The Relationship Between Perceptions of Video Game Flow and Structure [i]

Jayne Gackenbach
Grant MacEwan College
Department of Psychology
gackenbachj@macewan.ca

Abstract

This inquiry asks whether or not there are preferred structural characteristics of games that are more or less likely to be associated with the experience of psychological flow during gaming. It was found that high-end game players, as defined by a variety of variables, reported relatively more flow and specific structural preferences than low-end game players when controlling for sex. Moderate game dynamic structural preferences were most predictive of pure game flow experiences. This finding echoes Csikszentmihalyi's injunction for a balance between perceived challenges and perceived skills to attain flow.

Author Keywords

Psychological flow, game structure, game content, video game, video game players, consciousness

The Relationship Between Perceptions of Video Game Flow and Structure

Investigations into the effects of video game play on various measures of consciousness have begun. Variables examined include changes in attention (Green & Baveller, 2003), absorption (Funk, Buchman, & Jenks, 2003), presence (Ermi & Mayra, 2005), dreams (Gackenbach, 2008), and flow (Chou & Ting, 2003). In the present study, consciousness was examined from the lens of psychological flow (Csikszentmihalyi, 1988a,1988b).

These considerations are part of the larger question of how technology is affecting mind. A main issue in evaluating the effects of technology on the mind is the increasing ability to couple our mental representational systems with technological systems that augment input data. There are many examples of this, from absorption in a movie or TV show to chatting on a cell phone to playing a video game. Not only are we immersed in and enjoying these augmented realities but it is also becoming increasingly obvious that technology is altering a range of mental functions (Sternberg & Preiss, 2005).

Although widely studied in communication studies literature, flow is typically seen as an explanatory variable for why people enjoy media and is thus most often viewed from the uses and gratifications perspective (Sherry, 2004). However, while this conceptualization of flow is correct, it is also limited. Csikszentmihalyi (1988b; Csikszentmihalyi, Abuhamdeh, & Nakamura, 2005) speculates that flow has implications for consciousness. The concept of flow appears to be similar to that of the peak experience described by Maslow (Privette, 1983). Similarly, Gackenbach (2008) reported flow reports during video game play as related to a variety of dream and waking experiences thought to be indicative of consciousness growth. It is within this broader conceptualization of the meaning of flow that the present inquiry lies. The question herein is: are there structural characteristics of games that are more or less likely to be associated with perceptions of psychological flow during game play?

Psychological Flow

Csikszentmihalyi, Abuhamdeh, and Nakamura (2005) have summarized research identifying what flow is, how you get to it, and what the outcomes of flow are. Flow consists of three major components: the merging of action and awareness, a sense of control, and an altered sense of time. For one to have experiences of flow, several conditions have been delineated. These include a clear set of goals, a balance between perceived challenges and perceived skills, and the presence of clear and immediate feedback.

As far as outcomes from the experience of flow are concerned, the Csikszentmihalyi group noted that the literature has reported “a strong positive relationship between flow and performance” (p. 604). This includes, “Artistic and scientific creativity […] effective teaching […] learning […] and peak performance in sports” (p. 604). Directly relevant to the concerns of this paper, is an especially provocative finding by this group. In a national sample, “Teenagers who had experienced high adversity at home and/or at school” (p. 604) and experienced flow in extracurricular activity fared better later in life. This sort of outcome research on flow argues that it does not reduce to only a motivational variable but has broader long term implications.

Flow and Media Use

Csikszentmihalyi, Abuhamdeh, and Nakamura (2005) argue that cultures select artifacts as a function of the degree to which their use elicits flow. This theme is picked up in the communication studies literature which has examined the relationship between flow and media enjoyment for some time. In a review examining how flow might account for media enjoyment, Sherry (2004) points out that the most often cited theory is the uses and gratifications theory, which holds that we use media because it is fun and gratifies some need, but that the nature of that gratification is unclear. He suggests that flow offers a construct which clarifies why we enjoy media. He summarizes his position by drawing parallels between the media enjoyment literature and flow:

> It is clear from the gratifications research that media use provides an enjoyable experience. Second, the gratifications of using media to escape and to forget are indicative of the intense focus and loss of self-consciousness in media use. […] Third, many have experienced temporal distortion […]. Finally, the entire uses and gratifications research tradition is predicated on the empirical observation that media use is at least in part, intrinsically motivating. (Sherry, 2004, p. 333)

He qualifies his summary of the parallels between flow and media enjoyment by saying that not all media experiences are enjoyable; only some experiences induce feelings of flow. It should be noted that there are other criticisms of flow as an explanation for media use, including, most prominently, that of Myers (1992).

Flow and Computer and Video Gaming

Computers as media have also garnered research attention relative to flow. Flow in this literature has been associated with online web experience (Mathwick & Rigdon, 2004; Skadberg & Kimmel, 2004; Chen, 2006), hacker motivation (Voiskounsky & Smyslova, 2003), use of a broad range of information technologies (Pike, 2004), and Internet based education (Hedman, 2004).

