Stacking the Deck for Learning: What Educational Game Designers Can Learn From Card Games Designed by Kids

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Abstract

This paper details the results of an exploratory informant design workshop in which nine 10-12 year olds were asked to design their own card games with the aim of having them incorporate information about West Nile Virus into their design. This paper details the workshop process in its entirety and considers the rule systems, allowable choices, artificial conflicts and conditions of victory incorporated by the children into their games. This paper concludes by evaluating the participants' game design choices, the manners in which content was incorporated and their potential usefulness to future educational game design pursuits.

Introduction

As commercial video games continue their domination of both the entertainment market and the attention of North American youth, there has been a developing interest over the last several years in using video games as a platform for educating today's children.

In the vein of previous research conducted by Lloyd Rieber, Yasmin Kafai and others, it is the aim of this study to bring to light some of the elements that underpin the design of successful educational games by turning to children as design informants. The goal is to learn more about how children themselves would design games requiring the incorporation of 'serious' subject matter using only rudimentary materials and a strict time allotment.

With this goal in mind, an exploratory informant design workshop was conducted with nine 10-12 year olds which asked them to make their own card games in the hopes of understanding what they would create when met with the challenge of designing a "fun" game which incorporated information about disease prevention and treatment. It was hoped that such a paper-based workshop would elucidate some of the information incorporation techniques and base gameplay elements that children found appealing and useful in their design processes. This could subsequently act as informative building blocks for the developing field of educational game design.

The Trouble With 'Edutainment'

Over the last several years, strides made in the development of educational video games have been relatively lackluster, with a great many projects being pedantic and prescriptive in their approach to

educational game design and educational content often sanitarily inserted into games with little notice paid to the directed attention of the children playing them (de Castell & Jenson, 2003; Gee, 2003).

Starkly put, there has yet to be a significant number of engaging educational video games, which keep children as transfixed or entertained as commercial games. Educational games to date are, by general estimation, not as 'fun' as commercial games and from a design perspective there has been a tendency to insist on directing content at a player as one would in a traditional classroom, instead of facilitating the already assumed direction of a player's attention (Gee, 2003). The problem with this approach is that well designed games are not about 'making' someone play or directing them to play—they're about facilitating the process of play and as such, educational games should not be about 'making' someone learn, but about facilitating the learning process.

Of course this statement is largely predicated on this author's firm belief in one thing: that play is learning (de Castell & Jenson, 2003; Gee, 2003; Koster, 2005). It is this notion that forms the underlying rationale for this research.

Defining Play

One can conceive of 'play' as one of any number of things, which may include the playing of a game with formalized rules like card games, less formalized forms of play such as tossing a ball back and forth between two parties or simply engaging in playfulness which would encompass mischievousness, roughhousing, teasing or other forms of hi-jinx (Zimmerman, 2004). Play can be found in a formal game such as chess as one follows the rules, or even as one maneuvers their way around the loopholes and allowances of those rules. It is what also allows us to informally throw a ball either high or low without consequence in a casual, informal game of catch. Play is constituted by the relationship between elements in a system or given situation and is effectively that "free movement within the interstitial spaces between and among [that system's] components" (Salen & Zimmerman, 2004; Zimmerman, 2004, p. 159).

Play can dichotomously be broken down into the elements of *ludus* and *paideia*: a distinction made by French philosopher and scholar, Roger Callois (Callois, 1961; Newman, 2004). Similar to various 'types' of play that Zimmerman alludes to in his work, *ludus* refers to play that is organized and rule-delineated, while *paideia* refers to play that proceeds without the necessity for pre-determined game objectives or rules (Callois, 1961; Frasca, 2003; Newman, 2004).

This research focuses on ludic forms of play, and most importantly, on the rule-systems and contexts in which play occurs as the center of player-learning. Specifically, this research looks at Salen and Zimmerman's outlined elements of a game: the specific rule systems, allowable choices, artificial conflicts and conditions of victory incorporated by the children into their ludic creations, operating on the belief that as design informants, children can help us design better 'play' if we can see where their attention is directed in the creation of their own games (Salen & Zimmerman, 2003).

It is pursuit of this work to discover what rule-systems children devise in the creation of their own games when given specific subject matter around which to design—to discover what children believe to be 'good' play in the face of subject-based parameters.

