How Computer Gamers Experience the Game Situation: A Behavioral Study

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Very little is known about computer gamers' playing experience. Most social scientific research has treated gaming as an undifferentiated activity associated with various factors outside the gaming context. This article considers computer games as behavior settings worthy of social scientific investigation in their own right and contributes to a better understanding of computer gaming as a complex, context-dependent, goal-directed activity. The results of an exploratory interview-based study of computer gaming within the "first-person shooter" (FPS) game genre are reported. FPS gaming is a fast-paced form of goal-directed activity that takes place in complex, dynamic behavioral environments where players must quickly make sense of changes in their immediate situation and respond with appropriate actions. Gamers' perceptions and evaluations of various aspects of the FPS gaming situation are documented, including positive and negative aspects of game interfaces, map environments, weapons, computer-generated game characters (bots), multiplayer gaming on local area networks (LANs) or the internet, and single player gaming. The results provide insights into the structure of gamers' mental models of the FPS genre by identifying salient categories of their FPS gaming experience. It is proposed that aspects of FPS games most salient to gamers were those perceived to be most behaviorally relevant to goal attainment, and that the evaluation of various situational stimuli depended on the extent to which they were perceived either to support or to hinder goal attainment. Implications for the design of FPS games that players experience as challenging, interesting, and fun are discussed.

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General Terms: Design, Human Factors

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1. INTRODUCTION

Computer games[1] constitute complex socio-technical behavior settings that permit diverse player behaviors based on gamers' decisions, strategies, and goals, their use of various game objects such as weapons or other resources, and their competitive or cooperative interactions with other players or with computer-generated game characters. Despite the fact that computer gaming is an extremely popular entertainment activity,[2]

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[1] We use the term "computer gaming" to include electronic games played on personal computers as well as those played on dedicated commercial video gaming consoles, such as Sony Playstation, Microsoft Xbox, etc., available at the time of this writing.
[2] A 2004 industry survey of the US gaming market reported that 50 % of Americans played computer games, and that these gamers played an average of 6.8 hours per week each and spent $7.3 billion collectively on games (ESA 2005).

very little is known about the social and behavioral properties of gaming as a form of human activity. Social scientific research has generally examined gaming as an undifferentiated activity potentially associated with various factors outside the immediate behavioral context of the game, and has tended to treat computer gaming in rather value-laden terms. For example, most research emphasizes negative aspects of gaming, including gaming addiction [Griffiths and Hunt 1998]; the effects of gaming on extra-game aggression and violence [Anderson and Bushman 2001; Sherry 2001]; poor sleep patterns [Higuchi et al. 2005]; or obesity [Vandewater et al. 2004]; and the prevalence in computer games of violent imagery [Smith et al. 2003]; gender stereotypes [Dietz 1998; Norris 2004]; or problematic cultural ideologies [Gottschalk 1995]. Other research has considered potentially positive social outcomes of gaming [Durkin and Barber 2002]; educational benefits of computer games for teaching [Amory et al. 1999; Ju and Wagner 1997; Malone 1981]; or skill acquisition [Day et al. 2001]; and the use of game design techniques to improve human-computer interfaces for other kinds of software [Johnson and Wiles 2003; Pausch et al. 1994]. Research that has treated computer gaming in more neutral terms has examined demographic [Griffiths et al. 2003)] or personality factors [Griffiths and Dancaster 1995; McClure and Mears 1984] as predictors of gaming behavior; the effects of gaming on perceptual, cognitive or motor functions [Castel et al. 2005]; and the use of computer games as methodological tools for studying various other behavioral phenomena [Donchin 1995; Washburn 2003].

Very little social scientific research has considered computer games as behavior settings in their own right [Blanchard 2004], or investigated computer gaming *in situ*, as a form of human behavior with its own characteristics worthy of study. In a survey study designed to identify aspects of computer games that might induce players to begin gaming in the first place or to continue playing after beginning a game, Wood et al. [2004] asked 382 college students to rate the importance of a wide variety of common video game characteristics, including sound, graphics, rate of play, control options, etc., and found numerous differences between male and female players' ratings of particular characteristics. Mallon and Webb [2005] used focus-group studies to identify narrative elements of games perceived to affect player engagement, including such factors as characterization, agency, plot, and authorial control, among others. Methods used by game developers to evaluate game play experience and fun have been described [Davis et al. 2005; Fabricatore et al. 2002; Sweetser and Wyeth 2005], though few empirical results have been reported. A few studies have used interpretive or ethnographic methods to describe aspects of specific game environments, such as communication and social relationships among players and the construction of identities in online role-playing games [Cherny 1999; Kolo and Baur 2004; Muramatsu and Ackerman 1998; Nowak and Rauh 2005; Reid 1994; Wright et al. 2002]; experiential properties of game play, such as flow and immersion [McMahan 2003]; and game design features that support collaborative interaction among players [Manninen and Kujanpää 2005]. Finally, a growing body of theoretical work has drawn on aesthetic, cultural or communications theory perspectives from the humanities, to interpret computer games as new forms of cultural expression similar in many ways to traditional plot-based narrative forms, but with interactive, or ergodic, properties that pose significant challenges for narrative theory and methods [Aarseth 1997; Frasca 2003; Juul 1999; Schell 2005]. Several gaming definitions and taxonomies have been proposed that attempt to conceptualize the structural and behavioral properties of games and to account for differences between computer-based and traditional games [Aarseth et al. 2003; Järvinen 2003; Juul 2003; Klabbers 2003].

Consistent with the latter work, it is a basic contention of this article that understanding how gamers make sense of computer games as complex socio-technical behavior settings and understanding how they behave while playing games are worthwhile research objectives. This article reports the findings of an exploratory interview study that investigated how computer gamers behaved and conceived of their situated activity in the context of playing a popular class of computer games known as first-person shooters (FPS). The study examines how players experience and understand significant social and technical aspects of the FPS gaming situation in relation to their own goal-directed activity within the game. As an exploratory study of a poorly understood behavioral phenomenon, the research questions guiding the design of the study were fairly general in nature: What do players like and dislike about their FPS gaming experience? What are the pros and cons of playing alone in single-player mode, compared to playing with others in multiplayer mode? How do players experience their interactions with other players, or with nonhuman game characters such as bots? Which aspects of the FPS gaming situation do players pay most attention to when they are playing (i.e., which aspects of FPS games are most salient to players)? How do players' goals within the gaming context influence their perception of various social and technical aspects of FPS games? Little is known about such gaming perceptions and experiences; their documentation contributes to an improved understanding of FPS gaming as a complex, context-dependent, goal-directed socio-technical activity.

The remainder of the article is organized as follows. The next two sections will describe the basic characteristics of FPS games as behavior settings and the research methods used in the study. This is followed by a detailed presentation of the interview results summarizing gamers' perceptions of various social and technical aspects of their FPS gaming experience. The article ends with a discussion of the results and their implications for game developers and future gaming research. The discussion considers the theoretical relationship between FPS gaming goals and how gamers perceive and evaluate salient aspects of their gaming experience. Suggestions about how game developers might improve the design of FPS games are also offered.

