GameFlow Heuristics for Designing and Evaluating Real-Time Strategy Games

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ABSTRACT
The GameFlow model strives to be a general model of player enjoyment, applicable to all game genres and platforms. Derived from a general set of heuristics for creating enjoyable player experiences, the GameFlow model has been widely used in evaluating many types of games, as well as non-game applications. However, we recognize that more specific, low-level, and implementable criteria are potentially more useful for designing and evaluating video games. Consequently, the research reported in this paper aims to provide detailed heuristics for designing and evaluating one specific game genre, real-time strategy games. In order to develop these heuristics, we conducted a grounded theoretical analysis on a set of professional game reviews and structured the resulting heuristics using the GameFlow model. The resulting 165 heuristics for designing and evaluating real-time strategy games are presented and discussed in this paper.

Categories and Subject Descriptors
H.1.2 [**Models and Principals**]: User/Machine Systems – *Human factors*; H.5.2 [**Information Interfaces and Presentations**]: User Interfaces – *Evaluation/methodology; User-centred design*; J.7 [**Computer Applications**]: Computers in Other Systems – *Consumer products*

General Terms
Design, Human Factors

Keywords
Games, enjoyment, flow, evaluation, game design, heuristics, model

1. INTRODUCTION
GameFlow [21] is a model of player enjoyment, comprised of a set of criteria derived from games user experience literature and structured into eight elements that can be mapped to Csikszentmihalyi's [6] concept of flow. Since the original publication of the GameFlow model [21], it has seen extensive use throughout the games research and development communities, as well as a number of related areas. Several additional models have been derived from the original GameFlow model, including

Pervasive GameFlow [14], EGameFlow [10], RTS-GameFlow [8], as well as a number of others. The GameFlow model has been used to evaluate a variety of games and applications, including mobile games [20, 23, 19], educational games [4, 13], virtual/augmented/mixed reality games [11, 15], as well as non-game applications [9, 18, 16].

The GameFlow model provides a set of general criteria or heuristics for designing and evaluating all types of video games. However, due to its generic nature, the GameFlow model lacks details on how to achieve the criteria for specific game types. Previous research has suggested that it would be useful to indicate what could promote or inhibit the various GameFlow elements, particularly immersion, in video games [2]. However, developing detailed heuristics for designing games in general is problematic, as there is a great deal of variance between game types. While GameFlow is designed to be generic and high level, we recognize that more specific, low-level, and implementable criteria are potentially more useful for designing and evaluating video games. Consequently, the research reported in this paper aims to provide detailed heuristics for designing and evaluating one specific game genre, namely real-time strategy (RTS) games.

In initial validations of the GameFlow model [21], two RTS games, one high-rating and one low-rating, were evaluated with the GameFlow criteria, to provide insight into how the criteria manifest in RTS games, what makes RTS games enjoyable, and the relative importance of each GameFlow element to RTS games. The result was a set of insights (see Section 3) into how GameFlow presents in RTS games. However, in order to provide actionable heuristics for design and evaluation, a more detailed and specific set of guidelines need to be created. Consequently, in this study, we have aimed to generate a detailed set of heuristics specifically for designing and evaluating RTS games. In order to do this, we conducted a grounded theoretical analysis on a set of professional game reviews and structured the resulting heuristics using the GameFlow elements. The resulting 165 heuristics for designing and evaluating RTS games are presented and discussed in this paper.

2. GAMEFLOW
Sweetser and Wyeth [21] conducted a comprehensive review of the literature on usability and user-experience in games to

determine the key elements of player enjoyment in video games. The result was the identification of eight core elements of player enjoyment in games – concentration, challenge, skills, control, clear goals, feedback, immersion, and social interaction. It was observed that these core elements overlapped closely with the elements of flow [6] and subsequently mapped their core elements of player enjoyment to the elements of flow, as shown in Table 1. The resulting structure, based on flow, formed the foundation of their model of player enjoyment in games, called GameFlow.

Table 1. Mapping of flow to GameFlow elements [21]

GameFlow	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	No corresponding element of flow

The first element of flow, 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 workload, with tasks that are sufficiently challenging to be enjoyable. The challenging tasks must match the player's skill level, 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 tasks match the player's skill level and have clear goals and feedback, then the player 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 the player 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 [21, 7, 1]. Recent research conducted with a large Australian sample shows that 70% of people who play games enjoy doing so with others [3].

