Towards a Model of the Design Process for Games

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ABSTRACT
In this paper, we present an approach to studying the game design process by drawing upon general models of design to support research into the process of game design. Several general models of design exist to consider the processes through which designers work. Many of these fit within a structure of analysis, synthesis and evaluation that was first proposed by Christopher Jones in 1963 and later adapted by Bryan Lawson to account for the messy nature of design and the undertaking of these activities while negotiating between problem and solution. This paper proposes the adaptation of Lawson's model of design to study the activities of game designers and to potentially find opportunities to improve and refine the process of game design. Specifically, the paper seeks to propose a model for facilitating the study of the game design process as it relates to the individual actions designers take when developing games.

Keywords
Game design, idea generation, creativity, pre-production, concepts, design education, design research

INTRODUCTION
The game design process is a relatively new subject of inquiry with the first books on the topic emerging in the 1980s (Crawford 1984). As the field of digital games has grown so has the body of academic and industry literature related to the topic of game design. Many books and dedicated journals on the topic emerged in the early 2000s with Aarseth (2001) writing that "2001 can be seen as the Year One of Computer Game Studies as an emerging, viable, international, academic field" with the launch of the Game Studies journal. This work seeks to explore whether applying general models of design to game design practice might provide new insights and areas of inquiry.

While much game research has traditionally taken place in humanities and computer science, Lankoski & Holopainen (2017) argue that it is through the discipline of design studies that the study of game design should take place. Kultima (2015) suggests that looking at the process of game design through general design models could help

improve the methodologies of game design. Kuittinen and Holopainen (2009) reviewed design models in comparison to game design textbooks and found that game design textbooks are often focused on the product of game design over the process of designing. Chiapello (2014) applied Schon's epistemology of design practice to the development of mobile games. Through interviews with developers and using a design-based approach, Chiapello uncovered a new perspective on mobile, casual and social games which have become widely accepted within the discipline (2017). Researchers Marcotte and Khaled (2017) used a design-based lens in their analysis of the practices related to critical game design. In this research new methods to study the practices of game designers were developed that provided unique insight and potential for future refinement as game design research methods. These examples show the potential benefits that can be gained through the use of a design-based lens when analysing the game design process. The following sections will provide an overview of design models, innovation and the game design process before presenting the proposed model and highlighting how we can apply this to the existing literature on the design process to better understand how game design occours in practice.

MODELS OF DESIGN

The discipline of design can be seen as separate from science and humanities (Archer 1979). The 1962 Conference on Design Methods is widely regarded as the origin of design methodology as a distinct academic discipline, Nigel Cross' coining of the term 'designerly ways of knowing' (1982) helped to further establish design as an independent academic discipline. The design process is an important area of research within this field with the debate around design models emerging in the 1970s. The field started to become more coherent in its approach from the 80s onwards with the establishment of journals, conferences and books on the subject (Cross 2007b).

Several models of the design process have been developed that detail the design process within fields such as product design, architecture, interaction design and more. These models seek to provide designers and educators with a shared vocabulary and ability to talk about the process, refine it and critique it (Dubberly 2005). Jones (1963) proposed a model of design based on the activities of analysis, synthesis and evaluation as the fundamental activities of the designer. Analysis is the process by which designers understand the problem space, synthesis is the process by which ideas are generated and evaluation is the process by which potential solutions are evaluated. Evbuomwan et al. (1996) reviewed design models within the literature and found that many of them included iteration and emphasised the activities of analysis, synthesis, and evaluation.
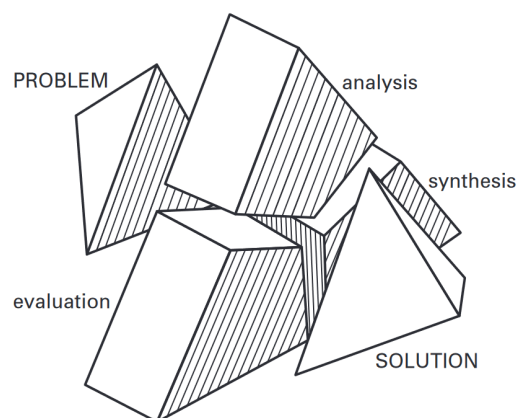

Figure 1: Lawson's (2010) design process model shows the three activities of analysis, synthesis and evaluation as activities occurring between the design problem and solution.

The model of the design process proposed by Jones (1963) outlines the steps of analysis, synthesis and evaluation and was expanded on by Lawson (2010) who frames the steps not as an ordered process but rather as activities that occur during the process as a negotiation between problem and solution. The model (**Figure 1**) is a simplification of the process but is intended as a method to describe the process without prescribing an order or rigid steps to be followed.

Game Design and Innovation

The market for video games is one where "novelty, innovation and originality are crucial" (Lê, Massé, and Paris 2013, 59) and games are seen as highly innovative products (O'Hagan and O'Connor 2015). Innovation within the game industry and the wider creative industries is an important aspect of production and this innovation is a result of the game design process. Traditional models of innovation focus on research and development activities (R&D) where research is focused on the sciences and development is the application of this research to novel technologies (Godin 2008). This is often described as *Technological Product and Process Innovation* (TPP). The Organisation for Economic Co-operation and Development (OECD) and Eurostat (2018) provide the following definition of innovation:

> An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process).
>
> <div align="right">(2018, 20)</div>

Several authors have proposed that this definition of innovation fails to capture the activities of the creative industries (Jaaniste 2009; Stoneman 2011). One approach called *Cultural Product and Process Innovation* (CPP) is concerned with "the research, development, application and diffusion of cultural products (stylistic changes, changes to forms, changes to content) and their processes (the ways in which products are made, delivered and distributed)" (Jaaniste 2009, 226). Similarly, Stoneman proposed a new definition for innovation within the creative and cultural industries called *Soft Innovation*: "Soft innovation is innovation in goods and services that primarily impacts upon aesthetic or intellectual appeal rather than functional performance" (2011, 22).

These models for innovation encompass innovation that is more driven by product differentiation as opposed to functional improvements. The concept of soft innovation in video games, for example, suggests that much of the innovation within games is related to the aesthetic appeal of the game (ie. the appeal to the senses) as opposed to functional or technical improvements. Jónasdóttir (2018) suggests that soft innovation in the games industry is "associated with shaping the experience of the users through new creative content and/or aesthetic design providing more pleasant, sophisticated, or simplified interactions and symbolic content" (35).

One of the critiques of the concept of soft innovation is that it places commercial success as a key metric for measuring innovation (Eltham 2013). While this critique may be especially valid for some creative industries, it is hard to argue that commercial success is not a key metric for the success of games projects given that Wijman (2020) estimates that players will spend over $2 billion on games by 2023. Even within the space of smaller indie game developers, there is a desire to achieve levels of commercial success to continue and grow the ability to release games(Guevara-Villalobos 2011). Jónasdóttir & Bygstad (2019) conducted interviews with several game studios and found that this tension between the desire to achieve market success

and artistic vision could lead to a level of anxiety and uncertainty during the development of games.

