using the tools he has at hand.

Marc's strategy is a powerful one, since by relying on his experiences of valuable designs he used them to organize his cognition about the expressive possibilities of Gamestar Mechanic's language of games. Thus, even though at this point it was not clear whether he was familiar with the notion of core mechanic, it was evident that he was able to think in its terms during game design, and express this using the visual and interactive modes of the language of games.

*Gamestar Mechanic schools of gaming and their influence on Marc's real player dialog*

While a real player dialog coming from outside Gamestar Mechanic game influenced Marc's game design strategies, as the previous section showed, as time went on and he became more familiar with the game narrative and functionality, another form of real player dialog began to influence him from inside the game. This dialog was a mediated one with the Gamestar Mechanic team through the schools of gaming narrative, which situate the players' virtual identity within one of several sub communities of mechanics that affiliate with specific aspects of games as those most likely to make good games.

As Gee (2003) has argued, one of the powerful ways in which players learn key concepts within good videogames is by trying on a variety of identities. In Gamestar Mechanic, affiliating to a school of gaming allows mechanics to set some boundaries on the kinds of designs they make, making it more challenging for players (and more interesting for some) to produce good games within them. Throughout the three years of his participation in the project, Marc's games displayed how the influence of some of the schools helped shape his designs practices. In doing so, he developed very sophisticated design patterns that made him stand out from most other players I interacted with during this time. In the beginning, many of the male players in the workshops tended to design games around the shoot'em up genre, tending to use simple and open game spaces full of enemies for a lone avatar to go against (Figure 7-7). In the previous section however, Marc's early design already showed a more sophisticated approach to design than this when using the shooting genre. More importantly perhaps, at this time many of his designs were already beginning to depart from the genre, showing the influence that playing with the different school identities was having on his designs.


Figure 7-7. A typical early design made by a boy using the pre-alpha toolbox

The influence of the Chronox Altair school, a group that values speed and time above all other factors as necessary to good games, was very typical in his earliest designs. Figure 7-8 shows an example of a typical chronox-influenced design during the pre-alpha stage of the game (a few weeks into the project). Entitled "Drive or Die" the game used an tank avatar typically associated with the Chronox school, designed to move faster than the creatures for other schools. The core mechanics in this game required the player to traverse a maze of damage blocks (which damage the avatar on touch), and get to the goal block before a timer ran out.

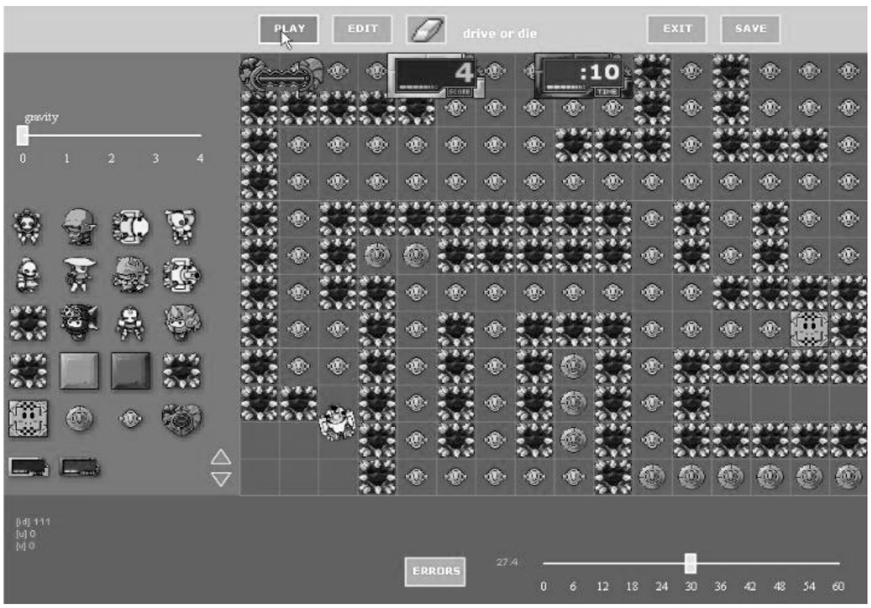



Figure 7-8. Marc's game drive or die

However, with the introduction of game jobs requiring players to share their games with other real players later during the alpha phase, interesting changes took place in his designs. In the beginning, a concern of mine with Marc was that while his early games were well designed, they tended not to feature any text beyond their titles in the game labels, making them unclear to potential players.  By the alpha phase (Six months into the project) this began to change, but it is how it changed that was most interesting. At this stage his labels were still succinct and with spelling and grammar issues, but they were more elaborate in their use of game design concepts, and displayed a specific function in the game, which was to entice other players to play in a way that would elicit some response from them.

