UNIVERSITY
OF WOLLONGONG
AUSTRALIA

ANALOGUE/DIGITAL HYBRIDITY IN TABLETOP GAME DESIGN

Honours thesis submitted in partial fulfilment

of the requirements for the award of the degree

BACHELOR OF CREATIVE ARTS (HONOURS)

from

UNIVERSITY OF WOLLONGONG

by

ELYSSE TURNER, BACHELOR OF CREATIVE ARTS

FACULTY OF LAW, HUMANITIES AND THE ARTS

2018

THESIS STATEMENT

This thesis is an exploration of key design features present in analogue/digital hybrid games. It provides case study analysis of existing hybrid games using a selection of Jesse Schell's (2008) principles of game design. This thesis is part of an honours project which has developed a digital/analogue hybrid game idea, however the thesis itself is informed by practice-led research (see: Candy & Edmonds 2018), as it synthesises a set of hybrid game design principles intended for use in further scholarly research and future development of hybrid games.

ABSTRACT

The tabletop games industry is experiencing a renaissance, with annual global sales estimated to be worth more than nine billion dollars (Graham 2016).[1] Typically considered a 'niche' creative industry, there has been little scholarly attention to contemporary analogue experiences as most research focuses on digital games. As new media technologies have become accessible over time, tabletop game designers have capitalised on the opportunities afforded by these products, integrating them into gaming experiences. This combination of analogue and digital is a part of a sub-genre of 'hybrid' games that has recently begun to experiment with mobile 'smart' devices. This thesis contributes to game design research by examining analogue/digital hybridity in tabletop games. It aims to identify key design features of analogue/digital hybrid games, exploring how hybrid games integrate digital technologies into the analogue gaming experience through case studies of three existing hybrid games: *Mansions of Madness 2nd Edition* (Valens 2016), *One Night Ultimate Alien* (Alspach & Okui 2017); and *DropMix* (Hasbro 2017).

[1] The terms tabletop games, board games and analogue games are used interchangeably in this thesis.

DECLARATION

I, Elysse Turner, declare that this thesis, submitted in partial fulfilment of the requirements for the award of Bachelor of Creative Arts (Honours) in the Faculty of Law, Humanities and the Arts, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Elysse Turner

20 October, 2018

TABLE OF CONTENTS

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

DDM	Double Diamond Model
App	Application for mobile or smart device
ONUA	One Night Ultimate Alien
MOMFE	Mansions of Madness First Edition
MOMSE	Mansions of Madness Second Edition

ACKNOWLEDGEMENTS

"For from him and through him and for him are all things. To him be the glory forever! Amen."
Romans 11:36 NIV

This work has been a journey in itself, and would not have been possible alone. I am immensely grateful to everyone who has helped me this year, in particular:

For God, my rock, without whom I would not be where I am today.

For my supervisors: Dr Christopher Moore, Jo Stirling & Grant Ellmers. Words cannot describe my appreciation and respect I have for you. Together, your support and guidance has not only kept me sane, but also helped me to grow as a researcher and creative practitioner. Thank you for everything.

For my friends, family, and church, who gave me love, support and prayer during this year.

For Daniel, the love, sacrifice, and support you've given by helping me with countless proof reads, second opinions, and little insecurities.

For my proofreaders: Daniel, Robert, and Ben, for taking my poor grammar in your stride.

For Bernice, your drama skills, excitement, and support.

1. INTRODUCTION

Scholarly research in game design typically focuses on digital games, with comparatively little attention given to tabletop games and analogue experiences. This thesis aims to bridge this gap, by examining a sub-genre of tabletop games that integrate digital components with traditional elements of tabletop gaming (Mandryk *et al.* 2002), described as analogue/digital hybrid games. This thesis is an exploration of key design features present in the field of analogue/digital hybrid games. It analyses three case studies from the current generation of analogue/digital hybrid games using a selection of Schell's (2008) principles of game design.

The thesis aims to answer the question: What key design features exist in analogue/digital hybrid games? The answers to this question are codified into a recommended set of hybrid game design principles intended for use in further scholarly research and the future development of analogue/digital hybrid games.

This thesis is inspired by design thinking and it uses the Double Diamond Model (Design Council 2015a) as a methodological framework to shape the practice-led research elements in the exploration of analogue/digital hybrid games (herein, 'hybrid games'). This thesis is accompanied by a creative work which applies the hybrid game design principles presented in this thesis to the development of an original hybrid game concept. This approach aims to highlight and provide innovation in this area that could point towards further scholarly research and/or practical application within the tabletop industry.