Additionally, several researchers have offered theoretical models of computer use embracing flow (Finneran & Zhang, 2003; Sherry, 2004; Sharafi, Hedman, & Montgomery, 2006). Sherry (2004) points out in his discussion that, “Some might comment that Csikszentmihalyi seemed to have video games in mind when he developed the concept of flow” (p. 339). And, indeed, several video game researchers have noted such a relationship. Voiskounsky, Mitina, and Avetisova (2004), Chou and Ting (2003), and Choi and Kim (2004) all note a positive relationship between video game play and the experience of flow. Voiskounsky’s group found flow evidenced by players in a Multi-User Domain role-playing game, while Chou and Ting examined self-reports of flow on a scale they developed among the “membership of virtual communities devoted to Internet games” (p. 666). Choi and Kim related flow to video game customers’ loyalty.

To summarize the work on flow, it is a way to think about motivation to play video games but can also be conceptualized as an element of consciousness which has been widely studied in the communications literature. Now we must ask: is there a particular feature or structural preference of video game play that is especially associated with flow experiences during gaming?

Structural Characteristics of Gaming

Structural characteristics of gaming have been variously defined. Wood, Griffiths, Chappell, and Davies (2004) offer this broadly conceptual definition of structural characteristics of video games: “Those characteristics that either induce gaming in the first place or are inducements to continue gaming irrespective of the individual’s psychological, physiological, or socio-economic status” (p. 1). In another review of the structural characteristics of games, Reinhard and Dervin (2007) go further in their definition of structure, which they call “game feature”. These game features have been described in two ways:

> First, there are the elements fundamental to the nature of playing the game, or the elements that impact the actual interaction, with these elements linked to both the technology used to play the game as well as to the structure of the game. Second, there are the features of the game's content, which may be linked to the technology used to play the game, but can also be more akin to content as it is

> often thought in other entertainment mediums, from novels to films. (Reinhard & Dervin, 2007, p. 8)

Both researchers created lists of game playing features/structural elements culled from the literature. Wood et al.'s list was more detailed with 13 conceptual clusters, while Reinhard and Dervin's had seven such clusters. Most of these clusters overlap. Other recent approaches attempting to delineate game structure are those of Choi and Kim (2004) and Joeckel (2007). Both are econometric analyses, or a focus on sales or customer loyalty as paramount to game structural preferences. Choi and Kim broke game design features into five conceptual categories, while Joeckel's analysis discussed three such categories of best selling games. Both Choi and Kim and Reinhard and Dervin considered the role of situation in their conceptualizations of game structure preferences. That is, questions were answered in terms of a specific game (Choi & Kim, 2004) or in terms of games liked, disliked, and desired (Reinhard & Dervin, 2007). Slightly different was the approach of Wood et al., who asked their game structure questions more generically (for example, asking what factors are most important for the enjoyment of video games).

The measure of game structure preferences utilized in the present study was taken from Wood, Griffiths, Chappell, and Davies (2004) for several reasons. First, their measure has more detail than the others just reviewed. More importantly, Wood et al. point out that their model is based upon similarities in structure between gambling, especially slot machines, and video games. This is important because the gambling literature on such structural characteristics have been well documented in terms of their role in the "acquisition, development and maintenance of gambling behavior" (Wood et al., 2004, p. 2). This parallel between slot machines and video games may be warranted due to several shared and important characteristics of both types of games.

The question posed in the present inquiry is: what is the relationship between perceptions of video game structure and flow during gaming? As in previous research, it is expected that hardcore gamers would report more flow during gaming than those who are not as involved in video game play. As for the potential relationship between game structure preference and flow perception during gaming, Choi and Kim (2004) found that flow was moderately predicted by their five conceptual components of game structure. Therefore, it is hypothesized that at least some structural preferences will be related to flow perceptions.

Method: Participants

Research questionnaires were mounted on the author's website, with all participation links going directly to the research itself. Unique user identification numbers were generated 591 times over the five and a half months that the study was available online. Data of some sort was collected on 464 participants. Ages of participants ranged from 12 to 60, with an average age of 24 of which 71% were male. The average education of the research participants was two years of college. Over half, 287 of 464 respondents, listed some college major. Nineteen percent of the majors were in the social sciences, with a wide range of other majors represented.

By way of comparison, Griffiths, Davies, and Chappell (2004) offer demographics of online players of *Everquest* as an example of player characteristics. Choi and Kim (2004) also offered such an analysis for Korean video game players. As with the current study, most of Griffith et al. and Choi and Kim's respondents were males (67% for Griffith et al; 78% for Choi and Kim; 71% for current study) between the ages of 18 and 30 (58% of Griffith et al.'s sample; 89% of Choi and Kim's sample; 57% in the current study).

In terms of education, Griffith et al.'s categories for education were a little different from this study, but some comparisons can be made. In Griffith et al.'s sample 29% of respondents were undergraduates, relative to 44% in this sample; 13% were postgraduates in Griffiths et al.'s study, compared with 20% of the sample herein.[ii]

Materials

Following an informed consent, participants were presented a questionnaire in seven parts. These materials included demographics and questions about typical video game play, as well as questionnaires dealing with game structure preferences and flow during gaming perceptions. The other questionnaire components dealt with other aspects of consciousness and are reported upon in part elsewhere.