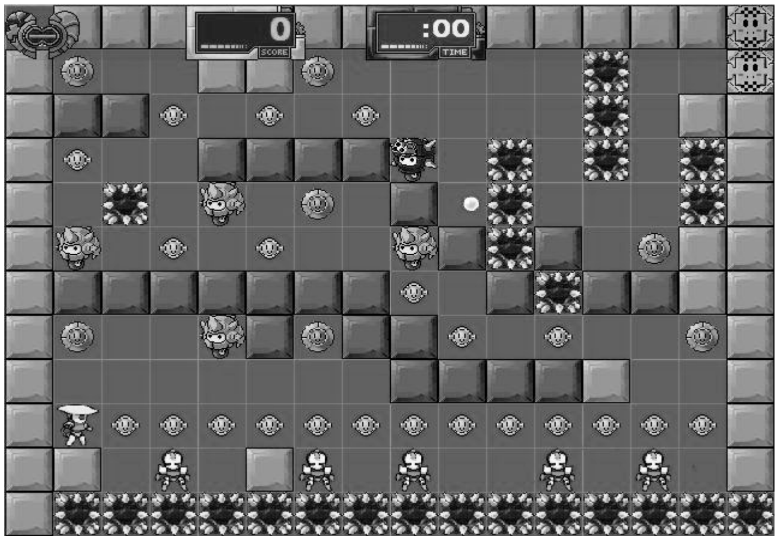


Figure 7-9. Marc's game invincibull

> "In invincibull the hole[sic] point of the game is to get out before 1 min and 30 sec and get all the coins[sic] and if you beat my record of 53 sec, leave me a comment with it and tell me how you did it. I ALMOST forgot, begin to holding the up buttn[sic] and the right buttn[sic] to hover a crost[sic] the screen"

Figure 7-9 shows an example screenshot of a game he called "invincibull", which used a similar maze-traversing mechanic as drive or die. Below the game screenshot is the label Marc wrote for it, challenging players to play the game and beat his record time for completing it. In doing so, Marc created a "metagame" (Zimmerman and Salen, 2006), a game that went beyond a specific instantiation of "invincibull" and instead placed it in a position as a mediator of a dialog between him as its author, and players as respondents, as shown earlier in Figure 7-2.

This game was quite successful with the other participants in the workshop, because it created an atmosphere of player competition that attracted a lot of attention and feedback from other players. As a consequence, Marc adopted this as a hallmark design strategy in many of his designs, and toward the Beta stage (two years into the project) decided to have his avatar adopt the identity of a member of Acheron rising, a school that places challenge and competition as the centerpiece of design. Figure 7-10 shows a sample of a sophisticated game he made using this pattern, designed as a race between an avatar (Marked 1) and an enemy (Marked 2), it challenged players to reach the bottom of the level before the enemy did or a timer ran out (Marked 3) and leave their times in the comments form.

