

GameFlow: A Model for Evaluating Player Enjoyment in Games

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Although player enjoyment is central to computer games, there is currently no accepted model of player enjoyment in games. There are many heuristics in the literature, based on elements such as the game interface, mechanics, gameplay, and narrative. However, there is a need to integrate these heuristics into a validated model that can be used to design, evaluate, and understand enjoyment in games. We have drawn together the various heuristics into a concise model of enjoyment in games that is structured by flow. Flow, a widely accepted model of enjoyment, includes eight elements that, we found, encompass the various heuristics from the literature. Our new model, GameFlow, consists of eight elements – concentration, challenge, skills, control, clear goals, feedback, immersion, and social interaction. Each element includes a set of criteria for achieving enjoyment in games. An initial investigation and validation of the GameFlow model was carried out by conducting expert reviews of two real-time strategy games, one high-rating and one low-rating, using the GameFlow criteria. The result was a deeper understanding of enjoyment in real-time strategy games and the identification of the strengths and weaknesses of the GameFlow model as an evaluation tool. The GameFlow criteria were able to successfully distinguish between the high-rated and low-rated games and identify why one succeeded and the other failed. We concluded that the GameFlow model can be used in its current form to review games; further work will provide tools for designing and evaluating enjoyment in games.

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1. ENJOYMENT IN MEDIA AND GAMES

Player enjoyment is the single most important goal for computer games. If players do not enjoy the game, they will not play the game. Current literature on usability and user-experience in games presents many heuristics for designing and evaluating games. However, the literature is focused on three aspects of usability in games, rather than player enjoyment in games. The three aspects are interface (controls and display); mechanics (interacting with the game world); and gameplay (problems and challenges) [Federoff 2002]. Although many useful and valid heuristics are presented in the games literature, there is no integrated model of player enjoyment or method to assess player enjoyment in games. Currently, there are many separate game design heuristics that are isolated, repetitive, and often contradictory. Hence there is a need to synthesize and integrate the game design heuristics into a well-structured model of enjoyment in games.

Many different models have been developed to explain and analyze media enjoyment, including disposition theory, attitude, transportation theory, cognition, parasocial

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interaction and flow [Oliver and Nabi 2004]. Attitude is a psychological tendency expressed by evaluating a particular entity with some degree of favor or disfavor [Nabi and Krcmar 2004]. Attitude is affected by previous viewing experience, previous behaviors related to the content, the viewers' intentions regarding the content, and behavior during viewing [Nabi and Krcmar 2004]. Parasocial interaction takes place when an audience member develops a parasocial relationship with a media character by talking to the character, imagining, or discussing the life of the character [Nabi and Krcmar 2004]. Transportation theory suggests that the experience of enjoyment is heightened by an immersion in a narrative world, as well as from the consequences of that immersion [Green et al. 2004]. Transportation is a melding of attention, imagery, and feelings [Green et al. 2004]. The theory of disposition relates positive or negative attitudes toward media characters to moral evaluations of their actions [Raney 2004], as well as empathy for the main character [Nabi and Krcmar 2004]. In addition to media content, social situations and parameters have also been identified as contributing to viewer enjoyment, [Denham 2004]. Finally, cognition, in relation to media enjoyment, involves viewers making judgments on, for instance, the characters' ethics, interest, and intelligence [Nabi and Krcmar 2004].

Each of these models and theories aims to analyse and understand enjoyment in terms of one specific aspect or concept. However, individually these theories are fairly narrow, and do not provide well-rounded models of enjoyment. For example, enjoyment cannot be sufficiently explained by attitude towards a particular genre (e.g., science fiction), or by social context alone (e.g., who an experience is shared with). Conversely, flow theory is based on the premise that the elements of enjoyment are universal, providing a general model that summarizes the concepts common to all when experiencing enjoyment (e.g., ability to concentrate on a task). The general, broad nature of flow theory makes it an ideal base on which to build a tool for analysis and design. Additionally, we found that the heuristics in the games literature overlap closely with the elements of flow. As a result, we used flow as a structural foundation for synthesizing and organizing the heuristics from the games literature into a concise model of player enjoyment.

The aim of the study in this article is to develop and validate a model of player enjoyment in games that is based on flow. The method involves refining and extending the elements of flow to model player enjoyment in games by using the heuristics in the games usability and user-experience literature. The result is a model, called GameFlow, of player enjoyment in games. Subsequently, an expert review of two real-time strategy games was conducted with the GameFlow criteria to investigate the utility and validity of the GameFlow model in designing and evaluating games with respect to player enjoyment.

2. ENJOYMENT AND FLOW

Csikszentmihalyi [1990] conducted extensive research into what makes experiences enjoyable, based on long interviews, questionnaires, and other data collected over a dozen years from several thousand respondents. He began his research with people who spend large amounts of time and effort on activities that are difficult, but provide no external rewards (e.g., money or status), such as composers, chess players, and rock climbers. Later studies were conducted with ordinary people with ordinary lives, asking them to describe how it felt when their lives were at their fullest and when what they did was most enjoyable. His research was conducted in many places (USA, Korea, Japan, Thailand, Australia, Europe, and a Navajo reservation). He found that optimal experience, or flow, is the same the world over-- very different activities are described in similar

ways when they're being enjoyed, and that enjoyment is the same, irrespective of social class, age, or gender.

Flow is an experience "so gratifying that people are willing to do it for its own sake, with little concern for what they will get out of it, even when it is difficult or dangerous" [Csikszentmihalyi 1990]. Flow experiences consist of eight elements, as follows:

- (1) a task that can be completed;
- (2) the ability to concentrate on the task;
- (3) that concentration is possible because the task has clear goals;
- (4) that concentration is possible because the task provides immediate feedback;
- (5) the ability to exercise a sense of control over actions;
- (6) a deep but effortless involvement that removes awareness of the frustrations of everyday life;
- (7) concern for self disappears, but sense of self emerges stronger afterwards; and
- (8) the sense of the duration of time is altered.

The combination of these elements causes a sense of deep enjoyment so rewarding that people feel that expending a great deal of energy is worthwhile simply to be able to feel it [Csikszentmihalyi 1990]. Additionally, an important precursor to a flow experience is a match between the person's skills and the challenges associated with the task, with both being over a certain level.