The first questionnaire asked for minimal demographic information: sex, age, education, college major, and type of employment. The next part covered video game habits and experiences: frequency of playing games in terms of number of days, length of typical session, length of last session, number of different video game formats played, age when played first game, age when peak playing occurred, and who was typically played with. This was followed by several questions regarding symptoms of apparent motion during video game play: nausea, stomach awareness, increased salivation, eyestrain, difficulty focusing, blurred vision, headache, dizziness, and vertigo. Part 3 questions dealt with video game type, asking about which games respondents typically played: action, adventure, arcade, role playing, strategy, simulation, driving, puzzle, sport, and violent[iii].

The 39 item structural preferences questionnaire taken from Wood, Griffiths, Chappell, and Davies (2004) was the sixth part of this research survey. Respondents were asked: "To what extent are the following features important to you when playing computer/video games?" Each game structure preference was listed with a response requested along a five-point Likert-type scale.

Questions dealt with sound (two items, including "Realistic sound effects"), graphics (three items, including "Quality of the graphics"), background and setting (three items, including "Realistic setting of the game"), duration of game (one item which asked if respondents preferred short, medium or long duration games), rate of play, advancement rate ("how fast action occurs, progression to next level"), use of humor, control options, winning and losing features (four items, including "Potential to lose points"), character development, and multiplayer features (five items such as "Multiplayer communications"). The biggest subscale was for game dynamics (sixteen items such as, "Having lots of different modes of transport" or "Solving puzzles").

The last questionnaire presented was the "Video Game Play and Flow Scale" from Chou and Ting (2003). Two of the seven subscales dealt with addiction while the rest were conceptualized as collecting information regarding components of flow. The addiction subscales were included in order to differentiate between video game play that may be maladaptive from that which is passionate. Sample items from the two addiction subscales include:

1. I keep returning playing cyber-games even after spending too much money on on-line fees. (addiction)
2. Playing cyber-games becomes the most meaningful activity in my life. (salience – addiction)

The flow subscales included concentration (four items, including "My attention is always highly concentrated when playing cyber-games[iv]"), playfulness (eight items, including "I experience the highest relaxation when playing cyber-games"), distortion in time (three items, including "Time goes by very quickly when playing cyber-games"), telepresence (five items, including "I feel that virtual world in the cyber-games is more real than the real world"), and exploratory behavior (eight items, including "Playing cyber-games make me feel like exploring a new world").

Research participants were asked to play an online version of *Pacman* after filling out the seven parts of the questionnaire.

Design and Procedure

Links to the research questionnaire were listed on seven Internet sites designed for psychological research solicitation. The survey was listed on November 21, 2005 and removed on April 30, 2006. Sites listed from a dozen to several hundred psychology experiments, often under a variety of headings. Five of the seven listings were with general psychology experiment sites, while there were two specialty listings: one for video game research and one for dream research. The reason primarily non-specialized sites were chosen was to ensure a wider range of participants regarding their video game play background.

The research questionnaires and a brief online game were mounted on the author's website, with all research participation links going directly to the research itself. The web pages for this research used forms to pass the participants' answers to the next PHP page, which also connected to the database where the answers were submitted. Along with the answers to the previous page, a "user ID" was passed along the pages and was also submitted with the answers. This user ID was used to keep track of which answers belonged to which participant. They were sequentially generated by the database when the participant accessed the first page of the study.

Data collection for the *Pacman* game will not be discussed herein, as only 71 subjects played the game.

Results

Video game groups were defined by frequency of play, length of typical play session, age play began (with high scores given to younger starts), number of types of games played, length of last video game played, and age of peak frequency of video game play (younger ages scored higher). The video game playing variables were first converted to z scores and then summed. This score was then split into sixths and low-end and high-end video game playing groups were used in most of the subsequent analyses. The use of sixths rather than thirds or a median split is due to the large number of high-end gamers in the entire sample. For instance, 63.7% played several times a week or more. Those who reported never playing video games were deleted from the low-end group. The sample characteristics are summarized in **Table 1**.

As is typical in gaming studies, sex of respondent was unevenly distributed across gaming groups ($X^2(1) = 24.81$, $p<.0001$) with fewer female high-end gamers (12) and male low-end gamers (18). There were 53 male high-ends and 32 female low-ends. Thus, in all subsequent analyses, sex was treated as a covariate. The first set of group analyses were based on demographics, followed by game play history. Unlike sex of subject, there were no differences between gamer groups for age ($F(1,112) = .549$, ns) or education ($F(1,112) = 1.543$, ns).

It can be seen in **Table 2** that for all video game group defining variables, including motion sickness during play and who respondents played video games with, the high-end group scored significantly higher than the low-end playing group. That is, the high-end playing group played more frequently, longer per typical and recent sessions, played more games, started playing younger, and reported more motion sickness during play[v] than the low-end playing group. There was one exception, and this was that both groups peaked at about the same time in their lives and did not differ in terms of their social play.