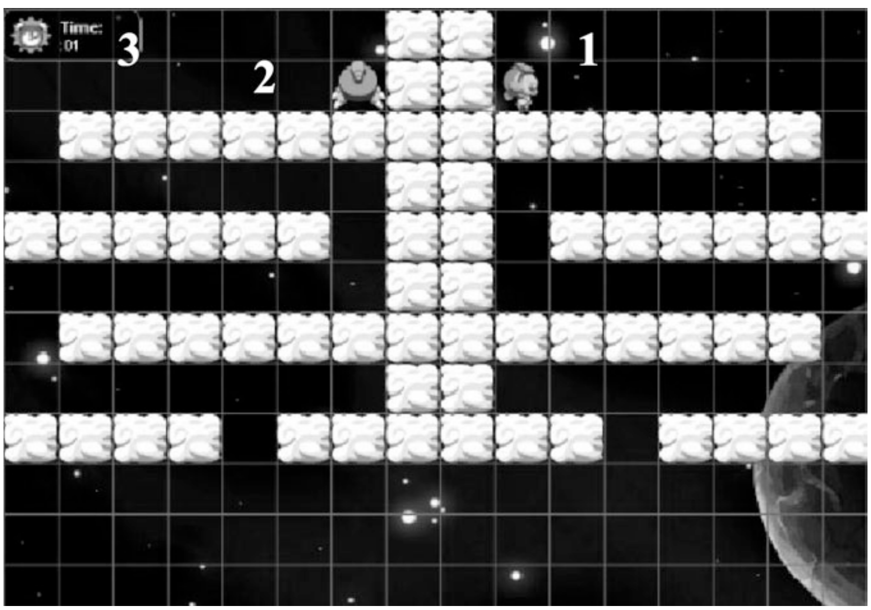



Figure 7-10. Marc's racing against time game

*The real player dialog and it's influence changing Marc's writing attitude and practices.*

In the previous section I briefly discussed the way in which the real player dialog impacted Marc's design strategies, and in particular how writing began to take a more important role in his designs. In this section, I would like to examine some of the factors that led to his change in attitude toward writing, and how they impacted Marc's literacy skills beyond Gamestar

Mechanic. As I mentioned earlier, when Marc first came to the project, his attitude toward writing was one of avoidance. His experiences with school writing had not been good, and his grades in language arts were floundering. This was especially evident in the pre-alpha stage jobs that required him to make games and write a label for them. During one of these jobs, he made a game where the player had to stop enemy characters from leaving an area surrounded by concrete blocks, by shooting at them as they exited through a gap between them. The label he produced at the end of this job read:

> "The presoners [sic]
> There was a war a big war[sic] It tuck [sic] out a lot of sogers [sic] but some servived [sic] but got capshered [sic] in the prison"

Not only was it evident that his spelling and grammar skills were poor, but more relevant to the game designer Discourse, his label did not connect to any of the core aspects of game play necessary for a player to understand it, beyond a surface thematic view. At the same time, this early narratives made no mention whatsoever as to the role that players might have or how they would play the game.

However, as I discussed earlier, I began to see some changes in his approach to writing once I began introducing Gamestar Mechanic's community features through job requirements involving direct exchanges with other players. Why was this? During the preliminary interview suggested that social status was a very important motivating factor behind his desire to make games.

During the interview, I asked him "Why do you interested in learning to make games?" to which he responded, "Because I want to make a game that people say, woah, this is so fun! I want people to remember my name".

In addition, as his exposure to the game jobs and schools of gaming narrative increased, so did his exposure to the specialist language of the Discourse of game design embedded in them by the team of professional designers from Gamelab and myself. In the job requirements and in the non-player character discussions within the narrative, terms such as rules, gameplay, levels, goals, core mechanics, and narrative were commonly used to describe the main elements that games should have in order to be good (see chapter V for a more complete description of these).

With this exposure, I also began to observe that Marc began to appropriate these terms within his discourse and in the labels, and as a consequence his writing began to take a slightly more sophisticated form, as in the example label for a racing game he wrote toward the middle of the alpha stage below:

> "This game is not like any other raceing[sic] game you have seen before[sic] it takes the game play of Jak-X Combat raceing[sic] And speedbike motersport[sic]. You play as Kenny trying to unravil[sic] his past but he's going to need his best friends and pit crew [sic] play 50 action pack levels with a bike you cutimiz[sic] And be the new battlbike[sic] racer champeon[sic]."

While it is evident in this sample that his grammar and spelling were still poor, this label, like the one in invincibull, was a definite improvement from the previous ones. Why? Because Marc was now trying to produce a more elaborated narrative tied integrally to the game. His use of terms such as game play, and levels, as well as the shift from a third to a second person perspective are very significant, for they suggest that his design strategy now considered the player as a central component that one needed to think about in order for the game to work, just like his label for invincibull in Figure 7-9 did. By bringing the player as an important element within the game design equation, the real player dialog allowed Marc to become a participant in the reflective activity of the ideal player dialog, which I have thoroughly discussed in Chapter VI.