2. FIRST-PERSON SHOOTERS AS BEHAVIOR SETTINGS

At the time of this writing, the first-person shooter genre includes numerous game titles such as *Unreal Tournament*, *Ghost Recon*, *Half-life*, *Quake 3 Arena,* and various others. As behavior settings, FPS games enable a complex variety of behavioral possibilities. Each player controls a single game character, or avatar, and experiences the game from a first-person perspective, as if s/he actually were this character interacting with others in the virtual environment of the game. Players manipulate various weapons and other items to defeat enemies and to achieve various goals or missions. They collect weapons located throughout the virtual environment, use them to "frag" (i.e., kill) or to inflict damage on enemy characters, while attempting to avoid getting "fragged" themselves. Players can collect health "medkits" to restore wounded characters to full strength and "powerups" to give their characters special powers or to increase their resilience to enemy attacks. Games take place in virtual environments called "maps," such as realistic World War II battlefields or imaginary settings such as space stations or other planets. There are two main types of FPS games, realistic (also known as strategic or tactical) FPS and action (or arcade) FPS, which differ mainly in terms of their relative interpretations of realism. Realistic FPS games have human-like characters who manipulate weapons modelled on real-world armaments, and whose behavior, health, and survivability generally conform to known scientific laws. Action FPS games have exotic characters

like robots or aliens that may be capable of leaping from enormous heights, surviving in outer space without oxygen, and recovering to full health after a rocket launch attack by simply running over a medkit.

FPS games are played using standard desktop computers or commercial video gaming consoles. Players interact with the game through an interface that typically must be configured before beginning the game. Players use menu settings to configure the look and sound of the game, how they will control their characters, and the level of playing difficulty. Commercial console interfaces include gamepads, joysticks, and other input devices. The gamers interviewed in this study all played on desktop computers using the computer's mouse and keyboard, and used other devices much less frequently. A "heads-up display" (HUD) on the screen provides the player with a view of the map environment and other information such as their character's current state of health, weapon inventory, aiming reticle (crosshairs), frag count, etc.

FPS games can be played alone on a stand-alone computer in single player (SP) mode, or in multiplayer (MP) mode, where two or more players control different characters within the same game by linking their computers together through a local area network (LAN) or the internet. In both SP and MP modes, players can choose from a variety of different game types, depending on whether they wish to compete as individuals or cooperatively in teams to achieve certain objectives. For instance, "capture-the-flag" is a common type of arcade FPS game in which teams must retrieve the enemy's flag and return it to their respective bases. In "deathmatch" individuals or teams battle one another to achieve a predetermined frag-count or to get the most frags in a given time period. In realistic FPS games, individuals or teams attempt to accomplish certain missions, such as an assault on a barricaded enemy position.

Besides human players, FPS games provide computer-controlled characters called bots, created using artificial intelligence (AI) algorithms, that act either as allies to human players or as enemies. Players have no direct control over "enemy bots" but can exercise varying degrees of control over the behavior of "friendly bots." In most FPS games at the time of this writing, players indirectly control friendly bots using an orders menu interface to direct bots to move to certain map locations or to perform specific actions such as assaulting or defending positions. The moment-by-moment behavior of these bots, however, such as directional movement, path finding, aiming and firing weapons, or avoiding enemy attack, are all controlled automatically by the game software. In some games, players can exercise more direct control over "buddy AI" bots by switching first-person control from one game character to another, while software controls the activities of the remaining bots on a team. Many FPS games also provide configuration menus that allow players to custom-build bots by altering their appearance, abilities, and other attributes. For instance, in *Unreal Tournament,* players can designate a bot's level of alertness, firing accuracy, aggression, and even favorite weapons.

Finally, FPS gamers strive to achieve a variety of behavioral goals within the game. These include fragging enemy players or bots, staying alive (i.e., not getting fragged), collecting weapons, medkits, and powerups, and seeking protective cover when attacked. Players strive to accomplish specific game missions, such as capturing an enemy flag or taking over an enemy position, and try to advance to higher game levels. In cooperative team games, goals related to coordinating strategies effectively with team-mates may also arise. More generally, gamers play FPS games to have fun, to be challenged, to compete with others, to improve their gaming skills, or to achieve various other personal goals.

3. METHOD

Given limited prior empirical research on gaming behavior, an exploratory method based on semi-structured qualitative interviews was used to investigate gamers' experiences, perceptions, and preferences related to playing computer games. The FPS game genre was chosen for the study because of the first author's substantial prior experience playing this type of game and the availability of a sample of regular FPS gamers willing to serve as interview subjects. The first author has been a regular player of computer games since the 1970s and FPS games since the 1992 release of *Wolfenstein 3D*, which is generally regarded as the first major title in the FPS genre. Thus, while not explicitly a participant observation study, long-term direct personal experience with FPS games and gamers helped to overcome potential communication barriers associated with the use of gaming and FPS jargon during interviews and in the interpretation and analysis of data. Besides interviews and direct personal experience, several secondary sources of information on FPS gaming were accessed during the design of the study and the interpretation of results, including gaming magazines, websites, and online discussion forums.

Interviews were designed to investigate both social and technical aspects of the FPS gaming experience, by inquiring about gamers' interactions with other players and their perceptions and preferences of various aspects of game design features. The interview questionnaire consisted mainly of open-ended questions to elicit free responses from participants on various topics. The beginning of the interview gathered demographic information about participant age, occupation, and computer gaming experience. Several questions asked about the participant's perceptions of various game design features including user interfaces, maps, weapons, and bots or artificial intelligence. Finally a number of questions examined aspects of game-play and interactions with other players, including perceptions of single player and multiplayer gaming using LANs and the internet. Most questions were designed to identify concrete examples of both positive and negative aspects of FPS game design and game play experience, using a style of questioning based on Bavelas' "echo method" [Bavelas 1942; Schaefer et al. 1980]. By asking for specific examples of positive and negative aspects of the game situation, the method encourages interviewees to provide descriptive information about their actual gaming experience, rather than ungrounded opinions or stereotypes. By asking for behaviorally relevant examples, the method is also designed to focus players' attention on aspects of the game situation that are meaningful in relation to their goal-directed action within the context of the game itself, rather than to evaluate FPS games from the perspective of an external observer.

Individual interviews lasting one to two hours were conducted over a two month period with eleven adult males. All were regular members of a group of gamers who met weekly to play FPS games on a local area network. The first author knew and had played FPS games on numerous occasions with each interviewee prior to the study. Seven interviews were conducted in person and four were conducted over the internet using microphones and voice communication software. All interviews were recorded and later transcribed. Interviewees were each offered $10 for participating in the study, although several declined this remuneration. The NUD-IST qualitative data analysis software was used for coding and analysis of questionnaire responses contained in the interview transcripts. Comments related to particular topics and issues were coded in topical or thematic categories by the two authors in an iterative process involving periodic discussions about the appropriateness and coherence of categorization schemes. The number of participants commenting in each thematic category is used as an approximate indicator of participant agreement and relative topic importance.

