Experiential Modes of Game Play

Dr. Bob Appelman,
Instructional Systems Technology, Indiana University
Bloomington,Indiana, USA
appelman@indiana.edu

ABSTRACT
In order to gather empirical & qualitative data on game play across all genres, and at the same time addressing multiple research questions, a framework was established at the VX Lab at Indiana University to standardize methodology. This *Experiential Mode Framework* allows for the inclusion of player perceptions, experiences, and allows for coupling with game structures and functionality. Following a post-positivist methodology devised by Robert Yin, this paper describes the logic, strategies, and incorporation of the *Experiential Mode Framework* in *Game Play Analysis*.

Author Keywords

Game Play Analysis, Experiential Modes, Frameworks, Learning, Serious Games, Game Testing.

GAME PLAY ANALYSIS (GPA)

Quantifying game play is one of the most challenging research endeavors to attempt. It is akin to unpacking the decision thought process of a forward guard during a basketball game, or that of a soldier engaging in battle. The observation of what a player does is relatively straight-forward, but determining the reason why they did any action or move depends upon the interactions of goals, environmental context, individual abilities, and options within the game itself. Tracking everything at once, through just 10 minutes of game-play, results in a massive data stream. Such a data stream requires a framework that can allow for easy categorization of all events and environmental descriptions. Such a framework has a primary burden of accommodating two primary points-of-view, that of the player and that of the game. In the Virtual Xperience Lab (VX Lab) at Indiana University we use the following framework, definitions, and protocol.

Points of View

There is considerable variance among players(Bonk & Dennen, 2005; Freitas, 2006; R. Garris, R. Ahlers, & J. Driskell, 2002; Prensky, 2001), so before the game play begins, the entry level of the player demographics must be defined, preceded by an in-depth analysis of the game goals and required strategies to reach that goal.

Player Demographic

To define the player we gather data on the following:

- Age
- Gender
- Ethnicity
- Education level
- Handedness
- Game Platform Preferences
- Game Platform Ownership
- Game Purchasing Habits
- Days per Week of Game Play
- Hours per Day of Game Play
- Mode of Play (PC, Console, On-line)
- Specific Game & Over-all Genre Favorites
- Percentage of play alone, team play, competing with others

Player Expert – Novice Ranking

For research classification and placement into testing, player ranking is derived from the demographic data as the number of hours per day and week spent in play. This is coupled with familiarity of platform and specific game or genre for testing placement. In other words, if we are testing a first-person shooter game, we will consider the person an expert if they play this genre of game over 15 hours per week, however if they are most familiar with a sports game genre, they are considered an "advanced novice" even though they still rank high on number of hours per week of play. Obviously the lowest level of novice is a player who is unfamiliar with both the platform (PC or Console) and the genre, plus low hours per week of game play.

Player Skill

A general classification of player skill is more complex because it must be ranked across multidimensional criteria. These criteria are:

- HCI manipulation and dexterity
- UI manipulation effectiveness
- The use of effective goal reaching game strategies

Situated Play, Proceedings of DiGRA 2007 Conference

- Time to goal and sub-goal completions
- Point accumulations
- Direct comparisons to expert play

It is relatively easy to observe a player's skill at manipulating a console controller, or knowing the "W, S, Q, & E" keyboard strokes that have become the convention in PC game control. This HCI interface challenge is often the primary obstacle for novice or moderate players, especially when attempting complex moves such as hanging on a ledge in Bounty Hunter, Half-Life, Indiana Jones, or learning to swing through the city in Spiderman 2.

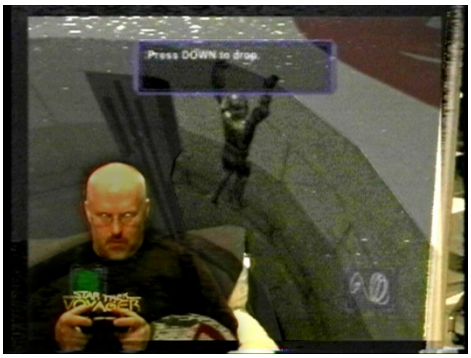

Figure 1: VX Lab Game Play Analysis-
Player and avatar hanging on ledge in *Bounty Hunter* (Lucas Arts)

Learning how to manipulate the UI in puzzle/strategy games through the Myst to Exile Ages or selection of character attributes in the Sims, or just how to pickup things or change weapons in Halo, Call of duty, or Medal of Honor, are obstacles for those who are "genre jumping" and must learn these new conventions that are often game specific. It is often a research question to specifically test the player's ability to move from expert status in one genre to novice status in another.