By analysing a dataset of 1,800 observations on AAA games Cox (2014) found that "as quality is found to be one of the most important factors affecting the likelihood of a video game becoming a blockbuster, optimisation of the gameplay experience would seem to have considerably more impact on sales than, say, paying for a license or franchise endorsement" (197). Cox uses quality as a term to describe the overall gameplay experience of the player and not just the technical implementation of the gameplay. This finding is in line with other industries where innovation has been seen as linked to commercial success (Shapiro 2006). Storz et al. (2015) highlight that the game industry is primarily focused on incremental innovation by citing the decline in the creation of new game genres since the 1990s. By analysing the design process and developing a shared understanding of the process academics and researchers may be better able to educate and understand the role of innovation and its importance to the field of game design.

THE GAME DESIGN PROCESS
Wynn and Clarkson (2018) reviewed design and development models and found that they can be categorised into three types: micro, meso, and macro-level models. These correspond to individual process steps; end to end flows of activity; and organisational and management level models respectively. Many models of game design correspond to the meso and macro level of design, focusing on project stages, deliverables and life cycles (Adams 2010; Fullerton 2019; LeMarchand 2021). Less focus has been given to the micro design process, the individual or small group process of design, as it relates to game design. Neil (2015) developed a tool to support this process through a participant-observer approach and Kultima (2017) describes her study of the role of stimuli in game idea generation as game design praxiology (2). In this study, Kultima drew on established literature in design studies on fixation (Crilly 2015) when developing methodologies and considering the results of her findings from a longitudinal study.

Within game development, those working on games can range from individual creators, artists and independent developers (indie) to large (AAA) studios that employ thousands of developers, with the primary platforms being mobile, console/handheld and PC. Young (2018) highlights how developers outside mainstream development can feel "alienated from the creative process of game development" (44) and instead develop their own game design process. Even within large studios the process used in the development of games often varies between large studios with formal processes such as Rational Game Design (Jolis-Desautels 2017), Cabals (Birdwell 2006), Method (Cerny 2002), and other approaches differing in terms of how prescriptive they are, the responsibilities of individuals, and the organisation of the project.

Keogh (2019) suggests that from the 1980s to the 2000s video games underwent a process of "aggressive formalisation" (16) which was driven by publishers and hardware manufacturers that regulated the release of games and created a clear distinction between 'professional' and 'amateur' developers. In the 2010s, as digital distribution and online marketplaces began to provide an opportunity for amateur developers to gain visibility and commercial success, the indie game development movement began to gain traction (McCrea 2013). These developers from outside the mainstream, AAA cultures, often follow fewer formal processes and have developed games that are more diverse and individualised than seen in the larger AAA industry (Young 2018). Keogh (2019) has described the current state of game development processes as one where there is a mixing of both the informal approaches and the formal approaches to development. To describe this mixing of processes and approaches

between indie and AAA developers, Keogh coined the term "intense in/formalisation" (2019, 16).

By nature of being part of the creative industries, game development is often seen as interdisciplinary, heterogeneous, and diversified as opposed to a single coherent discipline (Hagen 2011). Game development is highly multidisciplinary, bringing together programmers, artists, project managers, game designers and sound designers (Salen and Zimmerman 2004). In the book *What Is A Designer: Things . Places . Messages* Potter (2002) notes that every human is a designer if we consider design as "a blanket term to cover every situation in which adaptation of means to ends is preceded by an abstract of intent" (10). In this way, all members of the development team could be seen as game designers. However, for the purposes of this research, the definition of designer covers those who create meaningful experiences for people (Press and Cooper 2017) with specific relevance to game experiences. This work is focused on professional game design, that is those who have a job title related to or specific responsibility for the design of a game. This role varies by the game studio and can include several sub-disciplines such as level design, user experience, system design, narrative design, mission design, economy design and technical design.

The game design process is often seen to be similar to other design processes with an iterative cycle and a process that proceeds from ideation to pre-production, to production, and post-production (Fullerton 2019; Lemarchand 2021; Berg Marklund et al. 2019) Throughout this process there is constant iteration with new ideas and concepts being generated, then formalised through design documentation, tested through prototypes, and evaluated through player feedback(Fullerton 2019). Berg Marklund et al. (2019) highlight the nature of the game design process as being non-linear as ideas evolve and emerge through the development and testing process. This is echoed in numerous textbooks that highlight the importance of this iterative approach to the development of video games (Fullerton 2019; Macklin and Sharp 2016; Salen and Zimmerman 2004). Adams (2010) describes the game design process as split into three stages: concept stage, elaboration stage and tuning stage (See **Figure 2**) with constant prototyping, playtesting and evaluation throughout these phases.
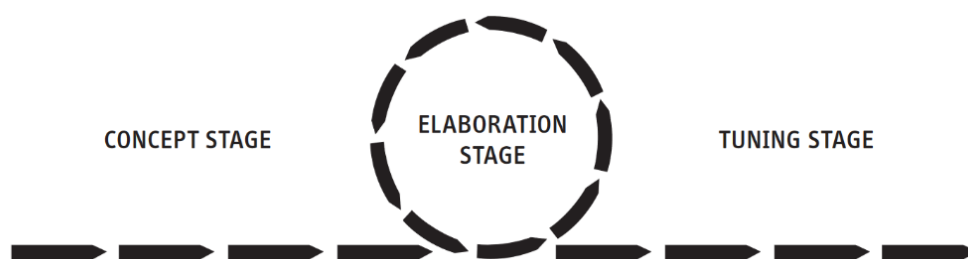

Figure 2: Adams (2010) shows the game moving from concept to elaboration and finally to tuning before release.

The first phase, ideation, involves the development of game concepts that may be suitable to develop further. Lemarchand (2021) highlights the emerging importance of ideation to the design process "As time passed, we learned in stages, first figuring out the importance of preproduction and its differences from full production, then realizing the importance of postproduction. Finally, we recognized that we were missing out on the very first step: we had something to learn from the ideation processes used in games academia and in other mature design disciplines" (18).

Cohendet and Simon (2007), highlight how a large studio approves the development of a proof of concept based on an idea. This proof-of-concept is then developed before the concept is ready for pre-production to begin on the project. During this pre-production phase, the game concepts and ideas are still refined further before entering a more formal and strictly controlled production phase. Once the game concept has been developed it is then time to test it to see if it achieves the desired gameplay goals through a prototyping phase. As prototypes become more formalised the game moves into production where there is a clearer understanding of what the game will be. Post-production has emerged as a significant factor in game development over the last number of years as games receive bug fixes, feature updates, expansions and additional content sometimes years after the original release.

The *Method* approach developed by Mark Cerny and Michael John (Cerny 2002) proposed a model of game development split between two phases: pre-production and production which has become the industry standard among large developers (Ivan 2020). The pre-production phase is described as "managing chaos" by Cerny where the macro design of the overall game, an approximately 5-page document, is the outcome of this initial experimentation phase. The Rational Design Method (RDM) developed by the large publisher and developer Ubisoft utilises a data-driven approach to quantify user experience and create gameplay to suit player needs (Jolis-Desautels 2017). This approach focuses on the use of metrics and data analysis in terms of identifying the aspects of player experience and, through evaluation by the designer, suggests potential solutions to design problems. The Cabal process operated by Valve Inc. describes a democratised process of design and development focused on the use of specialised groups or cabals within the larger studio organisation (Birdwell 2006). These cabals develop solutions through the development of specialised teams that use a team-based design process that is supplemented by regular feedback from players.