'Serious Play'

Game designer and CCO (Chief Creative Officer) for Sony Online Entertainment, Raph Koster suggests that play at its very basis is a process of pattern recognition. It is a manner in which players identify a context and attempt to make sense of it, ultimately mastering the pattern behind it and forming neurological pathways upon which players depend in order to deal with similar patterns in the future (Koster, 2005). In other words, to Koster, play is learning (2005).

James Paul Gee, who has earned much academic renown for his book, *What Video Games Can Teach Us About Learning and Literacy* asserts quite simply that the theory of learning in videogames is similar to what he perceives as the "best theories of learning in cognitive science" and outlines 36 learning principles, which he claims are inherent in well designed videogames (2003, p. 7). It is Gee's intention that videogames, in their design, can reflect good principles of learning: one, which can be conceivably transferred from one task to another across any given or related contexts (de Castell & Jenson, 2003; Gee, 2003; Prensky, 2001).

Without expanding on each of the 36 principles, one important principle which perhaps best exemplifies the capacity of videogames to be functional vessels for learning is that of "semiotic domains" (Gee, 2003, p. 18). Semiotic domains, in Gee's own phrasing, are "any set of practices that recruits one or more modalities to communicate distinctive types of meanings", or in the words of Jason Craft, "distinct and embodied contexts, matrices of environmental attributes and, crucially, social practices in which signs are given a distinct meaning, and in which a person can be literate" (Craft, 2004, http://www.cwrl.utexas.edu/currents/fall04/craft.html; Gee, 2003, p. 18; Myers, 2003; Rieber, 1996).

Rieber argues that these domains, or 'microworlds' as he terms them can be designed or changed, and cites the example of a child's sandbox, where different elements can either be added (such as buckets, shovels) or even changed (larger buckets, differently shaped shovels) depending on what one's aims are (1996).

Considering the semiotic domains of videogames, it is evident that a standard videogame is not directing the content of these domains *at* a player. Instead, the content of these domains is contextually embedded such that a player is situated in a position where making meaning from these domains becomes not only a requisite of play, but constitutive of play itself. In simpler terms, meaning emerges from 'doing'—or in this case, playing (de Castell & Jenson, 2003; Gee, 2003; Myer 2003; Rieber, 1996). If one is to heed Gee's principle, engagement with curriculum in an educational game should not be an obstacle to gameplay or an interstitial segue between moments of play--it should *be* the play (de Castell & Jenson, 2003; Gee, 2003).

Of course with the crafting of semiotic domains in videogames there resides a prominent obstacle which must be breached, but cautiously so. The conundrum is this: how can designers embed and create semiotic domains in videogames so as to cater to a given curriculum and still foster the engaging play attributed to commercial games? This author would suggest that the answer revolves around play itself.

Elements of Meaningful Play and Commercial Games

Rieber asserts that having children play games to learn is a natural process for them (1996). But the elements of ludic play are what construct the foundations of a given game and these base elements,

such as rule systems, allowable choices, artificial conflicts and conditions of victory, determine much of the meaning derived from the playing of games (Salen & Zimmerman, 2003). These are the elements that scaffold gameplay.

This is important considering that educational game designers have within their purview to convey the game's educational content as meaningful. After all, as educational game designers, our goal is to craft a semiotic domain through which educational content can be meaningfully engaged by children, and if the content means nothing to a child in the context of gameplay, it will likely be discarded or ignored. Thus, embracing Gee's notion that players who master the semiotic domains of the commercial games they play on a daily basis are learning *something*, educational game designers need to approach educational game design the same way a commercial game designer would as to foster that same level of engagement (deCastell & Jenson, 2003; Gee, 2003). deCastell and Jenson advise that commercial games are "fun and engaging because players are not continuously 'held back' but are instead encouraged to develop skills quickly (that is, learn within the environment of the game) and are rewarded within the rule and game structures; and that gaming is not a discrete activity or set of activities" (deCastell & Jenson, 2003).

The semiotic domains of videogames, it should be acknowledged, are co-constructed by the designer *and* by the player. Not surprisingly, the modern day commercial game designer is typically representative of the target videogame demographic for which they design (Spector, 2006).

It follows that if commercial games have reached the pinnacle of their success via game development for a target demographic by that same demographic (typically the male 18-30 year old), why should education game designers not seek out children as design informants in the design of games which are meant to be played by them?

If educational game designers wish to take advantage of the engaging potential of videogames for facilitating learning, and recognize that current videogames facilitate learning and the mastery of semiotic domains, incorporating children into the design process of games intended for them by analyzing the base-gameplay elements they utilize in the development of their own semiotic domains would appear to be of value. This rings particularly true if one is to use commercial games as a model for designing engaging gameplay experiences.