Points accumulated or time-on-task are easily quantifiable measures of player skill. However the question of skillful choice of play strategy is much more difficult to quantify (Edelman, 1992; Feil & Scattergood, 2005). It is often easy to observe a player's selection of a particular weapon, navigation path through a map, or choice to encounter NPCs or attempts to manipulate other objects within the environment, but understanding if there is a deeper underlying strategy that is driving these choices is difficult to imply through simple observation. Thus the determination of player goals and choice of strategies being are often left to more qualitative methodologies, or often they are simply ignored making the focus only on if, rather than how, the task was completed.

There is no "golden standard" to quantify game play skill such that an international ranking is possible (except in a specific game). This is different from what is available for ranking runners in 5 and 10K races around the world. Game play is more like a race where the finish line is known, but the race course is up to the player to determine, which is why it is a game instead of a race.

Player Goals (Personal / Social / Context)

In testing, player control is difficult to manage for fear of losing the play options that keep some players engaged more than simply completing the task or level at hand. For entertainment games the goals and the objectives of the player are personally driven (Crawford, 1984; Gee, 2003; Salen & Zimmerman, 2004; Vandeventer & White, 2002), and often influenced by the peer groups to which they belong (Edelman, 1992; Eklof, Sparf, Moradi, & Ayani, 2004). Achievement of specific levels of games, or having a broad exposure to many games might be the motivating factors to strategy making within game play. Often the goal is as broad as "beating the game", or just exploring the wide range of environments and challenges found in the multitude of game options, but from a game play analysis perspective we must select specific levels, and operations and tasks within these levels, so that between player, and between game comparisons might be made. The delicate research question must be balanced with the likely goals and preferences of the player, based on thorough analysis of the demographic data. This matching is very apparent when our Human Subjects Committee only authorizes us to test players with games that are at or below their ESRB rating, so when we ask 13 year olds whose favorite game is Grand Theft Auto to play Nemo, there is often a mismatch of goals within game play.

However, in serious game play, the task at hand is the focus, and successful completion of that task, as defined in the context, is the goal of the player (Baron, 1999; Egeneldt-Nielsen, 2005; Freitas, 2006; Pray & Gold, 1991; Schank, 1992; Sellers, 2002). If a soldier is being trained to perform a task through training within a serious game, there is a realization by the player that the stated goals within the game are more important than those identified in a game played for entertainment.

Thus, player control stands out as potentially being the most negatively impacted aspect of game play analysis, since the researcher may create such a foreign context or task for the player that the validity of the results are called into question.

Game Environment

There is considerable variance among games as well, so before the game play begins, the various attributes of the game must be defined, preceded by an in-depth analysis of specific tasks that must be performed within the game. Game genre, structure, and functionality are key descriptors of any game.

Game Genre

Game genre to game play analysis is less important than the research question posed by the researcher. In other words, if I am looking for how well a player adapts to different HCI controls, then I could use a first-person shooter, an

action-adventure, even a sports genre to gather data directed at that question. The tasks and operations that a player must perform must be abstracted and then mapped to the controlling device actions. Analyzing goals and strategies foster research questions that could suggest a particular genre, but there are many similarities of actions and strategies across genres now, that specific genre classification have become less important (Prensky, 2001). It is more about the specific tasks to accomplish within a game combined with the affordances the game offers to accomplish those tasks.

Game Structure

The overall game and level design impacts game play the most. Under the umbrella of any given storyline or context are challenges, and affordances within that game to meet those challenges. The part the player brings to game play is the effective, or often not so effective, execution of these affordances. The degree of ease-of-use and functionality of the tools offered, the UI and informational input that the game designers provide, directly affects ease of play and understanding of what goals and objects are there for the player to achieve. Thus it is not possible to rate a player without also ranking the structure of the game in relation to ease of use and clarity of objectives.

For serious games it is even more critical that the clarity of goals and objectives be made explicit, and that the AI underlying the functionality of the game be authentic and robust when it comes to the results of actions performed by the player.