In addition to the processes discussed above Whitson (2020) highlights how accounts of the development process often cover up the more 'messy' reality experienced by developers. This work highlights the importance of soft skills in game development as developers consider skill-building for "problem-solving, social coordination, and interacting within complex human–machine assemblages" (Whitson 2020, 285). These accounts illustrate how our understanding of design activities at the level of process flows and organisational structures provides clarity as to how games are made, however, our understanding of the individual processes and activities of designers remains limited.

ANALYSIS, SYNTHESIS AND EVALUATION IN GAME DESIGN

By looking at the design literature we propose examining the game design process through the adaptation of the process model outlined by Lawson (2010). This model (**Figure 3**) considers the flow of game design activity at a micro level where designers and those involved in the design of games are iterating and generating designs. The model moves through iterative cycles of analysis, synthesis and evaluation and can occur on a variety of scales from sketching solutions to potential problems to developing prototypes and systems to test and evaluate solutions.
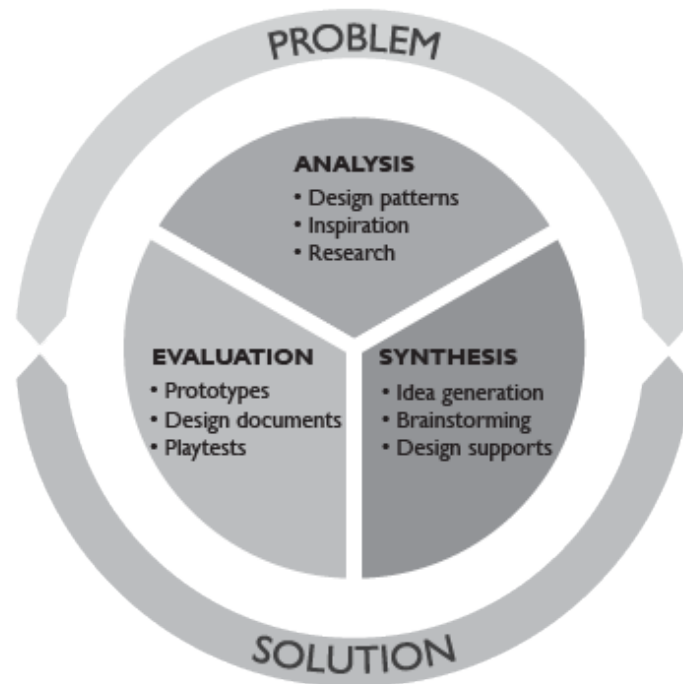
Figure 3: The proposed model situates analysis, synthesis and evaluation as activities that occur between design problems and solutions.

The individual activities of analysis, synthesis and evaluation are presented with reference to the game design literature. In the analysis phase, we consider how the interplay between technology and creativity impacts the process, how games are inspired through a variety of sources and the role of research in game design. In synthesis, we discuss how designers generate game concepts and solutions and methods for supporting design. Lastly, evaluation looks at how prototypes, documents and playtests are used to evaluate the effectiveness of design solutions. These activities are not process steps moving rigidly from analysis to synthesis to evaluation and so on in a continuous cycle, instead they are activities performed in design. By looking at game design through the design process model we can identify how activities within the design process might interrelate with one another and identify areas for further study. A game designer might immediately develop a prototype and be inspired to add a new element which in turn might lead them back to analysis to better understand the new concept or idea. In this way, it does not dictate a way to design but rather a way to understand the activities of designers and specifically, in the case of this paper, game designers.

The following sections review the literature related to game design and illustrate how analysis, synthesis and evaluation can be identified in the process of game design. Three examples of design activities are selected for analysis, synthesis and evaluation in order to demonstrate how the model can help provide insight into the design process and identify opportunities for further research. These examples are intended to be illustrative and not an exhaustive list of game design activities.

ANALYSIS IN THE GAME DESIGN PROCESS

Within game design, analysis involves building an understanding of the design problem through identifying the problems, patterns and relationships in a given design task. It refers to the "ordering and structuring of the problem" (Lawson 2010, 37). Here we

highlight three different approaches to analysis in game design: design patterns, inspiration and research.

Design Patterns

The concept of game design patterns is an adaptation of Alexander, Ishikawa, and Silverstein's concept of architectural patterns (1977). They propose that every pattern "describes a problem that occurs over and over again in our environment, and then describes the core solution to that problem, in such a way that you can use the solution a million times over, without ever doing it the same way twice" (Alexander, Ishikawa, and Silverstein 1977, x). Within the field of games, Björk and Holopainen published *Patterns in Game Design* (2005) which sought to adapt the concept of pattern design to the design of games. Since then their wiki has gathered more than 700 patterns (GameplayDesignPatterns.org) for game design. Other approaches to pattern design for games include Adams and Dormans (2012) game mechanics and associated *Machinations* (machinations.io) design tool as well as Christopher Barneys *Pattern Language for Game Design* (2021). These pattern approaches represent a formal way of analysing game design, which can also form the basis for designing solutions to common design problems.

Inspiration

Hagen (2012, 89) suggests that "video game design seems to be moving from engineering to artistic creation and from a division between design and construction to a more creative non-rational way to work with interplay between ideation and fabrication." Within the field of game design, the relationship between the game idea and the technical feasibility creates a trade-off between what is possible and the creative vision (Wang and Nordmark 2015). While Wang and Nordmark (2015) point out that the creative team can request changes to the development of a game throughout development, this decision depends on how advanced production has become and a cost/benefit analysis at this point. This means that new ideas are often easy to implement through rapid prototyping early in a project, but become more difficult as a game project approaches release.

The interplay between technological and creative considerations in the development of video games creates constraints for designers who must adapt concepts to new hardware or engines and develop games to use the potential offered by these technological advancements (Lê, Massé, and Paris 2013)Technology acts as a medium between ideas and their implementation within the game and it "allows a creative game designer to express and share ideas" (Lê, Massé, and Paris 2013, 55). The relationship between the idea for a game and the mechanical/thematic elements is also closely related to the process of prototyping. Manker (2012) highlights the importance of having a technical implementation of the game in the form of a prototype to communicate game ideas to the wider team. Hagen (2011) describes this process as a negotiation between the designer and themselves and the designer and the development team. Within game development, designers view "prototypes as sketches, visualizations, communication of a function, tests of a function, design aids, specified parts of an intended outcome and an experience of an idea" (Manker 2011, 2).