Table I. Background of Interviewees

Variable	Mean*	Range	*s*
Age (years)	36.6	25-52	8.3
Computer experience**	4.6	2-7	1.7
Computer gaming experience (years)	10.5	1-22	8.2
Time spent playing FPS games (hours/week)	9.8	2-20	5.9

*Eleven adult males were interviewed. Occupations included two carpenters, two millwrights, four information technology workers, one graduate student, one call center representative, and one ambulance attendant.
**Rated on a Likert scale from 1 (no experience) to 7 (very experienced).

4. INTERVIEW RESULTS

A summary and interpretation of participants' responses to the interview questions will now be presented. The results are organized in two sections dealing with interviewees' perceptions and preferences related to aspects of game design and game play experience, respectively. Table I summarizes the demographic background of the interviewees.

4.1 Game Design

Interviewees were asked to identify positive and negative attributes of several aspects of game design, including game interfaces, maps, weapons, and bots/AI.

4.1.1 *Interfaces*. Interviewees were asked to give examples of well-designed and poorly designed aspects of gaming interfaces, including any hardware or software devices used by players to configure, control, or interact with an FPS. Responses are summarized in Table II, which indicates the major response categories identified and the number of interviewees (out of eleven) per category. Interviewees commented about three aspects of interface design: the heads-up display (HUD), the keyboard and mouse as control devices, and menu systems. Comments about the HUD mainly dealt with the degree to which on-screen information either supported or interfered with a player's behavior in the game. Interviewees preferred HUDs that provided minimal necessary game-relevant information, such as a player's remaining ammunition, health, weapons inventory, and clearly visible aiming crosshairs, and presented this information on the screen in a format that did not obstruct a player's view of the game situation, distract attention, or otherwise interfere with game play experience. For instance, players liked HUDs that used translucent information icons or voice communication instead of text messaging to minimize visual obstruction. They also preferred games that let players configure both the content of HUD information and its placement on the screen, and most preferred icons located at the bottom rather than the top, sides, or middle of the screen. Players disliked HUDs with too much visually distracting information such as flashing lights or text messages, or information located on the screen in ways that blocked their view of the game and left them vulnerable to enemy attack or other in-game hazards. Following is an example of one interviewee's comments:

> "Too much information hinders the game experience. The main job for FPS in deathmatch is to go out and kill the next person that comes at you but if you have too much information, then you get information overload and sometimes the information obstructs your view. For example, there might be a little crack and you fall into lava because your icons obstruct your view and you fall and die."

Table II. Interface Preferences

Good interface design	Poor interface design
Heads-up Display (HUD)	
▪ Minimal on-screen information/clutter (9)*	▪ Too many items, clutter, obstructs view of game (7)
▪ Icon placement at bottom of screen (5)	▪ Icon placement at top, sides, or middle of screen (6)
▪ Clear but unobtrusive aiming crosshairs (4)	▪ Aiming crosshairs too small (3)
▪ Translucent maps and icons (3)	▪ Screen display should not include:
▪ Configurable HUD content & layout (3)	-Text messages (2)
▪ Voice communication instead of text messaging (3)	-Distracting flashing lights (1)
▪ Screen display should include -Remaining ammunition (7) -Health (7) -Weapons inventory (3) -Other misc. information (2)	
Keyboard & Mouse control	
▪ Configurable keys & mouse buttons (10)	▪ Poor key layout; can not reconfigure (5)
▪ Prefer keyboard & mouse control over gamepad controllers (8)	▪ Complex, tedious keystroke combinations to perform routine actions (4)
▪ Standard WASD key layout available (7)	▪ Standard WASD key layout not available (3)
▪ Hot keys/key binding instead of menu selections or multiple keystrokes (2)	▪ Prefer gamepad controller over keyboard & mouse (1)
▪ Separate lean/look, move, shoot controls (2)	
Menus	
▪ Fast/easy to navigate, configure & access information from within the game (1)	▪ Slow/difficult to navigate, configure & access information from within the game (6)
▪ Voice recognition instead of menu to control team-mate bots (1)	▪ Must quit mission to reconfigure game settings; can not pause game (2)

*Values in parentheses identify the number of interviewees (n=11) who mentioned each category.

Comments about the keyboard and mouse dealt mainly with the configuration of keyboard layouts as well as statements indicating preferences for the use of keyboard and mouse over gamepads, joysticks, or other control devices. FPS games are designed with a default keyboard and mouse control layout, which can be reconfigured in most games if desired. A common default layout is known as WASD, in which the A and D keys control a character's left and right sideways movement, and the W and S keys control forward and backward movement, respectively. The left mouse button is normally used for shooting and the mouse wheel is used to scroll through available weapons. The right mouse button is typically used for jumping, or to trigger a weapon's secondary fire mode if available.[3] Layout configurability was identified as the most desirable aspect of keyboard and mouse design, and most interviewees preferred games that offered WASD

[3]Some weapons are capable of firing in different modes. The default mode is used most frequently and called the primary fir mode. Secondary fire refers to a less frequently used method of dispensing projectiles.

as an available layout. Configurability or the use of a standard default layout enables players to use the same control layout regardless of which FPS game they are playing, thereby avoiding the need to learn a new layout for each new game:

> "Each FPS I play that I can customize I'd like to use exactly the same pattern of keys because I don't have to learn it. I already know it so if I can customize the game to it, my learning curve is much shorter."

Players disliked inefficient control layouts that required complex, tedious keystroke combinations or multiple menu selections to perform routine actions, or had control keys spread across the keyboard in ways that were difficult to reach. Such properties made control difficult, left gamers vulnerable to attack, and reduced their sense of realism: "I don't like it when realism and controls of the game don't match. For example, if it's one shot kill, (but) I have to press five buttons in a sequence to draw a gun or to reload, I don't like that." Configurability, therefore, enables players to improve perceived control efficiency, for instance by configuring a "hot key" to perform multiple functions with a single key stroke. Conversely, some interviewees noted that actions like leaning/looking, moving, and shooting were inappropriately combined into a single function in certain games and they preferred to control these separately.

Comments about the pros and cons of menu systems emphasized the ease of menu navigation such that menu use did not interfere with game play. Interviewees were critical of menu systems that were difficult or slow to navigate, thereby leaving players vulnerable to enemy attack, and games that forced players to quit missions in order to reconfigure various game parameters. Lastly, one interviewee preferred the use of voice recognition, which is available in certain games as a means of directing and controlling team-mate bots in co-op game play, over slower menu navigation. In summary, interviewees' comments about interfaces mainly emphasized their preference for behaviorally transparent interfaces that did not interfere with or detract from their game play experience, or leave them vulnerable to attack or danger within the game.

4.1.2 *Maps*. Interviewees were asked to identify positive and negative aspects of the virtual environments or maps in which FPS games are played; the responses are summarized in Table III. Maps depict realistic or imaginary locales, vary in geographical size and complexity, and exhibit environmental features such as sand and snow, buildings and hills, wind and rain, as well as hazards such as lava pools or slime pits. The most highly valued aspect of maps was topographical variety, including diverse settings and features such as multiple levels, terrains requiring jumping and climbing, and the availability of hiding places and camouflage. The most disliked aspect of maps was tedium, in which progress within the game depended on performing precise maneuvers such as jumping onto narrow platforms, following a precise or repetitive sequence of steps, solving puzzles, or navigating complex mazes. Interviewees also disliked poorly conceived or illogical design features, such as the presence of doors that could not be opened, or poor "respawn" (i.e., return to life after getting fragged) logics, for instance where game characters respawn right in front of an enemy just to get fragged again.