But with these extended narratives and games intended for players other than him to play, also came another factor that was a highly motivating for him and that changed his perspective and attitude toward writing substantially. As we moved into the third year of the project, one of the main features that got integrated into the game was the online mechanism for a larger community of mechanics to emerge, in the form of the game alley, and the ratings and comments forms for every published game. With this came an expanded exposure of Marc's games to a broader audience of players, who brought with them different perspectives, levels of experience and gaming preferences to the game.

During one of the sessions in the beta stage (two years into the project), Marc began to complain loudly that another player whom he didn't know had left him a horrible and unfair review, that said his game was bad because it didn't play like the player wanted it to. I asked him "So what are you going to do about it? Are you going to change your game?" and he responded that he wanted to tell the player he was wrong and did not understand what the game was about. So I responded "why don't you write a comment and explain what you intended?"

After the session where we had this exchange, Marc did not come back to the workshop for several weeks, which made me concerned that he had decided to abandon it. However, when I contacted his mother, I was surprised to hear that during this time he had been practicing his writing, because he realized how important it would be to his game design practice. His mother later explained how he had been doing a lot of writing at school and had improved his grades from an F to a B within a couple of months, though he was still a very slow writer.

Months later, during one of the beta sessions late in his third year, I asked him to show me one of the stories for a game he had been working on lately, he emailed it to me and said it was the game he was most proud of. The story read:

<u>KEYS TO HEAVEN</u>

> The year is 2151 and you play as a[sic] ex-convict (Kevin Smith) with a checkered past. The only way to the light is to find these keys but these keys aren't normal because the color is the key. In this adventure there are 5 levels of puzzles, bosses, collecting and people trying to put you back in prison for a crime you didn't commit. They will stop at nothing to get you.

> This is how the game 1st starts. You have been out of prison for one year. You feel like life is getting good again. Your[sic] married with 1 son and a daughter. You have a pretty decent job, however one day you come home only to find your wife and kids have been killed. The cops come and assume you did it but you know that you didn't so let the game begin.

By this point, it was evident that Marc had improved substantially not only in his writing ability (though at the point of this writing he is still a slow writer), having substantially less grammatical and spelling errors than in the previous labels. However, what is evident in this one is that his command of the specialist discourse of game design was substantially higher than in the beginning of the workshop, as he integrated elements such as the goal of the game (collecting the color keys), its genre (a puzzle game), the number of levels, and the virtual identity of the player into a coherent piece. It also shows how the real player dialog played an important role in achieving this change in his literacy practice.

*The real player dialog's influence in Marc's pragmatic conception of "the player"*

In any form of literacy, a fundamental aspect that differentiates good practices from bad ones is what in print literacy is called a text's *audience*. A writer's beliefs about the role of audience when composing a text is fundamental to its quality, as more experienced writers are able to ascribe an active meaning-making role to their readers, and account for possible differences in interpretations they might bring (Bereiter and Scardamalia, 1987).

In games conceived as a form of literacy the equivalent construct are a game's *players.* In this medium, conceiving the player as an active participant in the game is, if nothing else, more crucial than it is in text, because games have interaction as a core mechanism for player participation (Crawford, 2003). When a game is well designed, designers will use any mechanism at their disposal to take the diversity of player preferences into account, allowing them to manipulate their game experience within certain bounds, but making them co-designers of their own play experiences (Gee, 2003).

One of the most important changes that the real player dialog brought to Marc's game designer Discourse and its associated design practices, were the changes in his conception of who "the player" would be, and what they would expect from his games. This was particularly telling in the way that he conceived the role of challenge making a game good. Like many players, at the beginning of his participation in Gamestar Mechanic, Marc's perspective was that a more challenging game was equivalent to a more difficult game for himself.

Hence, many of his initial games, though simple, were designed with a very high level of difficulty, such as the God of War II-inspired game he made in a previous section. However, during one of our interviews he said this started causing a problem when I introduced play testing and game sharing into the workshop jobs, given that as he put it, what he "thought wasn't too difficult, I found was too difficult for other players, and they would complain about my games in the comments form, but then if I made it easier, it would be too easy for some and they would complain as well".

However, by interacting with different players over time, his realization of different player skills allowed him to devise clever approaches to design that would not only solve the design problem, but to so in a way that would satisfy a wide variety of play experiences. In the pre-alpha version, games made in the toolbox were limited to single-screen games whose edges had to be bound using concrete blocks (see Chapter III for details on this phase), hence having a game that satisfied the challenge preferences of multiple players was quite a challenging problem to overcome. Marc's creativity was displayed in his solution during the design of invincibull (see Figure 8), where using a metagame he had the players "make their own game out of it, and make it more difficult for themselves, by comparing times to complete it".