Player Experience

Player experience consists of a complex blending of player skill, chosen strategies, entwined with the affordances within the game environment itself.

Flow

In the late 80's Csikszentmihalyi addressed the goal of achieving a "flow state" or sense of true happiness by focusing ones attention to create psychic energy (Csikszentmihalyi, 1992). In much the same way one may define flow within a game as the interaction of game structure and a game player's actions where the personal cognition of the player resonates with the game tasks, goals, and objectives, such that play is optimized. Fun with game play is said to occur when such resonance is achieved, however learning in serious games context have yet to find correlations with this same resonance (Appelman, 2005; Freitas, 2006; R. Garris, R. Ahlers, & J. E. Driskell, 2002; Gosen & Washbush, 2004; Squire, 2003). However finding evidence of learning, fun, and engagement in games continues to be a kind of "holy grail" for many researchers.

The Experiential Mode Framework (EMF)

A player's level of engagement, fun, frustration, elation, or disappointment within the affective domain, and levels of learning, understanding of game play, and development of strategies within the cognitive domain are nearly impossible to observe. However, armed with a framework that acknowledges these mental states along with the choices and actions the player perceives to have, and then couples these to the content and affordances within the environment of the game structure, a strategy for game play analysis methodology can be defined. It is such a methodology that the Experiential Mode Framework (EMF) can facilitate.

The EMF approaches the game play analysis from the Player's Experience (PX), and a definition of the Game Structure (GS). By definition these two foci are mutually independent in that the GS exists whether or not the player plays it, and the PX is defined by his or her own unique experience traversing the environment of the game. The EMF attempts to allow the researcher to define couplings of a specific PX with a specific GS in the hopes that correlations between them can be identified. Should such correlations arise, designers of game environments could increase the chances of building game structures that foster specific Player Experiences.

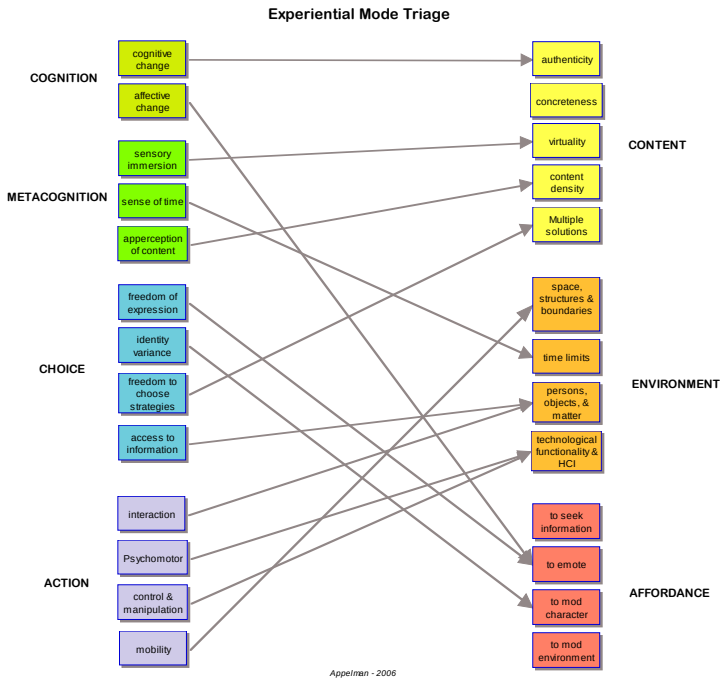

Figure 2:
The Experiential Mode Framework
Player Experience (PX) - left column
Game Structure (GS) - right column

The 4 primary categories of PX are:

1. **Cognition** – encompassing all cognition in both cognitive and affective domains
2. **Metacognition** – encompassing all that the player is aware of, including what is perceived by vision, audio, olfactory, kinesthetic, and haptic senses, plus an awareness of time and any objects, content or information that is encountered.
3. **Choice** – encompassing the player's perception of degree of control, and access to, variables and information during game play.
4. **Action** – encompassing the player's perception that they can do things such as interact with objects and elements within the game, that they have a degree of control of these objects and elements, that they have a degree of mobility to move through the virtual environment, and that the control interface allows their psychomotor capabilities to effect change.