Interviewees expressed mixed preferences with respect to map size and graphics quality. Some liked large maps with lots of players and some disliked small or crowded maps; some disliked large maps because they took a long time to learn or search. High-resolution graphics was mentioned as desirable, but graphics quality alone was described as irrelevant "eye candy" if the game was not enjoyable. Several interviewees disliked other miscellaneous map features, including environmental hazards, or the presence of either too many or too few hiding places.

Table III. Map/Game Environment Preferences

Positive	Negative
▪ Variety of topographic features/terrains (10)*	▪ Tedious map features -Precise maneuvers (e.g., jumping) required to progress or collect items (7)
▪ Multiple levels (9)	-Repetitive/slow storyline/plot; precise sequence of steps required to complete mission (4)
▪ Preference for indoor/outdoor maps: -prefer outdoor (4) -prefer indoor (3) -like both indoor and outdoor (4)	-Mazes, labyrinths, puzzles, secrets (3)
▪ Indoor/outdoor preference contingent on -style of play (run-and-gun vs. sneak-and-shoot) (5) -preferred or available weapons (4)	▪ Misc. disliked map features (environmental hazards; too many/no hiding places; single level) (6)
▪ Hiding places, camouflage (4)	▪ Poorly conceived/illogical graphics design (e.g., can not open door/enter tunnel/jump over low ledge, can not tell team-mates and enemies apart, etc.) (5)
▪ Jumping, climbing (3)	▪ Poor respawn logic (right in front of enemy; far back in mission) (5)
▪ High quality graphics (3)	▪ Large maps; slow to learn or search (4)
▪ Large maps/lots of people (2)	▪ Small, crowded maps (2)
▪ Variable, quick paced storyline/plot (1)	▪ Eye candy/good graphics irrelevant if game is not enjoyable (2)

*Values in parentheses identify the number of interviewees (n=11) who mentioned each category.

Finally, the results in Table III indicate that an important aspect of maps related to interviewees' preferences for indoor and outdoor map environments. Despite the variety of map environments available in FPS games (terrestrial versus extraterrestrial; realistic versus fantasy, etc.), players tended to classify maps in relatively simple terms, primarily distinguishing between indoor maps, in which game-play is generally restricted to indoor locales such as a large warehouse or a spaceship, and outdoor map environments, which allow players to exit structures and move freely about the external surroundings. About a third of the interviewees expressed a preference for indoor maps, a third preferred outdoor maps, and the remaining third claimed to like both types equally well. Interviewees explained these preferences in relation to two main contingency factors: style of play and preferred or available weapons. More will be said about weapons below, but two extreme styles of play were identified by interviewees, "run-and-gun" and "sneak-and-shoot," which have also been discussed on various FPS websites and discussion forums. Gamers using a run-and-gun style tend to run at full speed through the map environment, fragging opponents and collecting weapons, ammunition, and powerups as they go. They rely mainly on speed, physical manoeuvres such as dodging and jumping, and the judicious use of weapons and powerups to overcome opponents. Players adopting a sneak-and-shoot style of play move slowly with caution, stopping often to survey their surroundings for threats and rely on stealth and tactics to neutralize enemies. They use terrain and camouflage for cover, and make tactical use of topographic features such as buildings and hilltops for sniping and ambushing opponents.

These two styles represent the extreme points of a continuum, and gamers do not necessarily limit their play to one style or the other. Some prefer to stick with just one style of play, but others vary their style or adopt hybrid styles between the two extremes.

Players' comments suggest they perceived certain combinations of map type and playing style to give them a tactical advantage over opponents. For example, one interviewee who said he was "always running full tilt" and would "run and kill and run away" (a run-and-gun style of play) preferred indoor maps because it was "hard to run away from a guy with a chaingun in a great big field." By staying constantly on the move in an indoor map with many rooms and corners, run-and-gun players can kill quickly and move to safe areas to avoid being killed. A player who mainly used a sneak-and-shoot style preferred outdoor maps in which he could "camp out in a tower" and snipe enemies from a long distance away. Another who liked both indoor and outdoor maps said he used a sneak-and-shoot style of play to ambush opponents from dark corners on indoor maps. These examples suggest players individually learn to adapt particular styles of play to particular map environments, but that no fixed relationship between map type and style of play applies to all players. Furthermore, game objectives and other criteria can also influence preferred style of play. For example, if the goal of the game is to be the sole surviving player, a sneak-and-shoot style might better serve the goal than run-and-gun. Similarly, game characters do not respawn after getting killed in some realistic FPS games, so players may be more likely to use a sneak-and-shoot style in these games due to the higher risk of being fragged while using run-and-gun.

4.1.3 *Weapons*. Interviewees were asked to discuss the FPS weapons they liked and disliked, why they liked or disliked them, and whether or not they varied their weapon usage during play. Since different FPS games use different weapons, preferences for specific weapons used in particular games are less interesting than interviewees' reasons for preferring and using specific weapon types, which are summarized in Table IV. Most games offer players a choice of about ten weapons, which possess a wide variety of attributes and perform various functions. In many games, weapons are modelled after contemporary or historic military armaments, including such devices as machine guns, sniper rifles, crossbows, shotguns, bazookas, rocket launchers, and grenade-launchers.

Some games also offer various exotic imaginary or "alien" weapons such as lasers, plasma guns, lightning guns, light sabres, slime-guns, and even a bee gun in one game, which shoots hordes of bees at the enemy. In arcade-style FPS games, players begin the game with either no weapon at all or with a basic low-powered weapon such as a knife, pistol, or crowbar. They must then seek out and collect more powerful weapons and ammunition located throughout the map by running their game characters over them in order to build up personal weapon inventories. In realistic FPS, players typically select one or more weapons at the start of a game mission and become the team specialists in the use of those weapons.

Interviewees' preferences were associated with several perceived weapon attributes relevant to FPS play. Weapon power refers to the amount of damage a weapon can inflict upon an opponent per round of ammunition. High-powered weapons like rocket launchers can destroy several enemies with a single shot, while low-powered weapons like pistols often require several rounds to destroy a single target. Rate of fire refers to the speed at which a weapon can fire repeated rounds of ammunition and/or reload between rounds. For instance, machineguns fire rounds in rapid succession, but pistols and sniper rifles take longer to reload and aim between rounds. Weapon range refers to the distance at which a weapon is capable of inflicting damage on a target. For instance,

sniper rifles have a long range due to the player's ability to use the scope to magnify far-off targets, but the effectiveness of shotguns is limited to short-range targets due to the dispersion of pellets. With respect to weapon accuracy, most FPS games have assumed aim, which means that apart from range limitations bullets always hit exactly where the weapon is aimed. Interviewees did, however, distinguish weapons based on what might be called their required accuracy, which refers to the degree of aiming precision required to hit a target. For instance, single-round pistols and sniper rifles must be aimed precisely at a target to inflict damage, but less precision is required with dispersion weapons like shotguns or with explosives like rockets or grenades: "you don't have to be accurate. You just have to hit the ground somewhere near (the enemy) and you will cause damage." Other weapon attributes mentioned by interviewees included their degree of realism as mentioned above, weapon versatility (i.e., whether or not a weapon is capable of performing multiple functions), and the risk of self-damage from weapons. As an example of the latter, some powerful weapons like rocket launchers can inflict self-damage on game characters if they are used to attack enemies in close quarters at short range.

