Heuristics for Evaluating Video Games: A Two-Tier Set Incorporating Universal and Genre-Specific Elements

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Abstract

The continued significance of video games in contemporary society has led to the production of many heuristic sets by which the playability of games can be evaluated. These sets encompass a wide range of aims and theoretical perspectives, furthermore, they have been developed via a number of distinct methods. This thesis is the result of a two-stage investigation, the first of which was to identify and extract any heuristics that could be considered as having universal relevance, irrespective of the method or theoretical position by which they were developed. The second stage of the investigation complemented this universal list with genre-specific elements, providing a model by which further information can be added in the future. Comparative analysis was used to extract common principles from a selected body of work, resulting in a list of 19 heuristics. In addition, open and axial coding was applied to data sourced from online game reviews, extracting information relating to the Real-Time Strategy genre. This information was then converted into 25 RTS-specific heuristics and integrated with the set developed in the first stage. The results of this study, therefore, clearly demonstrate the existence of a core set of universal heuristics, and the value of incorporating genre-specific information. The finalised set was presented in the form of a deck of cards, with each face representing information according to two different levels of abstraction, thereby increasing accessibility and facilitating use in different contexts. These cards have been made available in a print-ready format and are included as an appendix.

Keywords: Heuristics, evaluation, expert review, video games, computer games, genre, Real-Time Strategy, RTS, universal, synthesis, comparative analysis, content analysis, game reviews, usability, playability, gameplay.

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1. Introduction

Video games have overtaken the film business to become the fourth-largest global entertainment market behind gambling, reading, and television (Business Tech, 2015), and the rapid growth of the industry is predicted to continue (New Zoo, 2015). Inextricably linked to this growth is the increased cultural significance of video games in contemporary society. Two major themes to have emerged in recent years are the convergence of gaming and everyday life (Raessens, 2006), and the growing prevalence of games as both leisure and instrumental activities (Hamari et al., 2015). As a result, there has been increased academic interest in the processes underpinning the design and evaluation of video games.

Video games are software products and, like other types of software, the degree to which they can successfully fulfil the needs of the end-user is dependent on the ability of the user to access and make use of the content. This quality, ease of use, in combination with that of acceptability gives rise to the term "usability" (Holzinger, 2005). However, video games are distinguished from utility software by the fact that, although both utility software and video games share the need to embody the principles of usability a game must also be judged on its playability. Despite widespread agreement on the ways in which video games and utility software differ from one another, there remains a lack of consensus on how to define playability as a distinct theoretical construct (Paavilainen, 2010; Zhu and Fang, 2014). This is in stark contrast to the situation regarding usability which was enshrined in ISO standard 9241-11 nearly two decades ago, and is defined thus: "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO, 1998). In the context of this environment, a significant degree of research has been aimed at providing a model through which video games can be evaluated in, and of, themselves.

The approaches to understanding the relationship between usability and playability are explored in the following chapter. However, a summary of the perspective employed in this research is that playability is a combination of user interface and gameplay that together constitute a game, thereby distinguishing it from utility software. This perspective is akin to that of Korhonen (2016), among others.

Heuristic evaluation is a form of expert review method in which a software product is evaluated according to a pre-determined set of principles (Nielsen, 1992). It is an established practice in the field of Human-Computer Interaction (HCI) and software development, employed as a means of improving usability by identifying problems in the interface (Nielsen, 1992). It has been found to be a useful tool, employed by both designers and expert evaluators to guide their assessment of products (Pinelle et al., 2008a). The need for an evaluation tool that can be applied to the early stages of the production process rises out of the fact that the common method of evaluating games through playtesting with end users is an approach which is suitable for mature prototypes, but not feasible to apply to early designs. This is primarily due to the fact that it is not possible to produce playable prototypes until the later cycles of the development process, at which point any underlying design issues must already have been resolved. Furthermore, early stage prototypes such as paper mock-ups are unsuited for evaluation via playtesting as the participants are unlikely to fully understand the process (Eladhari and Ollila, 2012).

In addition to the above points, the format of games and the plurality of playing styles are particularly challenging for traditional usability evaluation methods which typically employ a more restricted interpretation of usability, one which is typically focused on the user interface. A particular example would be that of task analysis in which users are presented with a series of tasks to complete, their performance being assessed primarily via quantitative metrics including successful completion rates, error rates, and time taken to

complete the task (Crystal and Ellington, 2004). Such approaches do not lend themselves well to the evaluation of games which, although goal-oriented, require a certain degree of challenge and incremental skill development. Indeed, skill development, alongside "incremental and engaging challenges and contextualised goals" are fundamental aspects of gameplay (Carr, 2006). We can see, therefore, that although the usability principles of utility software can be used in game development, predominantly in relation to the user interface, there are specific characteristics of games which require further consideration. The issue of errors, or user mistakes, is a particularly illuminating example as they are to be avoided in utility software, however, the potential for players to make mistakes in games is expected, providing a means of challenging the player. The work of Bopp et al. (2016) goes even further in examining how negative experiences during play can, in fact, contribute to an overall sense of enjoyment by fostering engagement and providing opportunities for self-reflection.

Heuristic evaluation makes use of a series of individual heuristics as a means of guiding the evaluation process. These heuristics are, in essence, tools which direct the evaluator's attention to specific issues that must be considered as part of the evaluation. As such, individual heuristics serve as a "rule of thumb" (Paavilainen, 2010) and can be violated if justified by the design choices of the development team. There has been a great deal of work concerned with producing heuristics for video games which address both game usability (Pinelle et al., 2008a; Schaffer, 2007) and the wider concept of playability (Desurvire et al., 2004, Korhonen & Koivisto, 2006/2007, Desurvire and Wiberg, 2009; Zhu and Fang, 2014; Sanchez et al., 2009; Korhonen, 2016).

The proliferation of video games into almost all areas of contemporary society has led to increasing attention being paid to such issues as mobility (Korhonen and Koivisto, 2006), sociability (Paavilainen, 2010) and educational games (Farhady et al., 2013; Shonkey et al.,

2015) among others. With this diversification of interests, it is surprising that more attention has not been paid to the role and effects of genre. This is despite the fact that a number of studies explicitly call for a study of genre issues in order to build upon their findings (Korhonen and Koivisto, 2006; Nacke, 2010). Whilst there are many works that refer to genre, few actually explore the topic in any depth, the work of Sweetser et al. (2012) is a notable exception in that it addressed a specific genre in great detail. A further work of note is that of Pinelle et al. (2008b) in which it was demonstrated that different game genres suffer from different types of usability problems and, therefore, that different heuristics are needed to identify these issues.

The diverse aims of existing research are matched by the range of methods employed to achieve those aims. As such, the majority of studies create their heuristic sets from the bottom-up and with limited reference to existing work when creating heuristics. That is, that although authors cite existing heuristic sets when discussing the theoretical background, their described methods often make little, or no, reference to the influence of such pre-existing work.

When considering heuristics published by different authors, similar ideas and concepts are often present: for example, the need for the game to provide adequate help to players (Korhonen & Koivisto, 2006; Pinelle et al., 2008a; Desurvire and Wiberg, 2009). Such instances suggest that a core set of universally-applicable heuristics exist, independent of either the specific focus of the study or the method by which it is realised. The work of Koeffel et al. (2010) can be considered as the first step toward identifying truly universal heuristics, however their finalised set was developed through a qualitative review of existing work rather than comparative analysis. As such, the final selection was based on the authors' assessment of the individual merits of particular heuristics, they were not concerned as to whether particular issues were represented in more than one set. As previously stated, the

presence of similar concepts across different works would suggest that the concept in question is likely to have more universal significance than a concept present in only one set. Of the 29 heuristics selected by Koeffel et al., eight were referenced as originating from a single source (Koeffel et al., 2010) rather than from multiple works. Therefore, the first question that will guide this research is:

> RQ1: Can a set of universally-applicable heuristics be extracted from a body of existing work through cross-comparison?

It is expected that the results provided by investigation of this problem will provide a base upon which further genre-specific elements can be added, removing the need to create a complete set of heuristics on each and every occasion. This position gives rise to a further research question:

> RQ2: Can genre-specific information be used to effectively supplement those heuristics found to be universally-applicable?

The aims of this research, therefore, are twofold: first, to consolidate existing research and, second, to establish a set of heuristics that enable the evaluation process to be effectively focused on issues relevant to a specific genre. These two goals will be reflected in the presentation of the final set which will consist of two distinct elements: a core, or universal, set that is applicable to any game; and a set which is relevant only to a specified genre. The Real-Time Strategy (RTS) genre has been chosen as the focus for this study as it is both a commonly recognised genre which is also familiar to the author.

The core set of heuristics will be derived via a comparative analysis of existing sets that utilise a range of methodologies, as it is felt that comparison would serve both to highlight common principles and areas of further study. Several sets of heuristics, from both academia and the games industry itself, will be selected and compared with one another, producing a consolidated list of heuristics. Genre-specific issues will be identified by through the content analysis of a number of online game reviews. Open coding and axial coding will be used to identify issues and convert them into a series of individual heuristics. It is anticipated that the core heuristics will be more abstract in nature, while those relating to genre are expected to be more specific. These distinct elements will, therefore, be presented in a two-tiered set and accompanied by explanations and/or examples informed by the comparative analysis of existing work.

The remainder of this thesis is divided into seven sections, the first of which will establish the theoretical landscape in which the work will be located: issues of playability, usability and the RTS genre will be addressed, as will the role and use of heuristics. The process by which the finalised heuristic set will be produced consists of two distinct stages, each of which will be addressed in a dedicated chapter. Each of these chapters will discuss the method utilised in the individual stage, before moving on to the analysis of the selected data sets, the presentation of the results and a discussion of any issues raised. Stage one will be concerned with the extraction of a universal list of heuristics from existing literature and stage two with the development of heuristics for the genre of RTS games. Once the heuristics have been finalised there will be an examination of the issues surrounding their manner of presentation. There will then be a discussion of any issues raised by this research, before proceeding to the conclusion and personal reflection.

2. Heuristic Evaluation

The contemporary video games industry is one in which many thousands of products compete against each other for market share. Modern technologies have facilitated the development of new distribution methods, constantly evolving business models, and the ability of consumers to access a wide range of information sources. In this highly competitive environment the need to optimise the experience offered by a game is crucial in both acquiring and retaining players. The processes underpinning the design of games have, therefore, become increasingly important, requiring an understanding of the needs of the end-users and the way in which they interact with the product. This perspective is called user-centred design and is part of the wider field of Human Computer Interaction (HCI).

The use of heuristic evaluation in HCI is well established, alongside such other evaluation techniques as user testing, cognitive walkthrough, and prototyping. Heuristic evaluation is a form of the Expert Review method (Korhonen, 2016) in which heuristics function as a guide the for evaluators, rather than constituting a rigid checklist of items. The evaluators, as the name of the method makes clear, are experts in the field and, as such, the method is implemented by professionals rather than end-users. The results of a heuristic evaluation, therefore, are dependent upon the existing knowledge and skills of the expert that is conducting the review.

Heuristic evaluation is considered a useful tool as it is cost-effective and easy to implement when compared to alternative methods such as playtesting (Koeffel et al, 2010). Furthermore, it can be performed at any stage of the production cycle (Schaffer, 2007). As a result, it can be used to guide the design process in the early stages of production, to identify and address particular issues whilst the project is ongoing, or to perform post-project evaluations alongside other techniques such as user evaluation (Desurvire and Wixon, 2013).

Probably the most influential set of heuristics was produced by Nielsen and Molich (1990), the focus of which was productivity software. The list was later revised by Nielsen (1994). The ten usability heuristics published by Nielsen have been used in varying forms across a range of applications, from website design to assessing smartphone usability (Inostroza et al., 2015), and have inspired numerous authors to either adapt them, or to develop their own. However, the focus on usability meant that many authors felt they were unsuited to the evaluation of video games due to differences in the way users derive satisfaction from the products. Whilst usability is an undeniably important aspect of the way in which players experience video games, there is an additional quality which must be addressed, that of gameplay. Together these qualities, usability and gameplay, constitute the concept of playability, by which games are judged (Korhonen and Koivisto, 2006; Desurvire et al, 2004). The concepts of both usability and playability, which will be addressed in the following section, must be incorporated into a single set of heuristics in order that they can properly inform the processes of game design and evaluation.

2.1 Playability and Usability in Video Games

The contrasting goals of video games and utility software, as conceptualised in reference to entertainment and productivity respectively, are neatly summarised in the following table 1:

Usability Goals: Productivity	Playability Goals: Entertainment
Task completion	Entertainment
Eliminate errors	Fun to overcome obstacles
External reward	Intrinsic reward
Outcome-based reward	Process is its own reward
Intuitive	New things to learn
Reduce workload	Increase workload
Assumes technology needs to be humanised	Assumes humans need to be challenged

Table 1. Differences in objectives between design for player experience and design for user experience. Reproduced from Lazarro and Keeker, (2004).

We can see that video games have been distinguished from utility software according to a range of characteristics: games are played for the experience they offer in, and of, themselves (Nacke et al., 2010) rather than to achieve an external goal (Pagulayan et al., 2003). Additionally, the potential to make mistakes in the game both challenges players and promotes the development of in-game skills (Pinelle et al., 2008a). Games are primarily for leisure purposes and are therefore more likely to be diverse in form (Sanchez et al., 2009). Furthermore, utility software seeks to minimise time spent by the user, whereas games seek to maximise (Raffaele et al., 2015; Novick et al., 2014), and, finally, unexpected and surprising content is desirable in games, but to be avoided in utility software (Korhonen and Koivisto, 2006).

Factors such as fun and challenge are common to almost all attempts to formalise the idea of playability, providing a contrast to the more technical considerations of usability (Federoff, 2002; Kothandapani et al., 2012). However, significant differences remain between alternative definitions of playability, these disparities can be attributed to varied views of the relationship between usability and playability. There are three main perspectives that can be identified in literature addressing the subject: first, that playability and usability are synonymous with one another (Olsen et al., 2011; Novick et al., 2014; Raffaele et al.,

2015); second, that the two are discrete entities (Pinelle et al., 2008a; Kothandapani et al., 2012; de Carvalho et al., 2013); and finally, that playability is a holistic concept which incorporates usability alongside such other aspects such as gameplay and narrative (Nacke, 2009; Sanchez et al., 2009; Korhonen, 2016).

As we have seen, playability is a notoriously subjective quality for many (Paavilainen, 2010). In an attempt to establish an objective and quantifiable means of assessing playability, Novick et al. (2014) analyse 48 "user-experience episodes" in reference to the frameworks of Sanchez et al. (2009) and of Nielsen and Molich (1990). In the first analysis the authors encounter difficulties assigning several episodes to the distinct categories of playability and usability, leading them to conclude that "problems with games may be simultaneously both problems of playability and problems of usability" (Novick et al., 2014, p. 727). It can, therefore, be understood that the for the authors there is no distinction between the two concepts. Similarly, in the second analysis 43 of the 48 problems were classed as both usability and playability issues, the remaining five were considered to be playability issues only. Once again, the subjective nature of these classifications is demonstrated by the fact that the remaining five issues can be considered technical and audio-visual in nature and, therefore, that they would belong exclusively to the domain of usability (Järvinen et al., 2002). The experiences of the authors lead them to the ultimate conclusion that "there is really a single technique of empirical testing of the user's experience in computer games, regardless of whether this is called usability testing or playability testing" (Novick et al., 2014, p. 729-730). It is unsurprising that the authors found so much overlap between the two terms as, in this work, playability is used as a catch-all term, concerned with any aspect of playing a game. However, it may have been more productive to frame the analyses in terms of technical qualities, usability, and non-technical, gameful, qualities which together

constitute playability. In their analyses playability is essentially presented as an alternative term of reference for usability, one which is applicable to the specific context of games.

The work of Pinelle et al. (2008a) is an example of the clear and definite separation of usability and playability. In the introduction to the paper, the authors distinguish the design elements of "game story, pacing, challenge level, and game mechanics" (Pinelle et al., 2008a) from the concept of usability. Despite the fact that they do not directly refer to playability, as a concept in itself, the implication is evident.

A clear distinction between playability and usability is also evident in the work of Kothandapani et al. (2012) and de Carvalho et al. (2013). In both these studies the two concepts together contribute to the overall success of a game, they are of equal importance in understanding how a game works. A particular problem in the work of de Carvalho et al., however, is that they employ the term usability without explaining what it means to them as authors.

The definition of usability employed by Pinelle et al. is "the degree to which a player is able to learn, control, and understand a game" (Pinelle et al., 2008a), and was derived both from previous work and as a result of the study itself. In addition to those elements mentioned previously, it also excludes technical issues connected to audio-visual design (Pinelle et al., 2008a). The separation of audio-visual elements from those other technical considerations which contribute to usability is at odds with a number of other authors, not least Korhonen and Koivisto (2006), Desurvire and Wiberg (2009) and Järvinen et al. (2002). In fact, in his discussion of Järvinen at el., Nacke (2009) explicitly states that audio-visual qualities are an essential aspect of the user interface, affecting both the input controls and offering feedback.

When we consider the model of playability presented by Järvinen et al, we can see how playability is the sum of four constituent aspects: functional, structural, audio-visual and

social (Järvinen et al., 2002). Together the functional and audio-visual aspects are concerned with the technical ways in which a user interacts with the game, and are therefore equivalent to usability, and the structural and social aspects together constitute gameplay. Nacke demonstrates the consistency of this framework by demonstrating the conceptual parallels between it and the work of Korhonen and Koivisto, and Desurvire and Wiberg (Nacke, 2009). We can see how both these heuristic sets offer a holistic picture of playability which is made up of usability and gameplay and is, therefore, free of the problems which affect the alternative approaches described previously. The position of this research will be to reflect this last approach rather than attempting to refine, or re-define, the concepts of usability and playability.

2.2 Heuristics for Video Games

The first heuristics concerned with game design were published by Malone (1982) and, although concerned primarily with the design of educational games, they are still of relevance today. Malone detailed three key categories that characterise enjoyable games: challenge, fantasy, and curiosity. The "challenge" category addressed such fundamental concerns as goals, both in terms of clear objectives provided by the game and that games should facilitate player-created goals. Variable difficulty settings were also included in this category. Malone's discussion of "fantasy" was centred around its application in the field of educational games and, as such, had less to offer the wider field of game design. Finally, the category titled "curiosity" dealt with issues such as audio-visual effects (sensory curiosity) and fostering engagement through "informative feedback (cognitive curiosity).

Despite the work of Malone, it was not until the early 2000's that the field began to benefit from further attention. The Master's thesis of Federoff is cited as being the first, truly modern, academic treatment of the subject (Paavilainen, 2010), based on a literature review

and a case study of a game development company (Federoff, 2002). The author developed a set of 40 heuristics which were influenced, at least in part, by the earlier work of Nielsen and were divided into three categories for easier reference: game interface, game play, and game mechanics. The finalised set has been criticised as lacking depth and being of use in limited genres (Koeffel et al., 2010).

Desurvire and Wiberg's PLAY heuristics (2009) were developed from the Heuristics for Evaluating Playability, or HEP (Desurvire et al., 2004) which were felt by the authors to be useful only in "limited circumstances" (Desurvire and Wiberg, 2009). Although the reasons why HEP were deemed to be insufficient for general use are not presented, the PLAY framework is described as providing a basis for the game design process, one which can be modified according to the individual game under development. The authors state that PLAY has been used by a number of design teams since its inception and it has been found to be useful throughout all phases of the development process (Desurvire and Wiberg, 2009).

Korhonen and Koivisto published a set of heuristics directed specifically at the platform of mobile games, although its modular structure meant it was equally of use in evaluating any other type of game (Korhonen and Koivisto, 2006). As with the work of Desurvire et al. (2004), the mobile heuristics were later updated, this time with the addition of a multiplayer module (Korhonen and Koivisto, 2007) and a "context-aware" module for pervasive games (Korhonen et al., 2008; Korhonen 2016). Both the sets produced by Desurvire et al. (2004/2009) and by Korhonen and Koivisto were holistic in nature, addressing usability and gameplay issues.

The work of Schaffer (2007) was more limited in scope, considering only usability in games. However, the work was notable for two main reasons: the first is that the heuristics were the result of the author's personal experience working in the industry. The second significant aspect was the presentation of the heuristics alongside detailed screenshots.

Schaffer felt that earlier heuristic sets were too abstract, the decision to utilise visual aids serves to improve accessibility and to effectively communicate meaning (Schaffer, 2007). It is, therefore, important as it is one of very few works available that provide a perspective from within the game development business, as well as utilising an alternative means of presentation.

Pinelle et al. (2008a) also chose to focus exclusively on issues of usability, specifically excluding elements such as story and game mechanics. The rationale provided for this approach was that the user interface fundamentally affects the quality and, therefore, the potential success of any given game. In addition, the authors assert that they are addressing the limitations of previous research which was too strongly focussed on aspects of fun and enjoyment and lacking in methodological variety (Pinelle et al., 2008a).

In 2010, Paavilainen performed a review of existing heuristic sets, and of research relating to social games, in order to produce an initial set of heuristics that would provide the basis for further work (Paavilainen, 2010). In the same year Koeffel et al. (2010) synthesised a list of heuristics from the previous work of eight authors, applying them to both video games and table-top games. The finalised set was the product of a qualitative review of existing literature and, as such, several of their heuristics were extracted from only a single source (Koeffel et al., 2010).

Similar to Pinelle et al. (2008a), Zhu and Fang used online game reviews to develop an initial set of game-specific heuristics. However, their work was significantly broader in scope: addressing the wider concept of playability rather than only usability, and employing a lexical approach to extract information from a far wider data set than Pinelle et al. (Zhu and Fang, 2014).

Heuristics for games have been produced through a range of methods and with numerous distinct aims, as we will see later in this thesis where the sets are examined in

detail. Similarly, the varied interpretations of playability and usability have affected both the form and content of the many different heuristic sets developed for evaluating video games. With an ever-increasing volume of work available to both academia and the games industry, this research is intended to bring clarity to the field through the consolidation of existing work.

3. Genre

Genre is defined by the Oxford Dictionary as “a style or category of art, music, or literature” (Oxford Dictionaries, 2016), and its use as a means of categorising games is a natural behaviour for academics, consumers and the industry itself. In this aspect games are no different from any other media, as Chandler states in “An Introduction to Genre Theory”, the process by which literature is classified and organised has been conducted for thousands of years (Chandler, 1997). The integration of genre into the processes of game evaluation is, therefore, a logical and arguably necessary development.

3.1 Genre and Video Games

Our understanding of new media forms is unavoidably informed by that of pre-existing forms (Bolter and Grusin, 2000). However, applying a framework based on one particular cultural object, say film, to another, such as video games, is neither a simple nor, ultimately, a productive approach. This is due to the fact that different media have their own distinct forms that shape both production and consumption. Equally as significant as the varied forms of different media is the fact that varied interpretations of genre exist within any given field of the media:

> “There are no undisputed “maps” of the system of genres within any medium (although literature may perhaps lay claim to a loose consensus). Furthermore, there is often considerable theoretical disagreement about the definition of specific genres.” (Chandler, 1997, p.1.)

One of the first attempts to “map” genre in the specific context of video games was made by Chris Crawford (1984) and was related to the game design process rather than any

academic endeavour. It was not until nearly two decades later that “The Medium of the Video Game” (Wolf, 2001) was published, a work commonly perceived to be one of the earliest academic pieces to establish a framework by which video games could be categorised according to genre (Clearwater, 2011). In it we are presented with the idea that genre is established via consensus between industry, the producers of games, and the wider public who consume the games. For Wolf the most significant issue that should influence this consensus is the idea that interaction is the most important characteristic of video games, rather than thematic content or iconography (Wolf, 2001).

The tensions between thematic and interactive features are also highlighted by Järvinen (2008) when discussing the potential to categorise games according to either of the two perspectives. The fact is that the theme of a game often drives the methods of interaction, the mechanics employed by the game, whereas in other cases new themes are overlaid upon pre-existing mechanics. Therefore, both interactivity and thematic characteristics require consideration when applying genre labels to games (Järvinen, 2008). Whilst acknowledging the impermanence of genre labels Järvinen offers a series of perspectives through which genre can be analysed, reflecting the varied uses in which genre is employed: game theme, game play, and player experience. He concludes that the importance of understanding genre lies in the relationship between a game and the wider environment in which it exists (Järvinen, 2008).

An alternative approach to categorising video games was put forward by King and Krzywinska, whereby the discussion of game types was framed according to four levels, or aspects: platform, genre, mode, and milieu (King and Krzywinska, 2002). In discussing both this model and the work of Wolf, Apperley reinterprets them both in relation to the notion of interactivity and, by extension, the wider debate between narrative and ludological perspectives (Apperly, 2006). Indeed, he concludes that the contemporary understanding of

video games is obscured by the underlying friction between concepts based on interactivity on the one hand, and those which reference pre-existing, representational forms of media on the other (Apperly, 2006).

We can see that the fundamental problem affecting attempts to establish a framework for categorising video games, is that attempts to do so are inextricably linked to the underlying motive for categorisation. The general public and academics employ different genre labels, and value existing labels differently, because they consume the content in different ways (Chandler, 1997). Producers adopt, and even create, genres to fulfil commercial aims (Elverdam and Aarseth, 2007; Chandler, 1997). In the wider context of the narrative versus ludology debate referred to earlier, genre has been used as a tool to further theoretical perspectives about the nature of games and of Games Studies itself (Aaresth, 2004; Clearwater, 2011).

A thorough investigation of theories addressing genre is beyond the scope of this research, as such the primary concern is how to identify and employ a definition of Real-Time Strategy games in order to collect comparable data during the experiment phase. The key to this dilemma is provided by the understanding that genre labels are social constructs, and are both historically and culturally situated (Dor, 2014; Clearwater, 2011; Chandler, 1997).

> "How we define a genre depends on our purpose … if we are studying the way in which genre frames the reader's interpretation of a text, then we would do well to focus on how readers identify genres rather than on theoretical distinctions."
> Chandler, 1997, p.3

One of the primary aims of this research is to reveal what online game reviews can tell us about RTS games, and to use this information to assess and inform existing heuristics. The aims of the research are felt to best supported by adopting the simplest and most widely accepted definitions; the categories that have been constructed and validated in wider society rather than those that are the result of a distinct theoretical perspective. It therefore follows that the identification of RTS games should be based on how the games are categorised by the online review sites themselves. As Clearwater states, the high degree of interactivity and social engagement of video games consumers and communities necessitates a culturally-orientated approach to genre (Clearwater, 2011). This position is further supported by Dor (2014), in which Foucault's concept of "discursive formation" is applied to the issue of genre. Dor finds that a number of regularities can be identified in the popular categorisation of RTS games, these include audio-visual representations, styles of gameplay and consistent modes of description in game reviews (Dor, 2014).

3.2 Characteristics of Real-Time Strategy Games

That this research has chosen to identify RTS games according to the social consensus does not mean that academic perspectives will be disregarded as they contain significant items of interest concerning the nature of the RTS genre. The differing perspectives of the narrative and ludological approaches to genre reveal that the term "Real-Time Strategy" is a description which is fully grounded in the interactive nature of video games. The term is constructed of two discrete concepts, but which both refer to gameplay rather than any aesthetic or thematic considerations (Arsenault, 2009). However, this does not mean that aesthetic considerations are unimportant when identifying RTS games, indeed, Järvinen notes that the isometric view is characteristic of strategy games, both real-time and turn-based (Järvinen, 2002). Although Järvinen notes that this view is required in order to facilitate

movement according to the rules of the game, Apperley goes further and in stating that the distinct aesthetic of these strategy games is a remediation of earlier board games (Apperley, 2006).