The 3 primary categories of GS are:

1. **Content** – the story, the context, the amount of information available, the degree of concreteness or abstraction of the content, the authenticity, and its variability
2. **Environment** – the virtual spaces and boundaries, the objects within these spaces and their functionality capabilities, plus any time limits imposed by the game.
3. **Affordances** – encompassing the abilities made available within the game for the player to change, manipulate, and/or to seek alternatives or information

GPA using an EMF Methodology

Using strict observation protocols and quantitative measures, plus interviews with players pre, during, and post game play, leads to a blended post-positivist inquiry methodology. The best fit for this type of analysis is a multiple case study approach described by Robert K. Yin. According to Yin, each instance of game play, or each classroom experience, is considered a separate case. Comparison of multiple players, or comparison of multiple classroom experiences would in turn be defined as being a multiple case research methodology (Yin, 2003).

The focus on each experience as a separate case is the key difference from traditional experimental design approaches, where each player's data would be aggregated under a criteria that generates a statistically produced number to compare to other criteria. In this case-based approach, the pattern of one experience is compared to the pattern of another experience using the same criteria in both to define each pattern. Pattern analysis results in the conclusions drawn from the study being the goal, and not significance from a statistical point of view.

According to Yin, a proper case study methodology begins with a theory and/or a proposition, follows a descriptive analysis of specific events from a wide range of inquiry techniques, and the evaluation results in models and patterns that describe each case. These patterns and models may then be compared to produce a more generalizable model or pattern. This methodology seems to fit Game Play Analysis very well, not only because it lends itself to a direct observation methodology, but also because it lends credence to every player's interactive session, rather than attempting to aggregate them into an overall number or general pattern.

The goal is to accurately describe each session driven by an inquiry theory or proposition using a standard set of criteria. The Experiential Mode Framework provides these criteria, and covers both the structural attributes and student perceptions.

The basic Game Play Analysis using an Experiential Mode Framework in a case based methodology involves 4 phases:

1. **Pre-Play Analysis** of both the Player and the Game
2. **Game Play Data Capture** using both quantitative and qualitative inquiry
3. **Game Play Data Analysis** using descriptive, pattern and ethnographic analysis
4. Drawing **Summative Conclusions**

Pre-Play Analysis

In the beginning a proposition, or set of propositions, are made by the researcher following a thorough analysis of the levels of a particular game or games. These propositions may appear as standard research questions, but they are supported by predictions of patterns already identified in the game through self play, or data from expert performance. Incorporated into these descriptions are the specific Game Structures primarily operating in the levels being tested. Specifically the GS definition would list the dominant attributes of the Content, Environment, and Affordances. By following this protocol, the researcher enters the actual game play testing with a hypothetical pattern of play within a known game environment. In addition are identified strategies that the player might incorporate, as well as known decision points that the player will encounter.

Potential players are then recruited and demographic information obtained. This data is then analyzed and based

on the player's expert/novice status, and familiarity with the game and platform(s) being tested, propositions relating to their anticipated game play are made.

Figure 3: VX Lab Game Play Analysis- Player and dynamic UI in *Star Fighter* (Lucas Arts)

Game Play Data Capture

Current data capturing strategies and techniques involve direct observation and video recording of individual learner/player/user's actions, decisions, resulting consequences, and some affective displays, as well as some verbalization. When multi-player games are the target game play, the player interactions and inter-communication is also recorded.

Figure 4: VX Lab Game Play Analysis- Multi-Players in *Halo* (Bungie)

Data Types

Demographic Data

Every player fills out an on-line form that inquires about the Player Demographic Information described earlier. This data ends up in a comma delimited file that is then imported into a statistical program for analysis. At this point the player is given a unique code that travels with all media and any other records or data.

Game Structure Data (GS)

During Pre-Play Analysis, all attributes are documented through actual game play. This play focuses on identifying an "ideal scenario" to complete an specific objective in the game. Often game play by an expert player is videotaped and then analyzed by the researcher prior to actual game play testing, then the researcher steps through the video, often second by second, to identify the objects, UI, and structural and functional elements within the game. All elements and attributes relative to the task at hand are then logged onto the VX Log sheet below. This log sheet is configured to accept any Content, Environmental, or Affordance identifiers that the researcher deems relevant within the EMF Framework. By filling out a log for the "ideal" play and comparing it to the "actual case" play, differences can be highlighted and questioned.