Table 1: *Descriptive Statistics for the Entire Sample on Demographics, Game History, Flow Subscales, Game Genre Preferences, and Game Structure Preferences*

	N	Range of Possible Responses	Mean	Std. Deviation
Sex	421	1=male; 2=female	1.2945	.45638
Age	394	12 - 66	23.61	7.997
Frequency of play	421	0 – 11 (every day)	7.9287	3.53212
Session Length	421	0 – 8 (>10 hrs.)	3.0475	1.47604
Last Session Length	421	0 – 8 (>10 hrs.)	2.9169	1.73211
Number Games Played	421	0 – 7 (over 100)	4.6033	2.31802
Age First Gamed	421	0 – 9 (before kindergarten)	6.6010	2.56578
Age of Peak Frequency of Play	421	0 – 9 (before kindergarten)	3.8907	1.76809
Who Play With	421	0 – 3 (with friends)	1.7221	1.01944
Sum of motion sickness	421	0 – 9 (checked all indicates)	1.5772	1.85981
Action	403	1 – 4 (often)	2.7767	1.09032
Adventure	403	1 – 4 (often)	2.6129	1.06926
Arcade	403	1 – 4 (often)	2.2928	.95606
Role Playing	403	1 – 4 (often)	2.6973	1.23493
Strategy	403	1 – 4 (often)	2.4268	1.12920
Simulation	403	1 – 4 (often)	2.0744	1.05067
Driving	403	1 – 4 (often)	2.3573	1.12031
Puzzle	403	1 – 4 (often)	2.3176	1.05960
Sports	403	1 – 4 (often)	2.1141	1.17048
Violence	403	1 – 4 (often)	3.0844	1.10756
Flow addiction	333	1 - 7 (totally agree)	3.2077	1.86145
Flow salience (addiction)	333	1 - 7 (totally agree)	3.8521	1.81891
Flow concentration	333	1 - 7 (totally agree)	4.6396	1.63085
Flow playfulness	333	1 - 7 (totally agree)	3.4467	2.00216
Flow distortion	333	1 - 7 (totally agree)	4.8368	1.78000
Flow exploration	333	1 - 7 (totally agree)	4.0852	1.85367
Flow telepresence	333	1 - 7 (totally agree)	3.0096	1.97939
Structure sound	372	1 – 5 (love)	3.5242	1.04840
Structure graph	372	1 – 5 (love)	3.8244	1.07891
Structure background & setting	372	1 – 5 (love)	3.2428	.92737
Structure humor	372	1 – 5 (love)	3.6344	1.23109
Structure duration game	372	1 – 5 (love)	2.1747	.77293
Structure rate of play	372	1 – 5 (love)	3.8038	1.20273
Structure advancement rate	372	1 – 5 (love)	3.5108	1.10006
Structure control options	372	1 – 5 (love)	3.0699	1.22440
Structure game dynamics	372	1 – 5 (love)	3.5227	.93045
Structure winning/losing features	372	1 – 5 (love)	2.9657	.82865
Structure character development	372	1 – 5 (love)	3.9032	1.28910
Structure multiplayer features	372	1 – 5 (love)	3.4946	1.14674

Table 2: *Means of Video Game History Variables as a Function of Gamer Group*

Video Game History Questions[vi]	Video Game Groups	N	Mean[vii]	Std. Deviation
Frequency of Play[viii]*	Low Video Gamers	50	4.74	3.05
	High Video Gamers	65	10.34	0.96
Typical Session Length*	Low Video Gamers	50	1.96	0.92
	High Video Gamers	65	4.58	1.18
Last Session Length*	Low Video Gamers	50	1.66	0.85
	High Video Gamers	65	5.09	1.47
Number Games Played*	Low Video Gamers	50	2.82	1.45
	High Video Gamers	65	6.54	1.02
Age First Played*	Low Video Gamers	50	5.24	2.27
	High Video Gamers	65	8.29	0.98
Age Peaked Play	Low Video Gamers	50	4.04	1.95
	High Video Gamers	65	4.29	1.43
Who Played With[ix]	Low Video Gamers	50	1.74	1.03
	High Video Gamers	65	1.80	0.73
Motion Sickness While Playing Sum*	Low Video Gamers	50	1.36	1.57
	High Video Gamers	65	2.06	2.21

Video Game Flow

As noted earlier, the Flow and Video Game Play Scale was taken from Chou and Ting (2003) and has five subscales dealing with flow and two with addiction. To examine the overall findings with this scale, a two (video game group) X seven (flow subscale) analyses of covariance was calculated on subscale scores, with sex as the covariate. The means and standard deviations are portrayed in **Table 3**.

Table 3: *Flow Subscale Means and Standard Deviations as a Function of Video Game Group*

Flow Subscales	Video Game Group[x]	Mean	Std. Deviation
flow concentration	Low Video Gamers	3.96	2.05
	High Video Gamers	4.97	1.47
flow addiction	Low Video Gamers	2.95	2.34
	High Video Gamers	3.47	1.47
flow salience (addiction)	Low Video Gamers	3.16	2.39
	High Video Gamers	3.99	1.51
flow playfulness	Low Video Gamers	2.99	2.38
	High Video Gamers	3.81	1.79
flow telepresence	Low Video Gamers	3.04	2.39
	High Video Gamers	2.70	1.53
flow exploratory	Low Video Gamers	3.41	2.27
	High Video Gamers	4.64	1.64
flow distortion	Low Video Gamers	4.22	2.16
	High Video Gamers	5.22	1.68

There were no significant main effects (Flow: Wilks' Lambda = .974, $F(6,83) = 0.37$, ns, multivariate partial eta squared = .026; Gamer Group: $F(1,88) = 1.26$, ns). There was, however, a significant Gamer Group by Flow Subscale interaction (Wilks' Lambda = .777, $F(6,83) = 3.96$, $p < .002$, multivariate partial eta squared = .223). In all but one subscale, high-end gamers reported more flow. The opposite was the case for the telepresence subscale.