In the beta version however, the editor introduced new functionality that allowed players to create games with different screens concatenated as multiple levels, as well as games with spaces spanning multiple screens. During this stage I conducted an interactive design interview with Marc in the middle of his design of "keys to heaven". I asked him whether discussions with other players had in some way impacted his design. He responded:

> "I decided to make the game in parts and publish small sections of each level to get comments on what I should do next. When I saw that some players found them too easy, I then added more difficult sections further ahead and used the new

> version to add more difficult levels later. I designed the levels starting with easy and difficult parts, and each level was more difficult than the one before. That way everyone would get a chance to play the game and enjoy it. ”

His strategy was effective. Keys to Heaven became one of the best and most praised titles in the beta stage of Gamestar Mechanic, among workshop players, with commentary praising how good of a game it had become. By diversifying his model of who a real players using his games would be, the real player dialog, mediated through Gamestar Mechanic's facilities, moved Marc to a more sophisticated perspective of games and game design, and a more effective use of the language of games to create good game experiences with it.

***Discussion***

The purpose of this chapter was to provide a detailed account of the way the ideal player dialog influenced the thinking, language, and literacy practices of a student across the three years of participation in the Gamestar Mechanic project. As with any language, appropriating and effectively using the pragmatics of the language of games to construct meaningful game artifacts for others is not something that happens immediately, but takes time to evolve.

For Marc, acquiring some of these pragmatics came at different rates. Some, like his knowledge of socially valuable design patterns, he brought with him to the game, and Ganmestar Mechanic just provided a flexible enough system of expression for him to use them as a basis to emulate.

Others took several months, like beginning to see the role of players in his games, like in the invincibull example. And yet others required some special scaffolding from Gamestar Mechanic to emerge, like his use of the schools of gaming principles or coming up with a multilevel solution to different player skill levels. These took not only time, but also interaction with other people and with the new expressive mechanisms made available with the game to emerge. What is certain, is a game like Gamestar Mechanic, designed with a specific educational purpose in mind, and taking into account the actual practices of those people who would use it, has shown much promise as a vehicle to help transform the understanding of literacy practices such as gaming, that they are now native to.

But this case also exemplifies the way in which Gamestar Mechanic shows promise as a learning environment for language and literacy practices beyond game design. The findings in this study show how even in these so-called 21$^{st}$ century literacies, central concepts of traditional literacy such as the role of audience, and the coherent articulation of a message are as fundamental as ever. This makes Marc's example all the more encouraging, for there is a growing and concerning trend in our nation with impoverished middle school children who, like Marc, have learned to disaffiliate themselves with these fundamental literacy practices. These are the same students who, unless we can help them find meaningful ways to use these practices, are at risk of dropping out of school sooner or later (Chall, Jacobs & Baldwin, 1990; Chall & Jacobs, 2003; de Leon & Carnegie Corporation of New York, 2002; Ewell & Wellman, 2007).

Given that so many children in Marc's demographic are increasingly showing an affiliation to playing videogames as well as well as making them (as evidenced by the long waiting list of boys we have had every workshop year), spaces like Gamestar Mechanic may prove useful tools helping them realize the practical value that these literacy skills can bring to their own lives, and hopefully one day extend this perspective to other school practices.

The game is still in its developmental phases, and much work still needs to be done in its assessment of the ways in which it does, doesn't or might benefit students. For example, while the schools of gaming narratives helped Marc organize his knowledge of design around certain principles, these do not necessary fully represent the conventions and standards by which professional designers would think about their own designs. Genres such as adventure, role-playing or puzzle are not part of the schools of gaming narrative, and this seems like an omission that must be addressed for the game to fully serve its purpose.

Hence, what changes need to be made will be the result of examinations such as this one, engaged in a larger conversation with professional game designers. However, it is my hope that the understandings that the real player dialog as an analytical framework can bring to this discussion however, make a useful contribution for future research and assessment with Gamestar Mechanic and other learning environments based on game and interactive media design.