Game Play Analysis Log

GAME: _____

PLAYER: _____

DATE: _____

pg.___of___

COG = I **Learned** or **enjoyed** something here
MET = I had to really **concentrate** here
OPT = I felt there were **options available** here
ACT = I was able to **control/manipulate** things
OR I felt **lost** here
CNT = **Information** was encountered here
ENV = **Challenges** or **NPR interactions** encountered here (explain)
AFF = The game gave me **options** to: (explain)

TIME	COG	MET	OPT	ACT	CNT	ENV	AFF	COMMENTS
: :								
: :								
: :								
: :								
: :								
: :								
: :								

Figure 5: VX GPA Log Sheet
data entry: EMF categories of PX elements: Cognition, Metacognition, Choice, & Action, plus GS elements: Content, Environment,& Affordance

Spatial Data

Each "Map" for a level is plotted on a grid that is estimated by the researcher during Pre-Play Analysis. Key "action nodes" are identified by an X, Y, and Z coordinate numbering system. The "generation point" for a player is identified with a 0,0,0 id. Movement from that point maybe anywhere along the grid, and a any key location will receive a positive increment if movement up or to the right occurs, and a negative number if to the left or down. Movement in elevation upward would also receive a "Z" positive number, and a negative number if navigation below the initial generation spot is noted. The granularity of the unit of measure can be determined by the researcher since relative distance is the only goal, however consistency is a requirement. A physical map is most often created, and one that is reminiscent of a Dungeons and Dragons playing board, and strategy guides are particularly helpful for this process. Grid locations of where events occur should be indicated in the "comments" section of the VX GPA Log Sheet.

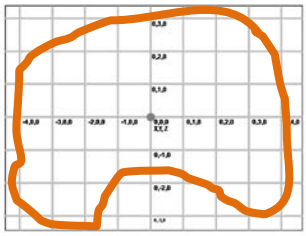

Figure 6: Spatial Grid
X, Y, Z coordinate map of a level

Time Data

Time is indicated in seconds from the beginning of game play. A common point is identified during Pre-Game Analysis so that "ideal play" and "actual case play" can be compared. This time is usually expressed in terms of hours: minutes: seconds in the left hand column of the VX GPA Log Sheet.

Player Experience Data (PX)

A player research subject is first read the Human Subjects Consent Form, and gives approval of the testing protocol. They are then led to the playing station which may be in a game console area, or to a PC Workstation. The videotape is started and the instructions are given to the subject. Possibly the game has already been advanced to a specific level prior to play, but the player will not begin until the researcher indicates they may begin play. The video capture includes both the game screen and video of the player's image while the game audio is sent to the left channel, while the voice of the player is sent to the right channel.

As the researcher observes the game play, they may note deviations from the ideal play previously identified and choose to interrupt the play with an inquiry about strategies, or goals of the player. If it is not desirable to break the concentration of the player, then stimulated recall may be used by playing back a portion of the video for the player after game play and make inquiries at that time. After game play, the researcher may choose to make more general inquiries about games in general, or about this particular case.

At a later time, the researcher reviews the video tape in detail and completes a VX GPA Log Sheet indicating specific Times, and Spatial Grid locations, for any pertinent PX and GS notations. Frequency granularity will have wide variance depending on the research focus and the pacing of action within the game. Tracking a World of Warcraft interaction my require an event notation for every second from generation to death (which can be just 30 seconds), or every minute while recording navigation through Myst.

The context of game play is noted in the comments section of the VX GPA Log Sheet, and in summary notes made by the researcher. These context notes may refer to particular attitudes or interpersonal characterizations that were recognized by the researcher that did not show up in demographic information. This very often is the point of doing a qualitative type analysis after game play, to confirm behaviors noted during game play. This is very common during multi-player game play analysis since the interactions between players are not possible to replicate prior to game play.