Of the preceding attributes, range was mentioned most frequently by interviewees, with both long- and short-range weapons viewed positively for different game situations. Interviewees generally preferred high power over low power, high rate of fire over low rate of fire, and low required accuracy over high required accuracy. The main reason for disliking low power, low rate of fire and high required accuracy related to a player's vulnerability to enemy attack during the time required to fire multiple low-powered shots, to reload a weapon, or to aim precisely, respectively. On the other hand, too much power and too little required accuracy were also disliked, since these attributes made it too easy to obtain frags, reducing the challenge of the game and the skill required to succeed. Realistic weapons were preferred over unrealistic or alien weapons, those with low risk of self-damage were preferred over those with high risk, and multifunctional weapons were also viewed positively. Besides discussing weapon attributes, interviewees criticized two other game properties related to FPS weaponry: slow menu navigation procedures for switching from one weapon to another, which left players vulnerable to enemy attack, and the view that some games provided too many redundant weapon alternatives, reducing game challenge by increasing the likelihood that players will always have an available weapon appropriate to the situation.

Finally, interviewees mentioned that they liked to use a variety of weapons with different "advantages and disadvantages depending on the situation," and identified map type (i.e., indoor versus outdoor) and style of play (i.e., run-and-gun versus sneak-and-shoot) as key situational contingencies that influenced their weapon choice during game play. Interviewee comments suggest that maps and style of play influenced weapon preferences in a variety of different ways. Generally, very high-powered weapons were seen as more suitable for outdoor maps than indoors, due to the risk of self-damage. Long-range weapons also suited outdoor maps with wide-open spaces, while short-range weapons were more suitable for indoor close combat situations. High accuracy and slower rate of fire weapons suited outdoor maps better than indoor maps, since greater distances gave players time to reload and aim with less risk of enemy assault. On the other hand, "if you're inside a building … you want something that's very fast, rapid-fire you know, for close range stuff." The run-and-gun style of play tended to be associated with the use of relatively powerful and high rate of fire weapons which let players "finish off an opponent as quickly as possible and go on to the next opponent." Low required accuracy was also associated with a run-and-gun style, since player speed precludes

taking time to pause and aim carefully. Slow rate of fire, long range, and high required accuracy weapons (e.g., sniper rifles) tended to suit a sneak-and-shoot style of play in which players have time to reload and aim at distant enemies from secure hiding places, so "you can kill from a long ways off and (the enemy) won't know who did it."

4.1.4 *Artificial Intelligence/Bots*. Interviewees were also asked to discuss what they liked and disliked about artificial intelligence in FPS games, referring primarily to the design and behavioral properties of bots. Responses generally related to the theme of providing a challenging game experience (see Table V). Challenging bots were appreciated because they made the game enjoyable, gave players a chance to practice and improve their skills, and filled in when there were not enough human players for multiplayer games. Much of the fun of playing FPS games comes from the challenge in pitting one's skills against those of opposing players, so a suitable challenge exists when there is a reasonable match between bots' skills and abilities and those of players.

However, such parity is sometimes difficult to achieve because "… there are so many different levels of human skills that it's too hard to match bots to them." Consequently, negative comments mainly related to bot characteristics that created gaps between

Table V. AI/Bot Preferences

Positive	Negative
▪ Challenging (11)*	▪ Unrealistic nonhuman-like behaviors
▪ Auto-adjust or manually configurable skill level/style of play to match players (10)	-Accuracy too perfect (11)
▪ Desirable realistic human-like behavior**	-Reflexes/reactions too fast (9)
-Act as human would in same situation (10)	-Predictable behavior/style of play (9)
-Variable/unpredictable behavior/style of play (6)	-Do not take cover/retreat when attacked; always fight to the death (8)
-Run away/seek health when hit (5)	-Team-mate bots hard to direct/control in co-op play (7)
-Make mistakes/misfire/panic/freeze/be surprised (5)	-Poor path-finding; getting stuck or lost (5)
-Take cover/retreat when attacked (4)	-Never make mistakes (3)
-Team-mate bots follow directions (2)	-Invincible (do not die when hit) (3)
▪ Bots fill in for humans in multiplayer games (8)	-Use weak weapon as default; do not use available weapons (3)
▪ Practice/improve skills playing bots (6)	▪ Bot & human skill level mismatch
	-Too challenging (9)
	-Not challenging enough (5)
	▪ Game gives unfair advantage to enemy bots
	-Bots know player locations (7)
	-Enemy bots smarter than team-mate bots (3)

* Values in parentheses identify the number of interviewees (n=11) who mentioned each category.

** These behaviors reflect desirable behavior for bots, not necessarily bot behavior encountered in actual FPS games.

gamers' and bots' skills, resulting in games that were either too challenging or not challenging enough. For example, interviewees complained that bots' aiming abilities were too perfect and too accurate, that their reflexes were too fast, that they never made mistakes, and that they appeared invincible, capable of surviving hits that would kill a human player's game character. Interviewees also criticized games that appeared to give enemy bots an unfair advantage over human players or friendly (team-mate) bots. For instance, interviewees suggested that enemy bots often seemed to behave more intelligently than friendly bots in similar circumstances, and enemies seemed to know a player's location in the map and would come around a blind corner already firing at a player, leaving the player no time to react. Such "super-human" bot behaviors created a game situation that was too challenging and led to player frustration: "You didn't even know the bots were there and you die, you respawn, you die, you respawn, you hit the reset button, kick your computer and leave."

On the other hand, interviewees also complained that bots often presented too little challenge and exhibited unintelligent "subhuman" behavior. For instance, bots tended to behave in predictable ways, such as by using only a run-and-gun style of play, and always advancing towards human opponents in a fight to the death, rather than retreating or taking cover when attacked. Such behavioral predictability made it relatively easy for human players to ascertain bots' weaknesses and to devise strategies to defeat them. Participants were also critical of bots that did not seem to act as humans would in the same situation, for instance by not taking cover when attacked: "I don't want stupid enemies that stand there and don't know you're there and you just kill them. That's not challenging enough. … If you're getting shot at and you don't know where it's coming from, most people would probably dive and try to take cover. A good AI has the (bots) doing that." Finally, interviewees complained that friendly bots were hard to control or direct during co-op team play, that they exhibited poor path-finding abilities becoming lost or stuck at some location in a map, and that they often failed to use the most appropriate weapon in their inventory, opting for less appropriate default weapons.