Chapters Two through Four provide a literature review across three areas: the Double Diamond Model; designing games for the existing tabletop games market; and hybrid games. Chapter Four investigates the history of hybrid games, before narrowing the scope to look at the hybridisation of apps ranging from low to high integration. Chapter Five examines three existing hybrid games as case studies, using a selection of Schell's (2008) principles of game design. Chapter Six offers a set of

hybrid game design principles built upon the identification of key design principles in Chapter Five.

1.1 The Niche of Analogue Games: The Tabletop Industry

In Chapter Three, the thesis explores the tabletop industry and considers existing game design principles, with specific focus on the principles proposed by Schell in *The Art of Game Design* (2008). The tabletop games industry is described as a 'hobby' games market, and although considered a 'niche' creative industry, it is experiencing massive sale growth in the US, with revenue increasing 56% between 2014 and 2015 (Griepp 2016), and estimated growth between 2016 and 2017 placed at 183% (Garry 2018).

This niche analogue games market has a large online presence, as seen through the online database and forum, *BoardGameGeek* (www.boardgamegeek.com). Described as "a repository of information built by gamers for gamers" (Healy 2009, n.p.), this website hosts a broad range of player-generated content. Additionally, tabletop games have their own internationally renowned annual awards ceremony - the *Spiel des Jahres* - held in Germany. Created in 1978 to highlight stand out games in the German market, being nominated for this award is an indication of excellence in game design (Dalton 2017).

Game design encompasses both analogue and digital mediums. The term 'game design' is very much linked to the practice of *digital* game design in the public understanding, and this is reflected in the large amount of scholarly research in this field (Salen & Zimmerman 2004; Trefry 2010; Fullerton *et al.* 2004; Zagal *et al.* 2006; Patrick 2013), however this should not discount the importance of analogue games. Academic game designer Professor Jesse Schell brings together analogue and digital game design in his book *The Art of Game Design* (2008) where he presents one

hundred 'lenses' that act as conceptual questions for reviewing game design decisions.

1.2 Hybrid Games

In Chapter Four, the focus turns to the combination of analogue and digital components to create hybrid games. 'Analogue' is defined as "not involving or relating to the use of computer technology, as a contrast to a digital counterpart" (Oxford Dictionary 2018, n.p.), and as such, the term 'analogue' within this thesis refers to the use of physical, non-digital technologies within a game, as demonstrated through tabletop games. Digital games are not traditionally thought of as 'tabletop' experiences, but rather video or computer games that are played with a screen (University of Washington 2005). Kerr (2006, p. 3) argues that the term 'digital' encompasses the entire field and avoids problematic labels such as 'computer games' or 'video games', which often cover media that sit outside these environments – such as games on mobile devices or digital experiences not yet considered, like potential new Augmented Reality devices. As such, tabletop games and digital games have been traditionally distinguished by the medium in which they are played.

Hybrid games have utilised a number of digital technologies to create crossover between analogue and digital gaming. Some of the digital technologies used to create hybrid games include VCRs and DVDs (Booth 2016), the use of screens to replace game boards (Magerkurth *et al.* 2003, Krause *et al.* 2014, Bakker *et al.* 2007), handheld gaming devices (Mandryk *et al.* 2002, Bergström *et al.* 2010, Kankainen & Tyni 2014), and tokens with embedded digital technology such as RFID chips (Mora *et al.* 2016). To narrow the scope, this thesis focuses on the use of mobile applications, or 'apps', as digital components in hybrid games. Chapter Four will look at three different ways that apps are used in tabletop gaming experiences: digital recreations, additive applications, and hybrid game designs; exploring the distinction

between high integration and low integration apps which connect the analogue and digital areas of play.

Chapter Five provides three case studies of hybrid games featuring high integration apps, in order to identify key game design features present in a range of hybrid games: *DropMix* (Hasbro 2017), *One Night Ultimate Alien* (Alspach & Okui 2017), and *Mansions of Madness Second Edition* (Valens 2016). Understanding the range of different ways existing hybrid games harness technology and identifying these key features is important for giving insight into how the game has been designed and structured to integrate the technology into the gameplay experience.