Most flow experiences occur with activities that are goal-directed, bounded by rules, and require mental energy and appropriate skills. For example, throughout the world, reading is one of the most frequently enjoyed activities [Csikszentmihalyi 1990]. Reading has a goal and requires concentration and knowledge of the rules of the written language. Reading skills begin with literacy, but also involve the ability to turn words into images, empathize with fictional characters, recognize historical and cultural contexts, anticipate plot twists, and critique and evaluate. Throughout history, activities such as games, sports, and literature have been developed for the express purpose of enriching life [Csikszentmihalyi 1990]. The key element in flow is that it is an end in itself – the activity must be intrinsically rewarding and *autotelic*. This rings true in games because people play games (computer or others) for the experience itself, as there is no external reward. Finally, every flow activity provides a sense of discovery, a creative feeling of being transported into a new reality (a familiar sensation for game players).

Flow has been applied extensively by researchers to assess enjoyment in a wide variety of domains. Previous applications of flow include *workflow* [Vass et al. 2002], which was developed to support creativity in problem-solving. Flow has also been used in a framework to construct engaging commercial websites [Jennings 2000], to assess enjoyment in an interactive music environment [Pachet and Addressi 2004], and to assess information systems [Artz 1996].

3. ADAPTING FLOW TO GAMES

A comprehensive review of the literature on usability and user experience in games was conducted to determine how the elements of flow manifest in computer games. A model of enjoyment in games was constructed from the literature based on the elements of flow and the evidence of flow experiences in games. The result is the GameFlow model, which consists of eight core elements – concentration, challenge, skills, control, clear goals, feedback, immersion, and social. Each element consists of a varying number of criteria that relate to Csikszentmihalyi's [1990] elements of flow, as shown in Table I.

Table I. Mapping the Elements from Games Literature to the Elements of Flow

Games Literature	Flow
The Game	A task that can be completed
Concentration	Ability to concentrate on the task
Challenge Player Skills	Perceived skills should match challenges and both must exceed a certain threshold
Control	Allowed to exercise a sense of control over actions
Clear goals	The task has clear goals
Feedback	The task provides immediate feedback
Immersion	Deep but effortless involvement, reduced concern for self and sense of time
Social Interaction	n/a

The first element of flow, i.e., a task that can be completed, is not represented directly in the GameFlow elements, since it is the game itself. The remaining GameFlow elements are all closely interrelated and interdependent. In summary, games must keep the player's concentration through a high work-load; but the tasks must be sufficiently challenging to be enjoyable. The player must be skilled enough to undertake the challenging tasks, the tasks must have clear goals so that the player can complete the tasks, and the player must receive feedback on progress towards completing the tasks. If the player is sufficiently skilled and the tasks have clear goals and feedback, then he or she will feel a sense of control over the task. The resulting feeling for the player is total immersion or absorption in the game, which causes them to lose awareness of everyday life, concern for themselves, and alters their sense of time. The final element of player enjoyment, social interaction, does not map to the elements of flow, but is highly featured in the literature on user-experience in games. People play games to interact with other people, regardless of the task, and will even play games they do not like or even when they don't like games at all.

In this section, each element of flow is described and its manifestation in games is discussed, drawing on the games literature on user-experience and usability. Based on this analysis, an initial model of player enjoyment in games (GameFlow) was developed. For each element, the GameFlow model includes an overall goal and a set of central criteria that can be used to design and evaluate games with respect to player enjoyment (see Table II).

3.1 Concentration

To be enjoyable, a game has to require concentration, and the player must be able to concentrate on the game. The more concentration a task requires in terms of attention and workload, the more absorbing it will be. When all of a person's relevant skills are needed to cope with the challenges of a situation, that person's attention is completely absorbed by the activity, and no excess energy is left over to process anything other than the activity [Csikszentmihalyi 1990].

Games should grab the player's attention quickly and maintain it throughout the game, at 10 seconds, 10 minutes, 10 hours, and even 100 hours of play [Pagulayan et al. 2003; Lazzaro 2004]. Games can captivate player attention by providing something worth

Table II. GameFlow Criteria for Player Enjoyment in Games

Element	Criteria
Concentration Games should require concentration and the player should be able to concentrate on the game	<ul style="list-style-type: none"> - games should provide a lot of stimuli from different sources - games must provide stimuli that are worth attending to - games should quickly grab the players' attention and maintain their focus throughout the game - players shouldn't be burdened with tasks that don't feel important - games should have a high workload, while still being appropriate for the players' perceptual, cognitive, and memory limits - players should not be distracted from tasks that they want or need to concentrate on
Challenge Games should be sufficiently challenging and match the player's skill level	<ul style="list-style-type: none"> - challenges in games must match the players' skill levels - games should provide different levels of challenge for different players - the level of challenge should increase as the player progresses through the game and increases their skill level - games should provide new challenges at an appropriate pace
Player Skills Games must support player skill development and mastery	<ul style="list-style-type: none"> - players should be able to start playing the game without reading the manual - learning the game should not be boring, but be part of the fun - games should include online help so players don't need to exit the game - players should be taught to play the game through tutorials or initial levels that feel like playing the game - games should increase the players' skills at an appropriate pace as they progress through the game - players should be rewarded appropriately for their effort and skill development - game interfaces and mechanics should be easy to learn and use
Control Players should feel a sense of control over their actions in the game	<ul style="list-style-type: none"> - players should feel a sense of control over their characters or units and their movements and interactions in the game world - players should feel a sense of control over the game interface and input devices - players should feel a sense of control over the game shell (starting, stopping, saving, etc.) - players should not be able to make errors that are detrimental to the game and should be supported in recovering from errors - players should feel a sense of control and impact onto the game world (like their actions matter and they are shaping the game world) - players should feel a sense of control over the actions that they take and the strategies that they use and that they are free to play the game the way that they want (not simply discovering actions and strategies planned by the game developers)

Clear Goals Games should provide the player with clear goals at appropriate times	<ul style="list-style-type: none"> - overriding goals should be clear and presented early - intermediate goals should be clear and presented at appropriate times
Feedback Players must receive appropriate feedback at appropriate times	<ul style="list-style-type: none"> - players should receive feedback on progress toward their goals - players should receive immediate feedback on their actions - players should always know their status or score
Immersion Players should experience deep but effortless involvement in the game	<ul style="list-style-type: none"> - players should become less aware of their surroundings - players should become less self-aware and less worried about everyday life or self - players should experience an altered sense of time - players should feel emotionally involved in the game - players should feel viscerally involved in the game
Social Interaction Games should support and create opportunities for social interaction	<ul style="list-style-type: none"> - games should support competition and cooperation between players - games should support social interaction between players (chat, etc.) - games should support social communities inside and outside the game

attending to [Brown and Cairns 2004], such as detailed game worlds that draw the player into the game [Johnson and Wiles 2003]. It is important to increase the player's workload, but maintain it at an appropriate level for the player's perceptual, cognitive, and memory limits [Lazzaro and Keeker 2004]. Also, the players shouldn't be burdened with tasks that don't feel important [Fullerton et al. 2004]. Finally, during play, distractions from major game tasks should be minimized by reducing nongame-related interactions (e.g., setting options) and reducing the game interface to maximize the amount of screen taken up with game action [Johnson and Wiles 2003].