Video Game Play Structure Preferences

While game structure is conceptualized through the generic questions of the Wood et al. scale in this paper, information is also available on game type preferences (genre). These different industry games also offer information about game structure which is less specific. In any case a 2 (Gamer Group) X 10 (Game Genre) ANCOVA with sex as the covariate was computed. Both main effects and the interaction were significant:

> Game Genre: Wilks' Lambda = .704, $F(9,96) = 4.495$, $p < .0001$, multivariate partial eta squared = .296.
> Gamer Group: $F(1,104) = 48.36$, $p<.0001$, partial eta squared .317.
> Gamer Group X Game Genre: Wilks' Lambda = .693, $F(9,96) = 4.732$, $p < .0001$, multivariate partial eta squared = .307.

The means and standard deviations for these genre items are portrayed in **Table 4**. High-end gamers overall preferred all types of games, but there were some places where there were no differences (thus, the interaction). Four genres evidenced no group differences: arcade, driving, puzzle, and sports. The main effect for game genre was accounted for by the higher ratings given to violence games, followed by action and role-playing.

Table 4: *Means, Standard Deviations and Number of Subjects for Each Game Genre Preference*

Game Structure Subscale Means	Video Game Group[xi]	Mean[xii]	Std. Deviation
Action	Low Video Gamers	2.18	1.02
	High Video Gamers	3.32	0.80
Adventure	Low Video Gamers	2.16	1.08
	High Video Gamers	3.00	0.82
Arcade	Low Video Gamers	2.36	0.97
	High Video Gamers	2.37	0.83
Role Playing	Low Video Gamers	1.98	1.13
	High Video Gamers	3.52	0.84
Strategy	Low Video Gamers	1.93	1.09
	High Video Gamers	3.13	0.96
Simulation	Low Video Gamers	1.68	0.83
	High Video Gamers	2.43	9.96
Driving	Low Video Gamers	2.23	0.89
	High Video Gamers	2.57	1.15
Puzzle	Low Video Gamers	2.48	1.15
	High Video Gamers	2.44	0.88
Sports	Low Video Gamers	1.59	0.84
	High Video Gamers	2.01	1.10
Violence[xiii]	Low Video Gamers	2.32	1.14
	High Video Gamers	3.76	0.50

The structural preference scale consisted of 39 items where the respondent was asked to indicate his or her preference along a five point, Likert-type scale rating from hate (1) to love (5). In order to reduce this data subscale, scores were computed along the dimensions recommended by Wood et al (2004). These included: sound, graphics, background and setting, duration of game, rate of play, use of humour, control options, game dynamics, winning and losing features, character development, and multiplayer features. The number of items per subscale ranged from a single item (for example, character development) to 14 items (game dynamics). Again, a 2 (Gamer Group) X 12 (Structure Subscale) ANCOVA was computed with sex of subject as the covariate. There was no main effect for structure subscale [Wilks' Lambda = .868, $F(11,88) = 1.215$, ns, multivariate partial eta squared = .132] but both the gamer main effect [$F(1,98) = 30.849$, $p<.0001$, multivariate partial eta squared = .239] and the gamer X structure interactions [Wilks' Lambda = .712, $F(11,88) = 3.233$, $p<.001$, multivariate partial eta squared = .288] were significant. In all cases, high-end gamers preferred that structural feature more than lows, with some subscales evidencing relatively more differential preferences. The interaction is accounted for by the lower rating and greater group difference of the duration subscale score. The means and standard deviations are depicted in **Table 5**.

Table 5: *Means and Standard Deviations for Each Game Structure Subscale*

Game Structure Subscale Means	Video Game Group	Mean[xiv]	Std. Deviation
sound	Low Video Gamers	3.12	1.15
	High Video Gamers	3.88	0.87
graphics	Low Video Gamers	3.33	1.13
	High Video Gamers	4.22	0.70
background	Low Video Gamers	2.92	0.87
	High Video Gamers	3.53	0.74
duration	Low Video Gamers	1.55	0.74
	High Video Gamers	2.47	0.63
rate of play	Low Video Gamers	3.07	1.24
	High Video Gamers	4.34	0.90
advancement	Low Video Gamers	2.95	1.19
	High Video Gamers	3.76	0.73
humor	Low Video Gamers	3.50	1.40
	High Video Gamers	3.98	0.90
control	Low Video Gamers	2.90	1.09
	High Video Gamers	3.80	0.76
dynamics of play	Low Video Gamers	3.09	0.95
	High Video Gamers	3.90	0.58
win lose	Low Video Gamers	2.72	0.88
	High Video Gamers	3.25	0.60
character development	Low Video Gamers	3.19	1.42
	High Video Gamers	4.44	0.79
multiplayer	Low Video Gamers	2.80	1.08
	High Video Gamers	4.10	0.78

Flow and Structure

Based upon the previous findings of a flow and structure relationship by Choi and Kim (2004), one might expect there to be a direct relationship between perceived flow and structural preference. In order to answer this question, a linear regression was computed on the mean of the flow subscales, sans the addiction flow subscales. This was done for the entire sample from whom this data was gathered. The reason why all subjects were used was to gather sufficient numbers to compute the regression with the individual difference and game preference/structure information available. According to Pallant (2005), 314 participants are needed for 33 independent variables. There are 333 participants with all relevant information in the entire subject pool for this research.