Each element of the GameFlow model consists of 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 2). Expert reviews of two RTS games were 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 [21]. From these expert reviews, it was concluded that some of the criteria are more relevant to different types of games and that some of the criteria are difficult to evaluate via expert review and require player testing. It was also suggested that the GameFlow model, in its original form, was suitable as a set of heuristics for conducting expert reviews, but that it would require further development to be used as an evaluation tool.

Table 2. GameFlow elements and criteria

Concentration Games should require concentration and the player should be able to concentrate on the game.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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

3. GAMEFLOW IN RTS GAMES

Sweetser and Wyeth's [21] evaluation of RTS games, using 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 in the evaluated games. Concentration was identified as being particularly important for making RTS games enjoyable, with player enjoyment pivoting on mastering, scheduling, and coping with the numerous tasks. It was found that in RTS games:

- Concentration is facilitated 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 path-finding, 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 cutscenes 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 facilitated 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.

3.1 Detailed Heuristics for RTS Games

In order to validate and further extend the findings of the original paper [21], in terms of the manifestation of the GameFlow criteria in RTS games, and to develop a set of heuristics for designing and evaluating RTS games, we conducted a grounded theoretical analysis on a set of professional game reviews and structured the resulting heuristics using the GameFlow elements. Previous research has involved conducting grounded theoretical analyses on game reviews to develop models of the play experience of video games. A grounded theoretical analysis of game reviews was conducted to characterize good and bad games [1], using reviews from GameSpot UK [12]. Similarly, grounded theory was used on game reviews as data, alongside interviews, to construct the Core Elements of the Gaming Experience (CEGE) model [5]. According to [5], game reviews are appropriate for analysing as data to capture the play experience as:

> "Game reviews are aimed at telling the general player the reasons that certain games should be played. They do not tell the ending of the game, but just try to describe what it is like to be playing. Game reviews, in some sense, convey the experience of playing video-games." (p. 54)

In our study, four RTS games, which were comparable in platform (PC), genre (fantasy), and technology/year of release (2002-2003), were selected for analysis. The main difference between the selected games was their review scores, as indicated by their aggregate professional review scores on the website Metacritic [17]. Two high scoring and two lower scoring games were selected for analysis. The selected games, along with year of release and Metacritic [17] aggregate review score were:

- **WarCraft III**: released 2002, aggregate score **92%** based on 40 professional reviews;

- **Age of Mythology**: released 2002, aggregate score **89%** based on 31 professional reviews;

- **The Lord of the Rings: War of the Ring**: released 2003, aggregate score **67%** based on 25 professional reviews.

- **Lords of EverQuest**: released 2003, aggregate score **62%** based on 25 professional reviews.

For each game, 10 professional reviews were analyzed, drawn from key game critic websites and magazines (see Table 3). Each distinct comment in each review was coded into content categories (e.g., campaign, missions, races) using grounded theoretic analysis. An initial set of heuristics was extracted for each content category. Each heuristic was then coded into GameFlow elements (e.g., Control, Challenge, Immersion). Both positive and negative comments were coded and incorporated into the heuristics. Positive comments (i.e., game strengths) were added as a heuristic and negative comments (i.e., game weaknesses) were reversed and added. The resulting initial set of heuristics for all games was compiled into a single list, sorted by GameFlow element and then content category. A second iteration was then conducted on the combined list of heuristics, in which redundancies were removed and remaining heuristics were combined and refined. Finally, the list was examined by three games design and evaluation experts and further refined. The resulting list is presented in the remainder of this section.

Table 3. Professional Review Sources for Selected Games

Professional Review Sources by Game
WarCraft III
GameSpy, GameSpot, IGN, PC Gamer, UGO, The Next Level, GameRankings, Cinescape Online, Game Chronicles Magazine, GameBlitz
Age of Mythology
IGN, GameSpy, GameSpot, GamePro, Avault, PC Zone, Game Planet, Game Zone, GameBiz, Game Blitz
The Lord of the Rings: War of the Ring
Gamespy, GameSpot, IGN, GamePro, Worth Playing, Game Raiders, Game Over Online, 3D Avenue, Game Revolution, Game Zone
Lords of EverQuest
IGN, Gamespy, GameSpot, GamePro, Worth Playing, Gaming Illustrated, Game Revolution, Videogame City, PC Gameworld, Game Zone

3.1.1 Concentration
The analysis resulted in 14 heuristics for the GameFlow element of Concentration, which fell into the content categories of: missions, AI, gameplay, and sound and graphics.