3.2 Challenge

Challenge is consistently identified as the most important aspect of good game design. Games should be sufficiently challenging, match the player's skill level, vary the level of difficulty, and keep an appropriate pace. An important precursor of flow is a match between the person's skills and the challenges associated with an activity, with both skills and challenges being over a certain level [Johnson and Wiles 2003; Sharafi et al. 2004]. If the challenges are greater than the skills, the result is anxiety; if the challenges are less than the skills, the result is apathy [Johnson and Wiles 2003]. Therefore, games should be designed to have a level of challenge that is appropriate and not discouragingly hard or boringly easy.

Games create enjoyment by challenging players, often taxing the limits of their memory and performance [Lazzaro and Keeker 2004]. Games must present the player with an appropriate series of distinct and challenging situations [Smith 1999] that are calculated from careful level and obstacle design [Pagulayan et al. 2003] and provide a positive game experience that results in the player wanting to continue to play [Desurvire et al. 2004]. Satisfaction in games comes from accomplishing difficult tasks [Lazzaro and Keeker 2004; Lazzaro 2004], challenging and surpassing opponents [Vorderer et al. 2003], testing skills [Lazzaro 2004], mastering skills [Lazzaro 2004; Fullerton et al.

2004], reaching a desired goal [Federoff 2002], and suspensefully coping with danger [Vorderer et al. 2003]. The rewards of challenge are intrinsic, and the process is its own reward [Lazzaro and Keeker 2004], for example feelings of personal triumph [Lazzaro 2004].

Games should also have variable levels of difficulty [Federoff 2002] to meet all players at the correct level of challenge [Pagulayan et al. 2003]. Players with different levels of skill should feel the game is challenging but do-able and that their effort is paying off [Gee 2004]. Challenges in games can be balanced with player skills via levels, player progress, and player controls [Lazzaro 2004]. Most games allow players to select an appropriate level of difficulty [Johnson and Wiles 2003], to regulate the probability of success or failure in competitive situations according to the players' skill [Vorderer et al. 2003].

The level of difficulty in games should be varied, gradually increasing to maintain the interest of the player but provide more challenge as he or she develops mastery [Desurvire et al. 2004; Pagulayan et al. 2003]. Games should not start out too difficult [Pagulayan et al. 2003], but invite players to try new strategies and extend their repertoire each time they play [Juul 2004; Pagulayan et al. 2003], culminating in the completion of the game [Johnson and Wiles 2003].

Pace is an important aspect of challenge. The rate at which players experience new challenges and details can be paced to maintain appropriate levels of challenge and tension throughout the game [Pagulayan et al. 2003]. An appropriate pace in games applies pressure but does not frustrate the player [Federoff 2002; Desurvire et al. 2004]. Player fatigue can be minimized by varying activities and pacing during gameplay [Desurvire et al. 2004].

3.3 Player Skills

For games to be enjoyable, they must support player skill development and mastery. In order for the player to experience flow, their perceived skills must match the challenge provided by the game, and both challenge and skills must exceed a certain threshold. Therefore, it is necessary that players develop their skills at playing the game to truly enjoy the game. The way players are taught to play the game is crucial to their skills development and enjoyment of the game.

Players should be taught to play games through interesting and absorbing tutorials [Federoff 2002] that allow the players to become involved quickly and easily [Desurvire et al. 2004]. In-game tutorial feedback can be used to allow quick progression in learning the basic mechanisms for playing [Pagulayan et al. 2003]. An alternative, or an accompaniment, to tutorials is for players to learn as they play. While learning as they play, players learn and practice skills as part of accomplishing things they need and want to do [Gee 2004]. Rewards are also an important part of learning to play a game. Players must be rewarded appropriately for continued play; the effort invested in a game should equal the rewards of success [Brown and Cairns 2004; Pagulayan et al. 2003]. Learning while playing enables players to learn the game in context and at a measured pace [Pagulayan et al. 2003].

Players should have enough information to start playing the game upon turning it on [Desurvire et al. 2004]; they should not need or be expected to use a manual to play [Desurvire et al. 2004; Federoff 2002; Gee 2004]. Lengthy explanations can bore the player [Pagulayan et al. 2003] and game manuals shouldn't be long, complex and overemphasise game story at the cost of what can be done and how [Cornett 2004]. Games should also include online help, so that players don't need to stop playing to get

help [Johnson and Wiles 2003; Federoff 2002]. Players can also be given help in the form of hints [Federoff 2002] or context sensitive help while playing [Desurvire et al. 2004], on demand or just in time [Gee 2004; Sweetser and Dennis 2003]. However, help shouldn't be given through in-game dialogue, as real-world things attached to game world characters (e.g. "to open the hatch press A on the control pad") causes immersion to break [Adams 2004].

Apart from more direct methods of teaching a player how to play the game, such as tutorials or help, player-learning can be supported by games that are easy to use and learn. Adhering to platform conventions [Johnson and Wiles 2003] and following the trends of game design can shorten the player's learning curve [Federoff 2002; Desurvire et al. 2004]. Game interfaces should be consistent throughout and adhere to industry standards for controller function [Federoff, 2002]. Game input devices must have a learnable mapping of buttons, keys, and other input mechanisms to functions [Pagulayan et al. 2003; Desurvire et al. 2004]. Game controls and interface should be simple and non-intrusive to provide easy access to the game [Federoff, 2002]. Games should use interface metaphors and analogies to the real world to help players understand how to navigate through the environment and interact with characters and objects [Federoff 2002].

3.4 Control

In order to experience flow, players must be allowed to exercise a sense of control over their actions. Players should be able to adequately translate their intentions into in-game behavior [Pagulayan et al. 2003] and feel in control of the actual movements of their character and the manner in which they explore their environment [Federoff 2002]. The player should be able to move the character intricately, effectively, and easily through the world and to easily manipulate the world's objects, which become tools for carrying out the player's goals [Gee 2004]. Players should also feel a sense of control over the game interface and game controls, with mastery of the control system being an important part of most games [Johnson and Wiles 2003]. Game controls should be basic enough to learn quickly, with a core set of buttons to promote a sense of control [Johnson and Wiles 2003], as well as be expandable for advanced options [Desurvire et al. 2004].). The player should be able to customise the controls [Federoff 2002; Adams 2004] and the gameplay to fit their learning and playing styles or the game should be designed to allow different styles of learning and playing [Gee 2004].