The fact that genre is not a fixed concept is stated by a number of authors (Järvinen, 2008). In relation to RTS games Dor provides the most significant example of this constant evolution, detailing how the emergence of eSports has resulted in new styles of play and victory conditions (Dor, 2014). The influence of competitive play on game design is manifest in such features as hotkeys and the importance of multiplayer game modes, the latter was significantly absent in some early RTS games such as *Dune II* (Dor, 2014). A final characteristic of RTS games highlighted by Dor is that, even in a single-player mode, the game requires players to participate in the "paradigm of prediction" rather than of decryption, this is facilitated by the use of the "fog of war" mechanic and scouting (Dor, 2014).

Describing RTS gameplay in terms of "observation and intervention", Apperley identifies periods of downtime where the player's direct actions are limited. This situation results from the need to accrue resources and to wait for their strategies to come to fruition. This style of play is likened to Manovich's description of post-industrial labour and implies that RTS games are primarily concerned with the management of information and that they require specific tools and a distinct UI in order to monitor a situation efficiently (Apperley, 2006). This central need for an effective and efficient UI may explain why RTS games are the least "cinematic" of the many varied video games (King and Krzywinska, 2002).

It is anticipated that those features identified as being characteristic of RTS games will be reflected in the finalised heuristics. The rationale being that as such features are fundamental to the cultural construct that is RTS, their absence would violate the "contract" (Järvinen, 2008) between developers and consumers. In summary, the characteristics expected to be present in RTS-specific heuristics are: the existence of hotkeys, the

importance of multi-player mode, the “fog-of-war” mechanic, periods of downtime, the role of information management tools in the UI, and an isometric view.

4. Stage 1: Defining Universal Heuristics

This research proposes to identify universal heuristics and to define genre-specific heuristics via a two-stage process, each of which will utilise a different method. It is felt that using distinct methods across each iteration will increase the robustness of the results and avoid the potential for the research to become a self-fulfilling prophecy.

In the first stage, four heuristic sets will be subjected to comparative analysis (Ragin, 1987) in order to attempt to identify and extract common principles. The process of analysis and comparison would undoubtedly become both complex and cumbersome if large numbers of heuristic sets were to be selected for analysis and comparison. It was, therefore, decided that four sets would be the optimum number to include in the research as they would represent a sufficient range of methodologies and aims, whilst at the same time remaining manageable. In order to select the appropriate sets there is a clear need to establish certain criteria for inclusion. The four heuristic sets subjected to analysis as part of this research were selected according to the following reasons: first, that they employed distinct methodologies; second, that they encompass a range of theoretical perspectives concerning issues such as usability and gameplay; and finally, that the sets are the result of both industry experience and academic research. It is the contention of this research that any common principles shared by the analysed heuristic sets can be considered as being "universal", in the context of video game analysis. Furthermore, any weakness in a particular methodological approach will be mitigated as a result of the comparison with studies that adopt alternative methodological approaches. A list of these universal heuristics will form the first iteration of the intended results of this research, thereby addressing research question 1. This list, and the process by which it was developed, will be compared to the work of Koeffel et al. (2010) as part of the wider discussion in Chapter 7.

4.1 Method: Comparative Analysis

The method of comparative analysis is a long established practice, forming one of the cornerstones of sociological investigation. Indeed, Durkheim went as far as to state that it, in itself, constitutes sociology (Durkheim, 1895/2014). Although this research is not explicitly sociological in nature, instead belonging to the interdisciplinary field of Game Studies, it is felt that the comparative method offers the best means of achieving the stated goals. That said, it remains important to identify the particular framework and "logic of inquiry" of the method in order that it can constitute an authentically scientific approach (Pennings et al, 2006).

Brewer (Miller and Brewer, 2003) states that contemporary comparative analysis is practiced in one of two ways, either through internal comparison or external comparison. In the first the object of study, whatever it may be, is compared across time, space, or culture whereas the second approach compares two or more to each other. However, both these practices are indicative of "textbook" social research (Ragin in Lewis-Beck, Bryman and Liao eds, 2006) inasmuch as they focus on variation as a means of identifying causal patterns. This is obviously at odds with one of the fundamental goals of this research: the identification of common principles that, in themselves, constitute universally applicable heuristics. At first glance the practice of deductive comparison, also described by Brewer (Miller and Brewer, 2003) appears to be a perfect fit as attention is focused on similarities. Yet once again it does not entirely fit the logic of inquiry as both inductive and deductive comparison are concerned with understanding widespread patterns rather than specific cases.

As we have seen, there exist several different facets in the practice of comparative analysis, this has resulted in the formation of several distinct methodologies, each with their own histories. Analytic induction, for example, has moved away from the search for the "invariant properties" of social life, the focus that characterised the approach in the mid-

twentieth century. It has instead become a means of defining categories and concepts. Cases within a given category are compared, with any similarities or differences providing the basis for refinement or amendment, this process is now known as the constant comparative method (Ragin, 1994).

This leads us to the work of Ragin, who established a mode of comparative analysis that was not fundamentally linked to the investigation of widespread sociocultural phenomena, he called it case-oriented comparison (Ragin, 1987). Indeed, Mills states that comparative analysis can be performed on any discrete entity, whether it be a nation state, a location (in time or space), an individual or even a statement (Mills, 2008). In contrast to Miller and Brewer, Ragin seeks to distinguish the comparative method from classic practices of social science, placing it in direct contrast to the established tenets of sociological research:

> "Comparative research focuses not on relationships between variables … but on the problem of making sense of a relatively small number of cases, selected because they are substantively or theoretically important in some way." (p.149, SAGE, 2008)

The distinction between case-oriented comparison and the classic sociological approach was established in order to account for differing research goals of the finalistic and causal-mechanic traditions. In the first of these perspectives the aim is explanatory in nature, whereas the second is predicative. This thesis belongs to the finalistic tradition as it is concerned with examining contemporary knowledge rather than forming a basis for making predictions about future developments. As such, the approach of case-oriented comparison is the appropriate method required to achieve the stated research goals of this thesis.

Ragin states that the majority of comparative studies are concerned with the "how" of particular socio-cultural or historical phenomena (Ragin in Lewis-Beck, Bryman and Liao eds, 2006). Although this research does not hold the same focus, it does share the primary scientific objective of detailed investigation of a particular concept. Indeed, the very concept of commonality, so essential to the comparative method, is a central to this research and further justifies the choice of method. Pennings et al. (2006), outline three core issues which must be addressed if research is to be considered truly part of the comparative method: describing the core subject; developing concepts that "travel"; and discussion of the method as a tool, not an end goal. It is important to note that while their examples are framed within the context of political science, the underlying principles and logic are applicable to any study based upon the comparison of two or more similar entities.

The key hypothesis of this research is that there exists a set of universal heuristics that can be used as tools to guide the evaluation of any video game. Therefore, any such heuristics will be present within the varied sets that have already been produced by both industry insiders and academic research, irrespective of methodology or focus. Many heuristic sets claim to be universally applicable, including all four that have been chosen for analysis in this study, however, such claims are undermined for a number of reasons. The first is that the existing works that have developed heuristic sets have incorporated a range of approaches, both theoretical and practical. The natural assumption is that such variation would, necessarily, produce content that differs from one set to another. This expectation has been validated by Paavilainen (2010). The second reason is that the varied methods of presentation make it hard to assess the relative content of differing heuristic sets without detailed comparison and analysis. Furthermore, the methods by which existing sets have been validated also vary considerably (Paavilainen, 2010) and, as such, the published findings cannot be adequately judged against one another. Finally, although there is a growing body of

heuristics that have been produced either through synthesis or modification of existing sets, the majority are produced from the ground up and with little reference to existing work. Any reference is usually present when introducing heuristic evaluation as a practice and is often absent from any discussions concerning either the form and content of the finalised set, or of the way in which it was developed. It is the primary aim of this research to address these issues through the detailed comparison of different sets, in order that these claims of universality can be assessed, and any core principles be identified.

Of the three concerns raised by Pennings et al. (2006), outlined above, the first and last have been addressed in this chapter. The second required more detailed attention as it reveals a source of potential confusion when analysing different heuristic sets. Terms such as "usability", "gameplay" and so on abound within literature in the field, however, there are no set definitions which are commonly adhered to (Speicher, 2014; Korhonen, 2016). The issue was addressed in section 2.1.

A final point to consider is the design of the research, that is, what specific type of comparison is to be performed as part of the research? Pennings et al. (2006) state that the most common approach in comparative research tends to be one in which all relevant cases are included. At first glance this would appear to suit the aims of this research as it deals with cases that are more alike than different, thereby serving to strengthen both internal and external validity. However, this initial impression is misleading as such an approach would be unwieldy and not suited to the specific research question: if any universal principles exist, they would necessarily be present in a small sample group as well as in the totality of work so far produced. It follows then that for the theoretical and methodological perspectives to be in concert it is the "closed universe of discourse" approach that should be adopted. Here the comparative analysis is focused on a limited number of specifically selected cases. Those cases that will feature in the comparison are detailed in the following section.

4.2 Analysis of Chosen Heuristic Sets

It was decided that four heuristic sets would be subjected to comparative analysis as including more would make the process unwieldy. The chosen sets encompass a range of studies whose individual aims, methodologies, and perspectives differ significantly from one another. The sets are: 1, Korhonen and Koivisto's "Playability heuristics for mobile games" published in 2006; 2, "Heuristic evaluation for games: usability principles for video game design.", Pinelle et al., 2008a; 3, Schaffer's 2006 work "Heuristics for Usability in Games, A White Paper."; and 4, "Game Usability Heuristics (PLAY) For Evaluating and Designing Better Games: The Next Iteration.", Desurvire and Wiberg, 2009. The focus of the analysis will be on the content and presentation of the chosen heuristic sets, rather than, for example, the theoretical concepts utilised in their construction. The focus on content is similar to the approach adopted by Koeffel et al. (2010), however, the qualitative review method adopted by the authors resulted in the inclusion of heuristics from single sources. It is felt that performing a comparative analysis will produce heuristics which are truly universal as the finalised list will represent heuristics developed by multiple studies.

4.2.1 Korhonen & Koivisto (2006)

When considering the area of game-specific heuristics, Korhonen and Koivisto (2006) noted that the issue of mobile gaming had not yet been addressed, in addition there were obvious problems with the existing research, most notably poorly defined and overlapping heuristics. These shortcomings were felt to be so significant that rather than attempting to consolidate the previous work, the creation of a new set was preferred. The resulting heuristics are primarily targeted at the pre-production and production phases of game development, additionally the authors state that they can be of benefit in post-production. Although these heuristics are focused on games for mobile devices (including smartphones

and dedicated portable gaming platforms), the modular structure of the final set allows them to be applied to alternative platforms (Korhonen and Koivisto, 2006).

An iterative approach was taken in which the initial list of 11 heuristics was determined through the combination of several analytic perspectives: first was an analysis of the context of use for mobile devices; second, a review of Nielsen's usability heuristics; and third, the review of an undefined set of game design guidelines (Korhonen and Koivisto, 2006). The initial evaluation, of a game in production at the time, revealed 61 playability problems, of which over 25% were unable to be allocated a specific heuristic. These results clearly demonstrated that further work was required (Korhonen and Koivisto, 2006).

The subsequent review produced a further 18 heuristics, more than doubling the total number. This list was then validated in a second practical evaluation. That 235 problems, of varying degrees of severity, were found using the final list of heuristics to evaluate 5 different games supports their validity as an effective framework for evaluation (Korhonen and Koivisto, 2006).

Korhonen and Koivisto's heuristic set was presented in a modular format whereby they created three discrete but related sections: mobility, game usability, gameplay (Korhonen and Koivisto, 2006). The rationale behind a mobility module is clear, being as it is the primary interest of the research, and it reflects the potential for diverse playing conditions. Game usability is integral to the game experience, but distinct from content, therefore is differentiated in the modular structure from gameplay. The Gameplay section is viewed as being independent of platform. Perhaps the biggest conceptual difference from previous research is the inclusion of "game mechanics" under the umbrella of gameplay, whereas the work of Federoff (2002) and Desurvire et al. (2004) had viewed them as separate entities "game story" is also incorporated, unlike Desurvire et al (2004).

The modular structure was chosen by the authors due to the intended use of the heuristics in the pre-production and production phases of the development process; it is suggested that any game evaluation deals with only one of the three modules at any one time, because the relevance of each module changes at any given point of the production cycle. Moreover, a modular structure is beneficial as further modules can be added if and when required, this is something that is likely to be necessary as the current heuristics are "very general and applicable to any game" (Korhonen and Koivisto, 2006). This provides some justification for creating genre-specific heuristics that can be contained within additional modules. However, the authors' statement that the heuristics are universally applicable must be treated with caution, it is possible that some might be irrelevant, even problematic, when considering specific genres, as they later note. A particular example of this might be GP14 "The player does not lose any hard-won possessions" which runs counter to the ethos underpinning the sub-genre of survival games, in which permanent death is a common feature.

An additional consideration, not mentioned by the authors is that the modular format facilitates ease of use. An extensive list of heuristics makes the evaluation harder as there is more to remember, a smaller list allows the evaluator to focus their efforts more effectively (Paavilainen et al., 2011). In order to maximise the potential afforded by the modular structure, it is suggested that the usability evaluations be carried out first, allowing the evaluators to effectively focus on game play in the latter stages of evaluation (Korhonen and Koivisto, 2006). This approach is supported by the authors' findings that game usability and mobility issues were easiest to identify. These factors resembled standard (i.e. non-game) usability evaluations, whereas gameplay issues were much harder to identify.

The success of the finalised heuristic set can be attributed to both the iterative process by which they were constructed and the use of a range of data-gathering techniques: context

analysis, literature review, practical evaluation, and expert interview. Perhaps the only evident weakness is that when the context of use was considered the focus was specifically on mobile phones, rather than also addressing hand-held gaming devices. However, this should not cause problems as the issues of changing conditions and interrupted game play can still occur when using a gaming device, albeit less frequently and perhaps less severely or unpredictably than with multi-use devices such as smartphones.

In their discussion of the expert evaluation method, Korhonen and Koivisto note that game genres each have their own requirements which need to be realised in order that the game be a success, they also state that "some of our game play heuristics are not relevant for all game styles" (Korhonen and Koivisto, 2006). Unfortunately, there is no breakdown of which heuristics were violated by which games in the second evaluation round, meaning that any genre-specific heuristics are impossible to identify.

According to the limited analysis of violated heuristics, the most widespread issues were revealed by gameplay heuristics: GP1 (goals); GP3 (rewards); GP4 (control); and GP5 (challenge). These were found to be valuable in highlighting fundamental design flaws and were found in all evaluated games, gameplay heuristic GP12 (consistency) was also highlighted as being a significant problem for the majority of games. These results suggest that heuristics GP1 (goals), GP3 (rewards), GP4 (control), GP5 (challenge), and GP12 (consistency) are significant for any game, irrespective of genre.

The fact that the longest evaluation revealed the most gameplay problems is significant, demonstrating the need for exhaustive exploration. As the authors noted, game evaluations take significantly longer than utility software evaluations, not least because evaluators need to learn how to play the game. Furthermore, games are typically structured so that they are incrementally revealed to the player, skills and experience are built up and new levels or areas become accessible (Korhonen and Koivisto, 2006). Such characteristics

support the author's assertion that different modules vary in significance at different stages of the production process. Consequently, the stated aim, of producing heuristics that support the production of games throughout the entire project cycle, was more effectively realised with the adoption of a modular structure (Korhonen and Koivisto, 2006).

Analysis of the way in which Korhonen and Koivisto's work was conducted provides several important lessons, the first of which is that an iterative approach is highly beneficial as it allows constant refinement of the final heuristics. This continual assessment and revision was further complemented by the range of data sources that the authors drew upon. The results of the research were presented in a modular structure which allows both adaptation and the ability to conduct the evaluation in discrete phases. The testing phase revealed that certain heuristics were more effective across all game genres (GP1, GP3, GP4, GP5 and GP12), suggesting that they may be of some significance.

4.2.2 Pinelle et al. (2008a)

The primary aim of the work of Pinelle et al. (2008a) was also to support the practice of game development. However, a significant issue is that the focus of this work was exclusively that of usability issues; a secondary aim is to produce an evaluation tool that can be applied to the early stages of development, or to functional prototypes.

The authors expressly state that they are focusing only on usability, which they define as: "the degree to which a player is able to learn, control, and understand a game" (Pinelle et al., 2008). This definition arose from the authors' work producing the paper, and is directly linked to the concepts outlined in previous work, as such, "artistic" and "technical" issues are disregarded (Pinelle et al., 2008a). The position of Pinelle et al. was that the existing game heuristics were too heavily centred on the wider notion of playability and that they did not properly examine usability. In addition, they were derived almost exclusively from literature

reviews and “author introspection”, the authors attempt to address these concerns by making use of in-depth information about common usability problems. The research upon which they base their position is that of Clanton (1998), Federoff (2002) and Desurvire et al. (2004). It is somewhat surprising that they did not consider the work of Korhonen and Koivisto (2006), as discussed above, as it is both methodologically sound and specifically address issues of usability.

The study adopted the approach of Dykstra (1993), whereby existing products in particular classes of software are analysed, leading to category-specific usability issues. As the expectation was that different usability issues would be evident in different game genres, they felt that it would be impossible to achieve a wide overview if they performed the analysis themselves. Therefore, game reviews were felt to be a useful resource, enabling a large number of games from a range of genres to be included in the research (Pinelle et al., 2008a).

The website GameSpot was chosen as the source of individual reviews because of its popularity and its extensive archive, going back over 10 years from the date of the study. The reviews are described as being “relatively comprehensive” (Pinelle et al., 2008a), covering gameplay, audio visual qualities and usability issues. The reviews were from a total of 108 games, equally divided between 6 common genre types as identified on the GameSpot website: Role-Playing Games; Sports/Racing; First-Person Shooter/Tactical Shooter; Action; Strategy (Real-Time and Turn-Based); and Adventure.

Games receiving scores of 8 or more, out of a possible 10, were discounted from the research as a pilot study revealed no usability problems mentioned in any of the reviews for that segment. The study was also limited to PC games due to the range of interaction methods provided by the platform. A final category for inclusion in the study was that only games after 2001 were considered, this was to ensure that contemporary practices were properly

reflected (Pinelle et al., 2008a). Whilst the exclusion of outdated games is prudent, the omission of those that are the most highly rated is more questionable. This is due to the fact that although reviews that award high ratings may lack examples of usability problems, it does not mean that they do not contain valuable information; a notable success can illustrate an area of interest as well as a notable failure.

The initial analysis produced a framework of 12 problem categories, the reviews were then re-assessed with reference to the established framework, resulting in an average of 2.64 problems per game (Pinelle et al., 2008a). The identified problems were then converted into heuristics whose descriptions included potential solutions. The authors highlight the fact that there are several similarities between the final list of heuristics and those produced by Nielsen (1994), thereby supporting the validity of their heuristics with reference to usability issues (Pinelle et al., 2008a).

The finalised heuristics were then tested in a practical evaluation of a playable demo. All heuristics were found to have been violated by the game, except number 5 (skip content), with the most problems found in 6 (input mappings), 8 (game status), 9 (help) and 10 (visual representations). Heuristics 1, 3, 4 and 9 had the highest mean severity rating (Pinelle et al., 2008a). Together these figures potentially reveal number 9 (help) to be the most significant issue affecting usability.

Despite the fact that the practical evaluation produced a higher average of found problems per game than the original analysis, 9 and 2.64 respectively, both figures are extremely low in comparison to other studies (Paavilainen, 2010). This reveals the limitations inherent in the practice of focusing solely on game reviews as a source of usability problems. The idea that game reviews include thorough descriptions of design problems is, in itself, problematic as game reviews are typically opinion pieces concerned with the overall game experience. That is not to say that the reviews cannot be a valuable source of information, but

that perhaps they are more suited to assessing the issue of playability, something which has, in fact, been expressly omitted from this particular research. Indeed, the authors note that the source material was not written either for, or by, usability professionals (Pinelle et al., 2008a); they were aimed at consumers, and as such only considered usability issues when they interfered with the enjoyment of the game. The methodological approach taken by the authors was further criticised both for a lack of diversity, and for potential bias in the original data (Koeffel et al., 2010).

While Pinelle et al. acknowledge the need for further validation of their usability heuristics, they feel that the initial results suggest they have achieved their aims of providing a "thorough" coverage of usability problems in video game design (Pinelle et al., 2008a). However, this position is somewhat undermined as the definition of usability employed by the authors is one which was formed, in part, as a result of studying game reviews. Using game reviews to find usability problems is, therefore, something of a self-fulfilling prophecy.

Despite these areas of concern, the presentation of the finalised heuristic set is found to be clear and concise, with detailed explanations that serve to illustrate the relevant heuristic well (Paavilainen, 2010). This assessment was echoed by the usability evaluators that took part in the practical evaluation stage who, in their post-evaluation questionnaires, cited both the benefits of focusing on the game interface and the limited number of easy to remember heuristics (Pinelle et al., 2008a).

In summary, the work of Pinelle et al. reveals that it is important to fully consider the constraints that are applied to the selection of source material. Although limiting the scope of the research to recent trends is good practice, the exclusion of highly-ranked games restricts the potential of the study. The data was further restricted as a result of having been obtained from a single online source, a website whose reviews were not written by, or for, usability experts. The fact that the final list of heuristics had similarities to Nielsen's work on usability

was significant, especially considering that number 9 (help) has a direct parallel in his general principles. A final lesson was that simple and concise presentation benefits comprehension as well as practical application.

4.2.3 Schaffer (2007)

This white paper is specifically aimed at game developers and is the fruit of the author's experience working in an Indian game development company (Schaffer, 2007). It is one of the very few published works in this field that is the direct product of games industry professionals, as opposed to academic interest. The resulting heuristics have been designed and presented with the intention to make them easy to use during the development process.

Akin to the work of Pinelle et al. (2008a), Schaffer's paper is framed exclusively within the context of game usability. The definition of usability adopted by the author is based on that of Jakob Nielsen, however, the interpretation is questionable as no supporting evidence or other references are supplied. Despite the fact that no references are made to the wider debate around the concepts of playability, Schaffer does state that "games are about enjoyment rather than efficiency" (Schaffer, 2007). This assertion leads to the removal of two usability attributes, "efficiency" and "errors", from the original list of five put forward by Nielsen. This decision is questionable, even more so in the light of the comments which immediately follow, where the author states that, in his experience, usability is concerned primarily with the user interface, control systems, and level design (Schaffer, 2007). These are all areas in which efficiency, error prevention, and help would be expected to have significant influence.

These three areas of concern identified by Schaffer, user interface, controls, and level design constitute three of the five categories into which the final heuristics have been divided. The complete list is: General, GUI, Gameplay – General, Gameplay – Control Mapping, and

Gameplay – Level Design (Schaffer, 2007). The first point of interest is that Gameplay is conceived of as contributing to usability rather than existing as a distinct concept, as it does in the work of others such as Korhonen and Koivisto (2006). A further issue is that the organisation of the heuristic set seems somewhat ad hoc, this is perhaps due to the absence of theoretical grounding. Examples illustrating a lack of clarity include: an inconsistent level of abstraction addressed by each section, two sections titled "general", and references to a single concept, such as "goals", appearing in more than one separate section. There may well be justification for the manner in which the set has been grouped, unfortunately any such reasoning is absent from the paper (Schaffer, 2007).

The lack of academic method is also evident in the fact that the heuristics are presented simply as the result of personal experience. No background or context was provided about details of earlier iterations, if there were any, or of any qualitative or quantitative assessments that may have occurred. Such information would be very insightful as it is interesting to note that the work of Schaffer and of Pinelle et al. (2008a) are significantly different, although they share the same primary focus and overall aims. We can see that of Schaffer's 25 heuristics, ten are represented to varying degrees by just one in the work of Pinelle et al., a lack of theoretical grounding means it is impossible to understand the reasons for such a disparity.

Schaffer is of the opinion that heuristics are a valuable tool for the industry as they can be implemented easily, whether discretely or and as part of a wider evaluative process, and because they are cheap (Schaffer, 2007). It is therefore easy to understand the critique of Federoff (2002) and Desurvire's (2004) works as being both vague and hard to use in real-life development situations as they lack the requisite detail to address specific problems. However, both works are acknowledged a being suitable for use in the post-mortem stage (Schaffer, 2007). In order to understand the requirements of those working in the industry,

the context of use must be properly considered: day-to-day work requires specific issues to be addressed, whereas overall assessments can be guided by more general statements. As a result, Schaffer's heuristics are presented with clear, detailed examples and are accompanied by screenshots (Schaffer, 2007). They are neither vague nor overly reliant on descriptive text.

It is easy to comprehend how a lack of clarity or focus is an impediment to successfully utilising heuristics, however, those presented in this paper are, if anything, too detailed. For example, in the section addressing the Graphical User Interface the following heuristics are listed: a) "All relevant information should be displayed"; and b) "Don't display irrelevant information" (Schaffer, 2007). This is unnecessary, and potentially unwieldy, the two could be instead be combined into a single heuristic. Similarly, the first heuristic of the Gameplay category is separated into six discrete elements that range from the rules of the game to the visual representation of enemy units (Schaffer, 2007). Incorporating such diverse elements under a single umbrella term could lead to confusion or lack of focus, despite the intentions of the author.

Whilst the level of information in the examples is to be applauded, it may be more effective to include such examples in supporting information, whilst the summary is kept free of that level of detail. Such an approach would mean that the heuristics would be usable in both the design phase and in the post-production evaluations. Indeed, Schaffer explicitly states that his set is a work in progress and calls for further work in the area, even noting the potential inherent in synthesised lists (Schaffer, 2007). This issue is particularly evident when we consider the discrepancies between work that share both the same aims and the same focus, as highlighted above.

Although the paper suffers from a lack of academic rigour it is the product of practical experience in game development and, as such, is one of the few primary sources available that reveals the requirements and perspectives of the industry. It highlights the fact that

heuristics are seen as a valuable tool that can aid different phases of the game development process, from design to post-mortem. However, it is important to be aware that the utility value of heuristics is directly and significantly affected by the manner of their presentation and the quality of examples that accompany them. The paper ends with an active call for further work in the area and the synthesis of different ideas (Schaffer, 2007).

4.2.4: Desurvire and Wiberg (2009)

PLAY is the result of work by Desurvire and Wiberg to develop and build upon the earlier HEP heuristics (Desurvire et al., 2004) which were found to be useful only in specific circumstances (Desurvire and Wiberg, 2009). The authors state that the PLAY framework is intended to provide a generalised base for game design which can then be further modified according to the individual game under development. Similar to the work of Korhonen and Koivisto (2006) the heuristics are presented in distinct categories, or modules, that can be implemented independently of one another.

The title of the paper "Game Usability Heuristics (PLAY) For Evaluating and Designing Better Games: The Next Iteration", is suggesting that the exclusive focus is on the area of usability. However, it is interesting to note that usability is instead just one of three categories into which the heuristics have been divided (Desurvire and Wiberg, 2009). The implicit suggestion therefore, is that usability is an overarching concept which is informed by other issues, such as gameplay, however, this conceptual framework seems to become blurred as, within the body of the article, the authors refer to "Game Playability (PLAY)". The lack of a clearly defined conceptual framework is at odds with other research (Pinelle, 2008a; Korhonen and Koivisto, 2006; Korhonen et al., 2009) and may potentially affect the clarity of both the individual heuristics and their presentation.