Missions

- The campaign should include optional side quests that give the player alternatives to the main objective and story

- The player should not spend the majority of a mission expanding their forces or performing tasks that feel like a slow grind

- Missions should require the player to perform multiple tasks in unison to achieve success

AI

- The player should not be required to micromanage unit movement, combat, or unit abilities

Gameplay

- The player should have many tasks to concentrate on during the game (e.g., collecting resources, scouting, expanding, constructing, producing, researching, upgrading, managing heroes, attacking, and defending)

- The player should need to split their attention, time, and effort between their many tasks throughout the game

- Early stages of the game, which are potentially slow in RTS games, should include sufficient elements to support player concentration

- The amount of micromanagement required in bases should be minimized

- Units should not have inventories that the player needs to micromanage

- Micromanagement should be minimized by automatic unit formations, unit attitude settings, good pathfinding, production, research queues, and intelligent autonomous unit behavior

- Building units, researching upgrades, and collecting resources should not be so slow that the player will be waiting with nothing to do

- Battles should be busy with many things to attend to

Sound and Graphics

- There should be a variety of sound effects and voice responses for the player to attend to and voices responses should not be repeated too often

- There should a visually rich, stimulating environment for the player to attend to

3.1.2 Challenge
The analysis resulted in 50 heuristics for the GameFlow element of Challenge, which fell into the content categories of: campaign, missions, races, AI, gameplay, multiplayer, and editor.

Campaign

- The campaign should provide many hours of play

- The early stages of the campaign should provide a good match for the skill level of new players

- The campaign should start slow and ease the player into the game

- The player should be required to change races during the campaign, so as to challenge them to adapt and learn new strategies

- As the player progresses through the campaign and their skills improve, the missions should ramp up in difficulty to match their skills, without becoming too difficult

Missions

- The campaign should include a range of mission objectives and not just typical RTS "build up and destroy" objectives

- The missions in the campaign should vary in complexity

- The missions in the campaign should have normal and hard difficulty settings

- There should always be a way for the player to finish a mission, so that they don't experience feelings of hopelessness

- The missions in the campaign should not be easier or harder than most RTS games

- Missions should be sufficiently challenging to force the player to explore different strategies

- Finishing missions should require tactics, strategy, and skill, rather than just superior firepower

Races

- Each race should necessitate its own style of play

- Different races should be different to play, but evenly matched and balanced

- Each race should include units that are specific to that race, with functional and strategic differences

- Each race should have units that counter the units in the other races

- Different races should not include units that are functionally the same

- Hero units shouldn't become so powerful that other units become worthless

- The player should never know exactly what they will be facing, even though they know the race of their opponent

- Races should include enough strategic variation that each game is a different experience

AI

- The opponent AI should use varied strategies, not just rush tactics

- The opponent AI should maintain a balance between expanding, defending, and building an economy

- The opponent AI should be unrelenting, but not overwhelming

- The opponent AI should not attack with small, intermittent groups of units that are easy to dispatch

- The opponent AI should not be overly aggressive and crush the player

- The opponent AI should not make obvious mistakes (e.g., leaving armies idle while its base is attacked)

- The opponent AI should be robust and flexible and not rely on preset conditions and scripted sequences

- The game should have multiple difficulty settings that accommodate for all player skill levels, by adjusting the aggressiveness and efficiency of the opponent AI

Gameplay

- Units and structures should have sufficient health, so as to focus gameplay more on combat than production

- Gameplay should maintain a fast pace, by not having lengthy troughs for unit production or research

- Upgrading units should have a significant impact on unit effectiveness

- Combat should focus more on unit manipulation than on controlling large numbers of units

- The game should rely more on management than on overwhelming the opponent with large waves of units

- The pace of the game should be fast enough to be exciting and should increase as the game progresses, ending in all-out tactical combat

- The game should provide new and unique twists on conventional RTS gameplay, to provide new challenges to experienced RTS players and to give the game appeal, depth, and lasting value

- The game should include numerous diverse maps that provide the player with varied challenges