The game shell should be easy to use, allowing players to start the kind of game they want [Pagulayan et al. 2003], turn the game on and off [Desurvire et al. 2004], and save the game in different states. These capabilities give players control over the game shell and the freedom to explore the game at their own pace [Federoff 2002]. The game shell menu should be easy to use, intuitively organized, and should not sacrifice readability and functionality for aesthetics [Johnson and Wiles, 2003].

Errors in games can make players feel they have lost control, especially if the errors or consequences are out of control of the player. Players should not be able to make mistakes that stop the game from working [Adams 2004], and games should help players recognize, diagnose, and recover from errors [Federoff 2002]. Players can be provided with the means for error prevention and recovery via warning messages [Federoff 2002]. Players should not be able to make errors when navigating the menu [Johnson and Wiles 2003].

It is important that players perceive a sense of impact onto the game world [Desurvire et al. 2004]. Players should feel as though their actions and decisions are co-creating the world they are in and the experiences they are having [Gee 2004]. The players' decisions

should shape the world and gameplay so that the game changes for each player [Gee 2004]. Games in which the players' decisions have an impact are highly replayable, as each time they play a game they make different decisions and change the game as a whole, which results in different possibilities for action [Garneau 2002]. Games shouldn't force players to make decisions that have no impact on whether they win or lose or decisions that don't feel important, as there is a fine line between granting players control and burdening them with chores [Fullerton et al. 2004]. Also, the game world should react to the players and remember their passage through it [Desurvire et al. 2004]. The changes that players make to the game world should be persistent, and be noticeable when players back-track to where they were before [Desurvire et al. 2004] to show they had an impact on the world.

Games that allow players to play the game the way that they want (and not the way the designer had intended) put the player center stage [Church 2002]. The player is given freedom to experiment, greater control, a sense of agency and less of a feeling of uncovering a path set for them by the designer [Smith 2002]. Games that include a limited number of predefined options from which the player must choose restrict the player's freedom in interacting and remove the possibility of emergent gameplay [Sweetser and Johnson 2004]. Games should hide that they are linear in structure from the player and let the player feel like they are in control of what happens next [Pagulayan et al. 2003]. Players should feel a sense of control over their character [Desurvire et al. 2004] and be free to play games and solve problems in the way that they want [Sweetser and Johnson 2004]. For players to become emotionally immersed in the world, they need to be given options for what they can be, do and have in the game [Kane 2003]. There should not be any single optimal strategy for winning and gameplay should be balanced with multiple paths through the game or ways to win [Federoff 200; Desurvire et al. 2004]. In short, the player should feel like they are playing the game, not being played by it [Kane, 2003].

3.5 Clear Goals

Games should provide players with clear goals at appropriate times. Games must have an object or goal [Federoff 2002]; but to achieve flow, the goals must also be clear [Csikszentmihalyi 1990; Johnson and Wiles 2003]. Games should present players with a clear overriding goal early in the game [Federoff 2002], which is often done through an introductory cinematic that establishes the background story [Pagulayan et al. 2003]. The goal should be conveyed to the player in a clear and straightforward way [Pagulayan et al. 2003]. Each level should also have multiple goals [Federoff 2002], and games often use "briefings" to describe a "mission" that outline the immediate goals of the current part of the game and suggest some of the obstacles that the players might face [Pagulayan et al. 2003].

3.6 Feedback

Players must receive appropriate feedback at appropriate times. During flow, concentration is possible because the task provides immediate feedback [Csikszentmihalyi 1990]. Games need to provide frequent in-game feedback for players to determine distance and progress towards objectives [Pagulayan et al. 2003]. Players should get feedback on their progress and when they lose they should get feedback about if and how they are moving in the right direction [Gee 2004]. Games should use scores to tell players where they stand and give positive feedback to encourage mastery of the game [Federoff 2002]. Players should always be able to identify their score and status in the game [Federoff 2002]. In-game interfaces and sound can be used to deliver necessary

status feedback [Pagulayan et al. 2003; Federoff 2002]. Games should also provide immediate feedback for player actions (Desurvire et al. 2004; Johnson and Wiles 2003) and games should reward players with feedback on progress and success [Lazzaro 2004].

3.7 Immersion

Players should experience deep but effortless involvement in a game. Immersion, engagement, and absorption are concepts that are frequently discussed and highly important in game design and research. The element of flow that describes immersion is deep but effortless involvement, which can often result in loss of concern for self, everyday life and an altered sense of time [Csikszentmihalyi 1990]. Deep but effortless involvement is commonly reported by game-players and people who observe them [Johnson and Wiles 2003]. Players become less aware of their surroundings and less self-aware than previously [Brown and Cairns 2004]. Many game-players report devoting entire nights or weekends to playing games without being concurrently aware of doing so or consciously deciding to do so [Johnson and Wiles 2003]. Players often have a high level of emotional investment in games due to the time, effort, and attention put into playing [Brown and Cairns 2004]. The game becomes the most important part of the player's attention and their emotions are directly affected by the game [Brown and Cairns 2004].

People play games to think thoughts and feel emotions that are not related to work, to calm down after a hard day or to escape from everyday worries [Lazzaro 2004]. Games are often seen as a form of escape from the real world or social norms, or as a way to do things that people otherwise lack the skills, resources, or social permission to do [Lazzaro 2004]. Games should transport the player into a level of personal involvement emotionally and viscerally [Desurvire et al. 2004; Sweetser and Johnson 2004]. Games should make players forget that they are participating through a medium, so that the interface becomes invisible or unnoticed by the player [Federoff 2002]. Games should entice the player to linger and become immersed in the experience [Lazzaro 2004]. Immersive games draw players into the game and affect their senses through elements such as audio and narrative [Sweetser and Johnson 2004]. Audio (e.g., sound effects, soundtracks) is important for drawing players into a game and keeping them immersed [Sweetser and Johnson 2004]. Narrative (e.g., introduction, storyline) is also important for immersion, as it gives the players a storyline and background, telling them who their characters are and what is happening, which makes the players feel they are part of the story [Sweetser and Johnson 2004].

3.8 Social Interaction

Games should support and create opportunities for social interaction. Social interaction is not an element of flow, and often can even interrupt immersion in games, as real people provide a link to the real world that can knock players out of their fantasy game worlds. However, it is clearly a strong element of enjoyment in games, as people play games for social interaction, whether or not they like games or the game they are playing [Lazzaro 2004]. Therefore, social interaction is not a property of the task as are the other elements of flow, but the task is a means to allow social interaction.