## SUMMARY OF FINDINGS AND CLOSING REMARKS

I set out to do this dissertation with two purposes in mind. The first was to investigate whether and how middle school children playing Gamestar Mechanic would learn to appropriate aspects of the Discourse of game designers within their language and literacy practices, by recruiting those meaning-making tools provided by the game in their language and literacy practices. The second, was to generate insights into the ways in which understanding these practices have influenced the overall theory and design behind the game, and how they might help educators, researchers, and designers interested in game design as a pedagogy, to develop their own interventions and assessment frameworks.

Regarding the first goal, in this dissertation I have provided empirical evidence that Gamestar Mechanic -and by extension computer game design as an activity- can foster in middle school children the learning and appropriation of language and literacy skills demanded by 21$^{st}$ century life. How does it do this? At its most fundamental level, the purpose of *any* literacy it is to provide people with a system of knowledge expression and interpretation that allow them to fully participate in the social, technical, civic and economic activities demanded by their day and age.

These chapters have shown that Gamestar Mechanic does this for children principally by teaching them to appropriate a game designer Discourse, by becoming competent at communicating using the *language of games,* a multimodal system of representation that in Gamestar Mechanic is embodied in the game's creatures, and the contexts in which they are articulated into games. The game does so by exposing them to a collection of tools such as the mechanic toolbox and contexts such as the factory jobs and game alley, which lead them to think and of their games in function of the three dialog framework (Figure 1). This way, they become gradually aware of the grammatical/structural, semantic, and pragmatic communicational possibilities of the language of games, and its implications for the creation of better games.

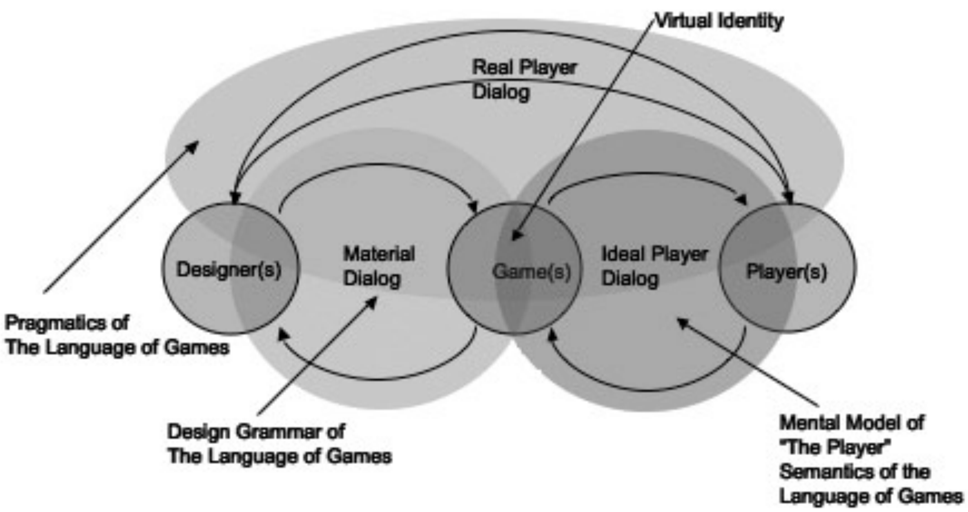



Figure 1. The Three Dialog Framework of the Language of Games

But as the chapters also show, the implications for children's thinking of learning to communicate with the language of games extend beyond Gamestar Mechanic and even beyond games themselves. Examining the material dialog in Chapter V, I showed that communication with this language is inherently multimodal, because it recruits not only visual and interactive meaning representations such as the toolbox creatures and the patterns of interaction that can be constructed combining them, but it also recruits specialist language terms such as *rules*, *goals*, *challenge*, and *core mechanics.* All of these tools hold in them a form of distributed intelligence that helps learners organize their cognition around specific and complex design goals or problems, and develop strategies to address them. Ultimately, they learn to think of their games strategically, and in function of complex systems of interaction, which are skills demanded by many areas of human activity in a time when computer simulations and interactive representations of world phenomena are used to understand concepts from global climate change to physics to economics.