Chapter Six proposes a series of game design principles for analogue/digital hybrid games, drawing upon the identified key features of hybrid games from the previous chapter's case studies. The seven proposed principles aim to assist the process of designing hybrid games and are examples of practice-led research (Candy & Edmonds 2018, Candy 2006), as they have been applied to the design of the accompanying creative work.[2]

[2] The creative work demonstrates the key principles from Chapter Six, applying them to the dice game *Yatzy* (the public domain version of Milton Bradley's Yahtzee) to transform this existing analogue game into a hybridised version, and then to *Ahoy!* (an original hybrid game prototype).

2. THE DOUBLE DIAMOND MODEL

The Double Diamond design process provides a framework to structure the research and creative process of the thesis and accompanying creative work. This Chapter introduces the Double Diamond Model (DDM), beginning with an overview of the model and its history in 2.1. It considers how others have used the model in 2.2. Section 2.3 provides an account of the strengths and weaknesses of the DDM. To conclude, 2.4 provides an overview of the application of the DDM to the thesis and creative work.

2.1 What is the Double Diamond Model?

The DDM uses 'design thinking', which is a form of creative strategising with solution-focused thinking (Naiman 2011). Generally, design thinking begins with a specific goal in mind and determines possible paths to that goal from both a practical and creative perspective, then explores these paths to determine the best course of action (Purdy & Popan 2016).[3]

The DDM was developed in 2005 by the *British Design Council*, as a graphical way of understanding and conveying the design process. Development of the model began by observing and reporting on different design processes across 11 influential, global companies including *Microsoft*, *LEGO*, *Sony*, and *Yahoo!* (Design Council 2007). By analysing these design processes the *British Design Council* (2007) proposed four core stages of design: Discover, exploring previous work in relevant areas; Define, establishing which ideas are worth pursuing; Develop, actively pursuing these ideas; and Deliver, releasing a final product and reflecting on its success relative to the initial goal.

[3] A comprehensive account of design thinking is outside the scope of this thesis but would be a suitable topic for future research.

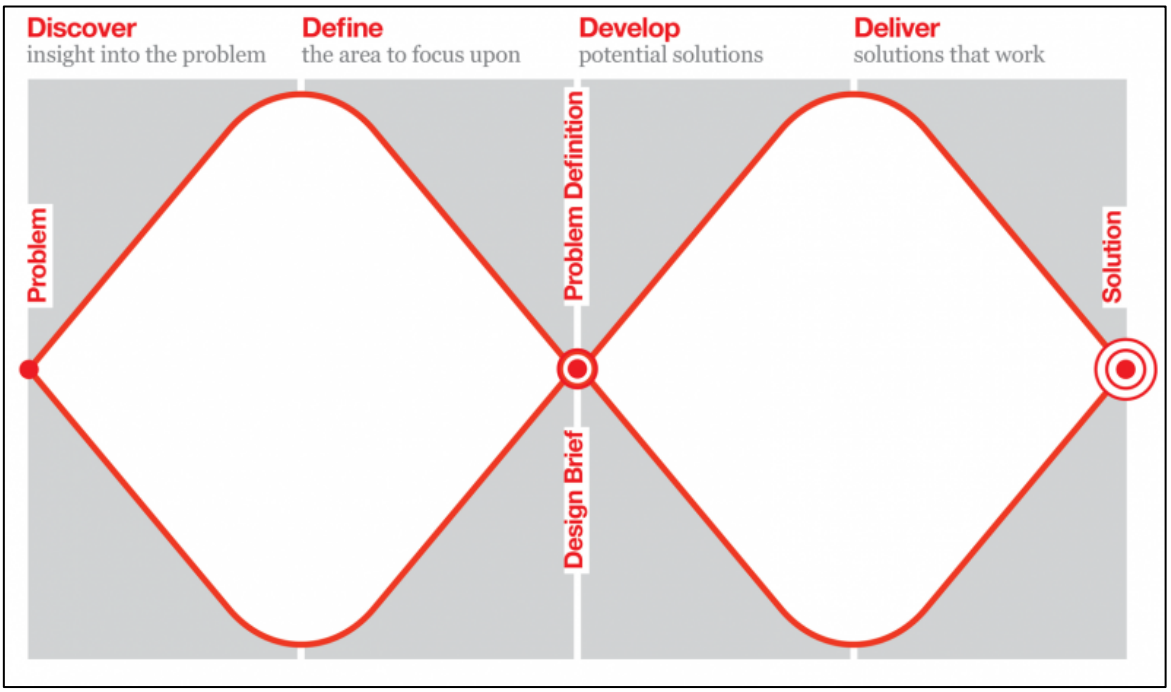


Figure 1. The Double Diamond Model (Design Council 2015a).