- Small population limits should be used to force players to make hard decisions about what kinds of units to use

- Players should be discouraged from overly defensive play and forced outside of their comfort zones, by making defensive structures weaker, siege weapons more powerful, and by not starting with enough resources to win the game

- Map terrain should be varied and setup for tactical gameplay by including choke points and high ground

- As the player progresses through the game, new structures, units, and technologies should become available

- The economic aspects of the game should be compelling

- The game should use the classic RTS rock-paper-scissors format for combat between different categories of units (e.g., infantry, archers, and cavalry)

- The game should be accessible to inexperienced RTS players, who should be able to play without being overwhelmed

- The game should not have overpowered units that make all other units redundant

- The game must be sufficiently complex and challenging for experienced RTS players

Multiplayer

- Multiplayer games should be accessible to new players

- Players in multiplayer games should be allowed time to build up a base before they are rushed by other players

- Multiplayer games should not be too slow before hostilities erupt

- The game should have a skirmish mode that allows a large number of players on a single map (e.g., 12 players)

Editor

- The game should include an editor that allows players to create and share missions, which extends the replayability and life of the game

3.1.3 Player Skills

The analysis resulted in 26 heuristics for the GameFlow element of Player Skills, which fell into the content categories of: campaign, races, gameplay, interface and controls, and help.

Campaign

- The campaign should include an optional, introductory mission to teach new players about the controls and basics of the game (e.g., movement, combat, base building, gathering resources)

- The game should provide opportunities for the player to learn about and experiment with the game concepts contextually through the campaign, including units, structures, technologies, and races (for later use in the skirmish mode)

- The campaign should gradually introduce new units, structures, technologies, and races so the player learns a little at a time

- The campaign should consistently reward the player for their effort and achievements and motivate them to keep playing, through cinematics and story developments

Races

- Races should have some level of commonality, in terms of types of buildings, technology, and units, to allow players to easily learn how to use new races and switch between different races

- Races should vary in function (beyond the surface level), to challenge the player to develop new skills and strategies

Gameplay

- The game should conform to RTS conventions (e.g., resource gathering, base building, unit capacity, unit control, technology advances, building tree, managing defenses, forming an army, attacking the enemy) to allow the player to have an inherent understanding of the game

- The gameplay should conform to the traditional RTS model (e.g., building a base, collecting resources, producing units, upgrading and researching, amassing an army, attacking the enemy, defend own base) to meet the benchmarks of the genre

- The hierarchy of structures, units, technology, and special abilities should be kept simple

- The game should indicate which unit types are best suited to attack other unit types

- The gameplay should be easy to pickup for new players

Interface and Controls

- The game's interface should be uncomplicated and uncluttered

- The game's interface should be intuitive and easy to use

- The game's controls should be straightforward

- The game's controls should conform to RTS conventions (e.g., point and click with mouse, hotkeys, command icons, drag boxes around units to select)

- The game's interface should use RTS conventions (e.g., bottom-heavy menu)

- Detailed tool tips (i.e., descriptions of what it is, what it does, what it's good for) should appear when the player mouses over items

Help

- The player should be able to record and watch matches to learn from previous games

- The game should have a manual that covers the basics and allows novices to establish the essentials quickly and start playing

- The game should include a technology tree to give an overview of some of the strategic avenues

- The game should have a comprehensive in-game help system that includes detailed information on technology, structures, and units

- The player should be able to click a button to view detailed information on a selected unit (e.g., combat statistics and interesting information)

- The player should be able to click on most things in the game to access well laid-out help and information screens

- The player should be able to access the technology tree in-game, with hyperlinks to detailed information on each element in the tree

- The game should have a tutorial, so that many of the more unique in-game features do not go unnoticed by the player

- The game should have a tutorial that explains the basics (e.g., building and combat)

3.1.4 Control

The analysis resulted in 34 heuristics for the GameFlow element of Control, which fell into the content categories of: campaign, missions, races, AI, gameplay, interface and controls, sound and graphics, and editor.