An examination of the ideal player dialog shows that by setting up contexts where game narratives are part of its game design jobs, the language of games in Gamestar Mechanic can also help players use their commonly held perspectives of games as narratives as entry points into think of them as representations of identities to be adopted by an “audience”. As chapter VI showed, this move from stories to identities had implications beyond the game itself, for by placing the meanings conveyed by the game at the center of their analysis, it helped children think more deeply and critically about how those same meanings would be discussed in other games and media they consume. Adopting this critical stance to their consumption of texts and media is a very important skill today, since children are now required to navigate through massive amounts of information that enters their lives via the Internet, mobile communications and information platforms and mass media.

As Chapter VII shows, another implication of coming to see games as vehicles for communication of complex meanings can also help students develop stances towards traditionally academic practices such as writing, that are more conducive to their practice than the school context is. The evidence in children’s stories in Chapter VI and in Tec’s writing in chapter VII, shows how the distributed intelligence in the specialist language of games provided within Gamestar Mechanic, can help children to organize their thoughts and express their ideas in more coherent and effective ways. With an increased success in communication, also came a perspective of the value that such an activity could have towards accomplishing social goals valued by them. Hence, my examination of Tec's ideal player dialog shows how situating communication in the context of a real community can provide powerful forms of motivation to immerse oneself more deeply in the nuances of a Discourse such as game design, that had a positive and life changing impact for the child.

Together, all these tools and contexts help players learn to think of their games through the perspective of the three dialogs. They gradually allow them to integrate the dialogs as a system into their productions, and become more competent at constructing games capable of communicating the identities and experiences that they wish to convey, with grammatical, semantic, and pragmatic effectiveness that make them better play experiences and repositories of shared meaning.

Regarding the second goal, this dissertation shows how using a design research methodology in a rigorous and well-documented way can help produce a robust theoretical model that can then be used to design robust game assessments. The three dialog framework is not only the central finding coming out of three years of design research with the game, it is also a model that suggests a minimum set of factors that a learner should be able to recruit in the design of games to be considered competent at using the language of games in communication.

Such an assessment framework should take into careful consideration the different expressive strengths and weaknesses of each one of the modalities of the representations that constitute games, and examine whether the meanings conveyed in one mode in certain games would be best conveyed in another one or vice versa.

The three dialogs also highlight the importance of attending not only to the process of articulating games or to the games themselves, but rather, to the process of meaning negotiation that takes place during the three dialogic interactions. It is at these exchange points that we can assess the players' true understanding of the language of games, and its use within the literacy practices of the game designer Discourse, by examining the way in which grammar, semantics and pragmatics are applied within the systems of meaning representation players construct in their games. A good assessment framework then, should account for the dialogic nature of this meaning production, and, as with the interactive design interviews, utilize data collection methodologies that will do justice to it. Future research into assessments for learning environments based in games and game design should consider this area within their programs of work.