The PLAY heuristics are the result of a synthesis of previous work, further academic research and contemporary practices within the games industry (Desurvire and Wiberg, 2009). Such an approach is of great benefit, combining as it does the theoretical principles of academic research and the practical results of industry experience. Unfortunately, the paper does not include any detailed discussion of the process, and no information is provided as to which areas were most strongly influenced by each of the different perspectives.

When discussing the method by which the PLAY framework was developed, the authors reveal that the heuristics are in fact derived from the study of three specific genres: Real-Time Strategy (RTS), Action Adventure, and First-Person Shooter (FPS). Similarly, the questionnaires used in the evaluation phase were genre-specific (Desurvire and Wiberg, 2009). This is seemingly at odds with the earlier assertion that PLAY is a set of general principles that can be applied irrespective of genre, delivery method or other considerations. The fact that only games belonging to specific genres were used as sources could potentially result in particular issues being either under-, or over-represented. In addition to undermining the claim for universality, the statement raises a number of questions that are not addressed in the paper, not least the justification for selecting these three genres and according to what definitions they conformed.

The authors missed a significant opportunity to explore the genre-specific data that was gathered when they developed the PLAY heuristics. This is especially surprising when we consider the statement that PLAY is intended to provide a general base for game design and which requires further modification with the individual game in mind (Desurvire and Wiberg, 2009). The discussion of any genre-specific information would have provided a useful starting point for such modifications.

A particular strength of the evaluative process is the requirement for participants to assess both high- and low-rated games. This approach is beneficial as it can capture both

positive and negative play experiences, thereby providing a wider range of data than the work of Pinelle et al. (2008a), as discussed previously.

An important issue highlighted by the study was the significance of difficulty and challenge in game design. Whilst such a finding conforms to the conceptual differentiation of games and utility software, it stresses the fact that games need to reduce challenge relating to usability whilst promoting challenge as part of gameplay (Desurvire and Wiberg, 2009). This distinction is worthy of note and is not always obvious.

A further key concept relating to games is that of immersion (Ermi and Mäyrä, 2005), when discussing this issue the authors note that it is important to create a gameworld that provides both context and motivation to players (Desurvire and Wiberg, 2009). Whilst this is not disputed, it seems unnecessary for those heuristics concerned with immersion to be divided into, and replicated within, two of the three modules. This division serves to make the set as a whole both unwieldy and potentially confusing. It is felt that the needs of those that utilise the PLAY framework would be better served if both heuristics addressing immersion were presented together. In general, the fact that PLAY is presented in such a way that each category can be considered as a distinct module makes the set easy to use. However, the lack of supporting information or examples is an obvious hindrance to the user, as seen in the example above where no reasoning is provided to explain the duplication of heuristics relating to immersion.

In summary, the finalised heuristic set is modular in format and is expected by the authors to form a foundation for game design which would be further enhanced with individual modifications on a case by case basis (Desurvire and Wiberg, 2009). The manner of presentation facilitates ease of use, but would be further improved with the provision of supporting materials and examples. The method by which the research was conducted is also lacking in detailed description, and did not address areas of potential significance such as

genre-specific issues. The study did, however, benefit from the balancing of both academic and industry sources which served to strengthen the heuristic set by utilising diverse sources of influence. The range of the data set was further enhanced by the decision to include both high- and low-ranked games in the evaluation phase.

4.3 Establish a Consolidated Set of Heuristics

Both Schaffer (2007) and Pinelle et al. (2008a) developed a set of heuristics concerned simply with the usability of video games, whereas Korhonen and Koivisto (2006) and Desurvire and Wiberg (2009) produced sets which sought address both usability and gameplay. However, the definitions of usability and gameplay employed by the respective works differ in scope, for instance issues of a technical nature have been excluded from the usability heuristics of Pinelle et al. (2008a). Similarly, while Korhonen and Koivisto (2006) conceive of both gameplay and usability being discrete factors, Schaffer's (2007) approach sees gameplay as a component of usability. It is therefore expected that the sets will not share the same areas of focus and that any similarly named categories or sub-categories will not be analogous.

For the purposes of this comparison each heuristic will be coded according to its name as labelled in the original research, with either "PIN", "SCH", "DES" or "KOR" attached as a prefix to that name. For example, heuristic GU7 from Korhonen and Koivisto's usability module will be referred to as KOR-GU7 and heuristic 7 from Pinelle et al. will be referred to as PIN-7. As the results of Schaffer's work lack any form of individual numbering, instead being grouped according to a range of sub-categories, the heuristics will be numbered from 1 to 25 in the order in which they are presented. "Minimise flashing" will therefore be coded as SCH-1. One stylistic change will be made to the presentation of Schaffer's finalised set in order to facilitate ease of comparison: the four types of element that are listed (Avatar,

Enemies, Obstacles and Power Ups) will be considered under the umbrella term of "game element" rather than having a separate heuristic for each. Having examined the supporting examples, it is felt that the problems and solutions are so similar that maintaining the separation provides no further insight or information.

Korhonen and Koivisto's (2006) work will be used as the base for the comparison, the primary reason being that it's manner of presentation facilitates easy use, even though it has one of the widest scopes of the reviewed sets. Additionally, the analysis of Schaffer's 2007 white paper suggests that the modular set is more likely to be able to accommodate the products of alternative approaches. The "Mobility" module will not be considered as it is platform-specific and does not, therefore, apply to the PC games that will be used as a data source in this research.

The sets are featured below, in tables 2 to 8, with full explanations being included in appendices 1 to 4:

PIN-1	Provide consistent responses to the user's actions
PIN-2	Allow users to customise video and audio settings, difficulty and game speed
PIN-3	Provide predictable and reasonable behaviour for computer controlled units
PIN-4	Provide unobstructed views that are appropriate for the user's current actions
PIN-5	Allow users to skip non-playable and frequently repeated content
PIN-6	Provide intuitive and customisable input mappings
PIN-7	Provide controls that are easy to manage, and that have an appropriate level of sensitivity and responsiveness
PIN-8	Provide users with information on the game status
PIN-9	Provide instructions, training and help
PIN-10	Provide visual representations that are easy to interpret and that minimise the need for micromanagement

Table 2. Usability Heuristics, Pinelle et al. (2008a)

KOR-GU1	Audio-visual representation supports the game
KOR-GU2	Screen layout is efficient and visually pleasing
KOR-GU3	Device UI and game UI are used for their own purposes
KOR-GU4	Indicators are visible
KOR-GU5	The player understands the terminology
KOR-GU6	Navigation is consistent, logical, and minimalist
KOR-GU7	Control keys are consistent and follow standard conventions
KOR-GU8	Game controls are convenient and flexible
KOR-GU9	The game gives feedback on the player's actions
KOR-GU10	The player cannot make irreversible errors
KOR-GU11	The player does not have to memorise things unnecessarily
KOR-GU12	The game contains help

Table 3. Game Usability Module of Korhonen and Koivisto (2006)

KOR-GP1	The game provides clear goals or supports player-created goals
KOR-GP2	The player sees the progress in the game and can compare the results
KOR-GP3	The players are rewarded and rewards are meaningful
KOR-GP4	The player is in control
KOR-GP5	Challenge, strategy and pace are in balance
KOR-GP6	The first-time experience is encouraging
KOR-GP7	The game story supports the gameplay and is meaningful
KOR-GP8	There are no repetitive or boring tasks
KOR-GP9	The players can express themselves
KOR-GP10	The game supports different playing styles
KOR-GP11	The game does not stagnate
KOR-GP12	The game is consistent
KOR-GP13	The game uses orthogonal unit differentiation
KOR-GP14	The player does not lose any hard-won possessions

Table 4. Gameplay Module of Korhonen and Koivisto (2006)

	General
SCH-1	Minimise flashing
SCH-2	Avoid large blocks of text
SCH-3	Don't rely on player's memory – Don't use abbreviations
SCH-4	Don't rely on player's memory – Don't require the player to count resources
SCH-5	Don't rely on player's memory – Players shouldn't have to memorise the level design
	Graphical User Interface
SCH-6	All relevant information should be displayed
SCH-7	Don't display irrelevant information
SCH-8	Critical information should stand out
SCH-9	Don't bury frequently used information
SCH-10	Menu item names should be intuitive and obvious
SCH-11	The player should know where they are on the mini-map, if there is one
	Gameplay - General
SCH-12	Players should understand and be able to identify - Goals
SCH-13	Players should understand and be able to identify – Failure conditions
SCH-14	Players should understand and be able to identify – Game elements
SCH-15	Give players the feeling that they can make a few mistakes – give some room for error
SCH-16	Players should feel in control, they need time and information to respond to threats and opportunities.
	Gameplay – Control Mapping
SCH-17	Use natural mappings
SCH-18	Adhere to industry standards
SCH-19	Users should be able to play mobile games with one hand
SCH-20	Make it hard to accidentally hit the wrong button – the more trouble it causes, the harder a button should be to hit
	Gameplay – Level Design
SCH-21	Don't make it easy for the players to get stuck or lost – there should be a sense of progress
SCH-22	Things the player needs to see should stand out
SCH-23	Objects in the game should look like they'll do what they do

SCH-24	The player shouldn't easily misinterpret things as power ups, enemies or obstacles
SCH-25	If there are tasks which you expect to be challenging, don't require players to complete them more than once

Table 5. Heuristics for Usability in Games, Schaffer (2007)

Category 1: Game Play	
A. Heuristic: Enduring Play	
DES- 1A1	The player finds the game fun, with no repetitive or boring tasks.
DES- 1A2	The players should not experience being penalized repetitively for the same failure.
DES- 1A3	The players should not lose any hard won possessions.
DES- 1A4	Gameplay is long and enduring and keeps the players' interest.
DES- 1A5	Any fatigue or boredom was minimized by varying activities and pacing during the game play.
B. Heuristic: Challenge, Strategy and Pace	
DES- 1B1	B1. Challenge, strategy and pace are in balance.
DES- 1B2	B2. The game is paced to apply pressure without frustrating the players. The difficulty level varies so the players experience greater challenges as they develop mastery.
DES- 1B3	B3. Easy to learn, harder to master.
DES- 1B4	B4. Challenges are positive game experiences, rather than negative experiences, resulting in wanting to play more, rather than quitting.
DES- 1B5	B5. AI is balanced with the players' play.
DES- 1B6	B6. The AI is tough enough that the players have to try different tactics against it.
C. Heuristic: Consistency in Game World	
DES- 1C1	C1. The game world reacts to the player and remembers their passage through it.
DES- 1C2	C2. Changes the player make in the game world are persistent and noticeable if they back-track to where they have been before.
D. Heuristic: Goals	
DES- 1D1	D1. The game goals are clear. The game provides clear goals, presents overriding goals early as well as short term goals throughout game play.
DES- 1D2	D2. The skills needed to attain goals are taught early enough to play or use later, or right before the new skill is needed.
DES- 1D3	D3. The game gives rewards that immerse the player more deeply in the game by increasing their capabilities, capacity or for example, expanding their ability to customize.
E. Heuristic: Variety of Players and Game Styles	
DES- 1E1	E1. The game supports a variety of game styles.

DES- 1E2	E2. The game is balanced with multiple ways to win.
DES- 1E3	E3. The first ten minutes of play and player actions are painfully obvious and should result in immediate and positive feedback for all types of players.
DES- 1E4	E4. The game had different AI settings so that it was challenging to all levels of players, whether novice or expert players.
F. Heuristic: Players Perception of Control	
DES- 1F1	F1. Players feel in control.
DES- 1F2	F2. The players have a sense of control and influence onto the game world.

Table 6. PLAY Heuristics – Category 1, Desurvire and Wiberg (2009)

Category 2: Coolness/Entertainment/Humor/Emotional Immersion	
A. Heuristic: Emotional Connection	
DES- 2A1	A1. There is an emotional connection between the player and the game world as well as with their "avatar."
B. Heuristic: Coolness/Entertainment	
DES- 2B1	B1. The game offers something different in terms of attracting and retaining interest.
C. Heuristic: Humor	
DES- 2C1	C1. The game uses humor well.
D. Heuristic: Immersion	
DES- 2D1	D1. The game utilizes visceral, audio and visual content to further players' immersion.

Table 7. PLAY Heuristics – Category 2, Desurvire and Wiberg (2009)

Category 3: Usability & Game Mechanics	
A. Heuristic: Documentation/Tutorial	
DES- 3A1	A1. Player does not need to read the manual or documentation to play.
DES- 3A2	A2. Player does not need to access the tutorial in order to play.
B. Heuristic: Status and Score	
DES- 3B1	B1. Game controls are consistent within the game and follow standard conventions.
DES- 3B2	B2. Status score Indicators are seamless, obvious, available and do not interfere with game play.
DES- 3B3	B3. Controls are intuitive, and mapped in a natural way; they are customizable and default to industry standard settings.
DES- 3B4	B4. Consistency shortens the learning curve by following the trends set by the gaming industry to meet users' expectations. If no industry standard exists, perform usability/playability research to ascertain the best mapping for the majority of intended players.

C. Heuristic: Game Provides Feedback	
DES- 3C1	C1. Game provides feedback and reacts in a consistent, immediate, challenging and exciting way to the players' actions.
DES- 3C2	C2. Provide appropriate audio/visual/visceral feedback (music, sound effects, controller vibration).
D. Heuristic: Terminology	
DES- 3D1	D1. The game goals are clear. The game provides clear goals, presents overriding goals early as well as short term goals throughout game play.
DES- 3D2	D2. The skills needed to attain goals are taught early enough to play or use later, or right before the new skill is needed.
DES- 3D3	D3. The game gives rewards that immerse the player more deeply in the game by increasing their capabilities, capacity or, for example, expanding their ability to customize.
E. Heuristic: Burden On Player	
DES- 3E1	E1. The game does not put an unnecessary burden on the player.
DES- 3E2	E2. Player is given controls that are basic enough to learn quickly, yet expandable for advanced options for advanced players.
F. Heuristic: Screen Layout	
DES- 3F1	F1. Screen layout is efficient, integrated, and visually pleasing.
DES- 3F2	F2. The player experiences the user interface as consistent (in controller, color, typographic, dialogue and user interface design).
DES- 3F3	F3. The players experience the user interface/HUD as a part of the game.
DES- 3F4	F4. Art is recognizable to the player and speaks to its function.
G. Heuristic: Navigation	
DES- 3G1	G1. Navigation is consistent, logical and minimalist.
H. Heuristic: Error Prevention	
DES- 3H1	H1. Player error is avoided.
DES- 3H2	H2. Player interruption is supported, so that players can easily turn the game on and off and be able to save the games in different states.
DES- 3H3	H3. Upon turning on the game, the player has enough information to begin play.
DES- 3H4	H4. Players should be given context sensitive help while playing so that they are not stuck and need to rely on a manual for help.
DES- 3H5	H5. All levels of players are able to play and get involved quickly and easily with tutorials, and/or progressive or adjustable difficulty levels.
I. Heuristic: Game Story Immersion	
DES- 3I1	I1. Game story encourages immersion (If game has story component).

Table 8. PLAY Heuristics – Category 3, Desurvire and Wiberg (2009)

4.3.1 Results of the Comparison

KOR-GU1: Audio-visual representation supports the game

- PIN-4: The narrow focus of PIN-4 on the player's viewpoint within the games means that it reflects just one aspect of the range of issues encompassed by KOR-GU1.
- SCH-14: Once again this heuristic deals specifically with a particular type of Audio-Visual representation, in this case the in-game elements represented onscreen, rather than the wider scope of KOR-GU1.
- DES-2D1: Although dealing expressly with the concept of immersion, the idea is consistent with the wider concerns of KOR-GU1.
- DES-3F3: The lack of supporting material or other examples mean that this particular heuristic is difficult to evaluate. The suggestion seems to be that the User Interface should support the game experience rather than clashing with gameplay, potentially breaking an immersive state.

  Verdict: Keep KOR-GU1

KOR-GU2: Screen layout is efficient and visually pleasing

- PIN-10: Contains the recommendation that all visual representations are designed in such a way that minimises the cognitive load of the player. The scope is wider than just screen layout, also including the aspect of orthogonal differentiation.
- SCH-1 and SCH-2: Both these heuristics are concerned with the effectiveness of techniques used to present information visually. They are useful to highlight specific examples of both good and bad presentation, but do not justify individual entries in the finalised set.
- DES-3F1: Almost word-for-word the same as KOR-GU2, the lack of supporting material means KOR-GU2 is preferred.

- DES-3F2: Consistency in presentation contributes to both efficiency and a positive aesthetic experience, therefore KOR-GU2 is superior.

  Verdict: Keep PIN-10, whilst detailing specific examples (cognitive load, menus, scores, etc.)

KOR-GU3: Device UI and game UI are used for their own purposes

- PIN- = no match.
- SCH- = no match.
- DES- = no match.
- The lack of equivalents in other heuristic sets suggests that this heuristic should not be included in the core set. The primary concern of KOR-GU3 is to support immersion on mobile devices by means of maintaining a distinct arena in which the game is played, this has been sufficiently addressed elsewhere, for example in KOR-GU1 and KOR-GU2.

  Verdict: Disregard

KOR-GU4: Indicators are visible

- PIN-8: Although the wording of this heuristic is very different to that of KOR-GU4, the information provided in each of the accompanying descriptions reveals a shared focus.
- SCH-4, SCH-6, SCH-7 and SCH-8: All four of these heuristics are specific examples of the general concept embodied by KOR-GU4 and PIN-8. They do not, therefore, justify individual entries.
- DES-3B2: Although the title of this heuristic means it could easily be classified as relating to screen layout, KOR-GU2, the reference to status indicators means it is a

better home under the umbrella of KOR-GU4 and PIN-8. It is important to note that the lack of further description or of any illustrative examples results in a lack of clarity and, therefore, an increased degree of subjectivity.

- The core issue underlying all of the heuristics listed above is perhaps equivalent to Nielsen's concept of "system status". With that in mind, it is unsurprising to find such similar heuristics across a range of different works.

  Verdict: Keep PIN-8 as the title is more descriptive, and thus more useful to users.

KOR-GU5: The player understands the terminology

- PIN- = no match.
- SCH-3: The use of abbreviations can be confusing, particularly for those players that have no previous experience of the game, as the number of abbreviated terms grows it becomes harder to understand.
- SCH-10: Although this heuristic specifically addresses menus, it reflects the wider issue and can be considered an example of how to address terminology and naming conventions.
- DES-?: The sub-section titled "terminology" actually includes all three heuristics previously listed in the "goals" sub-section. A later version of the PLAY framework includes a new heuristic which is a direct match.
- Considering the influence of Nielsen, it is very surprising that this issue is so lacking in direct equivalents from works other than Korhonen and Koivisto, especially for those works whose specific focus is usability in games. The fact that the PLAY framework was later amended to reflect the concept goes some way to addressing the problem.

  Verdict: Keep KOR-GU5.

KOR-GU6: Navigation is consistent, logical, and minimalist

- PIN-7: This deals expressly with forms of navigating within the gameworld and implies that control systems be both logical and consistent with users' experience by mirroring the real world.
- SCH-9 and SCH-11: Contrary to the heuristic PIN-7, the two listed here are concerned with navigation within the UI rather than the gameworld itself, and are, therefore, complementary.
- DES-3G1: Word for word the same, as before the lack of supporting information means KOR-GU6 is preferred.

  Verdict: Keep KOR-GU6 due to greater scope and the use of supporting information.

KOR-GU7: Control keys are consistent and follow standard conventions

- PIN-6: This is directly equivalent to KOR-GU7, referring as it does to industry conventions, where they exist. However, PIN-6 also includes the concept of customisation mentioned in a separate heuristic KOR-GU8.
- SCH-17, SCH-18 and SCH-20: All three of these items relate directly to the controls' ease of use and are therefore contained within the wider scope of PIN-6.
- DES-3B1, DES-3B3 and DES-3B4: Similar to Schaffer's work, all three of these heuristics can be combined in order to match PIN-6. It is interesting to note that Desurvire and Wiberg include reference to industry standards in each of the separate heuristics listed above with no clear rationale provided as to why. Additionally, the wording of DES-3B1 is virtually identical to KOR-GU7.

  Verdict: Keep PIN-6

KOR-GU8: Game controls are convenient and flexible

- PIN-6: See KOR-GU7
- SCH- 17, SCH-18 and SCH-20: See KOR-GU7
- DES-3E2: Direct match

  Verdict: Keep PIN-6. The need to incorporate KOR-GU7 and KOR-GU8 is unsurprising, Paavilainen (2010) notes the overlap and suggests that they would benefit from consolidation.

KOR-GU9: The game gives feedback on the player's actions

- PIN-: no significant match, although PIN-7 and PIN-1 both hint at this issue.
- SCH-: no match
- DES-3C1 and DES-3C2: There is no need to separate these two heuristics into distinct items, however, it may be useful to stress the importance of appropriate feedback mechanisms.

  Verdict: Keep KOR-GU9

KOR-GU10: The player cannot make irreversible errors

- PIN-: no match.
- SCH-: no match.
- DES-3H1: The closest fit, although many games require players to make errors in order to learn. Therefore, KOR-GU10 is preferable, dealing as it does with mistakes which cause the game to reach a dead end rather than serving as a learning experience.
- This issue is difficult to address due to the nature of games and the ways in which they differ from other software applications. The explanatory information provided by

Korhonen and Koivisto reflects this concern but is seems that the issue can be conceived in terms of challenge, KOR-GP5, with the example of irreversible errors being referenced in the supporting material.

Verdict: incorporate as part of KOR-GP5.

KOR-GU11: The player does not have to memorise things unnecessarily

- As the description highlights, the fact that memory can form part of a game's challenge means this issue applies to all aspects of a user's interaction with the game, not just gameplay. With that in mind, the "unnecessary" memorisation can be considered part of the burden of cognitive load, therefore, this heuristic is addressed by the two concepts inherent in PIN-10.

  Verdict: Incorporate into PIN-10

KOR-GU12: The game contains help

- PIN-9: A direct match.
- SCH-: no match.
- DES-3A1 and DES-3A2: Although both these heuristics are presented in such a way that states the game should be playable without recourse to the documentation or tutorials, the implicit assumption is that such items exist.
- DES-1D2: The practical function of teaching in-game skills in a timely manner is akin to that of a tutorial despite the fact that it is not labelled as such.
- DES-3H3, DES-3H4 and DES-3H5: All three of these items further specify different aspects of help that are provided to the player, such differentiation is detailed in the supplementary information of PIN-9 and KOR-GU12 and is, therefore, unnecessary.

- Once again, Nielsen's Usability heuristics seem to be a direct inspiration for this group, additionally, the inclusion of training and instructions in PIN-9 serves to focus the reader's attention on the different aspects of help that a game can provide. It is an interesting point to note that the only set in the comparison which did not consider the issue of help, in any way, was that which originated within the games industry.

  Verdict: Keep PIN-9

What we can see from this comparative analysis is that, despite the explicit focus of both sets PIN- and SCH- being usability, neither were matched to more than half the items in the usability module of set KOR-. This highlights the problems inherent in the adoption of idiosyncratic definitions of usability, as highlighted in the previous chapter. Furthermore, it demonstrates the value of a holistic approach to the evaluation of video games. A summary of the matches to Korhonen and Koivisto's usability module is presented below in table 9:

	Set PIN-	Set SCH-	Set DES-
KOR-GU1	Y – 1 match	Y – 2 matches	Y – 2 matches
KOR-GU2	Y – 1 match	Y – 2 matches	Y – 2 matches
KOR-GU3	N – 0 matches	N – 0 matches	N – 0 matches
KOR-GU4	Y – 1 match	Y – 4 matches	Y – 1 match
KOR-GU5	N – 0 matches	Y – 2 matches	N – 0 matches
KOR-GU6	Y – 1 match	Y – 2 matches	Y – 1 match
KOR-GU7	Y – 1 match	Y – 3 matches	Y – 3 matches
KOR-GU8	N – 0 matches	N – 0 matches	Y – 1 match
KOR-GU9	N – 0 matches	N – 0 matches	Y – 2 matches
KOR-GU10	N – 0 matches	N – 0 matches	Y – 1 match
KOR-GU11	N – 0 matches	N – 0 matches	N – 0 matches
KOR-GU12	Y – 1 match	N – 0 matches	Y – 6 matches

Table 9 – Summary of matches to Game Usability Module

KOR-GP1: The game provides clear goals or supports player-created goals

- PIN-: no match.
- SCH-12: A direct match with the principles of KOR-GP1, although the reference to player-created goals and discussion of long- and short-term goals mean that KOR-GP1 is superior.
- DES-1D1: As above.

  Verdict: Keep KOR-GP1

KOR-GP2: The player sees the progress in the game and can compare the results

- PIN-: no match.
- SCH-21: There is a clear match between aspects of this heuristic and KOR-GP2, in that both refer to the need for a clear sense of progress within the game. It can be argued that a lack of progression, players feeling lost for example, would lead to the game stagnating, KOR-GP11. SCH-21, therefore, has a greater scope than either KOR-GP2 or KOR-GP11.
- DES-1C1: It is something of a stretch to say that this and KOR-GP2 are directly equivalent to one another, especially as the lack of explanation makes it hard to form a definitive judgement. The "passage" of a player through the game can be read as simply being a physical record of movement or action, however, it can be interpreted in the context of Korhonen and Koivisto's "implicit" indicators.
- The description of KOR-GP2 provided as part of the supporting material makes reference to heuristics KOR-GU4 and KOR-GU9, there is further crossover of scope with KOR-GP11. With this is mind, it seems viable to disregard KOR-GP2 in favour of SCH-21, although the spirit of simplicity in the title should be retained.

  Verdict: Keep SCH-21, with revised wording.

KOR-GP3: The players are rewarded and rewards are meaningful

- PIN-: no match.
- SCH-: no match.
- DES-1D3: That rewards are framed exclusively within the context of immersive effect means that DES-1D3 is narrower in scope than KOR-GP3 and can, therefore, be incorporated as part of the latter heuristic.
- Similar to set DES-, set KOR- positions rewards both as the product of in-game progress and the facilitator of further progress. The lack of matches to Pinelle et al. and Schaffer are likely due to their focus solely on usability issues.

  Verdict: Keep KOR-GP3

KOR-GP4: The player is in control

- PIN-: no match.
- SCH-16: Despite the fact that the accompanying explanation provides fairly specific examples of how the feeling of control can be achieved rather than addressing the wider issue, the general principle is the same.
- DES-1F1 and DES-1F2: There is no obvious distinction between these two heuristics and as such they can be combined. The concept they embody is directly equivalent to KOR-GP4, but the unsupported presentation means that KOR-GP4 is preferred.

  Verdict: Keep KOR-GP4

KOR-GP5: Challenge, strategy and pace are in balance

- PIN-2: The reference to difficulty and pace directly match the over-riding ideals of KOR-GP5, however, there are additional references to Audio Visual settings which may benefit from being separated.

- PIN-5: Directly relates to the pace of the game and the facilitation of a flow state, as detailed by Korhonen and Koivisto in the supporting materials.
- SCH-15: The ability to make errors and to learn from them contributes toward the degree of challenge afforded by the game, and the potential to develop new strategies as a reaction. Therefore, KOR-GP5 is wider in scope.
- DES-1A4 and DES-1A5: Once again, the need to separate these two heuristics is unclear. The successful realisation of balanced challenge, strategy and pace serves to create enduring and interesting play, therefore, KOR-GP5 is preferred.
- DES-1B1: Word-for-word the same, KOR-GP5 is preferred due to the manner of presentation.
- DES-1B2, DES-1B3, DES-1B4, DES-1B6 and DES-1E2: Each of these items are specific examples of how to achieve balanced pace, challenge and strategy.
- DES-1B5 and DES-1E4: These two heuristics seem to embody the same principle, once again the lack of examples or explanation mean that the authors' intentions are unclear. Once more, they are specific examples of how the game should achieve balance.