Setting of Propositions

The critical Pre Game Play Analysis decisions are the formation of a set of appropriate propositions which will guide the experimental observation of game play. The impact a serious game has on the cognition or metacognition of the player is most often the starting point for formulation of a proposition. These might appear as:

1. Learning will be facilitated through access to specific UI tools that provide content information
2. A player will enjoy a game less when also learning to use a new interface or platform
3. A player's previous knowledge of content within a game will increase success in game play if that content is authentic
4. A player will complete a task sooner when interactions with NPCs or Peers are able to respond just-in-time to specific questions posed by the player.

To a great degree, these propositions are quite obvious and one could easily predict some viable outcomes, but the question of what observable behavior would substantiate that answer within a specific game structure is harder to pinpoint. The EMF allows us to select specific games and level attributes that could be used to quantify both specifics of PX questions of "how much learning", and compare those to GS questions of "which game attributes are most involved to facilitate or hinder learning".

For instance, in the game Shrek II, Luxoflux developed a first level for Activision that informed the player that the goal of that level was to collect eyeballs for an impending journey. This information was first stated in the opening cut scene, but we observed many players who ignored this form of information (plus a UI "counter of eyeballs captured" in the upper corner of the screen) and wandered aimlessly around until they encountered a particular UI "magic mirror" that presented them with a text statement of this goal information again, and player performance improved dramatically. This observation supports proposition #1 and ties a specific UI to an instance of learning, or in terms of the EMF, a specific GS to a specific PX.

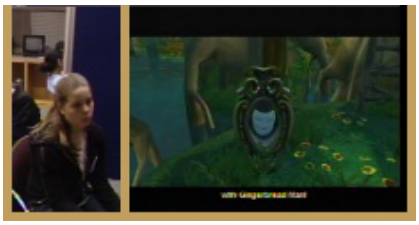

Figure 7: VX Lab Game Play Analysis- Player getting info from UI in *Shrek 2* (Luxoflux)

Observing one player who's favorite platform is a PS2, and likes RPG genres, when challenged with playing Syberia II, published by Global Star Software, the unfamiliar PC interface combined with a new storyline and embedded strategies, caused considerable frustration for the player. Microids developed this particular level such that specific tasks needed to be done in specific order, with little guidance other than the player's trial and error. Although presenting a significant challenge, the interactions with NPCs or any UI was not helpful, so traversing multiple navigation paths was the only avenue. For this player who liked RPGs, the GS was familiar, however, when combined with a novice player using an unfamiliar HCI, it was much less enjoyable. This was observable through facial expressions as well as utterances by the player and supports proposition #2 where a particular PX with a GS is designed for a player with different demographics.

Figure 8: VX Lab Game Play Analysis-
Player – Advanced Novice
in *Syberia II* (Microids)

Sports games make the claim that they are authentic and would actually make good training environments. To test this proposition, the VX Lab pitted expert sports gamers against actual college football players playing EA's Madden NFL 2006. We identified a GS where the *Content* was authentic, with a high level of content density, and offering *Multiple Solutions*, and in an *Environment* where all *Action* was bounded by the virtual stadium, had specific *Time Limits*, and robust *Functionality*, and with *Affordances* that allowed the player to *Modify* their own team by selecting specific players. While observing game play, we noticed both the gamers and the athletes spending considerable time building their teams, but both populations were equally adept with the HCI and decisions during game play. The winners were the Athletes, primarily because they selected better teams and better plays at different points during the game play. This supports proposition #3 where outside of game information increased the effectiveness of the PX when the GS was authentic to that previous knowledge.

Figure 9: VX Lab Game Play Analysis-
Player making play decision
in *Madden NFL'06* (EA Sports)

Peer interaction and collaborative play is dynamic to measure, as are questions concerning gender. Although it is generally accepted that women do not like first-person shooter games, while doing testing in the VX Lab, we found contrasting results. During testing of Microsoft's game of Halo, developed by Bungie Software, we paired a novice girl with her friend who was an advanced novice. It must also be mentioned that the researcher was also a friend, and this is important primarily because failure had much less consequence among these peers. Such a context allowed the player to have have a PX with more Freedom of Choices such as trying out different strategies, able to freely *Express Themselves*, and to know that they would not be criticized for doing poorly. Because there was such prolific verbalization during game play, it was evident when there were player questions about content, the HCI, what UI elements meant, and what the overall goals were.