The Value of Children as Design Informants

Rieber notes that children are not only exceptionally adept at understanding semiotic domains and the concepts within them naturally through gameplay, but are also expert game designers (1996). Referencing Piaget's process of equilibration (a process through which a child's cognitive constructs are created and refined) as one which prepares children ideally for game design, Rieber notes that children are particularly well skilled at those design endeavors which revolve around generating an understanding about a given domain (1996). Because children are entirely used to having to create constructs through which they can understand the world and the things in it, their experience in generating these constructs lends them credibility in the design of game-based semiotic domains. On this view, children are not only "naturals" at learning by playing, but they are also naturals at both participating in and learning from the design process. This certainly supports their inclusion as credible design informants in educational games research.

The aim of this exploratory design workshop was not only to assess what types of ludic elements children weaved into the design of their games, but also to see how the content they were asked to

include in those games was implemented. Using children as informants to demonstrate what types of ludic elements they prefer and how they implement them in their own design processes is of certain salience. However, it is of equal merit to discover the way in which a child embeds content in their game: to learn how they craft their semiotic game domains with the information they're given to use.

It is important in assessing children's design process to consider differences between types of approaches to game design whether exogenous or endogenous (Malone & Lepper, 1987; Rieber, 1996). Endogenous design attempts to weave content into the design of the game such that the game and the content are intrinsically related. Exogenous design, in contrast, is that which was described at this paper's onset. Exogenous design takes an existing game premise and simply 'inserts' the content provided 'on top' of or in-between game play elements. Considered in this work is the type of design philosophy to which the children adhered to when incorporating the content provided into their games (Malone & Lepper, 1987; Rieber, 1996). Quite simply, children can inform us of things that we as educational game designers cannot see in our efforts to design for them, and success in studies involving children as either design partners or informants is certainly considerable (Druin, 2002; Kafai, 1996; Rieber, 1996; Rieber, Luke, & Smith, 1998).

Methodology

The study was conducted at an elementary school in rural British Columbia. The school itself had an active student body of approximately 65 students and according to the school's principle is run by an enthusiastic faculty that maintains an open-minded willingness to embrace new approaches to learning. The school teaches a number of disciplines on the premise of 'learning by doing' and the students are quite active both in classroom settings and the surrounding natural environs as part of curriculum requirements.

The nine participants in this study, ages 10-12, were divided up equally into 3 groups and each waws given a work sheet with information about West Nile Virus. This disease was chosen because of its relevance to nearly everyone in Canada as all those who are in proximity of mosquito populations have at least heard of the disease and are aware of it in some capacity.

The worksheets simply listed causes/vectors, symptoms, preventions and treatments in point form. Because West Nile has no proven treatment, it was stated on the sheet that no treatment exists beyond rest, fluids and good nutrition. It was felt that perhaps the students might take this opportunity to be creative with the areas of the worksheet which lacked information. Kids were also given large blank, thick paper cards, which resembled large playing cards, along with markers and pens.

Two groups were comprised of two boys and one girl, and the third group consisted of two girls and one boy. Although gender differences were not being explicitly monitored for in this workshop, the gender balances in each group were recorded for potential use in data analysis.

Participants were informed of the task at hand: to create a card game using the materials provided and incorporating the information on the sheet into their game. After a 10-minute introduction, kids were asked to spend approximately an hour creating their game so that they could spend the last section of the workshop playing and explaining their games to the observer who was moving from group to group. The children had a 10-minute recess break approximately half-way into the session and were permitted to keep their games and all the materials brought in for their use.

It should be reiterated that students who participated in this study were not explicitly asked to create an *educational* game. They were asked to create a game using information about the topic presented. The goal of this research was not necessarily to see how children responded to the creation of an educational game per se, but to see how they crafted their own ludic semtiotic domains using given subject matter and materials.

I took field notes as I moved from group to group during the design process and answered questions from the players as they came up. Maintaining a broad, class-wide perspective on the three groups between note-taking rotations was facilitated by the small size of the groups and the contained space of the classroom.

I asked and answered questions from the students as I moved from group to group in order to keep a log of each groups' design process through the workshop period. I also took photophraphs at three stages in order to visually document the design process at the beginning, middle and end of the session.