To support social interaction, games should create opportunities for player competition, cooperation, and connection [Lazzaro 2004; Pagulayan et al. 2003]. Game experiences should be structured to enhance player-to-player interaction and to create enjoyment in playing with others inside and outside the game [Lazzaro 2004]. People enjoy interacting with other people, spending time with friends, watching others play, chatting and talking about the game, seeing other people's reactions and expressions,

gloating when beating a friend, or feeling pride when they win [Lazzaro 2004; Sweetser et al. 2003]. Games should support social interactions through chat and online boards [Lazzaro 2004]. A large part of the attraction of online games is the virtual community, and many players spend hours chatting online with friends, forming clubs and associations, and gradually over time improving their play character [Cornett 2004]. Social competition is also an important aspect of social interaction [Vorderer et al. 2003], as people gain satisfaction from competing against and beating other people.

4. VALIDATING THE GAMEFLOW CRITERIA

In order to validate the GameFlow criteria and to expose weakness, ambiguities and issues, two games were evaluated by expert review, using the GameFlow criteria. Two similar games were chosen, with the aim to match the games as closely as possible in game type, year of production and genre. The two games chosen were Blizzard's Warcraft 3 [Blizzard 2002] and Sony's Lords of EverQuest [Sony 2003]. Both games are real-time strategy, fantasy games released in consecutive years (2002-2003). The major difference between the two games is that one game was rated highly and one game was rated poorly. Based on 32 professional game reviews, the average rating of Lords of EverQuest was 61%, with a range of 30% to 80% (GameRankings, 2004). Warcraft 3 was given an average rating of 94%, with a range of 80% to 100%, based on 51 professional reviews [GameRankings 2004].

Real-time strategy games are games in which the player controls a force of "units" (e.g. soldiers, tanks, wizards etc), which they must build, train, upgrade and use to defeat the enemy. The players have a god-like view of the game map, and use the mouse, keyboard, and game interface to build structures, control units, and mine resources in an attempt to defeat the enemy. Real-time strategy games often consist of "campaigns," in which the player is lead through many maps or levels that progress the game story. They also include "skirmishes," in which the player plays a single map against other humans or computer-controlled opponents. Skirmishes can be played individually or in teams.

A description of the extent to which both games fulfil the GameFlow criteria is presented in this section. For each criterion, both games were also assigned a numerical value between zero and five, indicating the extent to which the games support that criterion (see Table III). A value of zero indicates "not applicable," whereas values from one to five indicate "not at all," "below average," "average," "above average," and "well done," respectively. These values were combined into overall values for each GameFlow element, as well as an overall rating for the game.

4.1 Evaluation of Warcraft 3

Concentration. Warcraft 3 meets the concentration criteria by providing a multitude of high-quality stimuli. The world, units, buildings, and characters in Warcraft 3 are all intricately detailed, with unique animation, sound, speech, and appearance (see Figure 1). Stimuli are always in multiple forms (e.g., sound, animation, graphics, speech), there is no repetition in the stimuli, and every stimulus in the game has a purpose and fits into the game. Each race (i.e., Human Alliance, Orcish Horde, Night Elf Sentinels, Undead Scourge) has a different theme, which affects the appearance of the interface, terrain, units, and buildings.

Warcraft 3 also meets the concentration criteria by quickly grabbing the players' attention through a compelling, visually spectacular introduction that intrigues the players, making them want to know more. The players' attention is held throughout the game by the growing dramatic tension, interesting and varied goals, good-sized missions, and rewarding cut-scenes that leave the player wanting more.

The player is alleviated of unimportant tasks and left to concentrate on more important or interesting tasks through good automation (e.g. units and heroes cast spells autonomously, workers move to the next task, unit pathfinding is good). The missions and goals feel important and central to the storyline, as the background the player is given in the introduction and through the narrative makes the missions seem meaningful.

The workload is high because there are lots of things to monitor (e.g., resource collection, population limit, unit activities, progress of fights, research, building and production, number of units, upkeep) as well as many tasks to perform (e.g. upgrading, building, defending, exploring, maintaining, researching); see Figure 1. At the same time, the game is simplified so the player is not overburdened. For example, there is a population cap so that players can have only a limited number of units, which they must take care of and use wisely. There are also a limited number of buildings, unit types and upgrades that reduce the cognitive load of the player. The simplicity and design of the interface also makes it easier for the players to express what they want to do, so the workload comes from playing the game not from using the software.

Challenge. Warcraft 3 easily meets the challenge criteria in the campaign, but is less successful in skirmish mode (i.e., quick matches against other players or AI). The opponent AI in the skirmish mode is very hard and there are no difficulty settings. It is difficult for expert players to beat and would be impossible for novice players. However, the campaign has difficulty levels that can provide a reasonable challenge for novice to expert players. As the campaign progresses, the difficulty of the missions increases, and



Fig. 1. Warcraft 3 includes an intricately detailed game world (1); a simple, well-designed interface with detailed tool tips (2); and a bottom-heavy menu structure (3); many things to monitor (4); clear feedback on goals (5); and status (6); easy access to the game menu (7); and visual differentiation between units (8).

the players progress through each of the four races. With a switch to a different race, comes a completely new playing style, as well as new units, buildings, and heroes. The game is well-paced, with optional side quests that players can complete if they want more to do or more breadth to the game.

Player Skills. Warcraft 3 is exceptional for developing and accommodating player skills. Players are able to start playing Warcraft 3 immediately, without reading the manual, even though real-time strategy games are complex with a steep learning curve. The interface is simple and well-labelled, the game follows real-time strategy conventions, and there is an abundance of help in the form of tool tips, online help, tips, and a tutorial. The tutorial is an optional prologue to the story, so it fits the storyline and expert players can choose not to go through it. In the actual campaign, one race is introduced at a time and new units and buildings are incorporated gradually, so that the player can become familiar with each one in turn. Players are rewarded in the campaign for their skill development with items, experience and skills for their heroes. The cutscenes are also rewarding, providing entertainment and more of the story, and mastery of the game is its own reward in strategy games. The game interface and mechanics are easy to use and learn, as there is plenty of help. Also, the game and interface are simple and adhere to the conventions of real-time strategy games (which Blizzard helped to define).