  Verdict: Keep KOR-GP5

KOR-GP6: The first-time experience is encouraging

- PIN-: no match.
- SCH-: no match.
- DES-1E3: This heuristic views the first 10 minutes of the game experience as being critical to the player's experience, whereas Korhonen and Koivisto consider the first five minutes as critical. It may be that the difference is the result of Korhonen and Koivisto's focus on mobile games, where the F2P business model has come to

dominate. Despite the differing period stated by the two papers, DES-1E3 does mirror the concept of learnability discussed in the supporting material of KOR-GP6.

- DES-2B1: A game's unique selling point can contribute greatly to expectations and therefore, to initial experience.

  Verdict: Keep KOR-GP6

KOR-GP7: The game story supports the gameplay and is meaningful

- PIN- = no match.
- SCH- = no match
- DES-2A1: The most pressing question is that of how an "emotional connection" is created between the player and the game. Unfortunately, the lack of further detail means that it remains a vaguely-defined concept, but the primary mechanism would most likely be via the game's narrative.
- DES-3I1: It could be argued that an immersive story contributes to a positive first-time experience KOR-GP6, however, the more significant effect is in facilitating an extended play experience. Therefore, DES-3I1 falls under the umbrella of KOR-GP7.

  Verdict: Keep KOR-GP7

KOR-GP8: There are no repetitive or boring tasks

- PIN- = no match.
- SCH-25: Although not directly equivalent, KOR-GP8 being wider in scope, SCH-25 frames the heuristic in such a way that failure to address the issue could lead to repetitive and frustrating gameplay.
- DES-1A1: Virtually word-for-word the same.

- DES-1A2: This item is difficult to fully understand without examples or further explanation, but the stress on repeated penalisation suggests a similarity to SCH-25.
- Once again, the particular business model adopted by the game developers mean that the potential universality of this heuristic is debatable. However, it must be remembered that heuristics are guidelines and can be violated if a design choice requires it.

  Verdict: Keep KOR-GP8

KOR-GP9: The players can express themselves

- PIN-: no match.
- SCH-: no match.
- DES-: no match.
- The rationale behind providing a means by which players can express themselves is that it allows the players to identify with the game, thereby increasing feelings of ownership and connection. The information supporting KOR-GP9 discusses not just the customisation of avatars but other behaviours such as modding. It is surprising that there are matches with the other heuristic sets, but this disparity may be accounted for by the similarity between KOR-GP9 and KOR-GP10 as both are concerned with supporting the needs and behaviours of diverse players.

  Verdict: combine with KOR-GP10

KOR-GP10: The game supports different playing styles

- PIN-2: Whilst there is no obvious parallel between playing styles and customisable Audio-Visual settings, the fact is that both KOR-GP10 and PIN-2 cater to the needs of individual users and, therefore, there is a degree of overlap.

- SCH-: no match.
- DES-1E1: Word-for-word the same.

  Verdict: combine with KOR-GP9

KOR-GP11: The game does not stagnate

- PIN- = no match.
- SCH-21: A direct match.
- DES-: no match.
- It is surprising that this issue is so fleetingly addressed in the chosen heuristic sets. It could be conceived of as resulting from a failure to successfully balance pace and challenge KOR-GP5. However, it is more directly related to the way in which a player progresses through the game.

  Verdict: Keep SCH-21, see KOR-GP2.

KOR-GP12: The game is consistent

- PIN-1: A direct match.
- PIN-3: The concept of "predictable and reasonable" AI actions contribute to, and are a product of, a consistent gameworld, as are reliable and logical player actions.
- SCH-23: This heuristic mirrors the concerns of KOR-GP12 in that consistency between the gameworld and the real world is maintained. I.e., that the game can use a visual code derived from real-world knowledge.
- DES-1C2: The rationale behind this heuristic is that the gameworld continues to show evidence of player's actions for the duration of its existence.

  Verdict: Keep KOR-GP12

KOR-GP13: The game uses orthogonal unit differentiation

- PIN-10: KOR-GP13 represents aspects that are present within the wider scope of PIN-10, in that it refers to the need for the representations of game elements to be easily interpretable.
- SCH-22 and SCH-24: There is no need for these two heuristics to exist as distinct items, they simply address the same issue on detailed and abstracted terms. KOR-GP13 is more succinct, whilst at the same time covering a wider range of issues.
- DES-3F4: For the purposes of this comparison it is assumed that "art" refers to the in-game visual representations, therefore this is a direct match.

  Verdict: Keep PIN-10, whilst highlighting the example of orthogonal unit differentiation, amend wording to make the heuristic more easily understandable.

KOR-GP14: The player does not lose any hard-won possessions

- PIN-: no match.
- SCH-13: Elements of this heuristic are consistent with KOR-GP14 as improperly communicated failure conditions could result in a loss of hard-won possessions. The interpretation of "possessions" could potentially include the time invested in a level or task.
- DES-1A3: Word-for-word the same.
- DES-3H2: Although DES-3H2 is not obviously equivalent, it can be argued that supporting player interruption, by allowing regular save points for example, limits the potential for "hard-won" possessions to be irretrievably lost. Furthermore, the idea "hard-won possessions" can reasonably be extended to include in-game progress. This issue is especially relevant for multi-function devices such as PCs and Smartphones.

Verdict: Keep KOR-GP14 with amended wording to reflect the importance of save points.

As found when matching items to the usability section of set KOR-, there is a significant disparity between the interpretations of usability and gameplay employed by the selected works. This is demonstrated by the fact that ten of Schaffer's (2007) usability heuristics, and six from Pinelle et al. (2008a), were matched to the gameplay section of set KOR-. Furthermore, multiple heuristics from sets PIN-, SCH-, and DES- can be matched to individual heuristics in set KOR-. This suggests heuristics of higher abstraction level are more useful as they encompass a wider range of issues, making them easier to use.A summary of the matches to Korhonen and Koivisto's gameplay module is presented below in table 10:

	Set PIN-	Set SCH-	Set DES-
KOR-GP1	N – 0 matches	Y – 1 match	Y – 1 match
KOR-GP2	N – 0 matches	Y – 1 match	Y – 1 match
KOR-GP3	N – 0 matches	N – 0 matches	Y – 1 match
KOR-GP4	N – 0 matches	Y – 1 match	Y – 2 matches
KOR-GP5	Y – 2 matches	Y – 1 match	Y – 10 matches
KOR-GP6	N – 0 matches	N – 0 matches	Y – 2 matches
KOR-GP7	N – 0 matches	N – 0 matches	Y – 2 matches
KOR-GP8	N – 0 matches	Y – 1 match	Y – 2 matches
KOR-GP9	N – 0 matches	N – 0 matches	N – 0 matches
KOR-GP10	Y – 1 match	N – 0 matches	Y – 1 match
KOR-GP11	N – 0 matches	Y – 1 match	N – 0 matches
KOR-GP12	Y – 2 matches	Y – 1 match	Y – 1 match
KOR-GP13	Y – 1 match	Y – 2 matches	Y – 1 match
KOR-GP14	N – 0 matches	Y – 1 match	Y – 2 matches

Table 10 – Summary of matches to Gameplay Module

Unmatched Heuristics:

Set KOR-:

KOR-GU3, KOR-GU11 and KOR-GP9 (as discussed above).

Set PIN-:

No unmatched heuristics

Set SCH-:

SCH-5: Don't rely on player's memory – Players shouldn't have to memorise the level design.

- Although this heuristic is part of the general principle of minimising cognitive load and unnecessary reliance on player memory, the specific example of level design seems somewhat out of place. This is further compounded by the supporting information in which the author states that memorising a sequence of actions is often part of a game's challenge.

  Verdict: Disregard

SCH-19: Users should be able to play mobile games with one hand.

- Relates specifically to mobile or hand-held devices, not relevant for PC games.

  Verdict: Disregard

Set DES-:

DES-2C1: The game uses humor well.

- Humour is a quality which is entirely subjective, dependent on both the user and context, therefore the principle of using humour "well" is entirely meaningless, in this or any other situation. Additionally, the implicit suggestion is that humour should be present in all games, an idea that is certainly open to debate. Once more, the lack of supporting information means that we are unable to understand the reasoning behind this heuristic, or the conditions for successful implementation.

  Verdict: Disregard

DES-3E1: The game does not put an unnecessary burden on the player.

- This heuristic is yet another where the absence of any explanatory information means it is hard to interpret with any degree of certainty. There are many potential burdens which could be placed on a player, from financial to emotional and many other qualities besides. Most likely this relates to the burden of memory and cognitive load, and is therefore adequately covered by PIN-10.

  Verdict: Disregard.

It was decided that in order to aid clarity the finalised universal heuristics would require their own set of codes, rather than utilising any of the individual codes from the works included in the comparison. The heuristics were grouped similarly to those of Korhonen and Koivisto (2006) as this was the set used as the basis of the comparison. The distinct sections are usability, with the prefix U, and gameplay, with the prefix GP with each individual heuristic being assigned an ordinal based on its position within the relevant section. The finalised universal heuristic set is presented below, in tables 11 and 12:

Universal Heuristics – Usability	
Code	Heuristic
U1	Audio-visual representation supports the gameplay.
U2	Visual representations should be easy to interpret and minimise micromanagement.
U3	Provide users with information on game status.
U4	The player understands the terminology.
U5	Navigation is consistent, logical and minimalist.
U6	Provide intuitive and customisable input mappings.
U7	The game gives feedback on the player's actions.
U8	Provide instructions, training and help.

Table 11. Finalised universal heuristics, usability section

Universal Heuristics – Gameplay	
Code	Heuristic
GP1	The game provides clear goals or supports player-created goals.
GP2	The player sees progress in the game.
GP3	The player is rewarded and the rewards are meaningful.
GP4	The player is in control.
GP5	Challenge, strategy and pace are in balance.
GP6	The first-time experience is encouraging.
GP7	The game story supports the gameplay and is meaningful.
GP8	There are no repetitive or boring tasks.
GP9	The game supports different playing styles.
GP10	The game is consistent.
GP11	The player does not lose any hard-won possessions and can save regularly.

Table 12. Finalised universal heuristics, gameplay section

In order to provide a quick visual reference, a diagram of the results of the comparison is provided below, in figures 1 and 2:

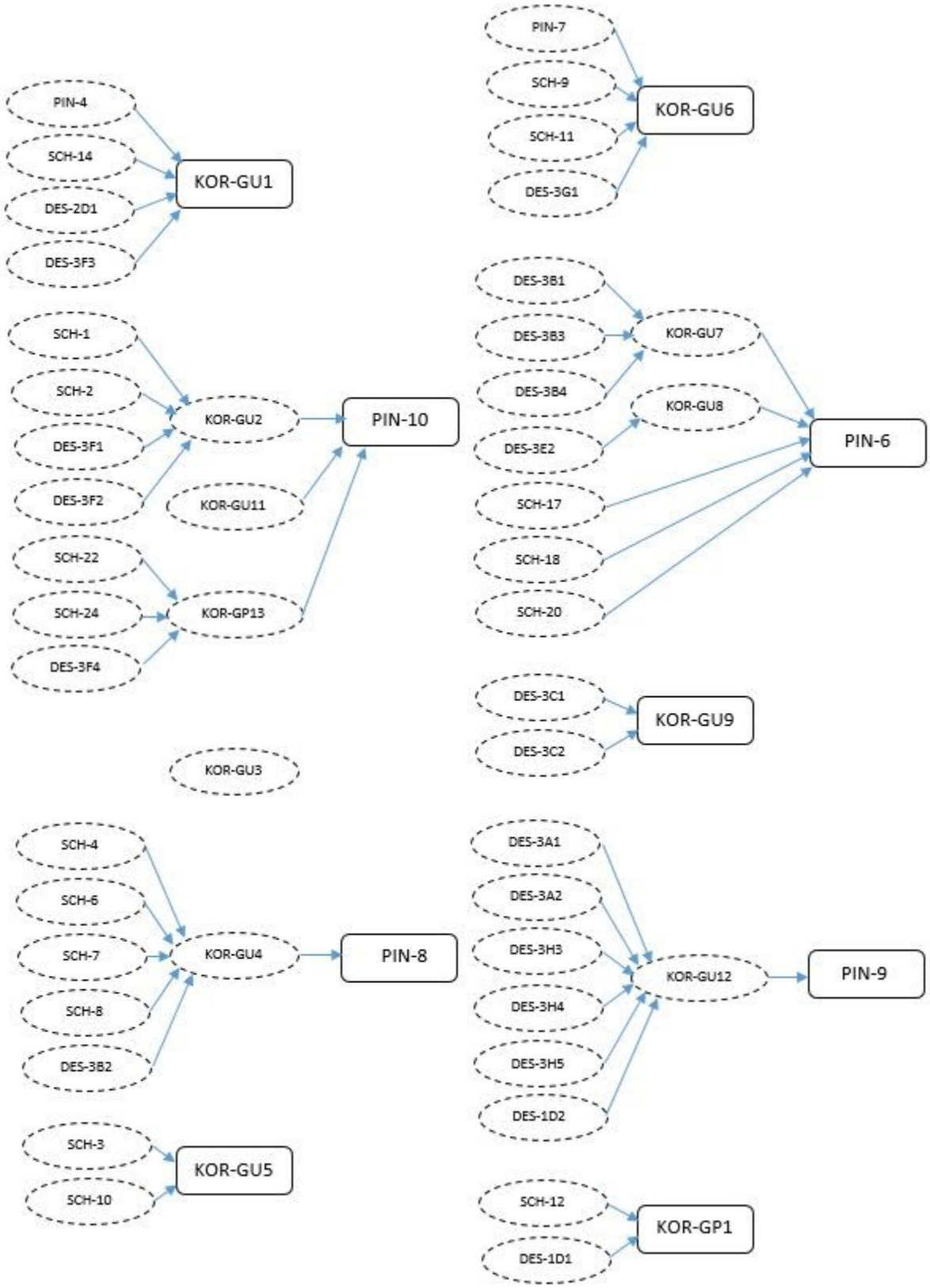


Figure 1. Heuristic Matching Diagram part 1

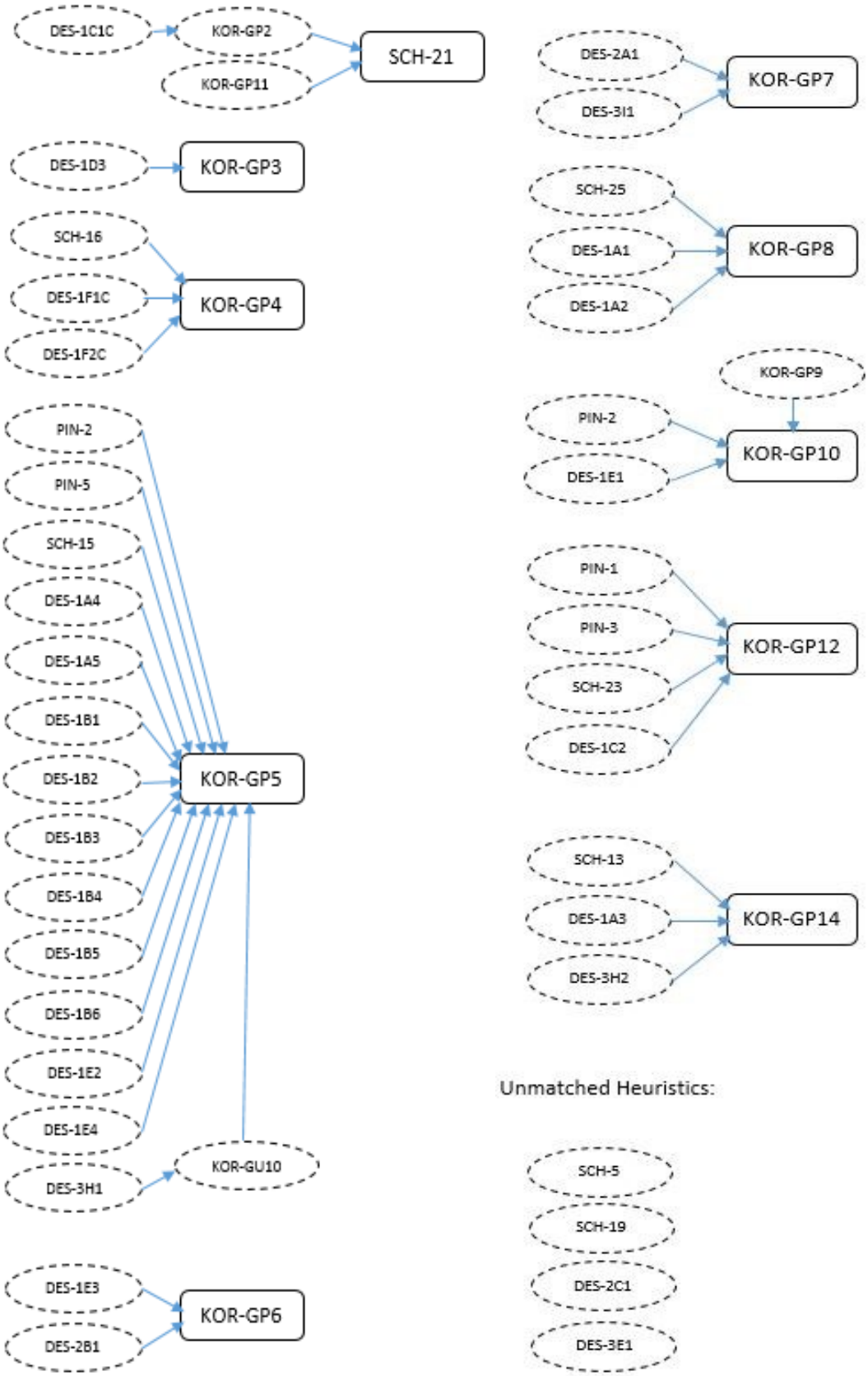


Figure 2. Heuristic Matching Diagram part 2

5. Stage 2: Genre-Specific Heuristics for Real-Time Strategy Games

As Pinelle et al. (2008b) have shown, different genres are subject to different types of problems, and that as a result they require specific heuristics that address their particular issues. This need will be addressed by the second stage of the research which will extract significant issues, pertaining to the genre of RTS games, from online video game reviews. This will be achieved by applying open and axial coding to the selected review texts. It was decided that in order to achieve the most robust results possible, a range of websites would be utilised as sources. Utilising several sites would minimise the potential for the sample to be skewed by extreme opinion, stylistic issues or potential bias of any individual site or author. Increasing the breadth of the data source has the added benefit of increasing the number of games that could be considered for use in the study. It was felt that utilising five distinct websites would provide sufficient diversity in the data sample, whilst at the same time remaining a manageable workload.

The primary metric used to select potential websites was popularity, as revealed by levels of web traffic for the individual sites themselves. A list of the 15 top-rated video game websites was obtained from eBizMBA.com, a site which ranks webpages based on an aggregated score from three different sources[1]. Several sites on the list did not feature game reviews as part of their content, and several of those that did were found to have limited archives. Of the original 15 sites on the list, only three were found to be suitable data sources: IGN.com, gamespot.com and PCGamer.com.

[1] http://www.ebizmba.com/articles/video-game-websites

Additional websites were researched and, in order to ensure the presence of usable data, only those that were dedicated to PC games were considered. Rockpapershotgun.com was selected as analytics showed it had high levels of web traffic (similarweb, 2016) in addition to focussing solely on the PC market. The final site chosen as data source, gamewatcher.com, had significantly lower levels of traffic than the other four (similarweb, 2016), but was included due to its relatively long online presence. The fact that it has been in existence for almost 15 years[2] is indicative of both a high level of quality and of enduring popularity. Furthermore, gamewatcher.com holds a significant archive of digital game reviews whilst at the same time sharing the characteristics of the other chosen sites.

The result of the analysis will then be compared to the first iteration in order to ascertain whether or not issues have already been addressed. Those issues that are not covered by the universal principles will therefore be considered as being characteristic of the RTS genre and will be converted into additional heuristics. This two-part list will constitute the second, and final, iteration, thereby answering research question 2.

5.1 Method: Discourse Analysis

Traditional Discourse Analysis has sought to arrange types of discourse along either hierarchical lines, with modality at the top and genre/register at the bottom, or to situate them on a spectrum. This serves to underline the fact that, whatever approach is adopted, classification allows the researcher to identify and understand the particular idiosyncrasies of any given type of discourse. Without classification effective analysis becomes almost impossible. As a reaction to the newly-emergent technologies of the latter half of the 20th Century, discourse analysts were concerned with the form and function of Computer

[2] http://www.gamewatcher.com/pages/advertising

Mediated Communication, and how it related to the existing modalities of speech and writing. This proved to be problematic due to the range of genres present (Herring, 2007).

5.1.1 Computer Mediated Discourse Analysis

Computer Mediated Communication (CMC), as defined by Herring (2007), consists of almost exclusively text-based interactions between humans, via networked computers or mobile devices. It is not limited by any specific textual functionality or characteristic, such as one-to-one messaging or real-time exchanges (Herring, 2007). Such a wealth of sources naturally leads to attempts to categorise in order to render the data usable. The needs of those analysing online language use, known as Computer Mediated Discourse and hereafter referred to as CMD, are, therefore, no different to those of traditional discourse analysts. Indeed, they may even be more acute due to the rate of technological change and the novel opportunities afforded to both users and producers (Herring, 2007). As such, Herring proposes a Faceted Classification Scheme, intended for use in linguistic analysis, particularly in Discourse Analysis, which can be adapted to describe both existing and emergent forms (Herring, 2007) and is a theoretical relative of Hymes' etic grid (Hymes in Herring, 2007).

The Faceted Classification Scheme derives from the perspective that CMD is, at the most basic of levels, affected by two primary considerations: the technological medium, or "mode", and the social, or "situational". The degree of influence each of these exert, and the particular form, is dependent on context and therefore varies between any given examples. It is stressed that technological factors are simply one type of potential influence and that the degree of influence is variable, thus distancing the scheme from the perspective of technological determinism (Herring, 2007). In order to apply Herring's classification scheme, the researcher appraises the sample text in light of the given categories, assigning labels where relevant. The researcher makes use of both information contained within the data, and

of any further contextual knowledge that they may possess. There is no obligation to assign a minimum or maximum number of facets to the text.

For the purposes of this study, the Faceted Classification Scheme will be used to categorise online game reviews, thereby highlighting factors which may influence their content and, as such, better inform the analysis. Such factors may, for example, include economic or cultural biases which, if present, can be fully understood through the lens of Foucauldian Critical Discourse Analysis. In addition, the consistency and, therefore, the inherent comparability of selected data sources will be ensured by applying the Faceted Classification scheme to all potential sources.

Online digital game reviews come in a variety of forms: from customer reviews, through amateur blogs to professionally published material. In order to ensure consistency and comparability this research will only consider game reviews of the latter category rather than incorporating material from a range of different textual types. Choosing material published on large, dedicated sites, produced by professional or semi-professional writers has a number of advantages, most significantly: the requirement for writers to be consistent in style and content, the large number of archived reviews that can be accessed, and the need to appear to be unbiased.

The analysis in section 5.2 will use Herring's classification scheme as a means of both ensuring comparability between sources and of understanding any issues that may affect the interpretation of selected data. This is consistent with the limitations of the scheme itself and the resulting recommendation for "selective classification" (Herring, 2007).

5.1.2 Open and Axial Coding

The coding procedure that is employed as part of the Constant Comparative Method, itself constituting a fundamental aspect of the Grounded Theory method, consists of three

stages. The first is Open Coding in which data is grouped and labelled according to conceptual similarities identified by the researcher. The second stage is one in which the conceptual categories are related to one another, this is referred to as Axial coding. The final stage is characterised by the formation of condition that govern the relationship of categories to one another. This is named Selective Coding and is the point at which an overall theory is developed (Scott and Howell, 2008).

Coding reveals key concepts in the data, be they individual words or phrases, and should be done without reference to any preconceptions. The data should not be bent to accommodate the researcher's pre-existing thoughts but should instead give rise to ideas in, and of, itself. It is important to avoid confusion by identifying key concepts and tone rather than focussing only on individual words whose meaning may be lost when removed from the original context (Moghaddam, 2006). This is an important issue to be aware of and highlights the problems inherent in the Lexical Approach, a reading of the text which focuses not simply on individual words, but on an individual category of words, adjectives. Although the aims of Zhu and Fang (2014) are close to those of this research, their approach is weakened by the narrow focus on adjectives. Such objective classification of individual words, removed from their original context, is not possible because of the variation in individual styles of discourse. This is especially true in an area which is dominated by informality and non-standard English usage. Just one example would be the categorisation of "nice" as relating to the aesthetic qualities of a game (Zhu and Fang, 2014), whereas it is more commonly used as a synonym for "good" (Cambridge Online) and could therefore be expected to belong to any of the six groups identified by Zhu and Fang.

This research will not be adopting the Grounded Theory Method in its entirety as the focus is not on attempting to develop a theory concerned with the form or content of online digital game reviews. Instead, the data extracted from the reviews will form a resource that

will be used both to test, and to expand upon, existing theoretical perspectives that have been presented in the form of heuristics. With this is mind, only the first two stages of coding, outlined above, will be employed in the data analysis. Open coding will be used to extract individual issues, both positive and negative, which will then be grouped accordingly. Axial coding will then be used to establish relationships between the grouped data, and analysed in reference to a core category (Moghaddam, 2006). In this research the core categories of axial coding are, in essence, the individual heuristics that will comprise the finalised set.

5.2 Analysis of RTS Game Reviews.

It was decided that in order to ensure data was varied, whilst remaining robust, it should be extracted from several different websites. Using a range of sites would minimise the potential for the sample to be skewed as a result of any potential stylistic issues or individual preferences of either the site or its authors. In order to ensure that the content of the sites is comparable to one another it is important that they display the same characteristics. Therefore, as discussed in section 5.1.1, Herring's Faceted Classification Scheme (Herring, 2007) was applied with the following table, 13, showing those situational facets considered to be key aspects:

S1 Participation structure	• One-to-many • Public • Authors are not anonymous • The audience varies according to site (the lowest rate of unique monthly visitors was 1.2 million) • Some sites allow readers to post comments
S2 Participant characteristics	• Proficiency with computers and CMC is presumed to be high • Both users and producers exhibit a high degree of pre-existing socio-cultural knowledge and interactional norms in relation to the subject of video games and game reviews
S3 Purpose	• The contributors are professional/semi-professional • The goal of providing game reviews is primarily to provide both information and entertainment
S4 Topic or Theme	• Video games
S5 Tone	• Tone varies according to site, although it is predominantly informal/casual
S6 Activity	• The published articles combine both information exchange and entertainment
S7 Norms	• There is a degree of presumed knowledge about previous games in general, and franchises in particular •There are certain linguistic norms related to the subject, for example abbreviations of popular genres etc.
S8 Code	• The sites use the English language

Table 13. Key Aspects of Social Facets of Online Video Game Review Sites

When considering the modal facets, see appendix 5, the selected data sources are similar in function to review pieces in traditional, printed, media. Therefore, they exhibit many of the same characteristics; they are produced asynchronously, are only transmitted in one direction and contain both text and graphics. The two areas in which online game reviews differ from traditional media are M3 (persistence of transcript) and M4 (size of message buffer), in both cases such issues are dependent on the characteristics and situation of the individual websites themselves. In order to maintain the consistency and, therefore, the comparability of the data samples, a small number of sites will be identified and reviews for any given game will be taken from each one of those sites.