At the end of the creation session, the class was informed that I would be coming around to each group and they should be ready to play their games to demonstrate the functionality of their creations. The note taker then moved from group to group and recorded how many and what rules, allowable choices, artificial conflicts and conditions of victory had been used in the childrens' games. The concept of the game, the recognizable re-appropriation of other game concepts and the games' exogenous/endogenous traits were also recorded.

Results

The same way in which one would assess the linguistic and grammatical usages and meanings of media via discourse analysis, it seemed that this study was doing something vaguely similar in that it analyzed the grammar and meanings of play design. This 'ludic design analysis' was conducted on the recorded observations from the workshop session in order to view the way in which the children crafted their games both in terms of structure (Salen and Zimmerman's five outlined elements of ludic play) and usage of content (exogenous vs. endogenous content incorporation practices).

Group One: 'West Nile Trivia'

The first of the three groups (2 girls and 1 boy) was the most problematic in terms of staying on task as a unit. This lack of task orientation most certainly impacted the design of their game.

Rule System

This game featured three draw-decks: a trivia card deck, a disease deck and a cure deck. Each player in turn would draw a trivia question about West Nile virus that they were required to answer. If a player could not answer the question correctly, they were given a West Nile 'disease' card. Correct responses granted a player a generic 'cure' card. Cure cards would cancel out a disease card such that if a player already had a disease card and then earned a 'cure' card from a correct response, their card total would be reduced to '0' with both cards being returned to their respective decks. The player to have the most 'cure' cards once the questions had run out was deemed the winner.
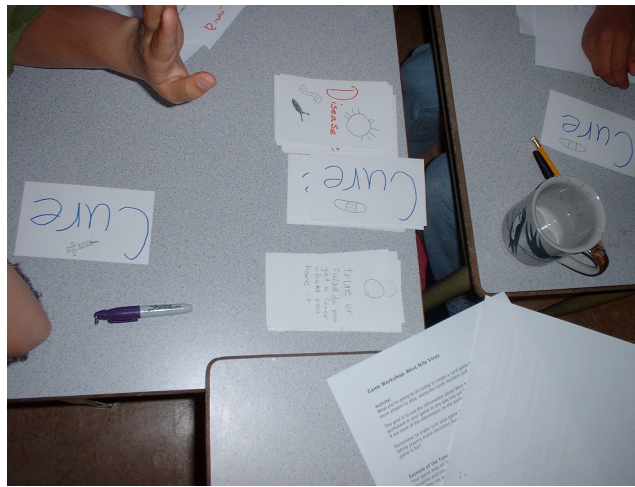
Figure 1: Group One's Final Trivia Game in Mid-Play

This game's rule system operated on the premise of a player being either punished or rewarded for their ability to answer questions about the disease, but other than utilize the 'disease' and 'cure' cards as a manner of scoring, the game did not present anything more in the way of rules.

Allowable Choices

Given the circumstances, most particularly the haste with which the participants had to produce their game and the group's lack of focus and attention during the preliminary portions of the workshop, the incorporation of allowable choices was predictably minimal. Players only had the option to draw cards and answer questions, leaving little leeway for player decision.

Artificial Conflicts

The game permitted only for indirect conflict between one player and their opponents and this conflict was mediated by the player's ability to answer questions correctly. The more questions a player could correctly answer was in certain conflict with the aims of the other players of the game to also answer questions correctly as a tie score was not a possibility under their rules. Hence, although there was indirect conflict between players (and even some cross-table taunting during the trivia portions of the game) there was never any direct conflict between players manifest in the game's mechanics. A player of this game played for themselves in the hopes that their performance would out-do the performance of the other players.

The lack of artificial conflict in this game however looks to most likely be a result of a lack of time, and also a lack of cooperation in the game's creation. This group suffered from poor group collaboration and the brunt of the game's design fell into the lap of one member. Since the game was created by one child, it would appear that its design was very much a function of the game's conditions of production, and as such, lacked much in the way of between-player interaction.
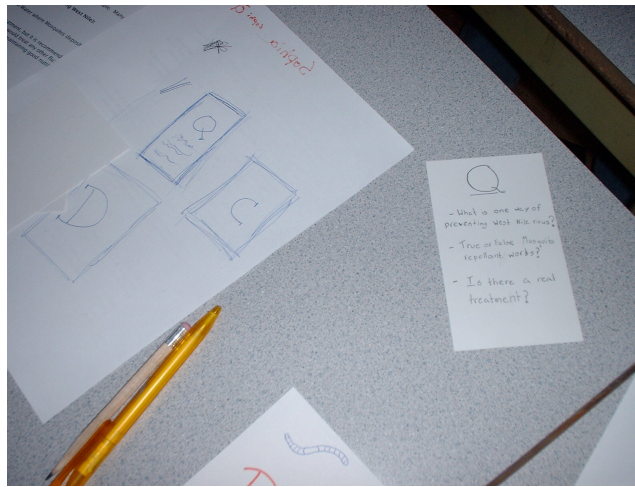
Figure 2: Sample of Group One's Conceptual Design