The work of Hagen (2009) showed that within a study of 25 games all titles combined a 'recycled part' and an 'innovative part'. Hagen proposed a model (See **Figure 4**) for this form of game innovation based on his research. This model shows how there can be elements of both radical and incremental innovation within a single game concept as games may innovate across aspects of the game concept.
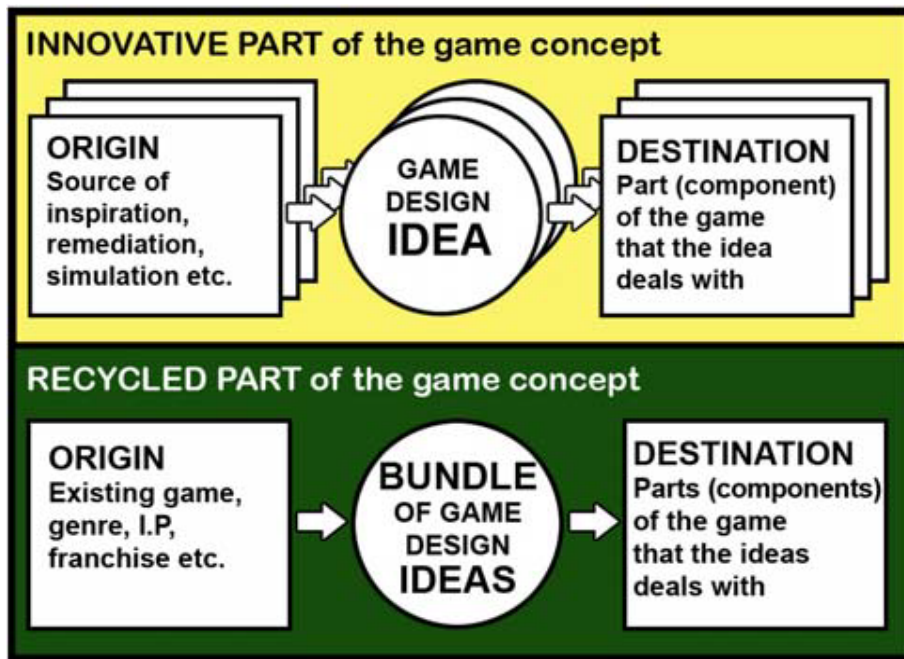
Figure 4: The game design concept model by Hagen (2009) highlights the nature of game concepts as including both innovative and recycled elements.

A model of the creative process in the pre-production of video games focused on the types of creativity shown was proposed by Sánchez et al. (2021). This model (See **Figure 5**) suggests creativity in the design of games can come from a mash-up of different sources, exploration of accepted structures and rules and transformation of existing approaches and norms. Designers often employ these different approaches depending on the types of challenges they face.

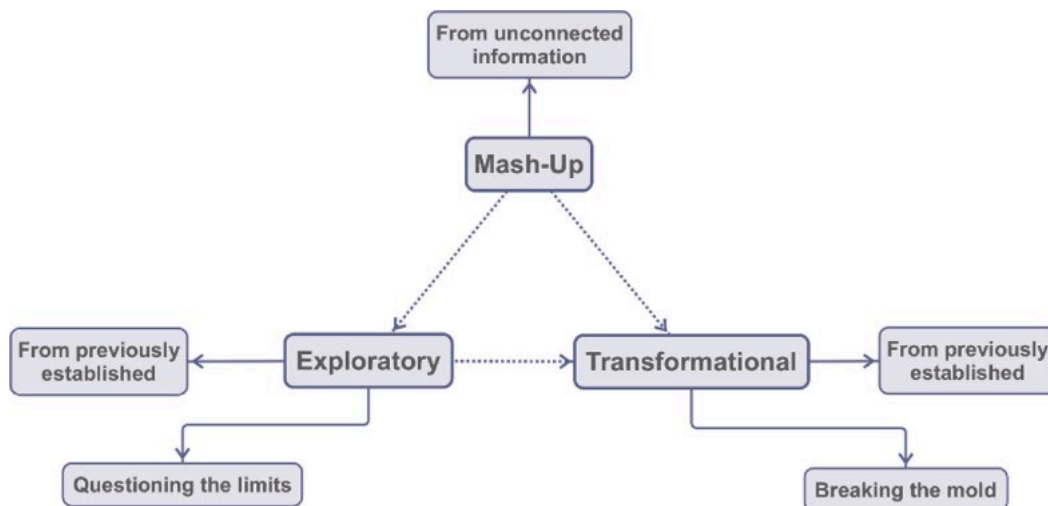**Figure 5:** The game design concept model by Sánchez et al. (2021) describes game concepts as arising from three different processes; mash-up, transformational and exploratory.

Research

Research as an aspect of the game design process may be underrepresented in the literature when compared to other design disciplines. Many textbooks focus on idea generation over research and exploration. LeMarchand (2021) however emphasises the

importance of research in the early design process and includes insights into how research informed the design of the Uncharted series: "Research is one of my favourite parts of the ideation phase, and it was important in the creation of every Uncharted game. We wanted to root our stories in historical and geographic fact, because we knew that "grounding" them in this way would help our audience suspend their disbelief" (2021, 30). This might suggest that the literature doesn't effectively capture the types of research conducted during the game design process.

SYNTHESIS IN THE GAME DESIGN PROCESS

Synthesis is the process of generating solutions and is focused on moving the design forward. It is the "attempt to move forward and create a response to the problem – the generation of solutions" (Lawson 2010, 37). Here we highlight three different approaches to synthesis in game design: idea generation, brainstorming and design supports.

Idea Generation

Tschang & Szczypula (2006) describe video games as "composed of ideas generated by individuals' creative processes." In this way, we can identify the importance of creativity and the ability to generate ideas for the work of game designers. Idea generation is generally an early phase of the design process when ideas are developed and evaluated for their suitability to pursue through further development. Many design models treat ideation as a single step where ideas are produced in one session; then, the ideas generated are evaluated, and one is selected to pursue (Daly et al. 2016; Hsiao, Wang, and Chen 2017) however others see it as a continuous, iterative process (Goldschmidt 2014; Shah, Kulkarni, and Vargas-Hernandez 2000). Design ideas and opportunities to develop solutions based on player feedback occur throughout the development of a game project (Berg Marklund et al. 2019).

Game ideas can be viewed quite differently by designers (Kultima 2010) from single line descriptions, to formal design documents and from thematic to mechanical concepts, this may be a facet of the absence of standardised practices within the industry (Keogh 2019). Ideas are often seen as a starting point by designers that are subject to change to meet the needs of the game, therefore "ideas are prone to be altered in one way or another during the design process" (Kultima 2010, 4). When designers spoke of game ideas in this study, they found it easy to develop new ideas but were challenged when developing good ideas and even found it difficult to describe the qualities of good ideas (Kultima 2010). For the interviewees in Kultima's study, the aspect that signified good ideas was how they were received by others, they are described as "inspiring for others to immediately build on top of them" (Kultima 2010, 4). Schon (1979) describes this as "tacit knowledge" where designers find it difficult to externalise their design knowledge. The concept of tacit knowledge is echoed by Cross (2007a) who highlights the importance of externalising this knowledge "What designers know about their own problem-solving processes remains largely tacit knowledge — i.e. they know it in the same way that a skilled person 'knows' how to perform that skill" (25).

Berg Marklund et al. (2019) reviewed 48 empirical studies on game development and found that the majority of them dealt with the concept of creativity. They found that the inspiration for ideas, how ideas are transformed, technological innovation, bugs and the interplay between collaborators affected the development of the project leading to the conclusion that the "game development process is nonlinear, whereby ideas evolve during the development and test process" (Berg Marklund et al. 2019, 186). In this meta-review, they found "that creativity is achieved through a collaborative, test-driven process where structure, documentation and control are de-emphasized" (187).