The strength of the DDM is in the movement between stages. Each diamond involves two stages, represented by the diagonal movements of the red lines in Figure 1. These stages alternate between expanding knowledge by divergent thinking (in stage one and three) and the focusing of ideas through convergent thinking (in stage two and four). These stages align with the design thinking concept of exploring possible paths before determining the best course of action, giving opportunity to explore new ideas and concepts in an iterative manner which may not have been initially considered (Design Council 2015a). The 'divergent' stages and 'convergent' stages of the model emphasise the importance of imagining a broad range of potential solutions and then eliminating the ones which don't work until arriving at the final design (Hartog 2016). The DDM aims to guide this design process by mapping out stages which encourage rapid prototyping and multiple iterations of ideas in order to begin exploring a variety of solutions before determining which one is best (Design Council 2015b).

2.2 Applications of the Double Diamond Model

The DDM has been pursued across many different industries and applications, including behavioural sciences (Gardiner 2014), secondary education (Allen 2016), and science and technology (Design Council 2015b).

The *Behavioural Design Lab* began using the DDM in 2014 as a way to evaluate ideas for approaching social issues. Their implementation, shown in Figure 2, outlines the process of design.

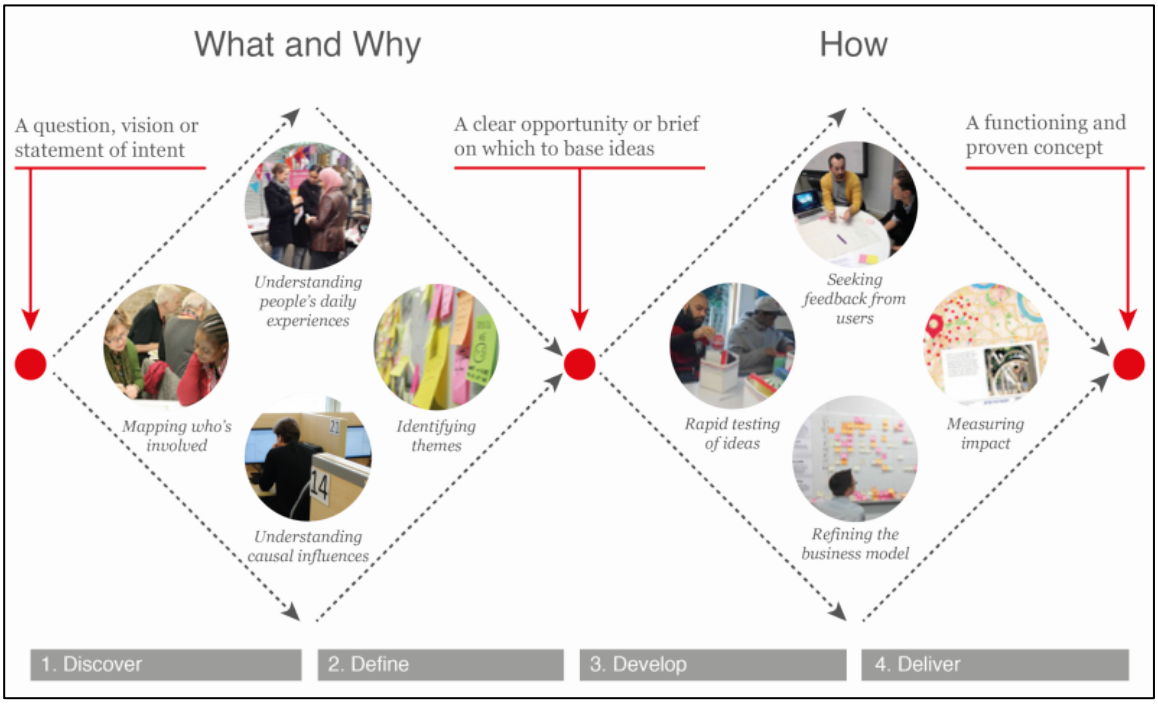


Figure 2. The Double Diamond Model applied to behavioural science (Gardiner 2014).

The *Behavioural Design Lab* apply the DDM to support the design of products and services with a social purpose (Niedderer *et al.* 2016). Their application addresses the complexity of social issues by focusing on the people involved in the Discover stage. This process begins with a question, vision, or statement of intent, mapping who this applies to, understanding the daily experience of these people and the casual influences that affect them. During the Define stage the *Behavioural Design Lab*

seeks to understand why this problem exists, identifying influencers of these behaviours in order to define the cause. As seen in Figure 2, this is done by identifying themes from the research conducted during the define stage, highlighting common behavioural patterns. This synthesis of understanding behavioural influences leads towards development of a 'brief' to orient solution ideas to. Figure 2 then shows the Develop stage, where cross-disciplinary networking is employed in order to consider creative solutions generated through the rapid testing of ideas. In the final Deliver stage the trials, tests, and refinement of ideas occur to deliver a solution (see: Figure 2; Gardiner 2014).