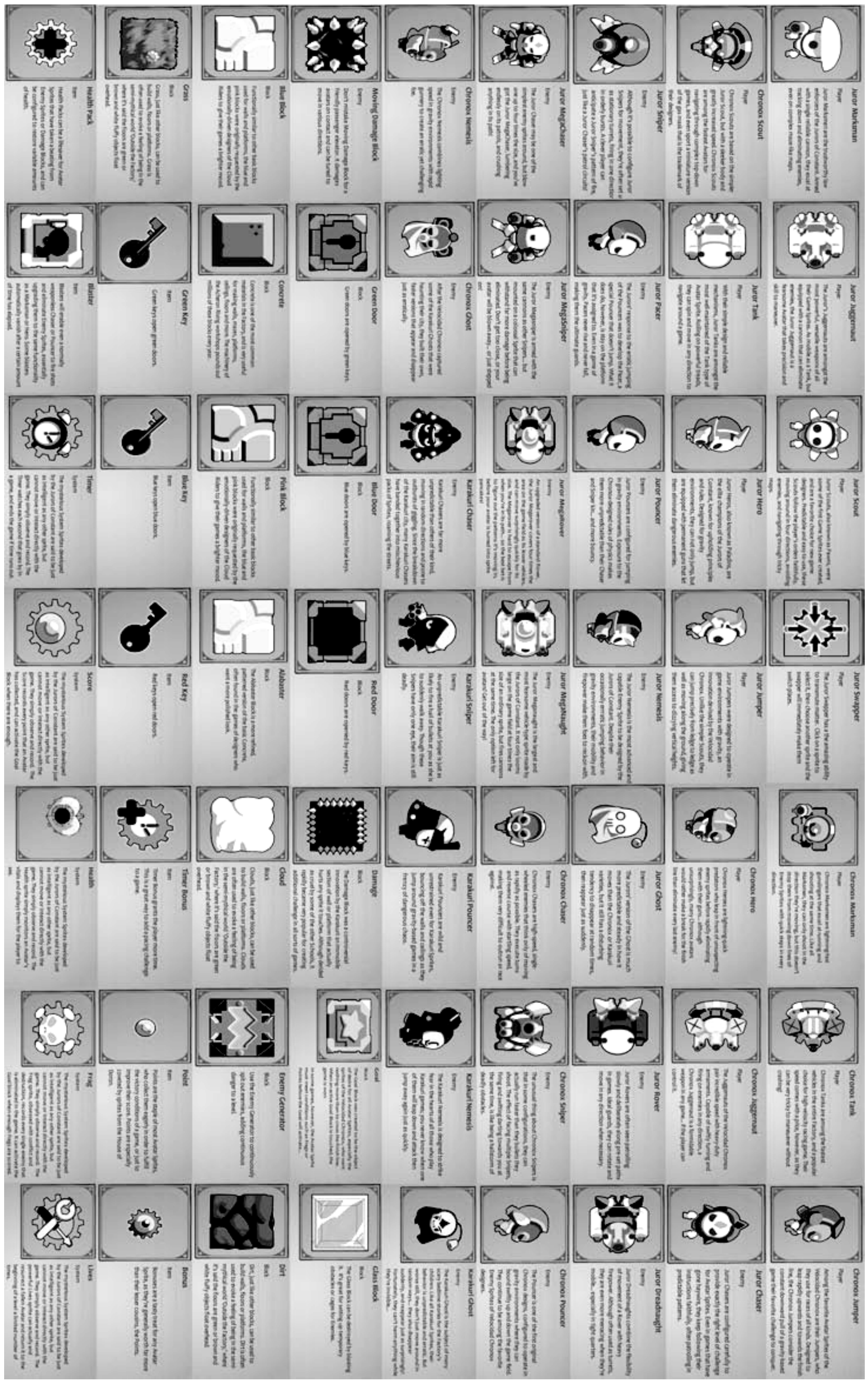
The framework also suggests that learning environments using design in general (and game design in particular) as their central pedagogy, should also implement mechanisms and contexts where learners can become active participants in the three dialogs, regardless of the specific knowledge representations that these mechanisms would want them to master. Gamestar

Mechanic implements the three dialogs by situating game design in a real online community of players (the real player dialog), by providing them with a lexicon of tools and components whose functionality can be tested and assessed iteratively, continuously, and transparently in the toolbox (the material dialog), and by framing the use of these tools and components in the context of authentic activities and meaningful expression germane to a game designer Discourse and beyond (the ideal player dialog).

With regards to these findings and their implications for children's academic learning, two important insights should be evident. First, in our workshops, most of the children involved came from impoverished, excluded or otherwise disadvantaged backgrounds. Many of them came with records of poor academic performance and strong attitudes of disaffiliation towards school. However, many of these same children engaged in activities such as writing, reading and even cycles of inquiry very similar to those of science once their interest was spurred. They also showed a substantial ability to think strategically, manipulate systems effectively and self-regulate their work in these activities once they saw their value in the context of game play and design, all of them skills demanded by those activities in the world of work and social participation that schools are intended to prepare them for. While the samples in these studies are too small to warrant any grand generalization, these findings certainly suggest that learning environments based on game design could show much promise helping children learn and practice concepts and activities that they would otherwise reject or fail to grasp in the school context, and this aspect warrants a future line of research.

Finally, I would like to conclude by saying that three years of research in Gamestar Mechanic have yielded a substantial amount of evidence for Gee's notion that games are not only *not* a waste of time (Gee, 2003), but they can become very effective learning environments for skills within and beyond games themselves, particularly if they are designed with specific learning objectives from their inception. It is my hope that as we move forward, research into games such as Gamestar Mechanic may inform the discussions on the role of games in learning, that they may become viable educational tools for researchers, educators and students in the 21st century.

# APPENDIX A: GLOSSARY OF GAMESTAR MECHANIC CREATURES



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