Control. Warcraft 3 allows players to feel in control of every aspect of the game. As there is a low population cap in Warcraft 3, players have fewer units and feel more in control of them. It is also easy to move the units around w3 (point and click), and once told where to go, the units are able to path-find their way there without further intervention by the player. Players can also feel in control of the interface because it is simple and well-designed, including a bottom-heavy menu system, hot keys, detailed tool tips, shallow menus, and clear icons (see Figure 1). The game shell is also easy to control, as it is simple to start, stop, pause, save, or join a game. Accessing options in-game is also easy, as it uses the “F10” convention to pull up a list of options. The game shell is also attractive and fits the style of the game, rather than looking like a separate menu. There is no problem with errors or recovering from errors since the game is very polished (i.e., no bugs) and the simple menu and point-and-click make it impossible to make errors.

Feeling a sense of impact and control of the game world is a criterion more suited to role-playing games. The linear story in the Warcraft 3 campaign means that players experience no real freedom or consequences of their decisions. The player does, however, have freedom and control of the actions and strategies that they use. The different races, as well as varying units and hero combinations, provide a large variety of play styles. The players can use their own strategies and find a race and set of units that suits their chosen strategy.

Clear Goals. Warcraft 3 clearly presents both overriding and intermediate goals. The introduction to the game provides an in-depth, intriguing background story. The overriding goals of the game are presented and questions are raised that require players to continue playing to find out the answers. Continuous in-game cut-scenes clearly present goals and further the story. Between the campaigns for each race, a movie cut-scene is presented that provides the overriding goals for that campaign and motivations for the race.

Feedback. Warcraft 3 provides continuous feedback to players on their goals, actions, and status. Players are immediately notified when goals or mission objectives are completed and can check the status of their goals, subgoals, and completed goals (see Figure 1). The mission objectives icon flashes when there is something new for players to

check, and areas on the map flash to guide players to completing the next goal. At the end of each mission, players receive their scores, broken down into heroes, units, and resources. Additionally, every action that players perform and the progress of every task provide feedback, usually in multiple forms (e.g., speech, sound, animation).

Immersion. It is easy to become engrossed in Warcraft 3, as there is so much to concentrate on, so many tasks to perform and things to monitor, as well as graphics, sound, animation, and intricate details to be admired. The game causes players to feel tension, excitement, anger at enemies, and feel a personal connection to their units and heroes. Players' visceral reactions to real-time strategy games are probably not comparable to other game types, such as first-person shooter games. Real-time strategy games are more abstract, whereas first-person shooter games are more like actually being in the world (e.g., 3D graphics, physics, and sound).

Social Interaction. Warcraft 3 supports competition and cooperation between players, as well as social communities inside and outside the game. Connecting to multiplayer games over a LAN is simple, and players can easily get online and start playing. Blizzard's Battle.net is a free online server that matches opponents automatically, by skill level or game-type preference, and allows players to play other teams. Battle.net also includes facilities for tracking friends and rank ladders. The included game editor allows players to create and share new game content. Players can chat to other players in the game via text, and although this is fairly limited it is the current standard in real-time strategy games.

4.2 Evaluation of Lords of EverQuest

Concentration. Lords of EverQuest provides numerous stimuli, which vary in quality. The game is visually appealing, with interesting character models and a detailed and attractive game world (see Figure 3). The game uses high-profile actors for the characters' voices, and although initially entertaining, each unit has only two or three responses, which become repetitive. The game sounds are average, with generic orchestral music and battle sounds. The camera in the cut-scenes is too close and stationary, which draws attention to the low-polygon models with static faces (see Figure 2). The game's introduction is visually attractive, but there is no background story or depth. The only information given is that the factions are fighting a war. The missions are also limited and repetitive, with no motivation or variation. The missions for each faction are the same; they play out over the same timeline, just carried out from the perspective of each faction. The game fails to capture the players' attention in the introduction, and does not manage to do so throughout the rest of the game.

The player is required to focus on unimportant tasks, such as micromanaging unit movement and combat. There are no unit formations and the units spread out as they move, making them vulnerable to attack. Unit spell-casting is automated and mining only one resource allows the player to concentrate on combat. However, the player's workload is too low, especially for a real-time strategy game. Units take too long to produce, so the player is often waiting with no other tasks to undertake. The slow unit production is more noticeable due to the lack of other tasks. There is only one resource to mine and buildings self-construct, removing the management of villagers between these activities. The players' only tasks are amassing a force and running across the map fighting enemies. The game's interface is far too big in low resolution, taking up more than half of the screen and detracting from the gameplay.

Challenge. The challenge in Lords of EverQuest is below average, in both the campaign and skirmish modes. The campaign missions are not challenging as they lack



Fig. 2. In the Lords of EverQuest (1) in-game cut-scenes, the camera is too zoomed-in and stationary, highlighting the static faces of the characters. The cut-scenes in Warcraft 3 (2) are zoomed out, with a 2D, animated inset (3) that shows the characters' facial expressions and mouth movements.

strategic depth, only requiring superior firepower to win. The game's level of challenge is especially poor for experienced players and would probably only accommodate novice players. The opponent AI is not very challenging, leaving armies idle while its base is attacked and attacking the player with small, intermittent forces that are easily killed. Players are able to reduce the speed of the game if they find it too challenging at its current pace and although this is a useful option, it is not necessary for this game.

Not only are the missions straightforward, but there is little variation between the missions. Each mission is basically the same: the player builds up a force and fights through the enemy. There is no need to explore the unit options as there is not sufficient challenge. The units are also very unbalanced, with a few very powerful units that make the rest of them pointless. Furthermore, there is no functional difference between the factions. Each faction consists of the same set of generic units (e.g., fighter, spellcaster); the only difference between the factions is the appearance of the units. Each faction has identical gameplay and mines resources and constructs buildings in the same way. Also, the lords eventually become so powerful that the other units are not needed, which actually reduces the challenge as the game progresses.

Player Skills. Lords of EverQuest provides average support and development for player skills, successfully meeting some criteria and performing poorly on others. The



Fig. 3. The game world in Lords of EverQuest is detailed and attractive (1); the interface is well-laid out with a bottom-heavy structure (2); and descriptive tool tips (3); the mission log is clearly visible (4); but the units are difficult to differentiate (5).

player is able to start playing the game without reading the manual, due to the descriptive tool tips, the tutorial, and the familiar interface (similar to Warcraft); see Figure 3. The player can learn the basic tasks through the tutorial. However, the tutorial is not related to the storyline and lacks interesting goals and story. There is no online help available to the player, but the tool tips usually provide adequate information. Players are rewarded by their lord and units gaining levels and the player can take some units on to the next mission.