The novice was initially very quiet and obviously was not performing well, but when she found she could get information on just about anything from her advanced novice friend, her performance, and enjoyment increased significantly. This supports proposition #4 where a particular demographic of an entire playing population can affect the PX with respect to multiple GS attributes and learning about them. It was only when the novice found that the warrior she just killed was her friend that she immediately stopped and began to profusely apologize, while her friend simply laughed about the incident.

Figure 10: VX Lab Game Play Analysis-
Multi-Players – "collaborative play"
in *Halo* (Bungie)

SUMMERY

The goal of the VX Lab research agenda in the IST Department at Indiana University is to establish emperical base-line data for game play. It is also to establish methodologies to measure any of the Player Experiences in conjunction with Virtual Learning Environments, and specifically games and their structure. We feel that a serious game designer must be able to create virtual structures and challenges such that predictable player experiences will be the outcome. One of these experiences is of particular interest for our IST student body and faculty, and is that of learning. We pride ourselves at being designers of

instruction where outcomes of learning are not only predictable, but essential in high-risk scenarios in the medical and military contexts. Serious game design cannot be viewed as offering any more latitude for outcome than any other medium.

REFERENCES

1. Appelman, R. (2005). Experiential modes: a common ground for serious game designers. *International Journal of Continuing Engineering Education and Life-long Learning*, *15*(3-6), 240-251.

2. Baron, J. (1999, November 10, 1999). *Glory and Shame: Powerful psychology in multiplayer online games.* Paper presented at the Gamasutra.

3. Bonk, C. J., & Dennen, V. P. (2005). Massive Multiplayer online gaming: a research framework for miiltary training and education. *Advanced Distributed Learning*, 60.

4. Crawford, C. (1984). *The Art of Computer Game Design*. Los Angeles: Osborne/McGraw-Hill.

5. Csikszentmihalyi, M. (1992). *Flow. The psychology of happiness*. London: Rider.

6. Edelman, G. (1992). *Bright air, brilliant fire. On the matter of the mind*. London: Penguin.

7. Egeneldt-Nielsen, S. (2005). *Beyond Edutainment: Exploring the educational potential of computer games.* Unpublished Doctoral Dissertation, University of Copenhagen, Copenhagen, Denmark.

8. Eklof, M., Sparf, M., Moradi, F., & Ayani, R. (2004). Peer-to-Peer-Based Resource Management in Support of HLA-Based Distributed Simulations. *SIMULATION*, *80*(4-5), 181-190.

9. Feil, J., & Scattergood, M. (2005). *Beginning game level design*. Boston: Thomson.

10. Freitas, S. d. (2006). *Learning in immersive worlds: a review of game-based learning*. London: Joint Information Systems Committee.

11. Garris, R., Ahlers, R., & Driskell, J. (2002). Games, motivation and learning: a research and practice model. *Simulation and Gaming*, *33*, 441-467.

12. Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & Gaming*, *33*(4), 441-467(427).

13. Gee, J. P. (2003). *What video games teach us about learning and literacy*. New York: Paulgrave Macmillan.

14. Gosen, J., & Washbush, J. (2004). A Review of Scholarship on Assessing Experiential Learning Effectiveness. *Simulation & Gaming*, *35*(2), 270-293(224).

15. Pray, T., & Gold, S. (1991). Goal Setting and Performance Evaluation with Different Starting Positions: The Modeling Dilemma. *Simulation and Gaming*, *22*(4), 476-489.

16. Prensky, M. (2001). *Digital Game-based Learning*. New York and London: McGraw-Hill.

17. Salen, K., & Zimmerman, E. (2004). *Rules of Play*. Harvard, MA: MIT Press.
18. Schank, R. (1992). Goal-Based Scenarios. *Defense Advanced Research Projects Agency*, 1-30.

19. Sellers, M. (2002, September 16, 2002). *Creating Effective Groups and Group Roles in Massive Multiplayer Games.* Paper presented at the Gamasutra, San Jose, Ca.

20. Squire, K. B., Sasha. (2003). *Engaging urban underserved students in learning world history through computer simulation games.*Unpublished manuscript.

21. Vandeventer, S. S., & White, J. A. (2002). Expert behavior in children's video game play. *Simulation & Gaming*, *33*(1), 28-48(21).

22. Yin, R. K. (2003). *Case study research: design and methods* (3rd ed.). Thousand Oaks: Sage Publications.