Instead of either superhuman or subhuman behavior, interviewees wanted bots to exhibit more realistic human-like behavior and identified several desirable bot characteristics. They wanted bots to be less predictable in their behavior and more variable in their style of play, and to occasionally make the sorts of mistakes humans make during game play, such as misfiring or "freezing" when suddenly encountering an enemy. They also wanted bots to take cover when attacked, to retreat and seek health powerups when hit, and friendly bots to follow directions more consistently during co-operative game play. Games that provide the ability to configure bots' skill levels manually or that automatically adjust bots' skill levels and styles of play to match those of human players were also desirable attributes:

> "One thing I like about *Quake 3* is that in the novice level the bot, in that stage because you're a beginner, the AI knows you're a newbie and gives you a chance to fight back. And if you're good, and more of a challenge, you go to a higher level of difficulty where the bot takes one shot and you're dead. I like that kind of gradient."

To sum up interviewees' preferences related to artificial intelligence and bots, players appreciated the fact that bots added a degree of challenge to the game, but disliked bot behavior that was either too challenging or not challenging enough. The following comments suggest that the ideal bot skill level should be somewhat higher than that of the human players in order to provide an appropriate degree of game challenge, but not so high as to produce a frustrating game experience:

"If bots weren't challenging in a game I didn't play the game."
"It's nice that they're a little bit more advanced. The harder they get the more you work at it."
"I want the AI smart enough or (to) behave close enough to a human so that it will give a person a challenge… as long as they're all not at the perfect level where I'm getting taken down every second-and-a half."

4.2 Multiplayer and Single Player Game Play

Interviewees were also asked to identify positive and negative attributes of FPS game play experience under various conditions, including playing alone in single player mode and playing with other people in multiplayer mode using local area networks or the internet. Responses are summarized in Tables VI and VII.

Table VI. Multiplayer Play Preferences

Positive	Negative
Playing with other people	*Playing with other people*
▪ Social interaction -Fun with friends; camaraderie (10)* -Chatting, teasing, taunting, joking (8)	▪ Mismatched skills (too weak/no challenge or too strong/frustrating) (6)
▪ Challenge to beat others; competition (8)	▪ Difficult to coordinate co-op/team play; disagree on strategy (3)
▪ Advantages of human players over bots -Unpredictable behavior/style of play (7) -Make mistakes; not perfect; slower reflexes (5) -Easier to coordinate co-op/team play with humans than bots (4) -Variable skill levels; matched skills; fair (3)	▪ Emotions; hurt feelings (3) ▪ Unable to save MP game midway (1)
▪ Share tips/techniques; learn from good players (5)	▪ Network connection problems; unfair competition due to better hardware, internet connection (6)
▪ Less need for bots (3)	
Online/Internet MP	*Online/Internet MP*
▪ Convenient set-up; no scheduling (2) ▪ Anonymous (2)	▪ Cheating/using cheat codes (10) ▪ Anti-social behavior (bullying; bad attitude/"assholes"; belittling/insulting; poor sports) (9) ▪ Violate game objectives; spoil the game (team-killing; not co-operating with team; ganging up in individual death match) (6) ▪ Anonymous; less social (4) ▪ Too much chatting (2) ▪ Too many players/crowded maps (1)
LAN MP	*LAN MP*
▪ More fun; more social; play with friends in same room (10) ▪ Better coordination in co-op/team play (face-to-face/talking/look at team-mate's screen vs. text messaging/online voice link) (6) ▪ No cheating/cheat codes (2)	▪ Inconvenient set-up/scheduling (8) ▪ Cheating (look at opponent's screen) (2)

*Values in parentheses identify the number of interviewees (n=11) who mentioned each category.

Table VII. Single Player Play Preferences

Positive	Negative
▪ Advantages compared to MP -Convenient set-up/no scheduling (9)* -No human team coordination required; complete control of game strategy (4) -No people/cheating/anti-social behavior (2) -No connection/hardware issues (2) -Able to save SP game midway (2) -Online player skill level too high (1) ▪ Challenging bots (2) ▪ Practice; improve skills; learn maps (2) ▪ Fun personal activity (2)	▪ Disadvantages of playing with bots (predictable; too difficult; too easy; unfair advantage/know location) (6) ▪ No people/social interaction; boring alone; make all decisions yourself (2) ▪ Time consuming/addictive (2)

*Values in parentheses identify the number of interviewees (n=11) who mentioned each category.

4.2.1 *Multiplayer Preferences*. Several themes emerged in interviewee comments about multiplayer (MP) game play, including the social properties of MP gaming, challenge associated with playing against other human players, characteristics of human player behavior, particularly as compared to bots, and technical concerns related to hardware, software, and computer networking (see Table VI). Interviewees valued the social benefits of playing with other people, including camaraderie, having fun with friends, chatting, teasing, and learning game play tips and techniques from better players. At the same time, many negative social aspects of MP gaming were identified, particularly for internet MP. These included cheating and various other forms of antisocial behaviors such as verbally abusing players, complaining, and "team-killing" (i.e., killing fellow team members in team-based MP games). Interviewees also complained about hurt feelings and emotions, too much chatting, overcrowded maps, and players who seemed intent on spoiling the game for others by violating game objectives. LAN MP was viewed as a far more enjoyable social activity than internet MP, and had much less cheating (though cheating by looking at another player's screen was still a minor concern). By contrast, internet MP was seen as largely an anonymous activity with little social benefit, to the extent that one interviewee compared it with playing against very intelligent bots in single player mode:

> If you're playing online with someone you've never met it's just like playing with a computer that's a little bit smarter. They're just out there…Conceptually, it's not much different than playing a computer with amazing AI. If it's your friends you're playing with (at) a LAN party, or even through a server but you know who you're playing with, then it's more personal, it's more fun to spend time with them playing games. But when you play with people you don't know, that's not a social aspect. Not to say that you can't get to know them, but nevertheless when you start they're just unreal AI, really intelligent."

The challenge and competition associated with playing against human players was viewed very positively, particularly when skill levels were well matched. Although challenge also ranked highly in players' comments about bots, several specifically mentioned that they preferred the challenge of competing against other human players over playing against bots: "I like the competitiveness, knowing that you're playing a real

player, so it's your skill versus their skill, which is good." Internet MP in particular offered opportunities to play against extremely skilled players, while LAN MP meant challenge and competition were limited by the skill levels of the players in the room. In general then, LAN MP was seen as offering both a challenging game experience and an enjoyable social activity, while internet MP was seen as providing potentially more challenging gaming opportunities, but at best a negative social environment.

Echoing earlier comments about bots, players disliked it when other player skill levels were mismatched, creating a game situation that was either too challenging or not challenging enough. As the preceding quote suggests, human players were viewed as "amazing … really intelligent" compared to bots. Human players were seen as having several advantages over bots, including unpredictable behavior and style of play, imperfect behavior that opponents could take advantage of, better team-play coordination, and variable skill levels. Some interviewees explicitly mentioned that an advantage of playing against humans was that there was less need for bots in the game. On the other hand, bots were seen as having some advantages over humans, since humans often disagreed about team strategies and engaged in the sorts of negative antisocial behaviors described above. As one interviewee noted: "bots are rarely asses." Finally, players commented about the technical set up and scheduling difficulties associated with LAN MP sessions, internet connection problems like speed discrepancies, disconnects, and computer lockups, hardware differences that gave players unfair advantages in internet MP gaming, and the inability to save MP games midway through a long mission.