Brainstorming

Fullerton (2019) describes the initial step of brainstorming as an individual process moving from developing player experience goals to testing a written design treatment with potential players. This is similar to the iterative process in other disciplines as it moves from initial game ideas to testing out written treatments for the same with players.
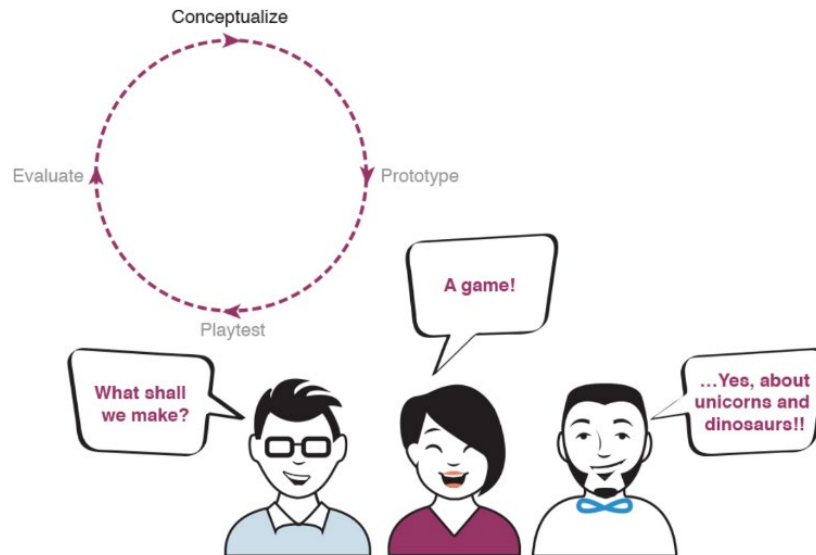

Figure 6: The conceptualise phase of the game design process by Macklin & Sharp (2016) highlights the exploratory nature of this phase but suggests a rigid cycle moving in stages.

The process outlined by Macklin and Sharp (2016) similarly starts with conceptualisation via techniques such as brainstorming, motivations and design values to develop an initial concept for a game before refining it further (See **Figure 6**). Methods for brainstorming such as Idea Speed-Dating (359), 'How Might We…' Questions (361), and Noun-Verb-Adjective Brainstorming (364) are suggested as methods to generate game concepts. Interestingly, these methods are suggested to novice designers as brainstorming has been shown by authors such as (Henderson et al. 2019; Keshwani et al. 2017) to be less effective than guided ideation supports.

Design Supports

Kultima et al. (2008) developed a series of game idea generation games: VNA Cards (Verb, Noun, Adjective), GameSeekers and GameBoard as interventions for discipline-specific creativity. In initial studies, they found benefits from the use of these interventions despite some of the complexities around the game systems on which they are built. Kultima (2017) studied the use of VNA (See **Figure 7**) cards for the development of game concepts and their impact on design fixation. In this study, the participants were paired and produced 100 game ideas (5 ideas per pair). While there was no control group Kultima found that the ideas generated were varied and showed unique attributes with only two similar ideas being developed.

Figure 7: Sample of Verb Noun Adjective Cards (VNA Cards), Kultima (2017) used to aid game designers in developing novel concepts.

EVALUATION IN THE GAME DESIGN PROCESS

Game designs can be evaluated to identify their potential in terms of the player experience and their impact on the gameplay. It involves the "critical evaluation of suggested solutions against the objectives identified in the analysis phase" (Lawson 2010, 37). Here we highlight three different approaches to evaluation in game design: documentation, prototypes and playtests.

Documentation

Documentation presents an interesting challenge in the field of game design as a formalised document would seem to be an inhibitor of the inherently chaotic nature of game development (Tschang and Szczypula 2006) and the messy nature of concept generation in other design disciplines (Daly et al. 2019). Fullerton (2019) recommends that novice designers pick their top three game ideas and write a single page treatment of concept document for each of these to then test with potential players. Adams (2010) suggests writing a 2-4-page high concept document that would take no more than 10 minutes to read once you've formed an idea for a game. Sellers (2017) describes a similar concept document with sections covering the working title, concept statement, genre(s), target audience and unique selling points. Both Adams (2010) and Sellers (2017) describe a short concept statement, 1-3 sentences long that captures the important aspects of the game. Sellers suggests considering it to be broadly the length of a tweet, "in 140 characters or less, describe everything that is important about your game…" (Sellers 2017, 195).

Game designer Stone Librande (2010) proposes one-page design documents, an example of which can be seen in **Figure 8**. This shows the design of a game laid out in a schematic format showing encounters, enemy types and important gameplay information. This document provides an overview to the team of what the proposed design is and allows a dialogue to take place regarding the design.
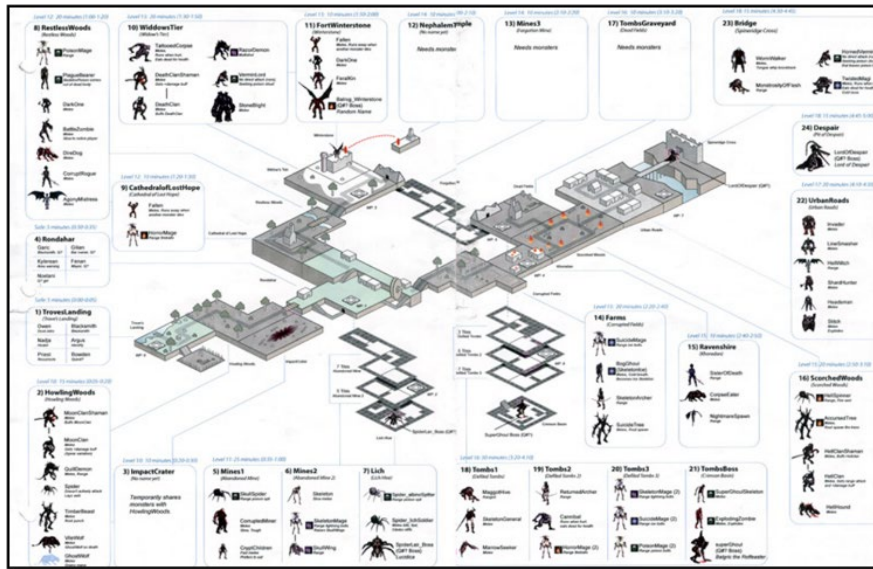
Figure 8: A sample one-page design document for a role-playing game by Librande (2010) provides an alternative to linear documentation.