The game interface is poor, as it is unreadable in high resolution and too large in low resolution (see Figure 4). The interface should stay at a constant size and resolution and not change as the player changes the settings. The icons at the top of the screen (for toggling windows) are unreadable in any resolution, and the text on the interface is hard to read due to the font and the background color. Also, it is difficult to visually differentiate between units, as they are too detailed for small units and there are no visual cues for identification (e.g., heroes in Warcraft 3 are bigger than the other units and have an aura).

Control. Players do not have full control over several aspects of the game, including units, interface, and gameplay. The units in Lords of EverQuest don't always seem to respond to commands the players issue, which may be related to poor pathfinding. The players' sense of control over the units is also eroded by the lack of unit formations, the



Fig. 4. In high resolution (1600 by 1200) (1), the icons and text in Lords of EverQuest are too small and in low resolution (800 by 600) (2); the interface is too large and detracts from the gameplay. In both resolutions, icons at the top are unreadable (3) and the text is difficult to read.

way units spread out into a line as they cross the map, and lack of attitude adjustment for the units, which are overly aggressive. The interface is easily controlled once mastered, but the poor readability means that players must remember what each button does by its position rather than being cued by its icon. The interface also uses real-time strategy conventions. One good attribute of the interface is that players can customise the interface by moving the windows around and toggling each window on and off. The game shell is also easy to control, including starting, stopping, and saving games. However, silencing units during play causes all sound to stop, including the cut-scene dialog.

In general, it is not possible to make errors that are detrimental to the game. However, if the player fails a mission for some reason then they only find out when they get to the end of the mission and must start over and replay the whole mission. It is not possible to feel a sense of control and impact onto the game world as the game never creates a sense of a “world” or “story”, with limited background and depth of narrative. Additionally, the narrative is scripted and linear, which is not uncommon in strategy games. Impact on the game world and centrality are more of an issue in role-playing games.

The player does not have freedom in the strategies that they use as the missions, factions and units are too limited. There is no real variation in the game and the factions

are identical, except for the visual appearance of the units. Consequently, there is no variety in play styles or strategies available to the player.

Clear Goals. Lords of EverQuest does not present any overriding goals in the introduction. Players are only told that there is a war between the factions, not why or how the players might be involved. Mission objectives are presented via in-game cut-scenes throughout the game. However, no goals are ever really presented. Players are told what they need to do, but not why. Furthermore, the objectives are not very clear or specific. The players are only given one general objective for each mission.

Feedback. Lords of EverQuest provides sufficient feedback in general, but there are a few important exceptions that lower its ability to meet the feedback criteria. The player is notified when they complete the mission objective and the player can view their mission objectives and status (see Figure 3). However, the player is not given any feedback that they have failed the mission until the end. The player is given immediate feedback when they issue commands to units (e.g. units respond when told to move). However, the



Fig. 5. In Lords of EverQuest, it is unclear why certain terrains cannot be built on and there is no feedback to guide players to an acceptable location (1). In Warcraft 3, players are shown the areas they can and cannot build on (2).

boosts that units receive to statistics when they level up are not visible. Constructing buildings is a problem as the player is only given feedback on whether they can build when they place their cursor over a given location (see Figure 5). There is no difference in the terrain (i.e. reason why it cannot be built on) or visualisation of available places to build. The player is given their score and a breakdown of their score (i.e. units killed, buildings destroyed etc) at the end of the mission.

Immersion. The game is really too slow for players to become immersed, as there is not enough to concentrate on (e.g., only one resource) and not enough challenge. Too much of the game is spent waiting (e.g., for units to build) without other tasks to occupy the players. There is not enough background, character development or storyline for the player to get emotionally involved in the game or connected to the characters. Finally, there is no visceral involvement at all, which could be due to the genre and consequent abstract nature and detachment of the game.

Social Interaction. The game supports competition and cooperation between players through several multiplayer modes and a free online service (SOEGames.net) that includes matchmaking, rankings, and the ability to search for a game or join a quick match. The team missions require significant teamwork to complete. The game supports social interaction through the ability to chat. The only support for social communities is the online service, which doesn't have many players due to the unpopularity of the game. The game does not include an editor and it is therefore not possible for players to extend the game and share their modifications with other players.

4.3 Comparisons

Warcraft 3 outperformed Lords of EverQuest significantly (see Table III), with an overall rating of 4.8 (96%) for Warcraft 3 and 2.4 (48%) for Lords of EverQuest. It is difficult to determine whether any elements or criteria in particular contributed to the success of one and the failure of the other, since Lords of EverQuest performed poorly to average in most criteria, while Warcraft 3 performed exceptionally in most criteria. Lords of EverQuest scored particularly low in challenge, clear goals, and immersion, and average to above average in player skills and social interaction. There were no elements where Lords of EverQuest performed above average and no elements where Warcraft 3 performed less than average.

Table III. Comparing Warcraft 3 (W3) and Lords of EverQuest (LoE)

Element	Criteria	W3	LoE
Concentration	- games should provide a lot of stimuli from different sources	5	4
	- games must provide stimuli that are worth attending to	5	3
	- games should quickly grab the player's attention and maintain their focus throughout the game	5	2
	- players shouldn't be burdened with tasks that don't feel important	5	2
	- games should have a high workload, while remaining appropriate for the perceptual, cognitive, and memory limits of the players	5	2
	- players should not be distracted from tasks that they want / need to concentrate on	5	2
		5	2.5

Challenge	- challenges in games must match the players' skill levels	4	2
	- games should provide different levels of challenge for different players	4	2
	- the level of challenge should increase as players progress through the game and increase their skill level	5	2
	- games should provide new challenges at an appropriate pace	5	2
		4.5	2
Player Skills	- players should be able to start playing the game without reading the manual	5	5
	- learning the game should not be boring, but part of the fun	5	3
	- games should include online help so players don't need to exit the game	5	3
	- players should be taught to play through tutorials or initial levels as though playing the game	5	2
	- games should increase player skills at an appropriate pace as players progress through the game	5	4
	- players should be rewarded appropriately for their effort and skill development	5	2
	- game interfaces and mechanics should be easy to learn and use	5	2
		5	3.1
Control	- players should feel a sense of control over their character or units and their movements and interactions in the game world	5	2
	- players should feel a sense of control over the game interface and input devices	5	3
	- players should feel a sense of control over the game shell (starting, stopping, saving, etc.)	5	4
	- players should not be able to make errors that are detrimental to the game and be supported in recovering from errors	5	2
	- players should feel a sense of control of and impact on the game world (as though their actions matter and they are shaping the game world)	4	1
	- players should feel a sense of control over the actions they take, the strategies they use, and feel free to play the game the way they want (not simply discovering actions and strategies planned by the game developers)	5	2
		4.8	2.3
Clear Goals	- over-riding goals should be clear and presented early	5	1
	- intermediate goals should be clear and presented at appropriate times	5	2
		5	1.5