A correlation matrix was computed in order to find which information was possible to enter into the regression onto pure flow. Pallant points out that correlations between the dependent and independent variables have to be .3 or higher. The correlation matrix included two types of game structure questions: genre of game preferred and subscale scores from the game structure questionnaire. Additionally, in order to account for the differences in gamer groups, the variables that asked about their gaming history were entered into the correlation matrix. These questions were: frequency of play, typical length of session, length of last session, number of games played, age first played, age of peak play, who played with, and motion sickness during play. The type of game favoured variables included: action, adventure, arcade, role playing, strategy, simulation, driving, sports, and violence. The subscales of the game structure inventory were sound, graphics, background and setting, duration of game, rate of play, use of humour, control options, game dynamics, winning and losing features, character development, and multiplayer features. Only these variables were correlated above .3 with the mean of the pure flow subscales and thus were entered into the linear regression. All these correlations were significant: age started playing video games ($r = -.304$) and seven game structure subscale scores: graphics ($r = -.406$), background and setting ($r = -.314$), humour ($r = -.313$), advancement rate ($r = -.345$), game dynamics ($r = -.424$), winning and losing features ($r = -.342$), and character development ($r = -.295$). It should be noted that none of the genre preferences correlated above .3 with the pure flow score, although all but two were significantly negatively correlated with pure flow. The two genres not so correlated were action and strategy. These relationships are likely more a function of the large sample size than accounting for any significant amount of variance. So, too, with the individual difference variables: all but motion sickness correlated significantly and negatively with pure flow but only one such variable was above the .3 cut-off, age first began playing video games.

The R Square was 0.209 ($F(8,324) = 10.71$, $p<.0001$). The Beta values for all variables that loaded in the regression are portrayed in **Table 6**.

Table 6: *Linear Regression onto Pure Flow Scale Scores of Age Began Playing Video Games and Selected Game Structure Preference Subscales*

Variables Loaded into Regression **significantly loaded*	**Unstandardized Coefficients** *B*	*Std. Error*	**Standardized Coefficients** *B*
Age Played First Game	-0.025	0.043	-0.039
Graphics*	-0.356	0.156	-0.228
Background & Setting	0.265	0.162	0.146
Humour	-0.119	0.091	-0.087
Advancement Rate	-0.053	0.116	-0.035
Game Dynamics*	-0.662	0.238	-0.366
Winning & Losing Features	-0.021	0.175	-0.011
Character Development*	0.211	0.110	0.162

While three game structure subscale scores significantly loaded into the regression, the marker was the dynamics of play game structure subscale. Lower scores on game dynamic items predicted pure flow.

Conclusions

Video game players' perceptions of flow during gaming and preferences regarding game structure and genre were examined in the present study. It was expected that hardcore gamers would report more flow during play, as well as more structural and genre preferences than those who are less serious about their gaming. While several hundred individuals filled out these inventories online, they tended to be males who played video games several times a week. Thus, in order to compare high to low-end gamers, it was necessary to pick the upper and lower sixths of the distribution. Also similar to previous research into video game players, sex was unevenly distributed across gaming groups. Thus, for all subsequent analyses, sex was entered as a covariate.

As previously found, hardcore video game players, as defined by a variety of variables, reported more overall perception of most types of flow except one type which was the reverse. Hardcore gamers also expressed preferences for most structural elements of games and for most game genres, relative to those who were classified as less serious video game players. Specifically, the more serious gamers reported more flow for most subscales of the Chou and Ting (2003) scale. Almost all individual subscales tapping flow favoured high-end gamers, with the exception of the telepresence subscale. This last may be more about the virtual environment richness than about individual differences. Items on this subscale asked about how real the virtual world feels.

There were two ways in which game characteristics were assessed: game genre preferences and game structural preferences. In terms of the former, high-end gamers preferred six of the ten genres asked about, demonstrating the range of their tastes in games more so than low-end gamers. Four genres showed no group differences. This may be because they represent particularly social games[xv] (arcade, driving, and sport) or casual games (puzzle) which tend to be attractive to most people.

The preferences for structural components of video games for these high and low-end gamers were assessed using a scale developed by Wood et al (2004). For ease of interpretation, subscale scores were computed based upon the suggested framing by the scale authors. High-end gamers reported significantly more preferences for each subscale of the game structure inventory, which one would expect given their relatively high commitment to gaming.