Librande (2010) also suggests storyboarding, an example of this is shown in **Figure 9**, to communicate game concepts on a single page. Maani (2014) developed an e-Learning framework to develop the storyboarding skills of game design students and found that this was a potential avenue to improve student design communication. Similarly, Healy & Lim (2019) discussed the use of single-page design documents and storyboards as part of a classroom intervention in games for learning based on the work of Librande (2010).
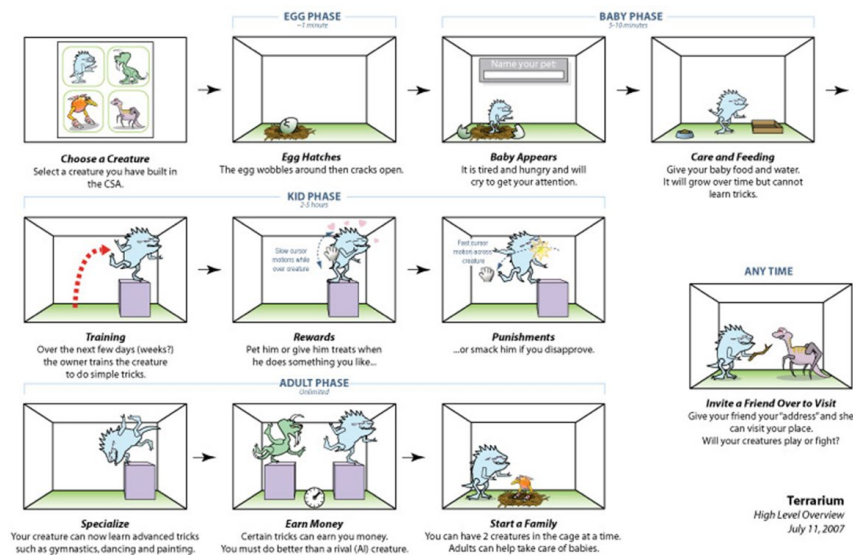
Figure 9: A sample game design storyboard by Librande (2010) suggests further alternatives for game design documentation.

Hagen (2012) describes the breadth of concept documentation for games as Lodestars that are "supposed to help game developers navigate the design space and reach their goal" (63). For Hagen the functions of Lodestars are to: externalise the vision, communicate the vision, inspire, make the game a unitary whole, guide, create self-

driven teams and team building (64-65). To be an effective Lodestar, according to Hagen, it should have all seven of these elements.

From reviewing the literature on design documentation there are several approaches taken for the documentation of concepts: initial ideas/concept statements, more detailed concept documents, one-page designs and lodestars (which encompass all previous concept approaches).

Prototypes

In addition to structured documentation, there are less formal approaches where designers might jump straight into development (Young 2018) or the approach taken by the well-known designer, Sid Meier, who describes design documentation before developing a prototype as "like drawing a map before you've visited the terrain" (Meier 2020, 130) This diversity of documentation practices reflects the diversity of methodologies at play in the industry (Keogh 2019). This lack of consistency across studios and creators presents a challenge to researchers seeking to understand the process and educators tasked with training future generations of game designers.

Manker (Manker 2012) highlights communication as important for game design concepts due to the complexity of the discipline. In addition to this, he highlights the need for designers to be able to communicate ideas to the team, often through prototypes. As he notes "communication around game design problems need to include as much of the idea of the game … as possible" (Manker 2012, 4). These prototypes could take the form of digital or paper prototypes or animations to communicate the game concept.

Playtests

A core aspect of the game design process is the playtest (or play test) which involves having players test versions of the game while in development to get feedback (Davis, Steury, and Pagulayan 2005). The method involves a combination of surveys and gameplay to provide game designers with "actionable feedback from consumers about how they perceive critical aspects of their games" (Davis, Steury, and Pagulayan 2005). Kasurienen et al. (2013) found that the use of playtesting as a method for external feedback was more evident among professional designers when compared to student teams. Liu et al. (2019) analysed feedback practices in ten major developers based in Taiwan, the researchers found that both feedback specificity and iterative feedback during development had a positive relationship with the game quality. Fullerton (2019) advocates for regular testing of games throughout development and including testing game concepts on potential players. Salen and Zimmerman (2004) describe the entire development of a game as a "play-based design process" (11) where games are prototyped and playtested in a regular iterative cycle. Adams (2010) advocates for a similar approach called "the player-centric approach" (30).

FUTURE WORK

Using the Lawson (2010) model of the design process in this paper has allowed us to consider the aspects of the game design process that align to design in general and it is hoped this will allow educators and researchers to consider how these elements of the process can be seen in practice. The model presented here has been used to develop an interview protocol and interviews have been conducted with practicing indie game designers and game educators to better understand the game design process as well as a study looking at student process in the game design classroom. We expect to elaborate further on the suitability of the model for studying the game design process in the future. Furthermore, we aim to develop supports for the game design process in our own classrooms to encourage the acquisition of game design expertise based on this research.

CONCLUSION

By analysing the process of game design through general models of design we can identify aspects of the process and consider these as areas for further research. For example, the lack of significant work looking into the role of research in the analysis phase of the design process might suggest potential research directions to evaluate the significance of this in relation to game design and initial interviews with educators have suggested this may be an under-explored area of the design process. Within the sphere of design synthesis, we might consider design method interventions that could lead to improved design outcomes or build design expertise. During design evaluation, we might look at how game concepts can be documented during germinal design activity to best communicate the designer's intent. Using a model of micro design may open up opportunities to consider the breadth and depth of design activity that happens across different genres and scales of game development. Lastly, having a general model of the design process may help educators, designers and researchers develop a shared understanding of the processes and practices at play in game design activities.

BIBLIOGRAPHY

Aarseth, Espen. 2001. 'Computer Game Studies, Year One'. *Game Studies: The International Journal of Computer Game Research* 1 (1). http://gamestudies.org/0101/editorial.html.

Adams, Ernest. 2010. *Fundamentals of Game Design (Game Design and Development Series)*. 2nd ed. New Riders.

Adams, Ernest, and Joris Dormans. 2012. *Game Mechanics: Advanced Game Design*. Berkeley, CA: New Riders.

Alexander, Christopher, Sara Ishikawa, and Murray Silverstein. 1977. *A Pattern Language: Towns, Buildings, Construction*. Oxford university press.

Archer, Bruce. 1979. 'Design as a Discipline'. *Design Studies* 1 (1): 17–20.

Barney, Christopher. 2021. *Pattern Language for Game Design*. 1st edition. Boca Raton: CRC Press.

Berg Marklund, Björn, Henrik Engström, Marcus Hellkvist, and Per Backlund. 2019. 'What Empirically Based Research Tells Us About Game Development'. *The Computer Games Journal* 8 (3–4): 179–98. https://doi.org/10.1007/s40869-019-00085-1.

Birdwell, Ken. 2006. 'The Cabal: Valve's Design Process for Creating Half-Life'. In *The Game Design Reader: A Rules of Play Anthology*, 212–25.

Björk, Staffan, and Jussi Holopainen. 2005. *Patterns in Game Design*. 1st ed. Charles River Media Game Development Series. Hingham, Mass: Charles River Media.

Cerny, Mark. 2002. 'Method'. Presented at the D.I.C.E. Summit.

Chiapello, Laureline. 2014. 'Formalizing Casual Games: A Study Based on Game Designers' Professional Knowledge'. In *DiGRA '13 - Proceedings of the 2013 DiGRA International Conference: DeFragging Game Studies*.

———. 2017. 'Epistemological Underpinnings in Game Design Research'. *Game Design Research: An Introduction to Theory & Practice*, 15–33.