None of the final five categories have been deemed as being applicable to the chosen data source, however M6 (anonymous messaging) and M10 (message format) offer some further insight into the reasons for selecting the chosen text type. The fact that contributions are not anonymous means that they are less likely to be reactionary, offensive or to indulge in any kind of anti-social behaviour (Christopherson, 2007). As such they are a more valuable data source than anonymous customer reviews or independent blogs. Finally, although game reviews are not a series of continuous, related messages their format reflects traditional structures. This familiarity means that they can be easily identified and accessed by users, and, additionally, that they are a more trusted source of information than the other types of review previously mentioned.

When considering the situational dimension of the chosen text types several themes are revealed, the first two of which have already been discussed when addressing the technological dimension. They are: similarity to traditional media and the way in which the characteristics of individual sites is responsible for the final format of the reviews. Once again, these serve to highlight the place of online reviews in the wider canon and to reinforce the need to be consistent when selecting specific game reviews.

Whilst online game reviews have been considered as belonging to the wider textual category of product reviews and information exchange, recent controversies have questioned the explicit and implicit purposes of these texts, S3 (purpose) focuses attention on this debate. Are these reviews truly independent critiques of digital products, or have they been compromised due to links to the games industry and a stylistic trend towards entertainment rather than simply providing information (Hamami, 2015). Whilst these are legitimate concerns, it is felt that any potentially negative influences can be minimised by selecting reviews of the same game from several different sources.

Although the tone of online games reviews can vary between sites, the fact that they serve a specific community means that they are influenced by wider trends and linguistic norms. The review texts presume a certain level of knowledge on behalf of the site's users, both in regard to terms of reference (genres, contemporary and historical issues for example) and to awareness of games themselves (game mechanics, history and development of different franchises etc.). All these issues result in the use of English that is informal, although of a highly specialised and often technical register. The comprehension and analysis of texts of this type is aided by being a native English speaker who has a long-standing interest in the area of video games.

As with the selection of data sources described above, the process of identifying the specific games that would be subject to analysis was framed by the need for information that was both consistent and easily identifiable. It was therefore decided that an aggregator site would be used to provide the solid foundation for the conduct of the search. Metaritic.com was chosen due to its influence and methodological rigour when ranking items[3]. Additionally, the site allows searches to be filtered by platform (in this case PC) and by genre (in this case Real-Time Strategy), and all five selected sites are included in their database of accepted critics and publications[4].

As discussed previously, the work of Pinelle et al. (2008a) used online game reviews as a source of data, however, rather than extracting all data from the reviews only issues identified as usability problems were considered. Indeed, the single focus on reported problems meant that the study explicitly excluded all highly-rated games from their data set. This approach is problematic as it removes a wealth of potential data from consideration,

[3] http://www.metacritic.com/about-metascores
[4] http://www.metacritic.com/faq#item21

valuable insights can be provided by examples of well-made games as well as those that are not so successful.

In order to obtain as broad a range of data as possible, two games were selected from each of the following categories: low-ranked games (metacritic scores in the range 0-50), middle-ranked games (metacritic scores in the range 51-80), and high-ranked games (metacritic scores in the range 81-100). These bands reflect those used by metacritic and were applied at the time of research, due to the way in which metacritic determines the published metascore it is possible that scores have since changed[5]. Once again, the total of six games was considered enough to provide sufficient depth of data while remaining a workload which was manageable. Using reviews from five different sources, for six different games would provide a total data set of 30 reviews.

The range of the potential data set was further refined by the decision to include only reviews of those games that had been published within a five-year period of the research. The exclusion of older games was the result of the need to ensure that the data reflected contemporary trends and development practices. This time constraint is similar, both in form and in function, to that applied by Pinelle et al. (2008a).

The initial requirement for the chosen games to feature on each of the five selected sites proved impossible to enforce, despite the extensive archives available. This was especially true for those games that had lower overall metacritic scores. In order to ensure consistency, it was decided that numbers would not be supplemented by including reviews from sites other than the five identified above. Instead, the availability of reviews would guide the selection of games to include in the research. The selected games are presented in table 14, below, with illustrative screenshots in figures 3 to 8:

[5] http://www.metacritic.com/faq#item21

Rank	Title	Metascore	Published	Summary
High	Homeworld: Deserts of Kharak	81	20/1/16	A ground-based RTS prequel to the classic Homeworld games ... Homeworld: Deserts of Kharak takes players to the deserts of Kharak where danger lurks over every dune. (Steam, n.d.).
	Sins of a Solar Empire: Rebellion	82	12/6/12	Command a space-faring empire in Sins of a Solar Empire: Rebellion, the new stand-alone expansion that combines 4X depth with real-time strategy gameplay. (Steam, n.d.).
Middle	Achron	54	29/8/11	It is the world's first meta-time strategy game, a real-time strategy game where players and units can jump to and play at different times simultaneously and independently (Metacritic, n.d.).
	Planetary Annihilation	62	5/9/14	Planetary Annihilation ... tak[es] large scale real time strategy games from the past to gameplay on a planetary scale. (Metacritic, n.d.).
Low	Stronghold 3	47	25/10/11	Like its predecessors, Stronghold 3 is a strategy game in which you are put in control of a castle ... building up your defences whilst also gathering wood and other resources. (Joseph, 2012).
	Trapped Dead	50	25/02/11	Trapped Dead is a tactical real time strategy game ... in a 3rd person isometric view [set in] a mature Zombie survival scenario inspired by the successful horror films of the early '80s. (Steam, n.d.).

Table 14. Selected games and their categorisation

Figure 3. Screenshot from *Homeworld: Deserts of Kharak,* (Bit-Tech, 2016).

Figure 4. Screenshot from *Sins of a Solar Empire: Rebellion*, (Strategy Core, 2012).

Figure 5. Screenshot from *Achron*, (War Games Bunker, 2013).

Figure 6. Screenshot from *Planetary Annihilation*, (Envul, n.d.).

Figure 7. Screenshot from *Stronghold 3*, (PC Games Hardware, n.d.).

Figure 8. Screenshot from *Trapped Dead*, (Game Watcher, 2011).

Of the six games detailed above, three were reviewed by all five websites and two of the games were reviewed by four websites. The final game had three reviews that could be accessed at the time of writing. The final data set, therefore, comprised of 26 individual reviews, as shown in table 15, below:

Game Title	Game Spot	IGN	Rock, Paper, Shotgun	PC Gamer	Game Watcher
Homeworld: Deserts of Kharak	Yes – available	Yes – available	Yes – available	Yes – unavailable at time of writing	Yes – available
Sins of a Solar Empire: Rebellion	Yes – available	Yes – available	Yes – available	Yes – available	No - unavailable
Achron	Yes – available	Yes – available	Yes – available	Yes – available	Yes – available
Planetary Annihilation	Yes – available	Yes – available	Yes – available	Yes – available	Yes – available
Stronghold 3	Yes – available	Yes – available	Yes – available	Yes – available	Yes – available
Trapped Dead	No - unavailable	Yes – available	Yes – available	No - unavailable	Yes – available

Table 15. Availability of reviews by website

5.2.1 Results of the Analysis

Open coding was performed on the data set, identifying 1096 discrete statements which were then grouped into 25 researcher-determined categories. Of these 25 categories, six were immediately excluded as they were judged to contain information that was not relevant to the aims of the research. Examples of the content deemed inapplicable are shown below in table 16:

Type of content	Example content
Review narrative structure	"I have a headache, and it's all ~~Arch~~ Achron's fault. I don't blame it, though I wouldn't turn down an ibuprofen if you've got – hmm? You have? Thanks." Rockpapershotgun.com
Simple reference to existing game(s)	"But the biggest problem with Planetary Annihilation is that it's nowhere near as good as the games its conspicuously aping. Total Annihilation, made all the way back in 1997, is still better than this game." Ign.com
Mechanical descriptions and anecdotes	"When you're not directing the carrier's production or resource gathering, battles revolve around the light-heavy-ranged trio of basic units … From there, you'll jump to light aircraft and small land-cruisers, and that's it." Gamespot.com
Discussion of bugs and glitches	"The Steam forums feature several players complaining that [multiplayer mode] wasn't working for them." Ign.com
Non-specific judgements	"It's the best use of a stand-alone expansion we've seen to date." Gamewatcher.com
Unquantifiable qualities	"if there's one thing I can say about Stronghold 3, it's that the game has a lot of charm, an awful lot." Gamewatcher.com

Table 16. Examples of excluded content

Removing the above categories and their associated statements from the data left 591 usable statements which were transcribed and grouped accordingly. The next stage was to apply axial coding to the data, as previously discussed in section 5.1.2 the core categories of axial coding are analogous to individual heuristics. Therefore, the axial coding stage consisted of mapping the individual statements to the heuristics identified in the first stage of the experiment. As anticipated, the vast majority of statements, 587 of 591, were found to be

representative of existing heuristics. This finding confirms the stated expectation that any genre-specific information was likely to consist of specific examples of those principles embodied by the over-arching heuristic set. Furthermore, that the overwhelming majority of coded statements could be mapped to the established heuristics, and that all individual heuristics were represented in the analysis, is evidence of the validity of the proposed set. That KOR-GU3 (device and game user interfaces) was the only heuristic of the original set KOR- not to be represented in the axial coding stage supports the decision to exclude it from the finalised set.

The most frequently matched heuristics were KOR-GU1 (AV representation) and KOR-GP5 (challenge), with 111 and 139 occurrences respectively across the 26 individual game reviews. These numbers are striking as the next highest hit rate was for heuristic KOR-GP12 (consistency), with 59 matched statements, and the average hit rate was 19 statements for each heuristic, excluding KOR-GU1 (AV representation) and KOR-GP5 (challenge). A total of five heuristics had less than five matches, an examination of these will feature in the discussion section (5.2.2). The total number of matched heuristics is provided in table 17, below:

	Achron	Homeworld: Deserts of Kharak	Planetary Annihilation	Sins of a Solar Empire: Rebellion	Stronghold 3	Trapped Dead	Total
KOR-GU1	19	44	7	13	16	12	111
PIN-10	10	6	8	5	1	0	30
PIN-8	0	4	0	0	1	2	7
KOR-GU5	1	0	0	0	0	0	1
KOR-GU6	0	0	0	0	0	4	4
PIN-6	3	10	3	0	6	7	29
KOR-GU9	1	0	0	0	1	2	4
KOR-GP5	20	28	21	17	35	18	139
PIN-9	5	0	8	2	13	0	28
KOR-GP1	0	2	0	2	0	3	7
SCH-21	8	16	0	7	0	5	36
KOR-GP3	0	0	1	2	0	0	3
KOR-GP4	1	1	5	1	0	4	12
KOR-GP6	2	3	4	0	1	1	11
KOR-GP7	11	15	0	3	1	5	35
KOR-GP8	0	8	2	0	17	2	29
KOR-GP10	6	8	7	16	0	2	39
KOR-GP12	11	6	14	1	14	13	59
KOR-GP14	0	0	2	0	0	1	3
unassigned	1	0	2	1	0	0	4
Total	99	151	84	70	106	81	591

Table 17. Number of coded statements per heuristic

Those statements found to contain information that is of specific relevance to RTS games were flagged during the axial coding process. After the coding had been completed, all non-RTS specific statements were removed from the data, leaving 135 statements. Having already been matched to the overarching heuristics, the statements were then grouped thematically in order that common principles could be identified and converted into RTS-

specific information. In total 23 different aspects were identified, distributed across 12 core heuristics, with a further two aspects that could not be assigned to any of the core heuristics. A full list of the RTS-specific heuristics developed from the extracted statements is provided below, in table 18, along with their assigned codes and their parent heuristics:

Parent Heuristic	RTS code	RTS Heuristic
U2	RTS-1	It is especially important for units to have a distinct appearance when the user has to command large groups; units must be easily distinguishable in the heat of battle. If units can be upgraded, such changes must be evident without the need to examine units individually.
U2	RTS-2	Main camera: default should be 3rd-person, isometric view. Needs to allow zooming, panning (tilt, yaw) etc. in order that players can fully explore terrain.
U2	RTS-3	The UI fundamentally affects the RTS experience, it requires two different views: main camera and strategic. Each provides different types of information and tools to the player.
U2	RTS-4	RTS games require management, and the appropriate tools with which to manage.
U2	RTS-5	Fog-of-war effect is required, can be affected by in-game developments.
U5	RTS-6	Tech trees should not be overwhelming, they can be segmented in order to aid comprehension and ease-of-use.
U6	RTS-7	Hotkeys have become an important aspect of RTS controls due to the rise of eSports, they are a useful means of circumventing menus and should be supported.
U7	RTS-8	Units should clearly acknowledge orders, and inform the user if conflicting orders have been given.
U8	RTS-9	Players need to be aware of the effects of choices when using tech trees.
New - U9	RTS-10	Single-player modes must be accessible offline.
New - U9	RTS-11	The actions needed to setup games (especially online games) must be automated and part of the game itself, and must not require outside intervention from the user.
GP3	RTS-12	Development is a reward: tech trees can be take many forms but should reflect the core theme of the game and provide meaningful effects.
GP4	RTS-13	The player should have the ability to pause the game if desired.
GP4	RTS-14	Players should be in control of game saves, with auto-save provided as a backup.
GP4	RTS-15	The ability to vary the in-game speed should be provided.
GP5	RTS-16	Maps are the basic gameplay environment for RTS games, there should be: a good amount of varied designs, environments that promote exploration, terrain/environments that affect unit abilities and support/promote different playing styles.
GP5	RTS-17	Micromanagement of resources, units, build queues etc., should not be mandatory - but attention to detail should be rewarded (i.e. via increased efficiency, reduced movement costs etc.).
GP8	RTS-18	Resource gathering is a fundamental aspect of RTS games, effort must be made to ensure that other actions/activities are available whilst resource gathering is underway, it should not be “dead time”.

GP9	RTS-19	Provide different factions with distinct characteristics and abilities.
GP9	RTS-20	The game should provide a range of modes and scenarios other than just campaign and multiplayer.
GP9	RTS-21	The game should have both single- and multiplayer options, each specifically designed to fulfil different functions. The first stages of the single-player, or campaign, mode are often used as a tutorial, but should also allow for independent play. Multiplayer should provide a diverse range of maps upon which players can engage with one another and which support the skills learned in the single-player mode.
GP9	RTS-22	Tech trees can be used to both facilitate, and promote, different playing styles.
GP10	RTS-23	AI guides all units with appropriate automated responses to context, such as when confronted by enemy units.
GP10	RTS-24	Particular attention should be paid to pathfinding in battle situations.
GP10	RTS-25	The AI should be bound by the same game rules as the player.

Table 18. RTS-specific heuristics and their parent heuristics

5.2.2 Discussion of Issues Raised by the Analysis

One of the primary concerns when planning the research was that results could potentially be affected by inherent biases of any given site, however, this fear was not realised and no discernible bias was observed. It may be, however, that the relatively small data set was not sufficient to reveal any patterns that would indicate bias. It is felt that the exclusion of those statements categorised as “unspecific value judgements” and “unquantifiable qualities” (see page 79) serves to mediate any hidden bias as overtly emotional triggers had already been removed.

The question as to whether the stylistic choices, by either the individual reviewers or the sites themselves, may have affected the content is, similarly, unanswerable as a result of the size of the data set. However, it was apparent that those reviews taken from Rock, Paper, Shotgun were particularly distinctive, adopting an extremely informal tone and relying on heavy use of narrative within the review itself.

As highlighted in the results of the analysis (5.2.1), the heuristics KOR-GU1 (AV representation) and KOR-GP5 (challenge) are significantly over-represented in the data, by factors of 6 and 7 respectively when compared to the average. It is unsurprising that KOR-

GP5 (challenge) features so prominently, concerned as it is with the fundamental aspects of gameplay: challenge, pace and flow. When reviewing a game, information and opinions concerning these issues communicate the essential experience of play, effectively rating its success as a game. That the audio-visual qualities are also very heavily referenced in the game reviews is more noteworthy. It may be that the role of the audio-visual elements in creating an emotionally engaging environment contributes significantly to the overall positive or negative opinion of a reviewer or player. Such an effect may be more pronounced in genres such as RTS, in which the opportunities to present a strong narrative element are traditionally limited. However, without more detailed investigation of the issue it is difficult to establish a definitive explanation.

Five individual heuristics were found to have less than five matches with the coded statements: KOR-GU5 (terminology); KOR-GU6 (navigation); KOR-GU9 (feedback); KOR-GP3 (rewards); and KOR-GP14 (loss of possessions). This does not necessarily mean that they are less important than the others, indeed three were each found to include one RTS-specific aspect. Once again, there are potentially many reasons why these heuristics were referenced so infrequently by the selected game reviews. While the individual games themselves are, of course, the main contributing factor, stylistic issues and editorial choices can affect the information that is presented in the review. As the aims of this research lie elsewhere, definitive explanations would require additional research. What is clear from these numbers is that analysing as many games as possible, from as many sources as possible, provides a more balanced picture than research conducted on a single case, or from a single source.

Of all the statements extracted from the online reviews, only two distinct issues were unable to be matched to the heuristic set produced in the first stage of the research. It was decided that although the issue was identified as a result of investigating a specific genre it

remains likely that similar issues will be present in alternative genres. As such, the two RTS-specific heuristics were included under the umbrella term “technical issues” and placed in the usability module. It was felt that these issues differ significantly from the “platform stability issues” identified by Korhonen (2016) that include bugs and crashes and, therefore, merit inclusion in the finalised list.

When considering the games themselves, it is unsurprising that the reviews for *Sins of a Solar Empire: Rebellion* yielded the least usable statements, both in total and averaged per review. This is because it is a stand-alone expansion of an earlier game, therefore many of the statements were couched in terms of the pre-existing game and consequently lacked detail or specific information. Of the data set as a whole, there were no categories of games, that were found to yield higher or lower amounts of usable statements. Therefore, the decision to include low-, middle-, and high-ranked games in the analysis was proved to be of benefit; usable data can be extracted from both good and bad examples.

The process itself, whereby the data was sorted several times, through open coding, axial coding and identification of RTS-specific aspects, resulted in a high degree of familiarity with the data. As a result, the researcher was able to gain a holistic view of the data set, and of the heuristics themselves. This ensured that a potentially cumbersome process proceeded smoothly and with the minimum amount of disruption.

One of the most important issues raised by the experiment is the question of how the RTS-specific results were presented; should they have been grouped by theme, UI or tech trees for example, or by their relationship to the core heuristics? The thematic approach serves to highlight the importance of particular characteristics of RTS games, whereas the relational approach serves to highlight the effects of those characteristic elements. Considering the hierarchical relationship between the core heuristics and the genre-specific aspects, the mode of presentation that focuses on the relationship is most appropriate. Not

only is it consistent with the theoretical framework of the research, it reflects the method and the proposed means of using the finalised set; the high level heuristics reflect overall design principles, the detailed explanations accompanying them address specific design issues.

On the RTS-specific aspects presented in this research, it was the inclusion of the pause option which presented the most cause for deliberation. There is an ongoing debate between players of RTS games as to whether or not a game which can be paused is, in itself "real-time"[6]. It is the position of this research that the inclusion of such an option is a design choice, and as such, heavily dependent upon the individual game. As with any heuristic, it is a principle rather than a definitive rule and can, therefore, be violated if justified by the overall design aims of the developers. Furthermore, the ability to pause a game is important as it provides benefits to the user outside the game itself. It has been included in the RTS-specific module in order to highlight the need to consider such an option in the specific context of RTS games.

In summary, the number of issues found by utilising game reviews as a source of data, and the spread of those issues across the core heuristics established in the first stage of the experiment, demonstrate that the approach is a productive one. That all of the established heuristics were found to be represented in the game reviews is proof of the validity of the finalised set. This is further supported by the fact that the one heuristic discarded from the base set, KOR-GU3 (device and game user interfaces), was the only one not to receive a single match to the coded statements. There were only two statements that could not be matched to the core heuristics identified in stage 1, these were added to the usability section, under a newly developed heuristic. Finally, that a significant number of RTS-specific aspects were highlighted suggests that the same can be expected if other genres were the object of study.

[6] https://steamcommunity.com/app/289580/discussions/0/540738051850507577/

6. Presentation of Finalised Heuristics

During the course of the research, the manner by which the heuristics are presented was revealed to be an issue requiring specific attention. This was a result of both the literature review and of practical problems encountered in the experiments. The value of providing supporting information was demonstrated during the comparative analysis of the selected heuristic sets, most notably in regard to the PLAY heuristics of Desurvire and Wiberg (2009). That the set lacked any explanations or examples alongside individual heuristics meant that, on several occasions, it was impossible to understand the intentions of the authors. Such a problem would also be likely to be encountered by anyone attempting to use these heuristics in a practical context, therefore, it is an obvious barrier to the use of PLAY in a live evaluation.

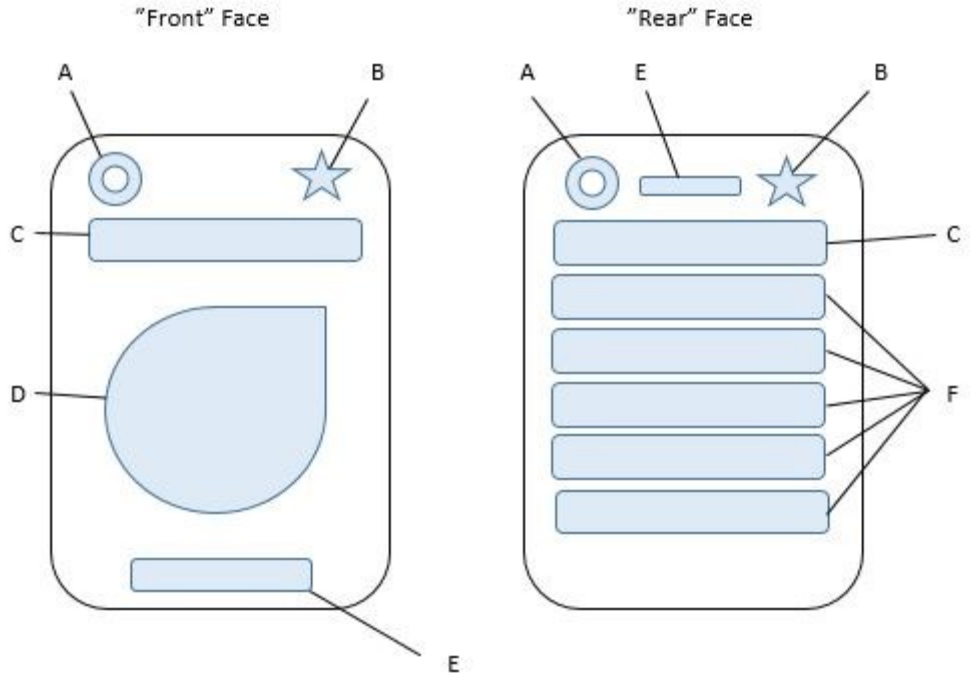
The inclusion of specific examples tied to each individual heuristic is also desirable when considering the different uses to which heuristics are put, either guiding the overall design or investigating individual problems (Schaffer 2007, Korhonen et al., 2009). These two functions of heuristics are the result of differing levels of abstraction and, therefore, require different types of information in order to be effectively realised: a guiding principle and specific examples, respectively. Therefore, the finalised heuristics will be grouped into two modules: Usability (U) and Gameplay (GP), this mirrors the original structure of Korhonen and Koivisto (2006) set which was used as the basis of the comparison made in section 4.3. They will then be numbered sequentially.

Numerous works have demonstrated the value of dividing the heuristics into distinct modules, whether these be based on theoretical or practical distinctions. Such a division allows evaluators to concentrate on distinct aspects at any one time, thereby aiding the overall effectiveness of the evaluation (Korhonen and Koivisto, 2006). The finalised form of

presentation should, therefore, allow distinct modules or categories to be clearly distinguished from one another.

The usual manner of presenting heuristics, in simple list format with pages of supporting information, has been criticised as being both uninspiring and potentially restrictive (Paavilainen, 2010). In order to combat these negative effects Paavilainen (2010) suggests producing heuristics in the form of a deck of cards, thereby creating a more playful and engaging experience. Using cards as a method of communicating information has a number of potential benefits that would increase the value of the finalised heuristic set as an evaluative tool. The first, and perhaps most significant advantage is that information of different abstraction levels could be presented on different faces of each card. An individual user would then be able to utilise a single, hand-held item, referring to the information which best allows them to fulfil their specific needs. Furthermore, in large teams the cards can easily be distributed among team members, ensuring that distinct tasks or areas of responsibility are clearly defined and understood.

The conventional appearance of playing cards can also be adapted to enhance their usefulness as evaluative tools, different modules can be presented as “suits” for example. The format would also allow for screenshots or images to be included on one face, these would serve as visual aids for the users. An example of the proposed design is shown below (fig.9), followed by an example of a finalised card (fig.10):



Key:

A – Heuristic Module

B – Genre-Specific Info

C – Title of Heuristic

D – Appropriate Image

E – Heuristic Ordinal within module

F – Specific Examples

Figure 9. Proposed design for heuristic playing cards

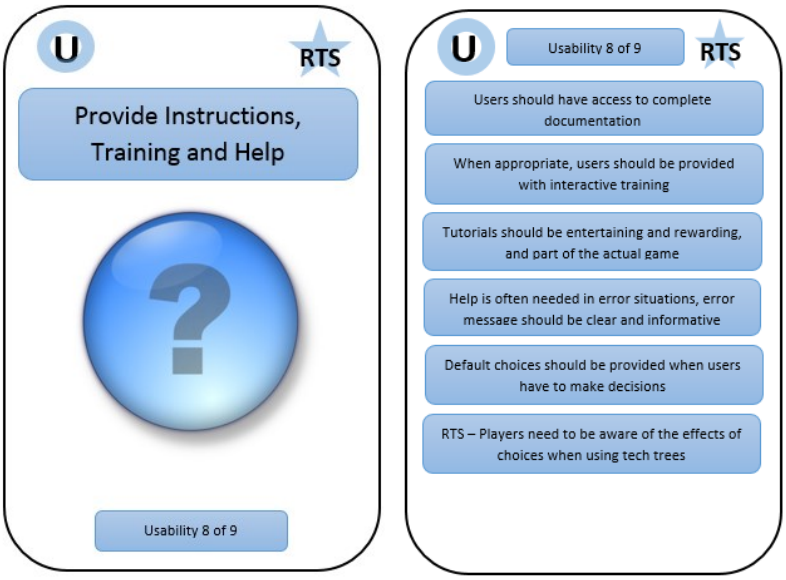


Figure 10. Finalised playing card for heuristic U8

A complete set of the finalised heuristics and the associated supporting information is presented in appendix 6, with a printable version of all 20 heuristic cards in appendix 7.

7. Discussion

The aims of this thesis were twofold, the first of which was to consolidate existing research by producing a list of universally-applicable heuristics. The issue was addressed through the application of the comparative analysis method to a selected body of work that address heuristic evaluation of video games. The chosen works utilised a range of methodologies in order to realise a variety of aims. The results of the analysis answer the first research question as they clearly demonstrate the presence of universal principles for game design and evaluation which exist irrespective of the methods employed to create individual heuristic sets. The use of four published works in the area of game design and evaluation heuristics proved to be sufficient to identify the core heuristics, it is worth noting that only one of the selected sets, that of Pinelle et al. (2008a), was fully represented in the finalised list. This is likely to be due to the fact that the set was relatively small in comparison to the others, having a total of 10 heuristics when the other three ranged from 25 to 50 individual items.