Conditions of Victory

As previously stated, the manner in which victory was achieved in this game was through the accumulation of 'cure' cards. Once all the questions were answered, the player with the most 'cure' cards was the victor. These cards were essentially just a way of keeping score of who had answered the most questions correctly and the least incorrectly, since 'cure' and 'disease' cards cancelled each other out.

Information Incorporation (Exogenous)

This team created an exogenous game: a game, which placed the content provided for them on their worksheet 'on-top' of a trivia concept. As a result, little meaning could be derived from the game or its play elements. To learn the trivia (the portion of the game which had included elements of West Nile information) one did not even have to play the game itself, but could simply separate the questions from the game and make the trivia its own exercise while keeping score in one's head. Consequently, the few play elements in the game had very little meaning crucial to gameplay: the content of the trivia questions could have been replaced with nearly any other topic. Not to mention that the 'cure' and 'disease' cards could have been replaced quite easily as well without undercutting the game's scoring premise.

When actually asked if they thought their game was fun, the responses from two of the children were "kind of" and "not really".

Group Two: 'Deck of Disease'

The second group (2 boys and 1 girl) was slow to warm up at first, but latched on to the design process voraciously by the mid-point of the session.

Rule System

Group Two's game required one deck containing cards that represented West Nile vectors, preventions and treatments. In turn, each player would draw a card from the deck. Each card had certain specifications as to what player-effect was for that draw. For example, a West Nile Mosquito bite would

give the player one West Nile 'unit' on a scoresheet. Other cards represented preventative measures such as the 'long sleeved clothing' card, which protected the player from a West Nile infected mosquito card for two turns (Figure 3). A 'rest and nutrition' card would allow the player to miss two turns to either avoid potential mosquito bite cards and to recover from one mosquito bite card. The first player to accumulate six un-prevented or untreated bites by an infected mosquito was out of the game until only one player remained.

The relationships between West Nile proliferation, prevention and treatment were all crucial to the rules of this game since they directly determined what the rules were with the exception of the numerical attributes such as turns missed for 'rest and nutrition', number of mosquito bites needed to 'lose' etc..
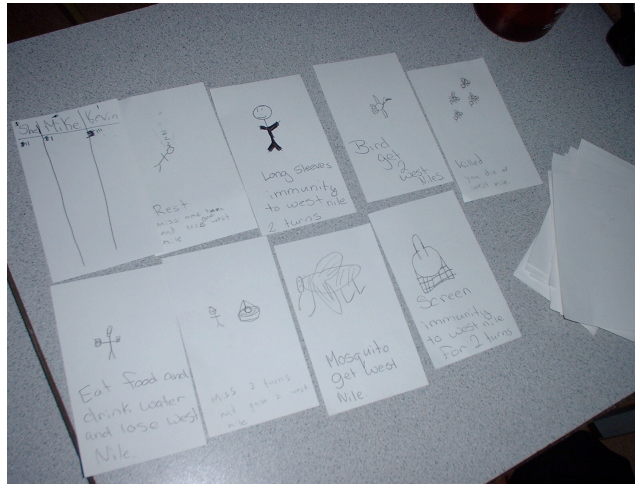

Figure 3: Sample of Group Three's Game Cards.

Allowable Choices

The game, much like the first, was rooted in a card-drawing mechanic that essentially did not grant the player much in the way of choice during the game. The game also did not challenge or require any particular skill or knowledge. There were a select few cards that the children had wanted to allow to be used strategically against the random onslaught of the deck's mosquitos, but they ran out of time to implement anything of that nature. Given the hour they had to produce what they did, it was clear that this group wanted to do more: as they play-tested their game, new tweaks and balances were already being added in order to both increase fairness and choice. For example, one card that the children immediately decided to eliminate upon playing the game was the 'Killed by West Nile' card since the card was so unforgiving in its indiscriminate power to simply eliminate a player upon being drawn (Figure 3).