Cox, Joe. 2014. 'What Makes a Blockbuster Video Game? An Empirical Analysis of US Sales Data: WHAT MAKES A BLOCKBUSTER VIDEO GAME?' *Managerial and Decision Economics* 35 (3): 189–98. https://doi.org/10.1002/mde.2608.

Crawford, Chris. 1984. *The Art of Computer Game Design*. Osborne/McGraw-Hill Berkeley, CA.

Crilly, Nathan. 2015. 'Fixation and Creativity in Concept Development: The Attitudes and Practices of Expert Designers' 38: 38.

Cross, Nigel. 1982. 'Designerly Ways of Knowing'. *Design Studies* 3 (4): 221–27.

———. 2007a. *Designerly Ways of Knowing (Board of International Research in Design)*. Basel: Birkhäuser.

———. 2007b. 'Forty Years of Design Research'. *Design Studies* 28 (1): 1–4. https://doi.org/10.1016/j.destud.2006.11.004.

Daly, Shanna R., Seda McKilligan, Keelin Leahy, and Colleen M. Seifert. 2019. 'Teaching Design Innovation Skills: Design Heuristics Support Creating, Developing, and Combining Ideas'. In *Design Education Today*, edited by Dirk Schaefer, Graham Coates, and Claudia Eckert, 37–60. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-17134-6_3.

Daly, Shanna R., Colleen M. Seifert, Seda Yilmaz, and Richard Gonzalez. 2016. 'Comparing Ideation Techniques for Beginning Designers'. *Journal of Mechanical Design* 138 (10): 101108. https://doi.org/10.1115/1.4034087.

Davis, John P, Keith Steury, and Randy Pagulayan. 2005. 'A Survey Method for Assessing Perceptions of a Game: The Consumer Playtest in Game Design'. *Game Studies* 5 (1). http://www.gamestudies.org/0501/davis_steury_pagulayan/.

Dubberly, Hugh. 2005. *How Do You Design?*

Eltham, Ben. 2013. 'Three Arguments against "Soft Innovation": Towards a Richer Understanding of Cultural Innovation'. *International Journal of Cultural Policy* 19 (5): 537–56. https://doi.org/10.1080/10286632.2012.658044.

Evbuomwan, NFO, Sangarappillai Sivaloganathan, and A Jebb. 1996. 'A Survey of Design Philosophies, Models, Methods and Systems'. *Proceedings of the Institution of Mechanical Engineers, Part b: Journal of Engineering Manufacture* 210 (4): 301–20.

Fullerton, Tracy. 2019. *Game Design Workshop: A Playcentric Approach to Creating Innovative Games*. 4th ed. AK Peters/CRC Press. https://www.routledge.com/Game-Design-Workshop-A-Playcentric-Approach-to-Creating-Innovative-Games/Fullerton/p/book/9781138098770.

Godin, Benoit. 2008. *Innovation: The History of a Category*.

Goldschmidt, Gabriela. 2014. *Linkography: Unfolding the Design Process*. Design Thinking, Design Theory. Cambridge, Massachusetts: The MIT Press.

Guevara-Villalobos, Orlando. 2011. 'Independent Gamework and Identity: Problems and Subjective Nuances'. In *Proceedings of DiGRA 2011 Conference: Think Design Play*.

Hagen, Ulf. 2009. 'Where Do Game Design Ideas Come From? Innovation and Recycling in Games Developed in Sweden'. In *Breaking New Ground: Innovation in Games, Play, Practice and Theory. Proceedings of DiGRA 2009*, 11.

———. 2011. 'Designing for Player Experience: How Professional Game Developers Communicate Design Visions'. *Journal of Gaming & Virtual Worlds* 3 (3): 259–75. https://doi.org/10.1386/jgvw.3.3.259_1.

———. 2012. 'Lodestars for Player Experience', 116.

Healy, John, and Basil Lim. 2019. 'Half Professional / Half Classroom'. In *Proceedings of the 9th Irish Conference on Game-Based Learning (IGBL2019)*. Cork.

Henderson, Daniel, Kathryn Jablokow, Shanna Daly, Seda McKilligan, Eli Silk, and Jennifer Bracken. 2019. 'Comparing the Effects of Design Interventions on the Quality of Design Concepts as a Reflection of Ideation Flexibility'. *Journal of Mechanical Design* 141 (3).

Hsiao, Shih-Wen, Ming-Feng Wang, and Chien-Wie Chen. 2017. 'Time Pressure and Creativity in Industrial Design'. *International Journal of Technology and Design Education* 27 (2): 271–89. https://doi.org/10.1007/s10798-015-9343-y.

Ivan, Tom. 2020. 'Who Is Mark Cerny, the Man behind PS5?' *Video Games Chronicle* (blog). 13 February 2020. https://www.videogameschronicle.com/features/who-is-mark-cerny/.

Jaaniste, Luke. 2009. 'Placing the Creative Sector within Innovation: The Full Gamut'. *Innovation* 11 (2): 215–29. https://doi.org/10.5172/impp.11.2.215.

Jolis-Desautels, Alexis. 2017. 'Rational Game Design Tutorial'. Workshop presented at the Fondations of Digital Games 2017, Cape Cod, September.

Jónasdóttir, Hrafnhildur. 2018. 'Soft Innovation in the Video Game Industry'. In *Trends and Advances in Information Systems and Technologies*, edited by Álvaro Rocha, Hojjat Adeli, Luís Paulo Reis, and Sandra Costanzo, 745:30–41. Advances in Intelligent Systems and Computing. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-77703-0_3.

Jónasdóttir, Hrafnhildur, and Bendik Bygstad. 2019. '"Whoever Is Educated by Anxiety Is Educated by Possibility" A Study of Creativity in Game Development'. *The Computer Games Journal* 8 (3–4): 121–41. https://doi.org/10.1007/s40869-019-00082-4.

Jones, J Christopher. 1963. 'A Method of Systematic Design'. In *Conference on Design Methods*, 9–31.

Kasurinen, Jussi, Saeed Mirzaeifar, and Uolevi Nikula. 2013. 'Computer Science Students Making Games: A Study on Skill Gaps and Requirement'. In *Proceedings of the 13th Koli Calling International Conference on Computing Education Research - Koli Calling '13*, 33–41. Koli, Finland: ACM Press. https://doi.org/10.1145/2526968.2526972.

Keogh, Brendan. 2019. 'From Aggressively Formalised to Intensely in/Formalised: Accounting for a Wider Range of Videogame Development Practices'. *Creative Industries Journal* 12 (1): 14–33. https://doi.org/10.1080/17510694.2018.1532760.

Keshwani, Sonal, Torben Anker Lenau, Saeema Ahmed-Kristensen, and Amaresh Chakrabarti. 2017. 'Comparing Novelty of Designs from Biological-Inspiration with Those from Brainstorming'. *Journal of Engineering Design* 28 (10–12): 654–80.

Kuittinen, Jussi, and Jussi Holopainen. 2009. 'Some Notes on the Nature of Game Design'. In , 8.

Kultima, Annakaisa. 2010. 'The Organic Nature of Game Ideation: Game Ideas Arise from Solitude and Mature by Bouncing'. In *Proceedings of the International Academic Conference on the Future of Game Design and Technology - Futureplay '10*, 33. Vancouver, British Columbia, Canada: ACM Press. https://doi.org/10.1145/1920778.1920784.