A further point worthy of note is that while all of the four sets addressed the concept of usability, two sets exclusively, none of the chosen works operationalised the concept in the same way. Consequently, issues framed in the context of usability by a particular study could be found in the gameplay section of a separate work. The lack of a common approach to such a central concept demonstrates the value in adopting a holistic approach when formulating heuristics for game design and evaluation.

The second aim of the research was to supplement the initial list with genre-specific information, using RTS games as an example of the procedure. This was approached by analysing the content of a number of online game reviews via the application of open and axial coding. The results of the analysis show that online reviews are indeed a valuable source of information that can be used to extract relevant issues relating to both gameplay

and usability. This information can easily be organised according to game genres and used to provide genre-specific examples which enhance the list of core heuristics identified in the first stage of the experiment, thereby answering the second research question.

What is especially noteworthy is that all of the core heuristics were represented in the content of the selected reviews, but that no single review contained examples of every heuristic. Therefore, the importance of utilising a range of data sources is paramount. Similarly, usable information was extracted from all reviews, whether they were for low-, middle-, or high-ranked games. This validates the stated expectation that positive comments by reviewers are as useful as negative ones when identifying areas of interest for the researcher. Limiting the data set to only good or bad games serves to restrict the potential of the research.

When considering the criteria for selecting those game reviews that would be used in the study, the temporal condition was beneficial as it allowed contemporary practices to be adequately represented, an example being the changes resulting from the growing popularity of eSports. However, this criterion did cause a minor problem when attempting to identify games that had enough reviews published on the selected sites, as discussed in section 5.2.

The decision to include reviews of six games, each published on five different websites, proved to be positive, as demonstrated by the degree and quality of the information extracted whilst remaining a manageable workload. No doubt the volume of usable data would increase if more games and/or sites were chosen as a source of data, but the results show that the selected data sources were appropriate to achieve the aims of this research. Overall, the use of a classification schema to assess the potential sources of online material was beneficial as it ensured that they were comparable with one another.

When performing the open and axial coding, the iterative nature of the process resulted in a high level of familiarity with the content of the reviews, this was undeniably

beneficial for the researcher and, therefore, for the research itself. The process of open and axial coding is highly recommended as it facilitates a high degree of engagement with the source material.

As a final comment on the process itself, the second stage of the experiment confirmed the initial expectation that genre-specific information would take the form of detailed examples of issues already identified in the core heuristics. Indeed, there was only one genre-specific issue not already addressed by the heuristics identified in the first stage of the experiment. This finding further validates the reliability of the core set itself.

The discussion of genre, section 3.2, revealed several key characteristics of RTS games: An isometric view; the importance of hotkeys and multiplayer modes; the "fog-of-war" mechanic; the presence of periods of "downtime"; and the need for a distinct UI and specific tools to manage in-game information. The subsequent analysis of online game reviews provided specific examples of all these characteristics, both confirming the academic perspectives and proving their worth as a source of data.

A particular point of interest was revealed through the discussion of usability and playability, section 2.1, and the subsequent analysis: the differences between usability goals and playability goals can be directly related to the format of RTS games in that the UI fulfils the aims of usability, providing as it does the tools needed to manage the game. Whereas the gameworld encompasses gameplay issues, including story, potential for self-expression, challenge, pace and so on. Therefore, RTS games can be seen to mirror the wider issues of usability and playability, something not so obvious in other genres. It can be seen as an example that serves to reinforce the perspective that usability and gameplay together constitute playability, rather than usability being a distinct aspect.

Of all the existing work concerning heuristics for game evaluation, only two were of sufficiently similar scope to be directly comparable to this research, they are: Koeffel et al

(2010) and Sweetser et al. (2012). The former assessed existing work with the aim of creating a two-tier set of heuristics, with one being “general game heuristics” and the other a “device and applications specific” set. The second study aimed to build upon their previous work in order to develop RTS-specific heuristics, extracting data from a series of game reviews. It is interesting to note that these works each reflected are directly comparable to an individual stage of the work described in this thesis, furthermore, the methods chosen to realise their aims are, in essence, the same as those employed by this work.

As stated above, Koeffel et al. (2010) employed a similar approach to the construction of a set of general heuristics to that employed by this study; existing work in the area was reviewed with the intention of developing a synthesised set. All four of the works selected for inclusion as part of this research were also included in their research, with the further additions of Federoff (2002) and Röcker and Haar (2006). The greater number of sources included in their review is commendable and can only benefit the overall quality of the finalised set. However, the underlying rationale of the work was distinct from that which governed this research: their aim was not to ascertain which heuristics might be considered “universal”, i.e. present in more than one study, it was to make qualitative judgements on individual heuristics with the intention of producing a new, combined set (Koeffel et al., 2010). The results of their work clearly illustrate the different approach as they include eight heuristics, out of a total of 29, that are cited as originating from a single source, almost 28 percent of the total. As such, this damages the authors’ claim that their “general” heuristics are applicable to all types of games.

Koeffel et al. have chosen to present a number of issues as distinct heuristics in order to emphasise their importance, whilst at the same time striving to ensure the final list remains as short as possible (Koeffel et al., 2010). The author of this thesis adopted an alternative approach to what is, essentially, the same problem, namely the need to include sufficiently

useful information without overwhelming the user. It was felt, by this author, that the most beneficial approach would be to include as few individual heuristics as possible, but with a greater degree of detail included in the supporting information. The issue of supporting information is, in itself, a further area of difference between the two studies, with no such examples being included in the work of Koeffel et al. (2010), this can be considered a severe shortcoming as it detracts from the ability of users to implement the heuristic set effectively and as the authors intended it to be used.

Despite the differences listed above, the overall number of heuristics, the abstraction level, and the degree of detail provided, the overriding intentions are the same in both studies: that presentation should facilitate ease of use. To this end both works present heuristic sets which are analogous to two main areas of interest: game play and usability, or "virtual interface" (Koeffel et al., 2012). This division mirrors that employed by the majority of others in the field, most notably Korhonen and Koivisto (2006), whose structure formed the basis for the comparative analysis detailed in chapter 4 of this thesis.

In regard to the finalised heuristic sets themselves there is, perhaps unsurprisingly, a certain degree of overlap with 16 of 20 heuristics listed in this thesis also being present in the work of Koeffel at al. Of the four that were absent, one was to be expected; U9 (technical issues). This is due to the fact that it was the product of the second stage analysis of online game reviews and, therefore, not present in any of the works reviewed by Koeffel et al. (2010). However, the other three omissions are harder to rationalise, they are: U5 (navigation); U8 (help); GP9 (different playing styles). As no information is provided concerning the decisions that were made during the qualitative review no further comment can be made as to why these three issues were excluded from the final set. However, the lack of a heuristic addressing help is especially noteworthy considering the almost ubiquitous presence of such a concept in heuristics developed for both usability and playability.

The second stage of this research was concerned with identifying genre-specific heuristics for RTS games, through analysis of online game reviews, both the aim and the method are directly comparable to the work of Sweetser et al. (2012). However, despite these similarities in approach, the rationale underpinning both pieces of research differ significantly in that the research of Sweetser et al. was modelled on that of Csikszentmihalyi and his work on flow states (Sweetser and Wyeth, 2005; Sweetser et al., 2012). As a result, the GameFlow framework presented by the authors is organised quite differently from the majority of pieces addressing heuristics for games: GameFlow is organised around 8 core elements: concentration, challenge, player skills, control, clear goals, feedback, immersion, and social interaction. These elements reflect various aspects of both usability and gameplay, as discussed in chapter 2, but are not directly equivalent to either concept. Perhaps as a result of this conceptual framework, a practical evaluation of GameFlow found that it was unsuitable for use as an evaluation tool without further development (Sweetser et al., 2012).

In order to adapt the GameFlow model to produce heuristics for RTS games, the authors performed a grounded theoretical analysis on a body of game reviews. The study looked at a limited number of games, four, but included data gathered from ten reviews for each game. It is arguable whether less reviews of more games would produce a greater range of data, however the most important aspect was that multiple sources were used to gather data. Similarly, the research used games of varying quality as the objects of study (Sweetser et al., 2012), this is a more robust procedure than simply concentrating on games rated as being of a certain quality, whether that be “good” or “bad”.

In order to ensure the chosen games were comparable, they were required to be published within a certain timeframe from one another, in this case a range of two years was specified. This approach was required in order that the games were of similar technological sophistication (Sweetser et al., 2012), however, they were almost ten years old when the

research was published. It would have been more productive to consider games that had been published within a period leading up to the time at which the research was conducted. Such an approach would ensure that the study reflected the most recent developments in the RTS genre.

A further issue that could potentially be problematic is that the authors restricted their analysis to games of a particular theme, in this case fantasy RTS games (Sweetser et al., 2012). As Järvinen noted, theme can be used to drive certain types of player interactions, however, it can also be limited to a form of window-dressing, applied to established formats (Järvinen, 2008). The value of only using thematically similar games is, therefore, questionable as it guarantees only a cosmetic similarity.

The work of Sweetser et al. (2012) produced a finalised set of 165 heuristics, this number is exceedingly high compared to all other published sets and, as a result it is likely to be difficult for users to implement effectively. Although the heuristics are categorised according to the core GameFlow elements, the titles of these elements are somewhat abstract and difficult to tie to specific aspects of a game. This is potentially why the GameFlow framework was found to be incompatible with the expert review method (Sweetser et al., 2012). The difficulty in evaluating abstracted concepts is, in part, remedied by the inclusion of a number of sub-categories into which the heuristics are organised. There are 13 sub-categories, of varying degrees of abstraction and consistency: missions, AI, gameplay, sound and graphics, campaign, races, multiplayer, editor, interface and controls, help, narrative, sound, and graphics. An example of the lack of conceptual clarity is that “sound and graphics” appears as a sub-category of both “concentration” and “control” elements, but “sound” and “graphics” are two, distinct, sub-categories of the “immersion” element.

The presentation structure, and the need to have 165 separate heuristics, is further called into question by the potential for repetition within the finalised set. Even the most

cursory examination of the first element, “concentration”, reveals duplication both across and within sub-categories. Examples of duplicated heuristics are provided in table 19, below:

Item Number	GameFlow Element – Sub-Category	Heuristic
1	Concentration - AI	The player should not be required to micromanage unit movement, combat, or unit abilities
2	Concentration - Gameplay	The amount of micromanagement required in bases should be minimized
3	Concentration - Gameplay	Units should not have inventories that the player needs to micromanage
4	Concentration - Gameplay	Micromanagement should be minimized by automatic unit formations, unit attitude settings, good pathfinding, production, research queues, and intelligent autonomous unit behavior
5	Concentration – Missions	Missions should require the player to perform multiple tasks in unison to achieve success
6	Concentration - 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)
7	Concentration - Gameplay	The player should need to split their attention, time, and effort between their many tasks throughout the game

Table 19. Examples of duplication in GameFlow Heuristics for RTS Games

We can see in the table above that the GameFlow element “Concentration” contains several heuristics which duplicate one another in the “Gameplay”, “AI”, and “Missions” sub-categories. It can be argued that each addresses a slightly different issue and provides a high degree of detailed information. However, both items 4 and 7 could be seen to be of a higher abstraction level than the others, thereby encompassing items 1,2,3, and 5,6 respectively. Even if all seven items were of the same abstraction level and reflected slightly different aspects, the value of including such a high degree of detail in distinct heuristics is doubtful.

The GameFlow heuristics for RTS games (Sweetser et al., 2012) contain more than seven times the number of individual, RTS-specific heuristics produced by this research, 165 and 25 respectively. Despite this fact, only 15 heuristics can be matched between the two sets, and of these only three are a direct match. Several of the RTS-specific heuristics

identified in this research are only reflected in part by the GameFlow set and seven others are spread across multiple GameFlow heuristics, partly as a result of the duplication highlighted previously.

In summary, despite sharing similar aims and methods with this research, the finalised set of Sweeter et al. (2012) is significantly different in both appearance and content. The manner of presentation utilised in the GameFlow heuristics for RTS games has produced an unwieldy and confusing set. Structuring heuristics around the work of Csikszentmihalyi, rather than established practices of utilising either usability or playability, appears to have contributed to a lack of clarity and the exclusion of such fundamental principles of the RTS genre as the "fog-of-war" mechanic. It is possible that the selection criteria employed by the authors of the GameFlow set also contributed to the lack of certain types of information; only four games were included and they were all thematically similar. However, this is likely to be mitigated, at least in part, by the fact that, for each game, reviews were sourced from ten different websites and magazines.

7.1 Limitations

Perhaps the most significant limitation of this work is that the finalised heuristic set has not been subjected to any practical evaluation. This is offset, however, by the fact that the primary data source for the first stage of the experiment was a selection of published works, the majority of which have been validated via some form of practical assessment. Furthermore, the results of the second stage of the experiment served to reinforce the validity of the finalised heuristic list.

An additional point is that the utilisation of relatively few sources, four heuristic sets and 27 game reviews in stages one and two respectively, may be seen as a limitation. However, as discussed above, the results clearly indicate that the selected sources were

sufficient to achieve the research aims whilst remaining a manageable workload. That more examples could be gathered from an increased number of sources is beyond doubt, however it is questionable as to whether or not these additional examples would provide further insight or instead simply serve to provide additional detail.

7.2. Future Research

It is hoped that this work will provide a basis for further research into genre-specific heuristics, that a core set of universally-applicable heuristics has been defined reduces the need for future work as researchers will not need to formulate an entire set from the ground up. Instead, attention can be focused on identifying issues that are important for individual genres and on matching them to the existing set of core heuristics. Whether future research should adopt the same practice of analysing game reviews in order to reveal such information cannot be dictated here, however, it is an approach which has served this research well and is recommended.

Further study of heuristic U9 (Technical Issues) is required in order to assess whether it should remain as a core heuristic, or whether it is, in fact, only relevant to RTS games. Theoretically there is no reason why such issues should be limited to a certain genre, or genres but the lack of equivalent items in existing research dictates the need for caution when making such statements. It is entirely possible that the issue is a result of contemporary technological sophistication, hence why it was not present in existing research.

An additional avenue for future research is linked to further studies of genre: once several genres have been mapped onto the core heuristic set, it may be possible to determine if there are any core areas which are strongly linked to genre-specific issues. If certain heuristics were consistently supplemented with additional information relevant to specific genres, it may indicate that the core heuristic embodies a particular area of significance to the

ways in which games are experienced. Alternatively, if certain heuristics remain untouched, irrespective of genre, they may also embody significant issues relating to games and game playing.

One final area of potential future research would be the practical assessment of the finalised heuristic set, via the evaluation of a Real-Time Strategy game. Whether this would be a post-production evaluation or one conducted as part of the development process, it is expected that the heuristics would prove to be a valuable tool. The easy availability of early-access games, through such digital distribution channels as Steam, mean that researchers would not need contacts within game development companies in order to realise such an aim.

8. Conclusion

In summary, this research proves the existence of a range of principles used for the evaluation of video games that are present in multiple heuristic sets. These principles exist irrespective of methodological approach, of theoretical perspective, or of the stated research aims of any individual study. It is, therefore, reasonable to conceive of these principles as being universally-applicable and to utilise them as the basis of a framework for the evaluation of video games. This study demonstrated the value of comparative analysis as a means of extracting these common principles, and the finalised set was validated through the finding of the second-stage experiment.

This study also proved the potential to extract genre-specific information from online game reviews, in addition to demonstrating how such information can be used to enhance the core set of heuristics produced through comparative analysis. Information obtained from the coding and subsequent analysis of game reviews effectively supplemented the core set by providing detailed examples for individual heuristics in regard to a specific genre of game. In addition, the information extracted from the online reviews provided the basis for a further heuristic that was not part of the core set.

Using data gathered from online reviews was found to be productive, provided that a range of sources was used, both in regard to individual websites and to the types of games that are analysed. This is emphasised by the fact that useful information was extracted from all game reviews, irrespective of whether the final rating was good, bad or somewhere in between. As such, a significant lesson provided by this research was the importance of approaching the topic with a holistic view, in this way no issues are left unaddressed as a result of theoretical or procedural ambiguities.

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10. Appendices

Appendix 1: Heuristic evaluation for games: usability principles for video game design - Pinelle, Wong, & Stach, (2008a).

1. Provide consistent responses to the user's actions.
Games should respond to users' actions in a predictable manner. Basic mechanics, such as hit detection, game physics, character movement, and enemy behavior, should all be appropriate for the situation that the user is facing. Games should also provide consistent input mappings so that users' actions always lead to the expected outcome.

2. Allow users to customize video and audio settings, difficulty and game speed.
The video and audio settings, and the difficulty and game speed levels seen in games are not appropriate for all users. The system should allow people to customize a range of settings so that the game accommodates their individual needs.

3. Provide predictable and reasonable behavior for computer controlled units.
In many games, the computer helps the user control the movement of their character, of a small group of teammates, or of a large number of units. Computer controlled units should behave in a predictable fashion, and users should not be forced to issue extra commands to correct faulty artificial intelligence. The game should control units so that pathfinding and other behaviors are reasonable for in-game situations.

4. Provide unobstructed views that are appropriate for the user's current actions
Most games provide users with a visual representation (i.e. a "view") of the virtual location that the user is currently occupying. The game should provide views that allow the user to have a clear, unobstructed view of the area, and of all visual information that is tied to the location. Views should also be designed so that they are appropriate for the activity that the user is carrying out in the game. For example, in a 3D game different camera angles may be needed for jumping sequences, for fighting sequences, and for small and large rooms.

5. Allow users to skip non-playable and frequently repeated content.
Many games include lengthy audio and video sequences, or other types of non-interactive content. Games should allow users to skip non-playable content so that it does not interfere with gameplay.

6. Provide intuitive and customizable input mappings.
Most games require rapid responses from the user, so input mapping must be designed so that users can issue commands quickly and accurately. Mappings should be easy to learn and should be intuitive to use, leveraging spatial relationships (the up button is above the down button, etc.) and other natural pairings. They should also adopt input conventions that are common in other similar games (e.g. many first-person shooters and real-time strategy games use similar input schemes). Games should allow users to remap the input settings, should support standard input devices (e.g. mouse, keyboard, gamepad), and should provide shortcuts for expert players.

7. Provide controls that are easy to manage, and that have an appropriate level of sensitivity and responsiveness.
Many games allow users to control avatars such as characters or vehicles. Controls for avatars should be designed so that they are easy for the user to manage, i.e. they are not too sensitive or unresponsive. When controls are based on real world interactions, such as steering a car or using a control stick in an airplane, the game should respond to input in a way that mirrors the real world. Further, games should respond to controls in a timeframe that is suitable for gameplay requirements.

8. Provide users with information on game status.
Users make decisions based on their knowledge of the current status of the game. Examples of common types of information that users need to track include the current status of their character (such as their health, armor status, and location in the game world), objectives, teammates, and enemies. Users should be provided with enough information to allow them to make proper decisions while playing the game.

9. Provide instructions, training, and help.
Many games are complex and have steep learning curves, making it challenging for users to gain mastery of game fundamentals. Users should have access to complete documentation on the game, including how to interpret visual representations and how to interact with game elements. When appropriate, users should be provided with interactive training to coach them through the basics. Further, default or recommended choices should be provided when users have to make decisions in complex games, and additional help should be accessible within the application.

10. Provide visual representations that are easy to interpret and that minimize the need for micromanagement.
Visual representations, such as radar views, maps, icons, and avatars, are frequently used to convey information about the current status of the game. Visual representations should be designed so that they are easy to interpret, so that they minimize clutter and occlusion, and so that users can differentiate important elements from irrelevant elements. Further, representations should be designed to minimize the need for micromanagement, where users are forced to interactively search through the representation to find needed elements.

Table 2. Game heuristics. Each heuristic is listed along with a paragraph describing how common problems can be avoided.

Appendix 2: Playability heuristics for mobile games – Koivisto & Korhonen, (2006).

3 Mobile Gameplay Heuristics

This chapter describes playability heuristics for mobile games. The heuristics are divided into three categories: *Game Usability*, *Mobility*, and *Gameplay*. Game usability heuristics contain also mobile game-specific issues that are highlighted in the text.

3.1 Game Usability

The game usability heuristics (Table 1) cover the game controls and interface through which the player interacts with the game. As a general rule, the game interface should allow the player to control the game fluently and display all the necessary information about the game status and possible actions. The game interface is usually the first thing that a player encounters when starting to play a new game. Good game usability ensures that the player will have another enjoyable play session.

No.	Game Usability Heuristics
GU1	Audio-visual representation supports the game
GU2	Screen layout is efficient and visually pleasing
GU3	Device UI and game UI are used for their own purposes
GU4	Indicators are visible
GU5	The player understands the terminology
GU6	Navigation is consistent, logical, and minimalist
GU7	Control keys are consistent and follow standard conventions
GU8	Game controls are convenient and flexible
GU9	The game gives feedback on the player's actions
GU10	The player cannot make irreversible errors
GU11	The player does not have to memorize things unnecessarily
GU12	The game contains help

Table 1: The heuristics for evaluating game usability

GU1. Audio-visual representation supports the gameplay

Due to the rapid development of graphic cards, games look visually appealing and the players expect that, too. However, the game graphics should support gameplay and story and be informative for the player. In addition, the graphical look and feel should be consistent throughout the game.

Audio can be used to evoke emotions and increase immersion. A good sound environment in the game supports a positive gaming experience. Normally, there are two types of audio present in the game: music and sound effects. Both of these have their own roles in creating the sound environment and they should work together seamlessly and not create cacophony.

The graphics or audio should not prevent the player from performing actions or make them unnecessarily difficult. For instance, using a nice 3D camera effect may look cool, but may make the game unnecessarily difficult to play.

Mobile game-specific issues:

Mobile games are played both outdoors and indoors. The game should be playable in different lightning conditions. In addition, the display usually shakes and moves because it is integrated with input devices. For these reasons, our experience shows that it is preferable to use high contrast with colors.

Mobile games can also be played in situations where non-players need to be taken into account. It should always be possible to control the volume level of the game or mute the game (see also GU3: The game accommodates with the surroundings). The game should never use audio as the only resource of providing feedback because players might be playing the game muted and are not able to hear sounds.

GU2. Screen layouts are efficient and visually pleasing

Designing a good layout is not always easy. The layout should present all necessary information for the player, but on the other hand, if the screen is filled with all kinds of information, it starts to look crowded. Also, games should follow the general principles of good screen layout design (see, for example, [7]). It is important that the player finds the navigation controls and they should not be mixed with the information that needs to be visible on the screen.

Mobile game-specific issues:

In general, this heuristic is specifically important for mobile games due to limited screen space. Designing the layout for a mobile-phone screen can be challenging, but a good rule of thumb is that information that is frequently needed should be visible to the player all the time.

GU3. Device UI and the game UI are used for their own purposes

It should always be noticeable whether the player is dealing with the game user interface or device functions. The game interface should not use the device's user interface widgets in the game interface, because it breaks the immersion. The most impressive immersion is achieved when the game uses full-screen mode hiding other features.

Mobile game-specific issues:

In mobile games, some features of the device, for example the network connection, should be visible in the game interface. However, the game should present this information using user interface widgets that are consistent with other elements in the game.

GU4. Indicators are visible

The player should see the information that is required for being able to play the game. An example of this kind of information could be the status of a game character. Information that is frequently needed should be visible for the player all the time — if possible. The player should always know the current state of the game, for example, whose turn it is to make the next move. Indicators for critical gameplay information should be presented to the player clearly enough. For instance, the player will feel very frustrated if the game character dies suddenly and there was no indicator that it was starving [9]. However, the "less is more" principle [20] is also important: information that is not critical or used frequently should not be visible all the time.

Mobile game-specific issues:

In mobile devices, there are different indicators for device functions that need to be visible during the mobile game. These can be, for instance, the typing modality of the keypad (such as number, alphabetical, or T9) or the connection indicators (such as Bluetooth). In addition, the player might want to know the battery level and time during a game session.

GU5. The player understands the terminology

The terminology that is used in the game should be understandable and not misleading or unfamiliar for the players. A similar rule also appears in Nielsen's original usability heuristics [20]. Technical jargon should be avoided. For instance, terminology that is related to the game concept or features that the game needs from the device should be translated into more understandable language. In network games, the player usually needs to connect to a game server before the play session can start. The command for doing this could be "Connect to the server." However, from the player's point of view, it is not interesting to connect to the server, but rather to join the game. In this case, a more understandable command name would be "Join the game."

GU6. Navigation is consistent, logical, and minimalist

The player navigates in the game menu, which usually consists of settings and selections for the desired game session, and in the game world, if the game has a visual world. In the game UI, different functions should be organized reasonably and possibly on different screens. However, long navigation paths in the game menu should be avoided. Short navigation paths provide more clarity and are easier to remember. In the main game menu, the player should be able to start a game and have access to other important game features.

In the game world, navigation should be intuitive and natural. The game world can be either a 3D world with forests and mountains or a table of cards or another simplified representation in 2D. Regardless of the complexity of the game world, players should be able to navigate there smoothly. With a proper set of control keys, navigation can be very intuitive and almost invisible.

Mobile game-specific issues:

The navigation on a mobile device is not easy because of the small screen and limited input devices. Mobile devices have two kinds of navigation controls: permanent and temporary navigation keys. Permanent navigation keys should be used primarily for navigation. Temporary navigation keys are often related to applications or to a specific user interface style. Since the games do not necessarily need to follow the device's user interface style, the use of these keys can be more flexible.

GU7. Control keys are consistent and follow standard conventions

Using common conventions reduces the time that is needed to learn to use any software application [20]. The same applies to games: using standard control keys reduces the time that is required for learning to play the game since the player can use his or her knowledge from other games. Game devices usually have specific keys for certain actions and every game should follow them.

Mobile game-specific issues:

The mobile device is a relatively new kind of device for playing games, but a few conventions already exist. For example, number five on the mobile device's keypad is usually the selection key. Forum Nokia mobile game usability guidelines specify control keys for mobile games [13] [14].

One interesting thing about mobile devices is the design driver of the device. If the device is meant to be operated one-handed, the game should be playable with one

hand. Correspondingly, the device's standard input methods should be used for controlling the game.

GU8. Game controls are flexible and convenient

Novice players usually need only a subset of the controls when they start playing the game. On the other hand, veteran players often need shortcuts and more advanced commands. It should be possible to customize the game controls or use shortcuts or macros. However, using shortcuts should not provide a major edge in a competitive player vs. player game [24].

The configurability and amount of controls needed to play the game should be kept at the minimum, but they need to be sufficient. In addition, the controls should be designed according to the device's capabilities.

Mobile game-specific issues:

Currently, mobile devices may not be as flexible as most of the other game devices and the possibilities to customize game controls are often limited. In mobile phones, some functions are specifically assigned to certain keys and they should be accessible even though the device is used for playing games. This reduces the number of available keys for controlling the game.

The mobile device is primarily used for communication. The player should be able to manage incoming calls during a game session. Two keys are assigned for call handling and they should never be used for controlling the game:

- The Send key (usually identified with a green symbol) is for answering calls. This will also move the game to the background because in-call functions are activated.
- The End key (usually identified with a red symbol) is for rejecting incoming calls.