Artificial Conflicts

Using Group One's trivia game as a point of comparison, Group Two's game was equally devoid of direct artificial conflicts between players. The central direct conflict was always between a player and the random draw of the deck, with the player only engaging in minor indirect forms of conflict with other players manifested through the outcomes of the players' respective card draws. Nevertheless, the children took delight in watching their opponents rack up West Nile points and would exchange light-hearted banter as each turn progressed. The interest in the progress of one's opponents and was

definitely of interest here, but the incorporation of a means of direct conflict between two or more players was never introduced.

Conditions of Victory

As mentioned previously, the game was won when there was only one person remaining who had not accumulated six West Nile mosquito bites. There were no other means by which a player could win, but conceptual tweaks, re-designs and new ideas were continually spouting from this group until the very end of the workshop. Time most certainly seemed to be the primary factor in limiting what could have been an even more complex, involving game.

Information Incorporation (Endogenous)

The endogenous use of the information provided by this group was plainly evident through their design process as they tried to shape the meaning of the gameplay directly through the interrelationships of the worksheet information. The gameplay elements in would not have functioned at all if one substituted other types of information into their game. The game was dependent upon the specific information shaping the interactions between cards and players.

This is something that cannot be said for Group One's trivia game, which could have had a set of questions of any other topic substituted for the West Nile questions and still functioned as a playable trivia 'game'.

The disease-related information in Group Two's game *meant* something to the actual play of the game. A player needed to have an understanding of the cards' meaning in order to play, and the cards and the rules that governed them were rooted in the relationships between the proliferation, prevention and treatment of West Nile. Playing the game inherently meant being familiar with the disease since the domain of meaning crafted by these children unearthed playful elements inherent to the checks and balances of real world West Nile virus activity. At a fundamental level, in the game one could acquire illness, prevent it and treat it in ways that reflected West Nile in a real-life context.

Group Three: West Nile 'Snap'

The third group, which also consisted of two boys and one girl may have been the most task-oriented group of the session. This group went through the most visual design concepts of the three, in an effort to perfect the look of their game.

Rule System

Group Three approached the design process differently from the other two groups; deciding to borrow a gameplay concept from a playing-card game they were all familiar with ,"Snap".

"Snap" is a game played with a standard 52-card deck which relies on both speed and accuracy of image recognition. The variant adopted by this group required that two cards first be placed in the middle of the table: a stagnant 'water' card and a 'human' card (Figure 5). The remainder of the deck consisted of items such as mosquitos, mosquito larvae, long sleeved shirts, screens and dragonflies (dragonflies being a natural predator of mosquitos, something which the children had decided on their own knowledge and volition to incorporate as a gameplay element).

Four piles of cards would be randomly distributed face down in front of each player, each with equal number of cards in each pile. On the mark of 'go' by an on-looker each player would have to flip the top card of one of their decks and immediately place the newly revealed card on either the water, if it was associated with the transmission and proliferation of West Nile (mosquitos, larvae, etc.) or on the human, if it was associated with the prevention and/or treatment of West Nile (DEET repellant, screens, etc.). Once the card was placed successfully on the appropriate center card (the accuracy of placement which was monitored not only by the players, but on-lookers as well) the next card on one of the four face-down piles would be turned face-up and the process would continue with deliberate haste until the first player with no cards remaining on their side would yell "Snap!".

Figure 4: Group Three's West Nile Variant of 'Snap'.

Allowable Choices

Out of the three groups, Group Three's game undoubtedly allowed for the greatest player choice. A player could choose which deck to reveal next, which center card to place a 'face-up' card on, and even the speed at which they played. One could choose to operate at a faster pace and risk misplacing a given card or take occasional pauses to ensure accuracy of placement. In this way, the children not only managed to create a game that permitted an engagement with the material they had incorporated into the game, but the game itself allowed for failure without the ensured loss of the game itself. After all, if a player could recover from the time spent on correcting the misplacement of a card, victory was still attainable. The ability to make mistakes without exclusion from progress is not only a desirable trait of games, but of effective learning as well (de Castell & Jenson, 2003; Gee, 2003).

Artificial Conflicts

Without question, Group Three's game was built around a thriving artificial conflict between the two players involved. Whereas the previous two games either indirectly pitted players against their opponents or pitted them against the random luck of the draw, 'West Nile Snap" situated two players directly against each other in a challenge of speed and accuracy. This game tended to have the healthiest competitive spirit about it as well. The Trivia game had some heckling and taunting among players as did the 'Deck of Disease' game. 'West Nile Snap', on the other hand, required players to be so engaged with the activity at hand, that taunting or heckling was most likely going to unnecessarily divert attention away from the game task. Upon completion of the game, both parties were amicable

and even the losing party in one game of 'West Nile Snap' was the first to exclaim how much fun the game was.