Campaign

- The player's actions should progress the story

- The player shouldn't be led by the nose and there should be more than one path through the campaign

Missions

- Missions should be creative and offer the player many choices

- The player should be able to be inventive about how they achieve the objectives

- Missions should be free of bugs that may cause player frustration

- The enemy should not be seen to "pick on" the player and not attack the player's computer-controlled allies

Races

- The player should be able to choose a race that suits their style of play

- The game should have multiple races, each of which favors a different style of play

- The player should be able to make choices that further customize and develop their chosen race, rather than having predetermined strengths and weaknesses

AI

- The player should be able to customize and control their units' behavior, by setting unit attitude, stance, and formations

- The player's units should move where they are ordered, without requiring intervention

- Grouped units should move in formation, so that they can easily move as a group without requiring player intervention

- Units should feel responsive, by immediately carrying out player orders

- Units should not just aggressively pursue enemies beyond reason

Gameplay

- The player should not feel overwhelmed by the number of units under their command

- The pace of the game should allow the player to manage their forces and use special abilities

- The player should be able to play the game in the way that they want

- The player should be able to modify the speed of the game

- The choices that the player makes should affect the outcome of the game

- The player should not feel like their base is too large to manage or defend

- The player should be able to choose from a wide variety of map and game settings

Interface and Controls

- The game should have keyboard hotkeys to allow the player to quickly perform important actions

- Setting attack and move orders, casting spells, and controlling groups should be simple

- The player should be able to customize the keyboard hotkeys and mouse controls

- The player should be able to customize the interface, by moving, minimizing, and opening control panels

- Creating custom matches should be intuitive

- The fonts and icons on the interface should be easy to read

- There should be multiple paths to achieve the same goal via the interface and controls (e.g., buttons should be available in multiple locations and/or accessible from different menus)

- Controlling the camera during the game should be smooth and intuitive

- The player should be able to quickly jump to important events that are happening in the game

- The player should be able to easily group units and cycle between groups and between units within groups

Sound and Graphics

- The player should be able to mute some sounds (e.g., unit chatter), without muting all sounds (e.g., combat sounds, cutscene dialogue)

Editor

- The game should include a map and mission editor that allows players to create custom content, maps, and campaigns

- The game's editor should be easy to use, robust, and flexible

3.1.5 Clear Goals

The analysis resulted in three heuristics for the GameFlow element of Clear Goals, which fell into the campaign content category.

Campaign

- The opening cinematic should clearly give the player the overall goals for the game

- Cinematics during the game should be used to clearly give the player intermediate goals

- The campaign should give the player more drive and direction for the game

3.1.6 Feedback

The analysis resulted in nine heuristics for the GameFlow element of Feedback, which fell into the content categories of: missions, gameplay, and interface and controls.

Missions

- The player should be given feedback on how well they achieved each mission, including a score and statistical information on the mission

- The player should be notified immediately if they have failed to complete a mission or if they will be unable to complete a mission due to some action

Gameplay

- The player should be able to immediately see the effect of attacking an enemy unit (e.g., hit point meter reduces)

Interface and Controls

- There should be a mini-map that clearly displays the surroundings

- The player should be clearly notified when there are things that need their attention (e.g., events, idle units)

- The player should be able to clearly see the contents of groups of units

- The game should include memorable audio cues to signify in-game events deserving attention

- The game should provide clear feedback on where a player can and cannot build and it should be clear why a player is unable to build on a certain spot

- The game should give clear feedback when a unit has received experience or increases in statistics

3.1.7 Immersion

The analysis resulted in 17 heuristics for the GameFlow element of Immersion, which fell into the content categories of: narrative, graphics, sound, and gameplay.

Narrative

- The opening cinematic should draw the player into the game

- The campaign should include cinematics that advance the storyline, ground the player in the game world, and add depth to the game world and characters

- The campaign should tell an entertaining, involving, and memorable story and progressively add depth to the story

- The player should become attached to the game world, characters, and story

- The game should provide additional background information for the races and story through manuals or other sources

Graphics

- Detailed graphics should be used to give life and personality to the game world, structures, and characters

- The terrain, structures, and units should be used to set the atmosphere and capture the feel of the game world

- The structures, terrain, and units of different races should have a distinctive look and feel that clearly captures the feel of the race they represent

- Different types of units should have a distinctive look and feel (not the same unit with different clothes and weapons)

- Animations and special effects should be used to give life to the game world and units

- Animations should not detract from the believability of characters and situations (e.g., repetitive nodding and awkward arm movements)

- Cinematography (e.g., camera manipulation) should be used to enhance believability in cutscenes and in-game

- The interface should be themed to the game world and race

Sound

- Voices should be used to give units distinct and vivid personalities

- Sound effects and voice responses should be varied and not repetitive

- Music should be themed for each race and help set the mood of the game

Gameplay

- The game elements should build up a rich and detailed world that is more like visiting a fully realised location than a constructed map

3.1.8 Social Interaction

The analysis resulted in 12 heuristics for the GameFlow element of Social Interaction, which fell into the content categories of: multiplayer, help, and editor.