In addition, some keys are defined dynamically. Following the conventions of using such keys is not always straightforward.

GU9. The game gives feedback on the player's actions

A good user interface has a low response time on the player's actions. An action can be either a single key press or a more complicated input sequence. The player should notice immediately that the game has recognized the action by providing feedback. The most common way of providing feedback is to present it graphically. Other alternatives are to use audio or tactile feedback. Providing only auditory feedback is not acceptable since a player may be playing the game without sounds.

Although the game needs to respond immediately to the player's actions, the consequences of the action can be shown to the player later (see, for instance, the "delayed outcome" game design pattern [2]). If an action cannot be performed immediately, the game should notify the player that it takes time.

Mobile game-specific issues:

In mobile devices, the network connection is usually considerably slower than in other game platforms and it can create latency in the response time, making the game unplayable. Usually the players try to repeat the command because it may seem that the input was not received. Mobile devices also lack processing power compared to other game platforms, but this gap decreases constantly.

GU10. The player cannot make irreversible errors

The game should confirm actions that can cause serious and irreversible damage [20]. Also, when mistakes happen, it is helpful to enable recovery. In games, making errors is often part of the gameplay. However, this heuristic deals with errors that are related to the bad usability of the game user interface.

Errors often happen when the player deletes game objects, such as avatars or items. Sometimes, however, the errors can be related to positive things that must be done, but the time is just not right.

GU11. The player does not have to memorize things unnecessarily

Nielsen has stated that a software application should not stress the user's memory unnecessarily [20]. This applies to game user interface design as well. Sometimes, the challenge in the game can be memorizing.

GU12. The game contains help

The game teaches the player what he or she needs to know to start playing the game. The players do not often read manuals, and a mobile game does not usually even have a paper manual. Even though a tutorial mode at the beginning of the game is usually helpful, having a complete tutorial is not well suited for a mobile game. The players do not necessarily encounter or need everything during the first play sessions.

If tutorials are used, they should be entertaining and rewarding, and part of the actual game. A mobile game should entertain the player even if he or she would only have a couple of minutes available to play it. The player should be able to accomplish something in the game within the first five minutes.

The tutorial should be divided into chapters that teach a couple of things that the player needs during the first play sessions. Ideally, the tutorial could be embedded completely in the game so that help would be provided every time when it is really needed[2].

Help is also often needed in error situations. If the game provides useful error messages, the player can understand better what caused the problem.

3.2 Mobility

While the game usability heuristics deal with the user interface issues, the mobility heuristics (Table 2) concern issues that affect the mobility of the game. Because mobile devices are flexible with when and where games are played, the game design should assimilate this freedom into the game experience as well.

No.	Mobility Heuristics
M01	The game and play sessions can be started quickly
M02	The game accommodates with the surroundings
M03	Interruptions are handled reasonably

Table 2: The heuristics for evaluating mobility

[2] See, for example, Sumea's Mafia Wars mobile game

M01. The game and play sessions can be started quickly

The players should be able to start game sessions quickly and easily, preferably in less than five seconds. A play session of a mobile game is usually shorter than a play session of a computer or console game. Browsing in a game menu consumes precious game-playing time and actions that need to be done frequently in the game should not be hidden behind a long navigation path either.

Introduction sections or other startup screens are very common in computer and console games. These are used for transferring the player into the game world or advertising the game developer or the publisher. In mobile games, long intros are not recommended since they take too much time. There can be an introduction but the player should have the possibility to skip it.

Games usually contain multiple settings for customizing the game user interface or giving information about the player or input devices. If these default settings are good for most of the players, they will be able to access the game faster. In addition, the game should store any changes that the player makes to the settings.

M02. The game accommodates with surroundings

Computer and console games are usually played indoors where disturbance is minimal. However, mobile devices have changed this pattern and mobile games are played everywhere. This sets new demands for graphics and audio.

Mobile games may sometimes disturb non-players who are in the same environment. Noise is the most typical way of disturbing other persons in the vicinity. A game should provide means for conveniently adjusting the volume level or muting the game. If the volume level settings are not easily accessible, the mobile game could also ask at the beginning if the player wants to disable the audio features of the game [13] [14]. The game should also respect the device settings, which indicate in which mode the player wishes the device to be, for instance, in silent mode.

M03. Interruptions are handled reasonably

Since the mobile devices are usually multi-purpose devices, interruptions when playing the game are inevitable. Sometimes the game must be interrupted because the player needs to do something else or he or she moves out of network coverage and is disconnected from the game without a warning. External interruptions during the play session are also probable. Incoming calls and messages are the most typical interruptions in that category. Incoming phone calls are usually handled immediately, but messages can often wait and they are handled after the play session. Moreover, the surroundings may require the player's immediate attention.

In case of a single-player game, there should be a possibility to pause the game at any time and continue playing later [11]. In multiplayer games, this is not that straightforward, since other players are involved. However, the need for interrupting the play sessions exists also in multi-player games, and the player may need to stop playing the game for a short period of time.

3.3 Gameplay

Gameplay is the most critical part of defining a successful player experience. Gameplay is dynamic and it occurs when the player interacts with the game mechanics and other players. Game mechanics consist of rules that define the operation of the game world and make up the core mechanics, the foundations on gameplay [24].

Gameplay heuristics (Table 3) are valid for any kind of game regardless of the platform on which the game is played. When evaluating gameplay, it is highly recommended that evaluators have at least some game design expertise. The evaluators should also understand the design goals and know the

target group of the game. If the evaluators do not belong to the target group themselves; it is useful to get more familiar with the potential users, for example, with focus groups.

No.	Gameplay Heuristics
GP1	The game provides clear goals or supports player-created goals
GP2	The player sees the progress in the game and can compare the results
GP3	The players are rewarded and rewards are meaningful
GP4	The player is in control
GP5	Challenge, strategy, and pace are in balance
GP6	The first-time experience is encouraging
GP7	The game story supports the gameplay and is meaningful
GP8	There are no repetitive or boring tasks
GP9	The players can express themselves
GP10	The game supports different playing styles
GP11	The game does not stagnate
GP12	The game is consistent
GP13	The game uses orthogonal unit differentiation
GP 14	The player does not lose any hard-won possessions

Table 3: The heuristics for evaluating gameplay

GP1. The game provides clear goals or supports player-created goals

The players should be able to understand the goals that exist in the game [9]. According to the Flow theory, having a clear goal in mind is the core of an enjoyable experience [3]. The goals can be either set by the game or the players themselves. Some games encourage player-created goals, and some allow the players to choose their goals from a set of pre-defined goals [2]. An example of supporting player-created goals could be providing the player information that makes him or her curious enough to want to do something, for instance, seeing a distant island and figuring out that there must be a way to get there somehow (even if it would not be necessary to do so in order to proceed in the game).

In case of a complex and long game, the game should contain both short-term and long-term goals. Especially clear short-term goals are important and the player should perceive that it is possible to achieve these goals. Short-term goals provide repeated opportunities for reinforcement and keep players motivated to play the game [23]. An example of a short term goal can be finding a specific item in the game world. Long-term goals are usually more difficult to achieve and they can consist of several short term goals. An example of a long them goal could be developing one's game character to be as good as possible. The distinction between short-term goals and long-term goals should be clear. The players should see the progress towards the goal (see GP2), be rewarded when they reach a goal (see GP3), and be able to compare the achievements (see GP2).

GP2. The player sees progress in the game and can compare the results

The players should have enough information so that they can see their progress towards the goals in the game. The progress can be shown to the player in two ways:

1. Explicitly, for instance, with numbers.
2. Implicitly, for instance by changing the behavior of non-player characters (NPC) in the game.

The players feel more motivated if they can compare themselves with the other players or the previous achievements. Without feedback, the performance can be unimportant and uninvolving [23]. Traditionally, this has been done with high-score lists, rankings, character levels, or different titles. (See also the heuristics that deal with the user interface side of this heuristic; GU9: The game gives feedback on the player's actions, and GU4: Indicators are visible).

GP3. The player is rewarded and the rewards are meaningful

The players should be rewarded as they progress in the game. The most important rewards should be meaningful for the player. A good example of a less meaningful reward could be to be able to perform a certain action 20 percent better than earlier. An example of a more meaningful reward in the same game could be being able to perform a completely new kind of action. The reward should be adjusted to the challenge that the player had to face in order to get the reward. If the player expects a bigger reward based on previous experience, and if he or she gets a smaller one, he or she will be disappointed.

A well-balanced varying reward schedule makes the players to try to get the next reward even harder than if the reward would be just given to the player every time [2]. The rewards should be frequent enough, but still unpredictable, because that keeps the motivation up for the player. However, using a varying reward schedule for reaching the major milestones (for example, a level in a game) is not recommended.

GP4. The player is in control

The game should provide at least an illusion that the player is in control of what is happening in the game world. The players should be able to decide on actions they want to take and these actions should have an influence to the game world.

In gambling games, the illusion of control is very important. For instance, in lottery games, the players often like to choose certain numbers, even if the probability of winning would be the same with a random set of numbers. The game should not include random uncontrollable events or tedious or difficult input sequences [20].

GP5. The challenge, strategy, and pace are in balance

The game should be designed so that the players do not feel frustrated or bored with the game. According to the Flow theory [3], if the challenge in the game is too high when compared to the player's current skills, the game is frustrating. Correspondingly, if the player has more skills than required to achieve the goal, the game feels boring. In single-player games, the player can often choose the difficulty level and thus affect the challenge.

A variable outcome is also related to challenge. If the result of the game is evident from the start, there is challenge and no reason for competitive play. Malone [18] describes in his heuristics ways to increase variable outcome: randomness, having multiple levels of goals (even if the outcome of one goal would be certain, the long-term outcome may still be uncertain), hidden information, and adjusting difficulty level. The balance between variable outcome and skill depends on the game style; casual games often, however not always, tend to favor variable outcome.

The players learn new strategies as they play the game. There should not be dominating strategies for any part of the game because it reduces the number of strategies that are used in the game. According to Rollins and Adams [24], "a dominant strategy is one that surpasses all others by being the best one to choose under any circumstances."

The pace should be adjusted to the game style. If the player needs to think about the next moves in the game, there should be time provided for doing that. On the other hand, an intensive game should not allow the player to analyze different options too long because it slows down the game. However, the game should allow the player to take a deep breath once in a while during the play sessions.

GP6. First-time experience is encouraging

The first five minutes in the game create the first impression of the game, which is very difficult to change. The players should feel that they have accomplished something and be rewarded [19]. If the first-time experience is discouraging, the player may never play the game again. The first play session should make the player desire for the next play session.

This heuristic has also to do with the learnability of the game. If the game is very difficult to play at the beginning and learning new things is hard in the game, the first-time playing experience may be frustrating (see also GU12: The game contains help).

GP7. The game story supports the gameplay and is meaningful

Even though the story plays an important role in many games, it should not dominate the gameplay. Some games do not even have or need a game story, but gameplay itself creates a "story" of victory and loss. A good example of such a game is Chess. The game should allow the players to make their own decisions and the story should follow the players' choices. A more complex game, such as a massively multiplayer online game (MMOG), should support the players to create their own stories [19]. Sometimes it can be useful to provide just a background story for the game, on which the players can base their own stories.

It is important that the story fits to other elements in the game and sounds plausible to the player. The dialogue with non-player characters (NPC) should be meaningful and interesting for the player. The player needs to have a reason to care about the game characters and the goals in the game (see [11]).

GP8. There are no repetitive or boring tasks

The game should not require repetition of tasks without changing any conditions. Repeating the same tasks over and over again is often called tread milling or grinding, and it is usually a guaranteed way of killing the fun in the game. One example could be killing the same monsters over and over again and knowing exactly how they will behave. Often, this repetition happens when the player needs to reach a certain goal before the game becomes interesting or challenging.

However, it should be noted that the training phase is not grinding because the player needs to practice basic actions, for instance, how the character is controlled in the game. During the training phase, it is useful to repeat certain tasks so that the player learns them.

GP9. The players can express themselves

The players should be able express themselves by, for instance, customizing their characters, acting in a certain way in the game world, or modifying the game world. Allowing the player to change the game world increases the feeling of ownership. Some games allow the players to change the textures or game logic, and this is often called "modding."

The players need something that they can identify with in order to feel attachment to a game [2]. Allowing the players to customize and personalize their characters makes it more probable that they can identify with their character. The simplest way of doing this is to give a name for a character. If it is not possible to modify the character (and the game has one), the character design becomes even more important.

GP10. The game supports different playing styles

The players of a game can vary a lot in terms of both experience and preferred play styles. There are also different playing styles that should be supported at least in the more complex games. In very simple games, this heuristic may not be relevant.

The most commonly used model for categorizing players in massively multi-player online role-playing games (MMORPG) is Bartle's player types [1]. The player types are defined based on how the players prefer to interact with the game world or with the other players, and if they prefer to collaborate ("act with") or dominate ("act upon"). Bartle's player types are:

- Achievers, who like to compete with the game mechanics.
- Explorers, who wish to explore different aspects of the game.
- Socializers, who prefer to socialize with other players.
- Killers, who enjoy dominating other players.

There are also other definitions for player types in other kinds of games, but Bartle's categorization serves as a good example, since it is pretty well known and also widely used.

GP11. The game does not stagnate

The players should always feel that it is possible to reach the goals. The player must have a feeling that the game progresses. Correspondingly, the game should recognize immediately when the game is over and inform the players. Ending of the play session should be clearly indicated and the game should provide a possibility to start the game again.

GP12. The game is consistent

The game world should be consistent [24]. If something works in the beginning of the game, the player assumes that it also works later on. Moreover, if the game world resembles the real world, the player assumes that the same principles also work in the game world.

The actions should work in a consistent and logical way. For example, if the player can jump over a gap, it should be possible to jump over a small fence or a bush as well. The game should not contain invisible walls.

GP13. The game design uses orthogonal unit differentiation

The different game objects should have different kinds of purposes. Harvey Smith has introduced the term "Orthogonal Unit Differentiation" [25]. This means that the units, for instance character classes, in the game should be designed so that they are functionally different.

A simple example of orthogonally different items would be arrows that do normal damage and poison damage. Orthogonally similar items would be arrows that do 1-3 points of damage or 2-4 points of damage. Orthogonal unit design can encourage strategic play and expands the game's possibility space.

GP14. The player does not lose any hard-won possessions

This heuristic is derived directly from Falstein's 400 project design rules [9]. The players will feel very frustrated if they have first earned something by hard work and then it is taken away. For instance, most players will feel very frustrated if they have worked on developing a game character for several weeks, and after making a single mistake, the character is permanently gone. Some game designs may break this rule on purpose in order to provide a more exiting game experience by providing very

Appendix 3: Heuristics for usability in games - Schaffer, (2007).

Heuristics for Usability in Games: Checklist

General

In a broad sense, make your game intuitive for your **player**. This includes controls, Heads Up Displays (HUDs), path finding, and goals.

- Minimize flashing.
- Avoid large blocks of text.
- Don't rely on players' memory.
    - Don't use abbreviations.
    - Don't require the player to count resources like bullets and life.
    - Players shouldn't have to memorize the level design (but it's arguable there are exceptions).

Graphical User Interface (the persistent displays on the screen, such as life points, score, level, ammunition, ext)

- All relevant information should be displayed, such as life points, lives, and ammunition.
- Don't display irrelevant information.
- Critical information should stand out (ie, if time is very important to the game, then the timer should be large and in contrast with the background).
- Don't bury frequently used information.
- Menu item names should be intuitive and obvious.
- The player should know where they are on the mini-map, if there is one.

Gameplay

General

- It should be clear what's happening in the game. Players should understand and be able to identify:
    - Goals
    - Failure conditions (How they lose)
    - Game elements
        - Avatar

        - Enemies
        - Obstacles
        - Power Ups
- Give players the feeling they can make a few mistakes by giving some room for error.
- Players should feel in control, so they need the time and information to respond to threats and opportunities. That is, players should see enemies, obstacles, and power-ups coming.

Control Mapping

- Use natural mappings. Control mapping should be intuitive enough that new players don't have to read the instructions. If the game has relatively complicated controls, new players should be able to play after reading the instructions only once.
- If industry standards exist for the controls on the type of game you're working on, then adhere to them. For example, if most fighting games use the back button to block, then you should do the same thing.
- If possible, users should be able to play mobile games with one hand.
- Make it hard to accidentally hit the wrong button. The more trouble hitting the wrong button causes, the harder the button should be to hit.

Level Design

- Don't make it easy for players to get stuck or lost. The goal of the game and the next step towards that goal should always be clear. There should be a sense of progress towards that goal, so players never feel lost or like they're going around in circles.
- Things the player needs to see (enemies, enemy fire, power ups, ext) should stand out
    - Everything the player needs to see needs to be big enough to be perceived. Remember that some players don't have perfect eyesight.
    - To make things stand out, use contrast with the background.
        - Texture contrast
        - Color contrast
        - Light/dark contrast
- Objects in the game should look like they'll do what they do. For example, things that make you bounce higher should look springy. Things that kill you should look dangerous.
- The player shouldn't easily misinterpret things as power ups, enemies, or obstacles.
- If there are tasks which you expect to be challenging, don't require players to complete them more than once. That is, make sure that if they die soon after completing a hard task that they don't have to complete the hard task again.

Appendix 4: Game usability heuristics (PLAY) for evaluating and designing better games: the next iteration - Desurvire & Wiberg, (2009).

Table 1. Play Heuristics: Category, Heuristic and Explanation

I. Category 1: Game Play
A. Heuristic: Enduring Play
A1. The players finds the game fun, with no repetitive or boring tasks A2. The players should not experience being penalized repetitively for the same failure. A3. The players should not lose any hard won possessions. A4. Gameplay is long and enduring and keeps the players' interest. A5. Any fatigue or boredom was minimized by varying activities and pacing during the game play.
B. Heuristic: Challenge, Strategy and Pace

B1. Challenge, strategy and pace are in balance.

B2. The game is paced to apply pressure without frustrating the players. The difficulty level varies so the players experience greater challenges as they develop mastery.

B3. Easy to learn, harder to master.

B4. Challenges are positive game experiences, rather than negative experiences, resulting in wanting to play more, rather than quitting.

B5. AI is balanced with the players' play.

B6. The AI is tough enough that the players have to try different tactics against it.

C. Heuristic: Consistency in Game World

C1. The game world reacts to the player and remembers their passage through it.

C2. Changes the player make in the game world are persistent and noticeable if they back-track to where they have been before.

D. Heuristic: Goals

D1. The game goals are clear. The game provides clear goals, presents overriding goals early as well as short term goals throughout game play.

D2. The skills needed to attain goals are taught early enough to play or use later, or right before the new skill is needed.

D3. The game gives rewards that immerse the player more deeply in the game by increasing their capabilities, capacity or for example, expanding their ability to customize.

E. Heuristic: Variety of Players and Game Styles

E1. The game supports a variety of game styles.

E2. The game is balanced with multiple ways to win.

E3. The first ten minutes of play and player actions are painfully obvious and should result in immediate and positive feedback for all types of players.

E4. The game had different AI settings so that it was challenging to all levels of players, whether novice or expert players.
F. Heuristic: Players Perception of Control
F1. Players feel in control. F2. The player's have a sense of control and influence onto the game world.
II. Category 2: Coolness/Entertainment/Humor/Emotional Immersion
A. Heuristic: Emotional Connection
A1. There is an emotional connection between the player and the game world as well as with their "avatar."
B. Heuristic: Coolness/Entertainment
B1. The game offers something different in terms of attracting and retaining the players' interest.
C. Heuristic: Humor
C1. The game uses humor well.
D. Heuristic: Immersion
D1. The game utilizes visceral, audio and visual content to further the players' immersion in the game.
III. Category 3: Usability & Game Mechanics
A. Heuristic: Documentation/Tutorial
A1. Player does not need to read the manual or documentation to play. A2. Player does not need to access the tutorial in order to play.

B. Heuristic: Status and Score
B1. Game controls are consistent within the game and follow standard conventions. B2. Status score Indicators are seamless, obvious, available and do not interfere with game play. B3. Controls are intuitive, and mapped in a natural way; they are customizable and default to industry standard settings. B4. Consistency shortens the learning curve by following the trends set by the gaming industry to meet users' expectations. If no industry standard exists, perform usability/playability research to ascertain the best mapping for the majority of intended players.
C. Heuristic: Game Provides Feedback
C1. Game provides feedback and reacts in a consistent, immediate, challenging and exciting way to the players' actions. C2. Provide appropriate audio/visual/visceral feedback (music, sound effects, controller vibration).
D. Heuristic: Terminology
D1. The game goals are clear. The game provides clear goals, presents overriding goals early as well as short term goals throughout game play. D2. The skills needed to attain goals are taught early enough to play or use later, or right before the new skill is needed. D3. The game gives rewards that immerse the player more deeply in the game by increasing their capabilities, capacity or, for example, expanding their ability to customize.
E. Heuristic: Burden On Player
E1. The game does not put an unnecessary burden on the player. E2. Player is given controls that are basic enough to learn quickly, yet expandable for advanced options for advanced players.
F. Heuristic: Screen Layout

F1. Screen layout is efficient, integrated, and visually pleasing. F2. The player experiences the user interface as consistent (in controller, color, typographic, dialogue and user interface design). F3. The players experience the user interface/HUD as a part of the game. F4. Art is recognizable to the player and speaks to its function.
G. Heuristic: Navigation
G1. Navigation is consistent, logical and minimalist.
H. Heuristic: Error Prevention
H1. Player error is avoided. H2. Player interruption is supported, so that players can easily turn the game on and off and be able to save the games in different states. H3. Upon turning on the game, the player has enough information to begin play. H4. Players should be given context sensitive help while playing so that they are not stuck and need to rely on a manual for help. H5. All levels of players are able to play and get involved quickly and easily with tutorials, and/or progressive or adjustable difficulty levels.
I. Heuristic: Game Story Immersion
I.1 Game story encourages immersion (If game has story component).

Appendix 5: Faceted Classification Scheme for Computer-Mediated Discourse (Herring, 2007).

4.2 Medium factors

This section and the following section enumerate and define the categories of the CMD classification scheme and cite empirical studies to justify their inclusion. The citations are meant to be indicative only; many other studies could be cited that contribute relevant evidence.

Table 2 lists some of the most important *medium* factors that have been observed to condition computer-mediated discourse, and that are therefore posited as categories in the classification scheme. Although they are not in any necessary order, they are numbered in table 2 for ease of reference.

M1	Synchronicity
M2	Message transmission (1-way vs. 2-way)
M3	Persistence of transcript
M4	Size of message buffer
,M5	Channels of communication
M6	Anonymous messaging
M7	Private messaging
M8	Filtering
M9	Quoting
M10	Message format

Table 2. Medium factors

The first medium factor relates to *synchronicity* of participation (Kiesler, Siegel & McGuire 1984). Asynchronous systems do not require that users be logged on at the same time in order to send and receive messages; rather, messages are stored at the addressee's site until they can be read. Email is an example of this type. In synchronous systems, in contrast, sender and addressee(s) must be logged on simultaneously; various modes of "real-time" chat are the most

common forms of synchronous CMC.[9] Most traditional forms of writing are asynchronous, and spoken conversation is typically synchronous, making synchronicity a useful dimension for comparing different types of CMC with spoken and written discourse (Condon & Cech 1996; Ko 1996; Yates 1996). Synchronicity is also a robust predictor of structural complexity, as well as many pragmatic and interactional behaviors, in computer-mediated discourse (Herring 2004a; Ko 1996).

A cross-cutting technological dimension has to do with the granularity of the units that are transmitted by the CMC system, that is, whether the transmission is message-by-message, or character-by-character (a third possibility is line-by-line transmission). This has implications for whether or not simultaneous feedback is available during message exchange. With message-by-message transmission, the receiver does not typically have any indication that the sender is composing a message until it is sent and received;[10] thus, it is impossible for the receiver to interrupt or otherwise engage simultaneously with the sender's message. Cherny (1999) terms this transmission "one-way"; most CMC systems in current use make use of one-way transmission.

In contrast, character-by-character transmission is "two-way", in that both the sender and the receiver are able to see the message as it is produced, making it possible for the receiver to give simultaneous feedback. In two-way CMC systems, participants' screens split into two (sometimes more) parts, and the words of each participant appear keystroke-by-keystroke in their respective parts as they are typed. Examples of two-way synchronous CMC include the VAX "phone" protocol studied by Anderson, Beard and Walther (forthcoming), UNIX "talk", and the split-screen mode of ICQ (Herring 2002). Anderson, Beard, and Walther (forthcoming) have observed that two-way transmission can profoundly alter the structure of turn taking.

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[9] CMC systems of intermediate synchronicity also exist; for example, Babble (Erickson et al. 1999), an experimental chat-like system with a scroll-back log that persists for days, allows users who missed real-time messages to read them later. Instant messaging clients similarly blur the boundary by allowing users to read messages sent while they were away from their computer upon their return, as long as their IM client remains open.

[10] An exception is instant messaging systems that indicate that a participant is typing a message, without yet displaying what is being typed.

"Persistence of transcript" refers to how long, relatively speaking, messages remain on the system after they are received. Email is persistent by default, remaining in users' mail queues or files until deleted by the users. Moreover, many listservs archive email messages sent to discussion lists, and messages posted to Usenet newsgroups have been archived since 1995 (first by dejanews.com, and since 2000, by Google). In contrast, most chat systems retain only a few screens of messages in their scrollback buffer, with old messages eventually disappearing as they are replaced by new ones. Even the messages in the buffer disappear when the user ends a chat session, unless he or she has chosen to log the interaction. Thus, chat is relatively ephemeral compared to email, but it is more persistent than spoken conversation, in that one's typed words linger before they scroll out of sight. The overall greater persistence of CMD heightens meta-linguistic awareness: It allows users to reflect on their communication – and play with language – in ways that would be difficult in speech. It also allows them to keep track of, and participate in, multiple conversational threads (Herring 1999).

"Size of message buffer" refers to the number of characters the system allows in a single message. In most email-based systems, the buffer is effectively limitless – or at least, it is larger than practical limits on how long most people are willing to type and others are willing to read. Many chat systems, however, impose limits on message size, and text messaging systems on mobile telephones limit users to 160 characters per message. Condon and Cech (2001) found that smaller buffers often mean shorter messages and different discourse organizational strategies (see also Baron forthcoming); small buffers also increase the likelihood that language will be structurally abbreviated (Anis 2007).

With multimedia increasingly augmenting textual online interaction, it is important to take into account how many and what kinds of "channels of communication" a CMC system makes available. Visual channels in addition to text include graphics (static or animated) and video; videoconferencing systems (such as CUseeMe and audiochat; Chou 1999) provide an audio

channel as well. Herring, Martinson, and Scheckler (2002) found that the presence and content of video images affected the amount and gender distribution of discourse on an educational website. Communication involving Voice-over-Internet Protocol (VoIP) technologies such as Skype also makes use of audio (and sometimes video) channels and could be classified as CMD using the proposed scheme.

"Anonymous messaging", "private messaging", "filtering", and "quoting" all refer here to technological affordances of CMC systems. It is possible for users to engage in these behaviors without any special technical means, but when such means are available, they facilitate the behaviors, presumably making them more likely to occur. Thus, many chat systems require a user to select a nickname that is different from his or her email address, encouraging the use of pseudonyms and anonymous interaction (Danet 1998). Some Web-based discussion forums have registration procedures that do not verify users' email addresses, encouraging users to make them up. Anonymity has been found to have important effects in online discourse, including increased self-disclosure (Kiesler et al. 1984), antisocial behavior (Donath 1999), and play with identity (Danet 1998).