In order to determine if types of structural or genre preferences predicted the experience of flow in gaming, a linear regression was computed. In order to enter variables into the regression, the correlation between the suggested variable and the dependent variable needs to be greater than .3. Following a correlation matrix comparing pure flow (the mean of the five flow subscales that do not examine addiction) was associated with seven game structure subscale scores and one individual difference in gaming history item. The linear regression was computed on pure flow with these eight predictors. It was found that while it was significant and about 21% of the variance of pure flow was accounted for by the independent variables, clearly flow during gaming is accounted for by other things as well. In this case, three game structure variables loaded significantly into the regression: game dynamics, graphics, and character development. Game dynamics was the marker. Thus, one can conclude that structure does predict flow to some extent. What is surprising was that it was a negative loading. That is, lower game dynamic scores were predictive of pure flow.

This last has to be interpreted within the nature of the sample. As noted, about 64% of this sample games several times a week or more. It can be seen in **Table 1** that this was a sample of mostly young men who are serious gamers and thus the moderate predictive value of low game dynamics is best understood within this broader sample picture. One could say that if a gamer prefers too many game dynamics, they interfere with flow. Rather moderate (not lower, as in general this group scored above-average in all flow subscales) game dynamics are best for the experience of flow. This, of course, echoes Csikszentmihalyi et al.'s (2005) injunction of a balance between perceived challenges and perceived skills to attain flow.

The present study has several limitations. First is that respondents were largely a gaming sample, so while there is a small group who rarely game, overall they tend to be involved in video game play. Secondly, while there was some predictive value for flow, it was limited. When the 14 items that made up the dynamic game structure subscale were separately correlated to the pure flow composite scale and to the subscales that constitute pure flow almost all the item correlations were significant and moderate. Thus attempts to further deconstruct the relationship between game structure and flow were not possible.

In conclusion, moderately dynamic game play, which balances challenges with skill, accounts for some percentage of the variance in predicting flow. One hopes that the flow experiences due to moderate game dynamics lead these gamers later in life to healthy life outcomes as was found by Csikszentmihalyi, Abuhamdeh, and Nakamura (2005) for teenagers who experienced flow in athletics.

References

Chen, H. (2006). Flow on the net-detecting web users' positive affects and their flow states., *Computers in Human Behavior*, *22* (2), 221-233.

Choi, D., & Kim, J. (2004). Why people continue to play online games: In search of critical design factors to increase customer loyalty to online contents. *Cyberpsychology & Behavior , 7,* 11-24.

Chou, T. J., & Ting, C. C. (2003). The role of flow experience in cyber-game addiction. *CyberPsychology & Behavior*, *6* (6), 663-675.

Csikszentmihalyi, M. (1988a). The future of flow. In Csikszentmihalyi, M., & Csikszentmihalyi, I. (Eds.), *Optimal Experience: Psychological Studies of Flow in Consciousness* (pp. 364-383). New York: Cambridge University Press.

Csikszentmihalyi, M. (1988b). The flow experience and its significance for human psychology. In Csikszentmihalyi, M., & Csikszentmihalyi, I. (Eds.), *Optimal Experience: Psychological Studies of Flow in Consciousness* (pp. 15-35). New York: Cambridge University Press.

Csikszentmihalyi, M., Abuhamdeh, S., & Nakamura, J. (2005). Chapter 32: Flow. In Elliot, A. J., & Dweck, C. S. (Eds.), *Handbook of Competence and Motivation* (pp. 598-608). New York: The Guilford Press.

Erml, L., & Mayra, F. (2005). *Fundamental components of the gameplay experience: Analysing immersion.* Paper presented at Digital Game Researcher Association conference, Vancouver.

Finneran, C. M., & Zhang, P. (2003). A person-artifact-task (PAT) model of flow antecedents in computer-mediated environments. *International Journal of Human-Computer Studies*, *59*, 475-496.

Funk, J. B., Buchman, D. D., & Jenks, J. (2003). Playing violent video games, desensitization and moral evaluation in children. *Journal of Applied Developmental Psychology*, *24* (4), 413-436.

Gackenbach, J. I. (2008). Video game play and consciousness development: A transpersonal perspective. *Journal of Transpersonal Psychology, 40* (1), 60-87.

Green, C. S., & Baveller, D. (2003). Action video game modifies visual selective attention. *Nature*, *423*, 534-537.

Griffiths, M. D., Davies, M. N. O., & Chappell, D. (2004). Demographic factors and playing variables in online computer gaming. *CyberPsychology & Behaviour*, *7* (4), 487-495.

Hedman, D. W. (2004). Prime-time television, sleeping habits and energy conservation. *Journal of Marketing & Public Policy*, 157-168.

Joeckel, S. (2007). *Games that sell: Determining factors that explain the success of video games in the US market.* Paper presented at International Communication Association conference, San Francisco.

Mathwick, C., & Rigdon, E. (2004). Play, flow and the online search experience. *Journal of Consumer Research*, *31*, 324-332.

Myers, D. (1992). Time, symbol transformations and computer games. *Play & Culture*, *5*, 441-457.

Pallant, J. (2005). *SPSS: Survival Manual (2nd edition).* Chicago: Open University Press.

Pike, E. M. (2004). Flow experiences in information technology use. *International Journal of Human-Computer Studies*, *61* (3), 347-357.

Privette, G. (1983). Peak experience, peak performance and flow: A comparative analysis of positive human experiences. *Journal of Personality and Social Psychology*, *45* (6), 1361-1368.