Cheating was the most frequently mentioned negative social behavior in MP gaming. Cheat codes are readily available on the internet for popular FPS games, which enable players to shoot with perfect accuracy, provide protection against enemy fire, etc. Comments suggest that participants disliked cheating because it obviated the need for skill by making opponents too powerful or invulnerable to attack, which in turn spoiled the fun associated with human competition and created frustration by upsetting the balance of challenge in a game. As one person stated, "I don't like playing with others who are so good they have to be cheating. I play to have fun and if I lose I don't care. But I don't want to be beaten to a pulp by a guy I know is cheating." Participants' comments suggested the use of three heuristics to identify cheating: obvious cheats, damage comparison, and an invulnerable style of play. Obvious cheats are cases in which players act in ways that are plainly beyond normal game parameters, such as a character moving much faster or jumping much higher than it should. Players also identified cheats by comparing the amount of damage inflicted on an opponent to the amount expected. If an opponent character shrugs off damage that should have resulted in a kill, the gamer is suspected of cheating. Style of play provided a third means of distinguishing cheaters from players who were just very good at the game. Good players remain vulnerable to attack and therefore use avoidance strategies like jumping and dodging to avoid being killed. Conversely, gamers using a cheat code to make their characters invulnerable need not take such precautions and tend to walk around destroying everyone in their paths with little apparent concern about getting attacked.

4.2.2 *Single Player Preferences*. Comments by interviewees about single player (SP) gaming had the unique property that most positive responses referred to the absence of certain negative qualities of MP gaming, but relatively few players identified positive aspects of SP gaming in its own right (see Table VII). For instance, players liked it that SP gaming was more convenient than MP LAN and required no scheduling; that they had complete control of the game and did not need to coordinate team-play strategy with

other players; that there was no cheating or other forms of antisocial behavior, no hardware or network connection issues, no highly skilled human opponents to make the game too challenging and frustrating; and that it was possible to save SP games midway through long missions. This pattern of responses suggests the interviewees generally preferred to play FPS games in MP mode, but played SP mainly to avoid the negative aspects of MP gaming. The few interviewees that identified other positive aspects of SP, referred to the presence of challenging bots, the ability to practice and improve one's game skills in SP mode, and the idea that SP gaming is a fun, enjoyable individual activity. Negative responses about SP gaming included comments about the disadvantages of bots as discussed earlier in this article, boredom due to the lack of social interaction while playing alone, and the tendency to lose track of time and get "addicted" to playing a particular FPS game.

5. DISCUSSION: GAMERS' GOAL-DEPENDENT GENRE MODELS

The interview results paint a rich picture of players' perceptions and evaluations of various social and technical aspects of the FPS gaming situation. Interviewees valued behaviorally transparent interfaces that did not interfere with the game experience or leave players vulnerable to enemy attack due to slow, inefficient control layouts, or screen icons that obstructed player view. Maps with a variety of features and levels permitting behavioral flexibility were preferred over repetitive maps or those with rigidly constrained action sequences. A wide variety of weapon features (range, power, rate of fire, required accuracy, etc.) were identified by interviewees and their preferences for weapons possessing particular features were perceived to be closely associated with map type and style of play, suggesting certain weapon features suited certain map environments and styles of play better than others. Further research is required to investigate systematically the associations between map types, styles of play, and weapon preferences.

Interviewees valued bots that provided an appropriate degree of challenge, whereby bots with abilities comparable to or marginally better than those of human players were desirable, but bots that were either too challenging or not challenging enough were disliked. The results further suggest that bot challenge was perceived as a multifaceted variable, corresponding to the various dimensions of bot behavior salient to gamers. For example, the same bot might exhibit perfect shooting accuracy, but a predictable style of play, or stupid path-finding behavior. In general, players desired bots that behaved as humans would in the same situation and exhibited human-like weaknesses as well as strengths. However, the variety of behavioral situations encountered in FPS games suggests that relatively few bots actually met such player expectations. The interviewees clearly preferred multiplayer over single player gaming due to the social camaraderie of MP games. They also preferred the competitive experience of playing against other human players over the challenge of playing against bots. There was also a definite preference for MP LAN gaming over internet MP gaming due to the prevalence of cheating and other antisocial behaviors online. Technical concerns related to MP gaming were also mentioned, such as the inconvenience of setting up a LAN session and unfair competition due to variable computer hardware in both LAN and online gaming. SP gaming was viewed as somewhat boring due to the lack of social interaction, and its advantages were mainly defined in contrast to certain drawbacks of MP gaming, such as the absence of antisocial player behavior.

By identifying the categories of gaming experience most salient to gamers, the results in Tables II-VII provide an indication of the structure of their mental models of game

play within the FPS genre. Such "genre models" reflect players' perceptions of the extent to which various aspects of the FPS gaming situation are behaviorally relevant to their goal-directed gaming activity. Reyes and Zarama [1998] (see also Tsoukas and Vladimirou [2001]) describe human knowledge as an ability to draw behaviorally appropriate distinctions within a given domain of activity. FPS games establish complex behavior settings that require players to attend to and make sense of a wide variety of changing environmental stimuli at high speed, and to respond with appropriate actions chosen from a large repertoire of potential responses. To handle these cognitive demands, players must filter out many behaviorally irrelevant stimuli and focus their attention on aspects of the situation that are perceived to be most behaviorally relevant. For example, the results suggest players distinguished between two general types of maps, indoor versus outdoor, which reflect their perceptions about the styles of play (run-and-gun versus sneak-and-shoot) most appropriate to these two kinds of environments. Although this distinction is very abstract, and one might imagine many other potential ways of classifying FPS maps (e.g., terrestrial versus extraterrestrial; historically accurate versus imaginary), the fact that interviewees organized their knowledge of FPS maps in terms of these two broad categories suggests other potential map distinctions were less behaviorally relevant to game play. In other words, it suggests players would likely use the same style of play in an indoor terrestrial map as in an indoor extraterrestrial map, and the same style of play in an outdoor historically accurate map as in an outdoor imaginary map. The division of styles of play into two general types similarly represents a kind of cognitive shorthand that subsumes a complex variety of behaviors into simpler bundles, and suggests interviewees were able to handle most FPS gaming situations satisfactorily using either one style or the other.

Gaming goals appear to have influenced significantly the structure of gamers' FPS genre models by shaping how they perceived and evaluated various properties of the gaming situation. Specifically, it is proposed that FPS gaming goals influenced gamers' perceptions and evaluations in two ways. First, aspects of the gaming situation perceived to be most behaviorally relevant to goal attainment were seen as most salient to gamers and aspects seen as less behaviorally relevant to goal attainment were less salient. In other words, goals acted as perceptual filters, such that players paid most attention to aspects of the gaming situation perceived to influence most their attainment of gaming goals, and ignored or paid less attention to aspects perceived to have little or no influence on goal attainment. For example, although only two map categories were sufficient to capture the salient behavioral differences associated with diverse map environments, gamers distinguished among a wide variety of different weapon attributes (range, power, required accuracy, rate of fire, risk of self-damage, etc.), all of which were directly relevant to accomplishing the goals of fragging opponents under various game conditions and staying alive in the face of enemy attack.