Conditions of Victory

The condition of victory for 'West Nile Snap' was clear—be the first one to accurately place the West Nile cards on their appropriate pile. Each of the three games created during the workshop had specific condition of victory, but this game was unquestionably the one that placed the greatest emphasis on a combination of more than one skill.

Like Group Two's game, to reach the end victoriously, one needed to understand the relationship between the various disease elements as these had a direct influence on the gameplay. Without an understanding of relationships between disease elements as represented in the game, one could not be victorious. However, unlike Group Two's game, a player only needed to be familiar with the general association between the deck cards and the center cards: nothing more. One did not need to know why those associations were being made. Therefore, Group Three's game, although successful, did not invoke the dynamics of West Nile Virus in the same detail as Group Two's game. Nevertheless, while explaining their game, the children demonstrated at great length the reasoning behind the in-game associations made between their cards and in a way, seemed somewhat limited by the concept they chose to borrow for crafting their game.

Information Incorporation (Exogenous/Endogenous)

The manner in which 'West Nile Snap' was created undeniably points to an exogenous design process: attempting to take another game idea and fit content directly into its existing rule structure. However, in order to do that, the participants also had to incorporate relationships between West Nile elements that certainly did not correspond to a standard deck of playing cards. For example, playing a spade card on another spade in a game of Snap is carried out because of the game's premise of card matching, but matching a mosquito larvae with still water requires the acknowledgement of another type of relationship altogether. Thus, Group Three effectively had to change some rules and elements of 'Snap' in an attempt to weave the disease content and associations between disease elements into their game and this points to a conscious integration of the disease information into their design.

This game was then perhaps exogenously approached, but subsequently endogenously modified, allowing a familiarity with the game concept for players, and yet also demanding a requisite familiarity with the game content for purposes of rule-following during play. Had this group decided to not borrow the game concept of another game, it is possible that their game might have made even greater strides. Group Three was the only group that addressed that the notions of mosquito larvae as a key component in the spread of West Nile, not to mention the role of the mosquito's natural predator, the dragonfly.

Analysis

Each of the three games demonstrated rules systems and conditions of victory that were clear and concise, but the greatest variation between the games was evident in the categories of choice, conflict and information incorporation.

Groups One and Two opted to design games that did not permit much player choice, although this seems to have been the result of both a lack of time, and in Group One's case, a lack of cooperation.

In short, Group One turned their game into a game about information mastery, while Group Two's game afforded a player no control.

Group One neglected introducing player choice into their designs from the very start, but Group Two had certainly expressed some desire to add more choice/strategy into their game by the workshop's conclusion (especially considering that Group Two's game did not demand any particular skill of a player). Group Three was the only group that ultimately made player choice even remotely pivotal to their gameplay, and this is most likely reflective of the concept around which they decided to design their game. Thus, at least two of the three groups actively expressed some interest (whether it be conceptually or in practice) in incorporating player-choice into their gameplay design. This would suggest that with some more time, and perhaps some more collaboration, greater choice-incorporation would have been realized in the children's game designs.

The lack of choice in the children's games on the whole seemed to coincide with their interest in the design process: the less choice and strategy incorporated by a group into their game, the less focused they seemed to be on the task at hand. In other words, despite the success and evolution of Group Two's design process and despite their effort to ultimately conceptualize a game that granted more choice and strategic options to players, one of the first ideas to emerge from out of their sheer frustration was conveying the worksheet information in a uni-directional format. Without any compunction, Group One adhered to a pedantic design philosophy even more ardently (notably, this group was situated closest to the teacher for the duration of the session). Group Three was the only group that decided to start by thinking of a game they really liked on which they could base their design, and consequently, this group seemed to have been one of the most actively involved with their game's content through both design and play.

Artificial Conflict was another area where the three groups clearly diverged. The 'Trivia' group simply did not promote any inter-player conflict: it was fundamentally a matter of a player and their knowledge vs. the question posed to them. The second group tended to foster a conflict between the random draw of the deck and the individual player drawing the card. Each of these two games featured players comparing the relative failures and successes of individual gameplay accomplishments to one's peers. The third group, on the other hand, produced a game which directly pitted two players against one another, and this element was key in making 'West Nile Snap' the most engaging game of the workshop session. Members from other groups even visited the 'West Nile Snap' group's gameplay session while they were demonstrating their creation: something that cannot be said for the demonstrations of Groups One and Two. Between-player engagement was certainly a key advantage of Group Three's design that the other groups lacked. But again, this is something that Group Two had expressed a desire to remedy with their own design.