Reinhard, C., & Dervin, B. (2007). *Situational and gender comparisons of digital game players' preferences for game features and gratifications.* Paper presented at International Communication Association conference, San Francisco.

Sharafi, P., Hedman, L., & Montgomery, H. (2006). Using information technology: Engagement models, flow experience and personality orientations. *Computers in Human Behavior*, *22* (5), 899-916.

Sherry, J. L. (2004). Flow and media enjoyment. *Communication Theory*, *14* (4), 328-347.

Skadberg, Y. X., & Kimmel, J. R. (2004). Visitors' flow experience while browsing a web site: Its measurement, contributing factors and consequences. *Computers in Human Behavior, 20* (3), 403-422.

Sternberg, R. J., & Preiss, D. D. (2005). *Intelligence and technology: The impact of tools on the nature and development of human abilities*. Mahwah: Erlbaum.

Voiskounsky, A. E., & Smyslova, O. V. (2003). Flow-based model of computer hackers' motivation. *CyberPsychology & Behavior*, *6* (3), 171-180.

Voiskounsky, A. E., Mitina, O. V., & Avetisova, A. A. (2004). Playing online games: Flow experience. *PsychNology Journal*, *2* (3), 259 – 281.

Wood, R. T. A., Griffiths, M. D., Chappell, D., & Davies, M. N. O. (2004). The structural characteristics of video games: A psycho-structural analysis. *CyberPsychology & Behavior*, *7* (1), 1-10.

---

[i] An earlier version of the paper was presented at Future Play 2006, London, Ontario, October, 2006. I would like to thank Danielle Klassen for her editorial input.

[ii] It's important to note that studying video game players through the typical college pool of introductory psychology students is somewhat difficult. Gackenbach and Kurvilla (2007) collected face to face and online data on media use including video game play over a 12 month period (May 2006 through April 2007). Of the 877 respondents, 72% were female and 45% of these women reported that they rarely or never played video games. The males in the Gackenbach and Kurvilla sample reported rarely or never playing video games 16% of the time. Thus, as reported by Griffiths et al. and herein, to get gamer information you almost have to go online outside the boundaries of the traditional academic subject pools. In fact, as Wood, Griffiths and Eatough (2004) point out regarding issues of video game players recruitment online:

> The speed and efficiency of online research means that often the study can obtain much larger and possibly more diverse samples than they could otherwise hope to attain. For studying video game players, these advantages tend to be more prominent. Firstly, gamers nearly always have access to the Internet and they are usually proficient at using it. They are invariably interested in what the researchers are studying and often want to take part. Furthermore, they usually know other gamers who will take part and can often recommend good places to post links to contact other gamers (p. 512).

[iii] While it is recognized that 'violent' is not a generally accepted genre of game within games studies or popular gaming communities, the popular interest in the effects of violence on gamers as well as the cross genre inclusion of violence resulted in the decision to include 'violence' as a game type.

[iv] The use of the term 'cyber-games' may be problematic as either less recognizable than video games or associated with other popular culture images like those in movies like "Lawnmower Man".

[v] This higher motion sickness during video game play is more likely due to the eye strain and headache questions than to the other questions about motion sickness which were scored very low by both groups.

[vi] All group differences were at $p < .0001$. Age variables for when peak frequency of play occurred and when participants began playing video games were coded as: before kindergarten = 9; kindergarten to grade 1 = 8; grade 2 to grade 4 = 7; grade 5 to grade 6 = 6; junior high school = 5; high school = 4; young adulthood/post secondary school = 3; middle adulthood (30 to 50 years old) = 2; late adulthood (over 50) = 1 and never played = 0. Frequency of play was coded as: every day = 11; 4 to 6 days/week = 10; 1 to 3 days/week = 9; three times/month = 8; twice a month = 7; once a month = 6; < once/month = 5; 7 to 0 times/year = 4; 4 to 6 times/year = 3; 1 to 3 times/year = 2; < once a year = 1; and never/"blank" = 0. The number of games played in their lifetime was between 50 and 100 for the high video game players

and 6 to 10 for the low video game play group. Finally, for the length of sessions variables the high group reported 2 to 4 hours while the low group reported < 1 hour.

[vi] All variables marked with an asterisk have significant group differences.

[vii] For the flow scale, responses ranged from 1 = totally disagree to 7 = totally agree.

[viii] All variables marked with an asterisk have significant group differences.

[ix] Who played with and motion sickness were not used to define the gamer groups.

[x] There were 39 low-end gamers with this information and 52 high-end gamers.

[xi] There were 44 low-end gamers with game genre information and 63 high-end gamers.

[xii] Responses to frequency of playing each game genre ranged from 1 = never to 4 = often.

[xiii] While there is no genre per se that is called violence, given the concerns about violence modeling due to game play it was of interest to ask if they played violent video games.

[xiv] There were 42 low-end gamers with game structure information and 59 high-end ones.

[xv] This survey was actually run prior to the new generation of music games thus no questions were asked about those as a genre. The genre categories were gotten from the commercial gaming literature. These three types of games were thought to be social relative to the other genre. In part this is because at that point, early 2000's, the online game component to the major game systems was just getting started.