Second, it is proposed that players evaluated salient aspects of the gaming situation based on the extent to which these aspects were perceived either to support or to hinder the attainment of FPS gaming goals. That is, aspects of the gaming situation perceived to support goal attainment were evaluated positively, while those perceived to hinder goal attainment were evaluated negatively. To consider this proposition, it is useful to divide FPS gaming goals into two general categories: extra-game goals associated with a player's motivation to engage in FPS game play in the first place, and intragame goals associated with a player's actions and behavioral strategies *in situ* within the context of the game. Extra-game goals identified during the study included having fun with friends, being challenged, engaging in fair competition against others, improving one's gaming

skills, etc. Intragame goals included fragging enemy players or bots, staying alive (i.e., not getting fragged), collecting weapons and medkits, seeking protective cover, accomplishing specific game missions such as capturing an enemy flag or taking over an enemy position, advancing to higher game levels, coordinating strategies with teammates, and various others. The results in Tables II-VII identified numerous categories of experience salient to gamers, most of which can be readily linked to one or more such intragame or extra-game goals. For example, weapon attributes like long and short range, high power, low required accuracy, high rate of fire, and low risk of self-damage, were all evaluated positively because they supported goals of fragging enemies under particular game conditions. On the other hand, interface designs that blocked the field of view were disliked because they left players vulnerable to enemy attack or other mishaps, contrary to the goal of staying alive in the game. Cheating by other players and bots with extremely fast reflexes were both disliked because they violated goals related to engaging in fair competition with an appropriate level of challenge. Due to the small sample size and exploratory interview methodology used in the current study, further research is needed to provide a rigorous test of these propositions about the influence of goals on the structure of gamers' perceptions and mental models of games within particular genres.

Genre models of the sort suggested by the results in Tables II-VII reflect how players experience games within a particular game genre, and as such, provide a framework for game developers to consider ways of improving game design within the genre. Two general strategies for improving FPS gaming experience might be considered, based on the results of the present study. First, by identifying the relevant categories of experience most salient to gamers, the results provide a kind of prioritization scheme indicating which sorts of game improvements are likely to be most valued by players. For instance, interviewees' comments about maps suggest that topographical variety was valued much more than high-quality graphics, suggesting that technical efforts to enhance computer graphics may go unnoticed by players and yield less benefit to developers than artistic design efforts to create topographically diverse map environments. Similarly, cheating was the most undesirable aspect of online MP gaming, suggesting developers could dramatically improve perceptions of their products by significantly reducing the likelihood of cheating. One approach might involve the periodic issuing of software patches to defeat known cheat codes in a manner similar to the periodic updating of computer virus definitions by the developers of virus protection software. Another approach might be to implement a kind of software referee in FPS games to monitor player behavior and flag known forms of cheating, such as moving too fast, jumping too high, or aiming too accurately, giving other players in the game an opportunity to address the situation, perhaps by having the cheater removed from the game server.

A second strategy for improving gaming experience is also conceivable. Since the results indicate that behavioral variety and challenge are generally seen as desirable, developers can deliberately transcend the structure of the classification schemes summarized in Tables II-VII in ways that create both variety and challenge for gamers. For example, with respect to the distinctions between indoor and outdoor maps and between run-and-gun and sneak-and-shoot styles of play, game designers could design maps that deliberately blur the boundary between indoor and outdoor environments. This might create behavioral situations that enhance the fun of the game by challenging players to develop more diverse styles of play, different from those with which they are currently most comfortable. This strategy amounts to creatively modifying the design assumptions of the FPS genre, to challenge players in unexpected and potentially fun ways. One risk of such a strategy, of course, is that the modifications could create or

aggravate undesirable aspects of the game. For instance, behavioral variety was an undesirable property of interface design (i.e., interviewees preferred to use standardized control interfaces across different FPS games), so it would make little sense to modify keyboard control layouts in ways that arbitrarily forced players to abandon their preferred layout.

Another risk is that this strategy would further complicate a behavioral situation that is already highly complex, potentially increasing the likelihood that bots would be perceived as behaving differently from humans in the same situation. That is, players perceived bot behavior as unrealistic relative to specific gaming situations, not that bots lacked intelligence in an absolute sense. To illustrate the difference, current FPS bots are far more intelligent than the enemy characters in a circa-1980 Pac Man game when the two are compared objectively. Relative to behavioral situations within the game, however, Pac Man's enemy characters behaved essentially the same as human players because the Pac Man gaming situation was highly constrained. So it is unlikely that players of Pac Man would have criticized these enemy characters for behaving unrealistically. FPS games offer far greater behavioral flexibility and situational variety than Pac Man, creating many more behavioral dimensions by which bot realism and challenge can be evaluated and, therefore, much more difficult bot programming demands for developers. Increasing the behavioral variety of FPS games by transcending distinctions associated with current genre models would amplify these programming demands, which if not met could increase player dissatisfaction with bot realism and challenge.

6. CONCLUSION

Most social scientific research on computer games has treated gaming as an undifferentiated activity (i.e., people either play computer games or not) associated with numerous variables outside the gaming context. This article considers computer games as behavior settings that are worthy of social scientific investigation in their own right, and contributes to a better understanding of computer gaming as a complex, context-dependent, goal-directed activity. An exploratory interview-based methodology was used to identify salient categories of players' FPS gaming experience. Gamers' perceptions and evaluations of several aspects of FPS game design and game play were documented, including positive and negative aspects of game interfaces, maps, weapons, bots, multiplayer gaming on LANs and the internet, and single player gaming. Specific results identifying positive and negative aspects of FPS gaming can serve as a useful guide to game developers in their efforts to design FPS games that players experience as challenging, interesting, and fun. By highlighting aspects of the FPS gaming situation most salient to gamers, the results provide insight into the structure of what we have called gamers' FPS "genre models," their mental models of gaming experience within the FPS genre. Similar studies investigating genre models in different computer game genres would contribute to an understanding of the structural differences between games and corresponding differences in gamer behavior associated with different genres.

The study results also contribute to a better understanding of the cognitive and perceptual processes involved in FPS gaming, which may generalize to other game genres and have implications for the analysis of human behavior in socio-technical contexts beyond games. FPS gaming is a fast-paced form of goal-directed activity, taking place in complex, dynamic behavioral environments where players must quickly make sense of changes in their immediate situation and respond with appropriate actions. Little is known about the cognitive and perceptual processes associated with such

complex, dynamic behavioral phenomena. In general, the gamers interviewed in the study seem to have attended preferentially to aspects of the gaming situation that were most behaviorally relevant to goal attainment and drew meaningful distinctions at a level of detail appropriate to the perceived demands of their goal-directed activity. It has been argued that gaming goals influenced how players made sense of the complexity of the FPS gaming situation by filtering perceptual stimuli based on behavioral relevance. Specifically, it is proposed that aspects of the game most salient to gamers were those perceived to be most behaviorally relevant to goal attainment, and that the evaluation of various situational stimuli depended on the extent to which they were perceived either to support or to hinder goal attainment. Further research using larger sample studies carried out in various game genres and in other socio-technical domains would be needed to test these theoretical propositions systematically. Improved understanding of the perceptual and cognitive processes underlying gaming behavior would contribute to improved game designs and have important theoretical and practical implications for the analysis of human behavior in many other diverse socio-technical settings.

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