Much like with a classroom environment, active engagement with a game is key in order to keep a player interested and penalties for failure must be kept above the level of outright discouragement. A losing player of 'West Nile Snap' was never very far from being in a situation to win again since the games were short, and the gameplay was exciting enough to encourage a player to return for another try whether the outcome of the previous game was positive or negative (Gee, 2003). Group Three kept participants engaged with their focus on intense strategic play.

Information incorporation was the category of analysis which placed the three groups the furthest apart from one another. And in the context of this study, this is a phenomenon of considerable interest considering that this category is arguably of the greatest salience to this research.

Group One's adoption of the direct approach and endogenously created Trivia game asked questions rooted in statements taken directly from the worksheet, resulted in low-player interest in the game and increasingly predictable outcomes during re-play.

Group Two's approach deviated sharply from Group One: they turned to the disease information itself as a starting place for their play-mechanics in an attempt to use the dynamism of West Nile as a source of play. As a result, the information in the game was not only the game's thematic content, but it also drove the gameplay. This made the information significantly meaningful to players since a mastery of the information was thus crucial to mastery of the game's mechanics, as they were one and the same. This endogenous approach undoubtedly proved to be the most laborious and time consuming approach adopted by the three groups, but as also the most creative.

The third group worked from a borrowed game-concept and moved downward to the disease information, proceeding to modify their game's design so as to naturalize the fit between their play and their selected content. This hybrid endogenous/exogenous approach resulted in their game being most immediately playable and most engaging, but accordingly resulted in evident, although shallow relationships among gameplay elements.

Comparing the three groups and their approach to information incorporation at face-value might be enough to convince some that an engaging educational game must come at the expense of the quality of content-integration. This author would suggest, however, that it simply takes more time to create a game that endogenously integrates content in the design of a ludic semiotic domain (Rieber, 1996).

Conclusion

An analysis of these three groups and their approach to information incorporation into their game designs would indicate that the exogengous approach is one that kids don't even take pleasure in designing, much less playing. But given the time, encouragement and focused design partners, the design tendencies of the children certainly leaned towards endogenous practices.

However, classrooms--even those in schools which promote a 'learning by doing' mandate—can often foster a pedantic mindset, which needs to be detached from the game design practices of children and needs to be detached from adult game design practices as well.

As was expressed by the child in Group One, there was a conscious recognition that although a game was being designed, it was being designed under the auspices of a 'school activity' which always tends towards a measurable learning outcome.

Learning is something which occurs as much in the design of these games as it does in the playing of them (Rieber, 1996; Rieber, Luke, & Smith, 1998). The 'learning outcome' per se becomes, therefore, embodied in the process of play, not one in the game's end-game lesson as is often presumed by the outmoded, reductionist question, 'what did you learn in school today?'. A focus on play, rather than on learning outcomes would then perhaps benefit designers of children's educational games, since creating quality play that stems *from* content rather than mediocre play which is mapped *onto* content produces a higher level of engagement, as was demonstrated in this workshop.

As workshops such as this would suggest, endogenous game design in a classroom may be a preferred design approach by children. When visiting Group Three's game play session, children

gravitated towards play—and they also gravitated towards finding what is already 'playful' and dynamic about the content they're dealing with when integrating it into their designs.

It is this sort of information that designers might profit from considerably when looking to inform educational game design practices. If children tend towards endogenous design and these practices require increased time, energy, and creativity with a focus on finding the 'playful' elements in the content they are designing around, it makes good sense to pursue the same approach when designing engaging educational games *for* children.

There is something we can perhaps learn from the design practices of children, not only as designers, but also as educators. Research of this ilk has been conducted before but this study has aimed, in a small way, to demonstrate that even using the most basic materials in a limited amount of time, something valuable could be learned from children when they assume the role of game designer. Most notable is that we as adult designers should consider pursuing more patiently endogenous design practices when designing for kids, but we should also encourage kids to design and pursue the crafting of semiotic domains. As remarked by Rieber, Gee, Piaget and others, children make ideal designers, and as they craft semiotic domains they generate an understanding of those domains *through* their crafting--a process worth reflecting on as a designer in any discipline.

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