———. 2015. 'Game Design Research'. In *Proceedings of the 19th International Academic Mindtrek Conference*, 18–25. Tampere Finland: ACM. https://doi.org/10.1145/2818187.2818300.

———. 2017. 'The Role of Stimuli in Game Idea Generation'. In *Proceedings of the 21st International Academic Mindtrek Conference*, 26–34. AcademicMindtrek '17. New York, NY, USA: Association for Computing Machinery. https://doi.org/10.1145/3131085.3131127.

Kultima, Annakaisa, Johannes Niemelä, Janne Paavilainen, and Hannamari Saarenpää. 2008. 'Designing Game Idea Generation Games'. In , 137. ACM Press. https://doi.org/10.1145/1496984.1497007.

Lankoski, Petri, and Jussi Holopainen. 2017. *Game Design Research: An Introduction to Theory & Practice*. http://press.etc.cmu.edu/index.php/product/game-design-research/.

Lawson, Bryan. 2010. *How Designers Think: The Design Process Demystified*. Reprint. Amsterdam Heidelberg: Elsevier Architectural Press.

Lê, Patrick L, David Massé, and Thomas Paris. 2013. 'Technological Change at the Heart of the Creative Process': *International Journal of Arts Management* 15 (2): 16.

Lemarchand, Richard. 2021. *A Playful Production Process: For Game Designers (and Everyone)*. Cambridge, Massachusetts: The MIT Press.

Librande, Stone. 2010. 'One Page Designs'. In *Presentation at the Game Developers Conference*.

Liu, Jing-Wei, Chia-Yu Ho, Jamie Y.T. Chang, and Jacob Chia-An Tsai. 2019. 'The Role of Sprint Planning and Feedback in Game Development Projects: Implications for Game Quality'. *Journal of Systems and Software* 154 (August): 79–91. https://doi.org/10.1016/j.jss.2019.04.057.

Maani, Leila. 2014. 'Encouraging the Acquisition of Drawing Skills in Game Design: A Case Study'. PhD, Gloucestershire: University of Gloucestershire.

Macklin, Colleen, and John Sharp. 2016. *Games, Design and Play: A Detailed Approach to Iterative Game Design*. Addison-Wesley Professional.

Manker, Jon. 2011. 'Game Prototyping - The Negotiation of an Idea'. In *Proceedings of DiGRA 2011 Conference: Think Design Play.*

———. 2012. 'Designscape – A Suggested Game Design Prototyping Process Tool' 6 (1): 15.

Marcotte, Jess, and Rilla Khaled. 2017. 'Critical Practices in Game Design'. *Game Design Research: An Introduction to Theory & Practice*, 199–218.

McCrea, Christian. 2013. 'Web Zero: The Amateur and the Indie Game Developer."'. *Amateur Media: Social, Cultural and Legal Perspectives*, 178–83.

Meier, Sid. 2020. *Sid Meier's Memoir!: A Life in Computer Games*. WW Norton & Company.

Neil, Katharine. 2015. 'Game Design Tools: Can They Improve Game Design Practice?' Flinders University of South Australia.

OECD and Eurostat. 2018. *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition*. The Measurement of Scientific, Technological and Innovation Activities. OECD. https://doi.org/10.1787/9789264304604-en.

O'Hagan, Ann Osborne, and Rory V. O'Connor. 2015. 'Towards an Understanding of Game Software Development Processes: A Case Study'. In *Systems, Software and Services Process Improvement*, edited by Rory V. O'Connor, Mariye Umay Akkaya, Kerem Kemaneci, Murat Yilmaz, Alexander Poth, and Richard Messnarz, 543:3–16. Communications in Computer and Information Science. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-24647-5_1.

Potter, Norman. 2002. *What Is a Designer: Things, Places, Messages*. 4th ed. London: Hyphen Press.

Press, Mike, and Rachel Cooper. 2017. *The Design Experience: The Role of Design and Designers in the Twenty-First Century*. Routledge.

Salen, Katie, and Eric Zimmerman. 2004. *Rules of Play: Game Design Fundamentals*. MIT press.

Sánchez, Raquel Echeandía, Nelson Zagalo, and Sara Cortés Gómez. 2021. 'Creative Process of Pre-Production of Video Games'. In *Interactivity and Game Creation*, edited by Anthony Brooks, Eva Irene Brooks, and Duckworth Jonathan, 198–211. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-73426-8_11.

Schon, Donald A. 1979. 'The Reflective Practitioner'. *New York*.

Sellers, Michael. 2017. *Advanced Game Design: A Systems Approach*. Addison-Wesley Professional.

Shah, Jami J., Santosh V. Kulkarni, and Noe Vargas-Hernandez. 2000. 'Evaluation of Idea Generation Methods for Conceptual Design: Effectiveness Metrics and Design of Experiments'. *Journal of Mechanical Design* 122 (4): 377. https://doi.org/10.1115/1.1315592.

Shapiro, Amram R. 2006. 'Measuring Innovation: Beyond Revenue from New Products'. *Research-Technology Management* 49 (6): 42–51.

Stoneman, Paul. 2011. *Soft Innovation: Economics, Product Aesthetics, and the Creative Industries*. Pbk. ed. Oxford ; New York: Oxford University Press.

Storz, Cornelia, Federico Riboldazzi, and Moritz John. 2015. 'Mobility and Innovation: A Cross-Country Comparison in the Video Games Industry'. *Research Policy* 44 (1): 121–37. https://doi.org/10.1016/j.respol.2014.07.015.

Tschang, F. Ted, and Janusz Szczypula. 2006. 'Idea Creation, Constructivism and Evolution as Key Characteristics in the Videogame Artifact Design Process'. *European Management Journal* 24 (4): 270–87. https://doi.org/10.1016/j.emj.2006.05.003.

Wang, Alf Inge, and Njål Nordmark. 2015. 'Software Architectures and the Creative Processes in Game Development'. In *Entertainment Computing - ICEC 2015*, edited by Konstantinos Chorianopoulos, Monica Divitini, Jannicke Baalsrud Hauge, Letizia Jaccheri, and Rainer Malaka, 9353:272–85. Lecture Notes in Computer Science. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-24589-8_21.

Whitson, Jennifer R. 2020. 'What Can We Learn From Studio Studies Ethnographies?: A "Messy" Account of Game Development Materiality, Learning, and Expertise'. *Games and Culture* 15 (3): 266–88. https://doi.org/10.1177/1555412018783320.

Wijman, Tom. 2020. 'The World's 2.7 Billion Gamers Will Spend $159.3 Billion on Games in 2020; The Market Will Surpass $200 Billion by 2023'. *Newzoo* (blog). 8 May 2020. https://newzoo.com/insights/articles/newzoo-games-market-numbers-revenues-and-audience-2020-2023/.

Wynn, David C, and P John Clarkson. 2018. 'Process Models in Design and Development'. *Research in Engineering Design* 29 (2): 161–202.

Young, Christopher James. 2018. 'Game Changers: Everyday Gamemakers and the Development of the Video Game Industry'. Faculty of Information: University of Toronto.