Multiplayer

- The game should provide an online service for playing multiplayer games

- The game should make it easy to connect to multiplayer games and start playing

- The online server should match opponents automatically based on skill level or game-type preference

- Teams of players should be able to play against other teams

- The online server should include features such as rank ladders, auto-handicap, ladder statistics, a chat client, and facilities for tracking friends

- The online play mode should be integrated into the game

- The online server should run smoothly and stably

- The game should include multiplayer support in-game, such as the ability to vote on the course of action if one player drops out and the ability to talk to other players

- The game should support cooperative gaming, so that players can effectively play as a team (e.g., the ability to build walled-in cities next to each other)

- Multiplayer games should require team work to achieve victory

Help

- Players should be able to record matches to replay them to recount the events of the game and learn from their previous experiences

Editor

- Players should be able to create custom maps to share online

4. DISCUSSION

In comparing our findings on the manifestation of the GameFlow criteria in RTS games with those of Sweetser and Wyeth [21], we see that the majority of the original findings have been confirmed and expanded upon in the new heuristics. The manifestation of the challenge, clear goals, feedback, and social interaction elements discussed in the original paper [21] was confirmed in this study, with substantial detail added in the new heuristics. In addition, some key differences and clarifications from the original paper [21] were found in this study, in regards to the concentration, immersion, player skills, and control elements.

The discussion of the manifestation of the GameFlow criteria in RTS games in the original paper included a considerable amount of overlap and blurring of boundaries between concentration and immersion. The study reported in this paper has made the distinction between these two elements much clearer. Heuristics related to narrative, graphics, and sound converged in the immersion elements, whereas heuristics related to gameplay and pacing fell in the concentration element. The immersion heuristics do not include heuristics for concentration, which was suggested as being key for achieving immersion in RTS games in the

original paper [21]. Instead, these heuristics are included in the concentration heuristics. However, that is not to say that these heuristics are not important for facilitating immersion. In fact, it has been suggested that immersion is on a different level than the other GameFlow elements [22], which is a question that requires further investigation.

It has been suggested [2] that it would be more useful to indicate what could promote or inhibit immersion, rather than describing what the player should experience. The heuristics presented in this paper provide specific details on how to achieve the GameFlow criteria for RTS games, including how to promote immersion in RTS games through narrative, graphics, sound, and gameplay.

Sweetser and Wyeth's [21] findings on the manifestation of the player skills element in RTS games was confirmed for the most part, except there was a lack of heuristics relating to rewards in our study. This simply means that there was no explicit discussion of rewards in the analyzed game reviews and not necessarily that rewards are not a requirement for enjoyment. However, it is interesting that rewards were omitted from the reviews, which could constitute an interesting aspect for further investigation.

In terms of the control element, all the points that were raised in the original paper [21] for facilitating control in RTS games were confirmed and expanded upon in our heuristics. However, an interesting addition was the number of heuristics that related to player choice and customization, in relation to choosing and customizing strategies, units, races, missions, and so on.

In conclusion, we have taken the GameFlow elements and criteria and developed a concrete set of heuristics for achieving the high-level GameFlow criteria in one specific game genre, real-time strategy games. For the most part, our findings were consistent with the discussion of the manifestation of the GameFlow criteria in RTS games presented in the original paper [21]. However, in this paper, we have provided heuristics that are considerably more detailed than the original criteria or Sweetser and Wyeth's [21] analysis of how the GameFlow criteria apply to RTS games. We have also clarified some of the blurred boundaries between elements in the original GameFlow paper, particularly between concentration and immersion. We further found that by analyzing a set of professional game reviews, alongside the GameFlow model, we were able to develop a set of detailed heuristics for designing and evaluating RTS games. Future work will allow us to assess the usefulness, validity, and potential applications of these heuristics in designing and evaluating video games.

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