Similarly, some chat systems (such as IRC and MUDs) have commands that enable users to carry on private as well as public conversations, while with other systems (such as some forms of Web chat), it is necessary to open a separate program (such as an instant messaging client) to converse privately. Along the same lines, a user can always choose to ignore messages from another user, but a number of CMC systems make this easier by providing technical mechanisms to filter out such messages (known variously as "kill files", "gag" commands, etc.). CMC systems also differ in the extent to which they provide mechanisms to facilitate the quoting of a portion of a previous message in a response. Some email clients provide the text of the message being replied to in the new message, as a default. In others, one must copy and paste in the quoted portions manually. Severinson-Eklundh (Severinson-Eklundh & Macdonald 1994; Severinson-

Eklundh forthcoming) has observed that this can affect the extent and manner in which quoting is used.

Finally, "message format" determines the order in which messages appear, what information is appended automatically to each and how it is visually presented, and what happens when the viewing window becomes filled with messages. Most CMC systems add new messages to the bottom of a list in the order received by the system, although this is not true of blogs (which add the newest message on the top), wikis (which allow users to choose where their content will be inserted), or some experimental systems. Herring (1999) has observed that systems that post messages in the order in which they are received – which is to say most chat and discussion forums – result in disrupted turn adjacency and interleaved exchanges. The information provided in message headers (as in email) and leaders (as in chat systems) has been found to affect online self-reference and addressivity practices (Herring 1996; Werry 1996). Scrolling direction determines which messages are on the "top of the deck" and hence more likely to receive a response.

The list of medium factors in table 1 is open-ended. It is expected that some factors will be added, others further sub-divided, and others perhaps omitted as new systems are developed and researchers' understanding of the effects of technological affordances on mediated communication deepens over time.

4.3 Situation factors

Various social and situational factors have been observed to condition variation in computer-mediated discourse (cf. Baym 1995) as in spoken discourse (cf. Hymes 1974). The set of features summarized in table 3 incorporates elements from Hymes' SPEAKING mnemonic (see figure 1) and factors identified by Baym (1995), along with additional factors found in empirical CMD research to affect online language use. As with the medium factors, this list is not presumed to be exhaustive.

S1	Participation structure	• One-to-one, one-to-many, many-to-many • Public/private • Degree of anonymity/pseudonymity • Group size; number of active participants • Amount, rate, and balance of participation
S2	Participant characteristics	• Demographics: gender, age, occupation, etc. • Proficiency: with language/computers/CMC • Experience: with addressee/group/topic • Role/status: in "real life"; of online personae • Pre-existing sociocultural knowledge and interactional norms • Attitudes, beliefs, ideologies, and motivations
S3	Purpose	• Of group, e.g., professional, social, fantasy/role-playing, aesthetic, experimental • Goal of interaction, e.g., get information, negotiate consensus, develop professional/social relationships, impress/entertain others, have fun
S4	Topic or Theme	• Of group, e.g., politics, linguistics, feminism, soap operas, sex, science fiction, South Asian culture, medieval times, pub • Of exchanges, e.g., the war in Iraq, pro-drop languages, the project budget, gay sex, vacation plans, personal information about participants, meta-discourse about CMC
S5	Tone	• Serious/playful • Formal/casual • Contentious/friendly • Cooperative/sarcastic, etc.
S6	Activity	• E.g., debate, job announcement, information exchange, phatic exchange, problem solving, exchange of insults, joking exchange, game, theatrical performance, flirtation, virtual sex
S7	Norms	• Of organization

		• Of social appropriateness • Of language
S8	Code	• Language, language variety • Font/writing system

Table 3. Situation factors

"Participation structure" refers to the number of participants in the online communication situation (both actual, i.e., actively participating, and potential); the amount and rate of participation (described impressionistically or quantitatively); whether the communication is public, semi-private, or private; the extent to which interlocutors *choose* to interact anonymously/pseudonymously as opposed to in their "real life" identities[11] (Myers 1987); and the distribution of participation across individuals – i.e., whether participation is roughly evenly distributed, or whether some individuals or groups dominate (Herring 1993). Participation structure has implications for, among other things, politeness: public CMD tends to be less polite than private CMD (Herring 2002), and individuals who post anonymously tend to "flame" more than individuals who post in their offline identities (cf. Donath 1999).

"Participant characteristics" describe participants' backgrounds, skills, and experiences, as well as the real life knowledge, norms, and interactional patterns they bring to bear when they engage with others online (Baym 1995). For example, participant gender has been found to affect behavior related to politeness and contentiousness within a social MUD (Cherny 1994) in two otherwise similar academic discussion lists (Herring 1996) and in a mostly-female Usenet newsgroup devoted to television soap operas as compared with norms of interaction elsewhere on Usenet (Baym 1996). Participants' attitudes, beliefs, ideologies, and motivations relevant to their

[11] This value should be assigned independently of how easy or difficult the system makes sending anonymous messages or using pseudonyms. Assuming that the medium does not preclude such choices, this value encodes the extent to which users in a particular discourse sample make use of them.

online communication may also affect what they choose to communicate and how. Participants with ideological differences may be more likely to become involved in conflict discourse, as, for example, in Hodsdon-Champeon's (forthcoming) study of Usenet newsgroups on the topic of racism.

"Purpose" is potentially relevant on two levels: "Group purpose" refers in general terms to a computer-mediated group's official raison d'être (professional, social, etc.), while "goals of interaction" are what individual participants hope to accomplish through any given interaction; these need not, of course, be the same for any two individuals in the same interaction. Even when the same technologies are used, CMD can vary according to purpose; for example, Herring and Nix (1997) found differences in topics discussed as well as strategies for topic development in pedagogical and social IRC.

"Activities" (similar to Hymes' "genres") are discursive means of pursuing interactional goals (e.g., "flirting" as a means of developing personal relationships; "debate" as a means of impressing others with one's intellectual acumen); each activity has associated conventional linguistic practices that signal when that activity is taking place (cf. "contextualization cues", Gumperz 1982). Many studies have noted the existence of computer-mediated contextualization cues, ranging from emoticons to user IDs (Bechar-Israeli 1995; Danet et al. 1997; Heisler & Crabill 2006; Herring 2001), that help to signal "what is going on" in online interaction. Flaming, or the exchange of hostile message content, also has characteristic syntactic and semantic structures that distinguish it from other computer-mediated activity types (Spertus 1997).

"Topic" at the group level indicates, within broad parameters, what discussion content is appropriate in that context, according to the group's definition. Some CMC modes not conceived as discussion forums but rather as role-playing environments, such as adventure MUDs, may have a geographical and/or temporal "Theme" (such as a medieval village) instead of a topic. In contrast, topic at the exchange level is what participants are actually talking about in any given interaction; this may or may not be on the "official" topic of the group. Distinctions of topic are

important in analyzing topical digression, which has been claimed to be a characteristic of multi-participant text-based CMD (Herring 1999).

"Tone" refers to the manner or spirit in which discursive acts are performed (cf. Hymes' "key"); it can be described along a number of continuous scalar dimensions, including (but not restricted to) degree of seriousness, formality, contentiousness, and cooperation. Contentious debaters on Usenet (Hodsdon-Champeon forthcoming) employ direct quoting of a discourse participant differently than do participants in friendly CMD. Emoticons similarly take on different pragmatic meanings depending on the tone of an exchange, which they may also help to establish (Huls 2006).

"Norms" refer to conventional practices within the computer-mediated environment and comprise three types. "Norms of organization" refer to formal or informal administrative protocols having to do with how a group is formed (if applicable), how new members are admitted, whether it has a leader, moderator, or other persons whose role it is to perform official functions, how messages are distributed and stored (if this is determined by social convention rather than by the system software), how participants who misbehave are punished, etc. "Norms of social appropriateness" refer to the behavioral standards that normatively apply in the computer-mediated context (cf. Hymes' "norms of interaction"); they may be implicit or written and publicly available, for example in the form of "netiquette" guidelines (Shea 1994) or lists of Frequently Asked Questions (FAQs). Supportiveness may be expected in a women's health newsgroup, but rudeness may be expected and approved of in the newsgroup *alt.flame*, which is devoted to flaming. "Norms of language" refer to linguistic conventions particular to a group or users; these may include abbreviations, acronyms, insider jokes, and special discourse genres (Baym 1995; Cherny 1999; Rowe forthcoming).

Finally, "code" refers to the language or language variety in which computer-mediated interactions are carried out. Although English is still the most common *language* on the Internet,

and most CMC research has been carried out on English data, this situation is changing rapidly as more non-English-speaking countries gain Internet access (Danet & Herring 2007). "Language variety" includes the dialect, and where applicable, the register of language used. The default dialect is the standard, educated, written variety of the language, although regional, social class or ethnic dialects may sometimes be used (Androutsopoulos & Ziegler 2004). Register refers here to specialized sub-languages associated with conventional social roles and contexts (such as academic discourse, psychotherapeutic discourse, teacher talk); one may also identify an unmarked register, ordinary conversation, associated with the role of the "everyday" self. Choice of linguistic code in multilingual computer-mediated groups has been observed to serve different discourse functions (Androutsopoulos & Hinnenkamp 2001; Georgakopoulou forthcoming; Paolillo 1996, forthcoming).

Relatedy, "writing system" refers to the font used and its relationship to the writing system of the language: Does the communication make use of a font (such as ASCII text) based on the Roman alphabet (e.g., for languages such as English, Spanish, and French); does it transliterate a non-roman writing system (such as those of Arabic and Greek) into Roman letters/ASCII (Berjaoui 2001; Tseliga 2007); or are special non-ASCII fonts used (such as those available for Japanese, Chinese, and Korean) to represent a non-Roman writing system? Since the introduction of the Unicode character encoding standard (see Danet & Herring 2007), it has become easier to transmit a variety of languages in their native scripts via the Internet, but transliteration into roman letters persists in some contexts, and script choice may serve different pragmatic functions (e.g., Tseliga 2007).

Appendix 6: Finalised list of heuristics and detailed information

Finalised Heuristic Set

Usability:

U1 – Audio-visual representation supports the gameplay.

U2 – Visual representations should be easy to interpret and minimise micromanagement.

U3 – Provide users with information on game status.

U4 – The player understands the terminology.

U5 – Navigation is consistent, logical and minimalist.

U6 – Provide intuitive and customisable input mappings.

U7 – The game gives feedback on the player's actions.

U8 – Provide instructions, training and help.

U9 (new) – Technical issues.

Gameplay:

GP1 – The game provides clear goals or supports player-created goals.

GP2 – The player sees progress in the game.

GP3 – The player is rewarded and the rewards are meaningful.

GP4 – The player is in control.

GP5 – Challenge, strategy and pace are in balance.

GP6 – The first-time experience is encouraging.

GP7 – The game story supports the gameplay and is meaningful.

GP8 – There are no repetitive or boring tasks.

GP9 – The game supports different playing styles.

GP10 - The game is consistent.

GP11 – The player does not lose any hard-won possessions and can save regularly.

<u>Finalised set with detailed explanations</u>

Usability:

U1 – Audio-visual representation supports the gameplay.

- Provide unobstructed views that are appropriate for the user's current actions.
- Game elements should be easily identifiable.
- Aesthetics should be consistent throughout the game.
- Music and sound effects should work together to create a smooth sound environment.

U2 – Visual representations should be easy to interpret and minimise micromanagement.

- Ensure screen layouts are efficient and visually pleasing: minimise clutter, occlusion, flashing and large blocks of text.
- Ensure game elements are easy to find; contrasts in texture, colour and tone can be used to make items stand out.
- Ensure navigation controls are easy to identify and are presented separately from other items.
- The player does not have to memorise things unnecessarily in order to use the UI.
- The game design employs orthogonal unit differentiation.

- RTS – 1: It is especially important for units to have a distinct appearance when the user has to command large groups; units must be easily distinguishable in the heat of battle. If units can be upgraded, such changes must be evident without the need to examine units individually.
- RTS – 2: Main camera: default should be 3rd-person, isometric view. Needs to allow zooming, panning (tilt, yaw) etc. in order that players can fully explore terrain.
- RTS – 3: The UI fundamentally affects the RTS experience, it requires two different views: main camera and strategic. Each provides different types of information and tools to the player.
- RTS – 4: RTS games require management, and the appropriate tools with which to manage.
- RTS – 5: Fog-of-war effect is required, can be affected by in-game developments.

U3 – Provide users with information on game status.

- Provide status information for: character, location, objectives, enemies and game state.
- Critical information may change depending on context, but should always stand out.

U4 – The player understands the terminology.

- Restrict the use of abbreviations, use standardised abbreviations where possible.
- Menu item names should be intuitive and obvious.
- Terminology connected to the game concept and/or technical issues should be presented in easy to understand language.

U5 – Navigation is consistent, logical and minimalist.

- Game input systems should mirror real-world interactions, for example when controlling vehicles.
- Frequently used information should be easily accessible, avoid long navigation paths.
- Consider navigation in the following contexts: game menu, game world, UI.

- RTS – 6: Tech trees should not be overwhelming, they can be segmented in order to aid comprehension and ease-of-use.

U6 – Provide intuitive and customisable input mappings.

- Mappings should be easy to learn and intuitive, leveraging spatial relations and natural pairings.
- Adopt standard conventions and support standard input devices.
- Allow users to re-map settings and provide shortcuts/hotkeys for expert users.

- RTS – 7: Hotkeys have become an important aspect of RTS controls due to the rise of eSports, they are a useful means of circumventing menus and should be supported.

U7 – The game gives feedback on the player's actions.

- Feedback must be both immediate, consistent and appropriate. Feedback can be audio-visual or visceral.
- Audio feedback must also be accompanied by another format as some players may play without sound or have reduced hearing capacities.
- If a requested action cannot be performed immediately the player must be informed, where possible provide options to cancel or continue with the requested action.

- RTS – 8: Units should clearly acknowledge orders, and inform the user if conflicting orders have been issued.

U8 – Provide instructions, training and help.

- Users should have access to complete documentation on the game.
- When appropriate, users should be provided with interactive training.
- Default or recommended choices should be provided when users have to make decisions.
- Tutorials should be entertaining and rewarding, and part of the actual game.
- Help is often needed in error situations, error messages should be clear and informative.

- RTS – 9: Players need to be aware of the effects of choices when using tech trees.

U9 (new) – Technical issues.

- RTS – 10: Single-player modes must be accessible offline.
- RTS – 11: The actions needed to setup games (especially online games) must be automated and part of the game itself, and must not require outside intervention from the user.

<u>Gameplay Module</u>

GP1 – The game provides clear goals or supports player-created goals.

- Player-created goals can be supported by providing cues that make the player curious about in-game events, locations or characters.
- Both long-term and short-term goals should be provided.
- Long-term goals can consist of several short-term goals, however, the two types should be clearly distinguishable from one another.

GP2 – The player sees progress in the game.

- Do not make it easy for players to get stuck or lost.
- Progress can be shown explicitly (with statistics, for example), or implicitly (such as changes in NPC behaviour).
- Ensure the game does not stagnate.

GP3 – The player is rewarded and the rewards are meaningful.

- Rewards should be adjusted to reflect the level of challenge faced by the player.
- Rewards should be frequent, but unpredictable.
- Do not use a varying reward structure in regard to completion of major in-game milestones.

- RTS – 12: Development is a reward: tech trees can be take many forms but should reflect the core theme of the game and provide meaningful effects.

GP4 – The player is in control.

- Players need time and information to respond to threats and opportunities.
- Players should be able to decide on actions they want to take; these actions should influence the game world.
- The game should not include random, uncontrollable events, or tedious or difficult input sequences.

- RTS – 13: The player should have the ability to pause the game if desired.
- RTS – 14: Players should be in control of game saves, with auto-save provided as a backup.
- RTS – 15: The ability to vary the in-game speed should be provided.

GP5 – Challenge, strategy and pace are in balance.

- Difficulty levels and game speed should be adjustable.
- Allow players to skip non-playable and frequently repeated content.
- Give players room to make mistakes and learn from them, challenges are positive game experiences.
- The game should be easy to learn and hard to master.
- The AI is robust and is varied in its playing style.
- When using the UI, the player cannot make irreversible errors.
- The player learns new strategies as they play, there should not be a single, dominating strategy.
- Pace should be adjusted to suit the game style, intense games should provide opportunities for players to recover.

- RTS – 16: Maps are the basic gameplay environment for RTS games, there should be: a good amount of varied designs, environments that promote exploration, terrain/environments that affect unit abilities and support/promote different playing styles.

- RTS – 17: Micromanagement of resources, units, build queues etc., should not be mandatory - but attention to detail should be rewarded (i.e. via increased efficiency, reduced movement costs etc.).

GP6 – The first-time experience is encouraging.

- During the initial session of play, the player should feel that they have accomplished something and be rewarded.
- Initial player actions are obvious and the game's learning curve is appropriately scaled.
- The USP should be exploited in early stages in order to satisfy expectations.

GP7 – The game story supports the gameplay and is meaningful.

- The story is important, but it should not dominate the gameplay.
- The story should be consistent with the overall game type and gameplay; it should sound plausible to the player.
- Dialogue with the NPCs should be meaningful and engaging, it should contribute to the environment of the game world.

GP8 – There are no repetitive or boring tasks.

- Ensure the player does not have to repeat especially challenging tasks, especially if they die soon after completing the task initially.
- The game should not require repetition of tasks without changing any conditions.
- In the training phase, however, it is useful to repeat certain tasks in order that they can be properly learned.

- RTS – 18: Resource gathering is a fundamental aspect of RTS games, effort must be made to ensure that other actions/activities are available whilst resource gathering is underway, it should not be "dead time".

GP9 – The game supports different playing styles.

- Game settings should be customisable.
- Players should be able to express themselves via character customisation, varied in-game behaviour and modding of the game-world.
- More complex games should support distinct player types, such as those defined by Bartle.
- Provide varied victory conditions.

- RTS – 19: Provide different factions with distinct characteristics and abilities.
- RTS – 20: The game should provide a range of modes and scenarios other than just campaign and multiplayer.
- RTS – 21: The game should have both single- and multiplayer options, each specifically designed to fulfil different functions. The first stages of the single-player, or campaign, mode are often used as a tutorial, but should also allow for independent play. Multiplayer should provide a diverse range of maps upon which players can engage with one another and which support the skills learned in the single-player mode.
- RTS – 22: Tech trees can be used to both facilitate, and promote, different playing styles.

GP10 - The game is consistent.

- Basic mechanics (hit detection, game physics, enemy behaviour, etc.) should be appropriate to the situation.
- Computer-controlled units should behave in a predictable fashion; players should not be required to issue commands rectifying faulty AI.
- Pathfinding should be appropriate to the in-game situation.
- Game elements that mirror real-world items should display the same characteristics and behaviours.
- The game should not contain invisible walls.
- Actions should be consistent and logical, especially in regard to movement and interaction with the game environment.

- RTS – 23: AI guides all units with appropriate automated responses to context, such as when confronted by enemy units.
- RTS – 24: Particular attention should be paid to pathfinding in battle situations.
- RTS – 25: The AI should be bound by the same game rules as the player.

GP11 – The player does not lose any hard-won possessions and can save regularly.

- “Possessions” are not limited to in-game items and include more abstract matters such as character development.

Player interruption is supported; players should be able to easily turn the game on or off and to save the game in different states.

Appendix 7: Printable Heuristic Cards

The pages below (151 - 160) have been organised in such a way that they are print ready. Please follow these instructions to ensure that they are printed in a usable format:

1. Ensure you are using a printer that accepts firm card and place 5 pieces of A4 card in the appropriate feed tray (using manual feed is usually the best option for thicker card).
2. Select the first five pages for printing (pp.156 – 160*).
3. Remove the printed pages and rotate 180 degrees.
4. Select the final five pages for printing (pp.161 – 165*).
5. Cut around the edges of the heuristic cards (either side will work).

*Ensure the page numbers selected for printing reflect those of the original document.

GP

The game provides clear goals or supports player-created goals

Gameplay 1 of 11

GP

The player sees progress in the game

Gameplay 2 of 11

GP

RTS

The player is rewarded and the rewards are meaningful

Gameplay 3 of 11

GP

RTS

The player is in control

Gameplay 4 of 11

GP

RTS

Challenge, strategy and pace are in balance

Gameplay 5 of 11

GP

The first-time experience is encouraging

Gameplay 6 of 11

GP

The game story supports the gameplay and is meaningful

Gameplay 7 of 11

GP

RTS

There are no repetitive or boring tasks

Gameplay 8 of 11

GP

RTS

The game supports different playing styles

Gameplay 9 of 11

GP

RTS

The game is consistent

Gameplay 10 of 11

GP

The player does not lose any hard-won possessions and can save regularly

Gameplay 11 of 11

U

Audio-visual representation supports the gameplay

Usability 1 of 9

U

RTS

Visual representations should be easy to interpret and minimise micromanagement.

Usability 2 of 9

U

Provide users with information on game status

Usability 3 of 9

U

The player understands the terminology

Usability 4 of 9

U

RTS

Navigation is consistent, logical and minimalist

Usability 5 of 9

U

RTS

Provide intuitive and customisable input mappings

Usability 6 of 9

U

RTS

The game gives feedback on the player's actions

Usability 7 of 9

U

RTS

Provide Instructions, Training and Help

Usability 8 of 9

U

RTS

Technical issues

Usability 9 of 9

GP

Gameplay 2 of 11

Do not make it easy for players to get stuck or lost. Progress can be shown explicitly (with statistics, for example), or implicitly (such as changes in NPC behaviour)

Ensure the game does not stagnate

GP

Gameplay 1 of 11

Player-created goals can be supported by providing cues that make the player curious about in-game events, locations or characters

Both long-term and short-term goals should be provided

Long-term goals can consist of several short-term goals, however, the two types should be clearly distinguishable from one another

GP

Gameplay 4 of 11

RTS

Players need time and information to respond to threats and opportunities

Players should be able to decide on actions they want to take; these actions should influence the game world

The game should not include random, uncontrollable events, or tedious or difficult input sequences

RTS – The player should have the ability to pause the game if desired

RTS - Players should be in control of game saves, with auto-save provided as a backup

RTS - The ability to vary the in-game speed should be provided

GP

Gameplay 3 of 11

RTS

Rewards should be adjusted to reflect the level of challenge faced by the player

Rewards should be frequent, but unpredictable

Do not use a varying reward structure in regard to the completion of major in-game milestones

RTS – Development is a reward: tech trees can be take many forms but should reflect the core theme of the game and provide meaningful effects

GP

Gameplay 6 of 11

During the initial session of play, the player should feel that they have accomplished something and be rewarded

Initial player actions are obvious and the game's learning curve is appropriately scaled

The USP should be exploited in early stages in order to satisfy expectations

GP

Gameplay 5 of 11

RTS

Difficulty and game speed should be adjustable

Let players skip non-playable/repeated content

Let players make mistakes and learn from them

Pace should be adjusted to suit the game style

The game is easy to learn and hard to master

The AI is robust and is varied in its playing style

the player cannot make irreversible errors

The player learns new strategies as they play

RTS – Maps are the basic environment, there should be a good amount of varied designs

RTS – Micromanagement should not be mandatory, but reward attention to detail

GP

Gameplay 8 of 11

RTS

Ensure the player does not have to repeat especially challenging tasks, especially if they die soon after completing the task initially

The game should not require repetition of tasks without changing any conditions

In the training phase, however, it is useful to repeat certain tasks in order that they can be properly learned

RTS – Resource gathering is a fundamental aspect of RTS games, effort must be made to ensure that other actions/activities are available whilst resource gathering is underway, it should not be "dead time"

GP

Gameplay 7 of 11

The story is important, but it should not dominate the gameplay

The story should be consistent with the overall game type and gameplay; it should sound plausible to the player

Dialogue with the NPCs should be meaningful and engaging, it should contribute to the environment of the game world

GP

Gameplay 10 of 11

RTS

- Basic mechanics are appropriate to the situation
- Computer-controlled units behave predictably
- Pathfinding is appropriate to the situation
- Elements mirroring real-world items should display the same characteristics and behaviours
- The game should not contain invisible walls
- Actions should be consistent and logical
- RTS - AI guides all units with appropriate automated responses to context
- RTS – RTS – 24: Particular attention should be paid to pathfinding in battle situations
- RTS - The AI should be bound by the same game rules as the player

GP

Gameplay 9 of 11

RTS

- Game settings should be customisable
- Players can express themselves via character customisation, varied behaviour and modding
- Complex games provide distinct player types
- Provide varied victory conditions
- RTS – Provide different factions with distinct characteristics and abilities
- RTS – Provide a range of modes and scenarios
- RTS – 21: The game should have both single- and multiplayer options, each specifically designed to fulfil different functions
- RTS – Tech trees can be used to both facilitate, and promote, different playing styles

U

Usability 1 of 9

- Provide unobstructed views that are appropriate for the user's current actions
- Game elements should be easily identifiable
- Aesthetics should be consistent throughout the game
- Music and sound effects should work together to create a smooth sound environment

GP

Gameplay 11 of 11

- "Possessions" are not limited to in-game items and include more abstract matters such as character development
- Player interruption is supported; players should be able to easily turn the game on or off and to save the game in different states

U

Usability 3 of 9

Provide status information for: character, location, objectives, enemies and game state

Critical information may change depending on context, but should always stand out

U

Usability 2 of 9

RTS

Ensure layouts are efficient and visually pleasing

Ensure game elements are easy to find

Ensure navigation controls are easy to identify

The player does not have to memorise things unnecessarily in order to use the UI

RTS – Units must have a distinct appearance

RTS - Default camera is 3rd-person, isometric

RTS - The UI requires 2 views: main camera and strategic

RTS - Games need tools to manage information

RTS - Fog-of-war effect is required

U

Usability 5 of 9

RTS

Game input systems should mirror real-world interactions, for example when controlling vehicles.

Frequently used information should be easily accessible, avoid long navigation paths

Consider navigation in the following contexts: game menu, game world, UI

RTS – Tech trees should not be overwhelming, they can be segmented in order to aid comprehension and ease-of-use

U

Usability 4 of 9

Restrict the use of abbreviations, use standardised abbreviations where possible

Menu item names should be intuitive and obvious

Terminology connected to the game concept and/or technical issues should be presented in easy to understand language

U

Usability 7 of 9

RTS

Feedback must be both immediate, consistent and appropriate. Feedback can be audio-visual or visceral

Audio feedback must also be accompanied by another format as some players may play without sound or have reduced hearing capacities

If a requested action cannot be performed immediately the player must be informed, where possible provide options to cancel or continue with the requested action

RTS – Units should clearly acknowledge orders, and inform the user if conflicting orders have been issued

U

Usability 6 of 9

RTS

Mappings should be easy to learn and intuitive, leveraging spatial relations and natural pairings

Adopt standard conventions and support standard input devices

Allow users to re-map settings and provide shortcuts/hotkeys for expert users

RTS – Hotkeys have become an important aspect of RTS controls, they are a useful means of circumventing menus and should be supported

U

Usability 9 of 9

RTS

RTS – Single-player modes must be accessible offline

RTS – The actions needed to setup games (especially online games) must be automated and part of the game itself, and must not require outside intervention from the user

U

Usability 8 of 9

RTS

Users should have access to complete documentation

When appropriate, users should be provided with interactive training

Tutorials should be entertaining and rewarding, and part of the actual game

Help is often needed in error situations, error message should be clear and informative

Default choices should be provided when users have to make decisions

RTS – Players need to be aware of the effects of choices when using tech trees