Feedback	- players should receive feedback on their progress toward their goals	5	2
	- players should receive immediate feedback on their actions	5	4
	- players should always know their status or score		
		5	2.7
Immersion	- players should become less aware of their surroundings	5	1
	- players should become less self-aware and less worried about everyday life or self	5	1
	- players should feel emotionally involved in the game	5	1
	- players should feel viscerally involved in the game	0	0
		5	1
Social Interaction	- games should support competition and cooperation between players	5	5
	- games should support social interaction between players (chat, etc.)	3	3
	- games should support social communities inside and outside the game	5	3
		4.3	3.7
Overall		4.8	2.4

0 – N/A, 1 – not at all, 2 – below average, 3 – average, 4 – above average, 5 – well done

5. DISCUSSION AND CONCLUSIONS

Evaluating two real-time strategies (RTS) games, one high-rating and one low-rating, with the GameFlow criteria provided insight into how the criteria manifest in RTS games, what makes RTS games enjoyable and the relative importance of each GameFlow element. Concentration seemed to be particularly important for making RTS games enjoyable, with player enjoyment pivoting on mastering, scheduling and coping with the numerous tasks. It was shown that in RTS games:

- *concentration* is manifest through detailed worlds, units, and buildings (i.e., animation, sound, graphics), as well as via compelling narrative in the campaign, good automation, simple gameplay and interface, and numerous tasks and objects to monitor;
- *challenge* comes from the difficulty of the opponent AI in skirmish mode, difficulty settings, mission variation, increasing difficulty in the campaign, mastering a new race or faction, and balanced units and races;
- *player skills* are developed with the aid of descriptive tool tips, online help, an optional tutorial that fits with the story, a simple and well-designed interface, adherence to RTS conventions, visual and auditory cues, a campaign that gradually introduces the various races, units and buildings, rewards of more skill, abilities or items, and rewards of cutscenes and story;
- *players* are given more control through pathfinding, attitude adjustment, unit formations, an easily controlled interface (e.g., hot-keys, bottom-heavy design, shallow menus, clear icons), a polished game with no bugs, and unique races that allow different play styles and strategies;

- *clear goals* are presented through an introduction that provides background, motivation, and overriding goals, in-game cut-scenes that present goals and further the story, as well as clear and specific mission objectives;
- *feedback* involves notifying the player of completion or failure of missions, keeping a log of mission goals, objectives, and status, providing a score and summary at the end of the mission, as well as visual and auditory feedback on actions, tasks, and events;
- *immersion* is achieved through concentration (i.e. tasks, monitoring, visual and auditory stimuli), feeling a connection to heroes, units, and the story, feeling excited by the pace of the game and no periods where the player is inactive or waiting;
- *social interaction* comes in the form of a variety of multiplayer modes, a free online service with matchmaking and rankings, being able to play with or against other players, text chat, and the ability to create and share game content.

It was identified that some of the GameFlow criteria are more suited to specific game genres and aren't applicable to strategy games. The control criterion of feeling a sense of control and impact onto the game world (like the player's actions matter and are shaping the game world) was identified as being more relevant to role-playing games. Also, the immersion criterion of players feeling viscerally involved in the game was identified as being more relevant to first-person shooter games, or other human-sized games where the player is immersed in a lifelike environment. However, it is not necessarily true that these criteria could not be applied to strategy games, as achieving these criteria could lead to more enjoyable play in strategy games in the future. For example, players could make choices in RTS game campaigns that change the direction of the campaign's story, leading the players to feel more influential and central to the game world and story. Interesting and valuable future work will be in investigating how the GameFlow elements manifest in different game genres, which criteria are relevant to different genres, and which elements are more important in the various genres.

Through the evaluation, it was also identified that some of the GameFlow criteria are difficult to measure through an expert review and that they would require player-testing to evaluate. In order to determine whether a game suits players with different skill levels, it would be necessary to evaluate players with varying skill levels playing the game. Similarly, it is difficult to define what constitutes good pacing in a game and play-testing would be required to determine whether a game is well-paced. Finally, immersion is not something that can be accurately evaluated through self-report (e.g. expert evaluation) and players would need to be observed playing the game. Future work will involve developing the GameFlow criteria into useable design and evaluation tools for game developers and researchers, utilising methods such as play-testing and observation.

In their current form, the GameFlow criteria could be used as the guidelines for an expert review or they could be used as the basis for constructing other types of evaluations (e.g. player-testing). The use of the criteria for expert evaluation allowed many issues in the two games to be identified and evaluated in-depth. The values assigned to the criteria resulted in a rating of 48% for Lords of EverQuest and 96% for Warcraft 3. These values are approximately in-line with the ratings from the professional reviews, which were 94% for Warcraft 3 and 61% for Lords of EverQuest. The criteria were successfully able to distinguish between the very popular, high-rated Warcraft 3 and the unsuccessful, low-rated Lords of EverQuest. More importantly, the criteria helped to identify how the issues affect player enjoyment of the games. Lords of EverQuest seemed

acceptable on the surface (e.g. good graphics and high-profile actors) but the use of the criteria helped to identify exactly why it was so much less enjoyable than its counterpart (e.g. the challenge level is particularly low in *Lords of EverQuest*).

Each issue presented by the expert review fitted at least one of the criteria of GameFlow. Therefore, it seems that GameFlow provides full-coverage of the issues that affect player enjoyment in games, at least for real-time strategy games. It was also revealed that it is easier to identify what is wrong in a game than what is done well. The evaluation of *Lords of EverQuest* brought to light some of the aspects of *Warcraft 3* that were well-designed but initially unnoticed.

The purpose of the GameFlow criteria presented in this paper is to build an understanding of enjoyment in games. In their current form, the criteria are not meant to be used as an evaluation tool for game developers. However, the expert evaluations showed that the criteria are a useful tool for reviewing games and identifying issues, as well as the affect of these issues on player enjoyment. Also, the criteria were used to develop a concrete understanding of what constitutes good design and player enjoyment in real-time strategy games. Further research will expand on this study to provide fully-fledged design and evaluation criteria for strategy games and other game genres. Additionally, the criteria will be developed into evaluation tools, including methods and measurements, that game developers can use directly for evaluating player enjoyment in games and predicting a game's potential popularity and rating. Finally, the GameFlow model serves as a starting point for academics and game developers to understand enjoyment in games and to conduct further research into understanding, evaluating and designing enjoyable games.

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