The *Technopolis Group* used the DDM to assess how design affects the commercialisation of science and technology research (see: Figure 3; Design Council 2015b). Here, the Discover stage is used to understand whether a particular invention is relevant through market research; the Define stage is used to assess possible applications through project development; the Develop stage is used to understand user needs through cross-disciplinary collaboration to develop and test potential solutions. The Deliver stage is used to respond to user needs with final testing, approval and launch of the product, with evaluation and feedback loops implemented to assess effectiveness (Design Council 2015b).

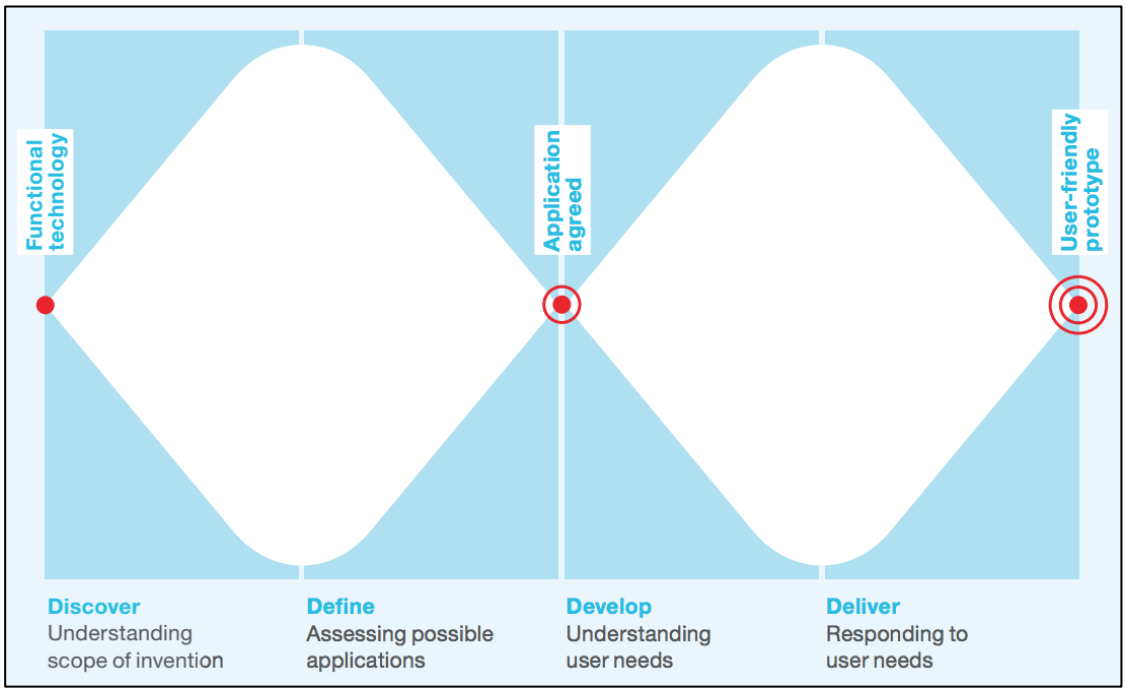


Figure 3. The Double Diamond Model applied to the commercialisation of science and technology (Design Council 2015b).

According to the Design Council (2015b, p. 5) "Research demonstrates that design accelerates commercialisation and increases value." This value is achieved by clearly communicating and pitching ideas, strategies and prototypes, and by offering a different perspective to identify commercial viability. This structure lends itself to clear communication at each stage so that ideas and strategies can be improved upon and result in a final product which has value to those it has been designed for.

2.3 Critiques of the Double Diamond Model

Acceptance of the suitability of the DDM is not universal. VanPatter (2017, n.p.) critiques the model, claiming that the methodology is "out-of-sync, over-hyped ho-hum [arriving] late to the party," having failed to reflect on the history of innovation methods. VanPatter's critique of the DDM invokes Osborn-Barnes's Creative Problem Solving (CPS) model developed in the 1950's, which is a more extensive divergent and convergent model (see: Figure 4).

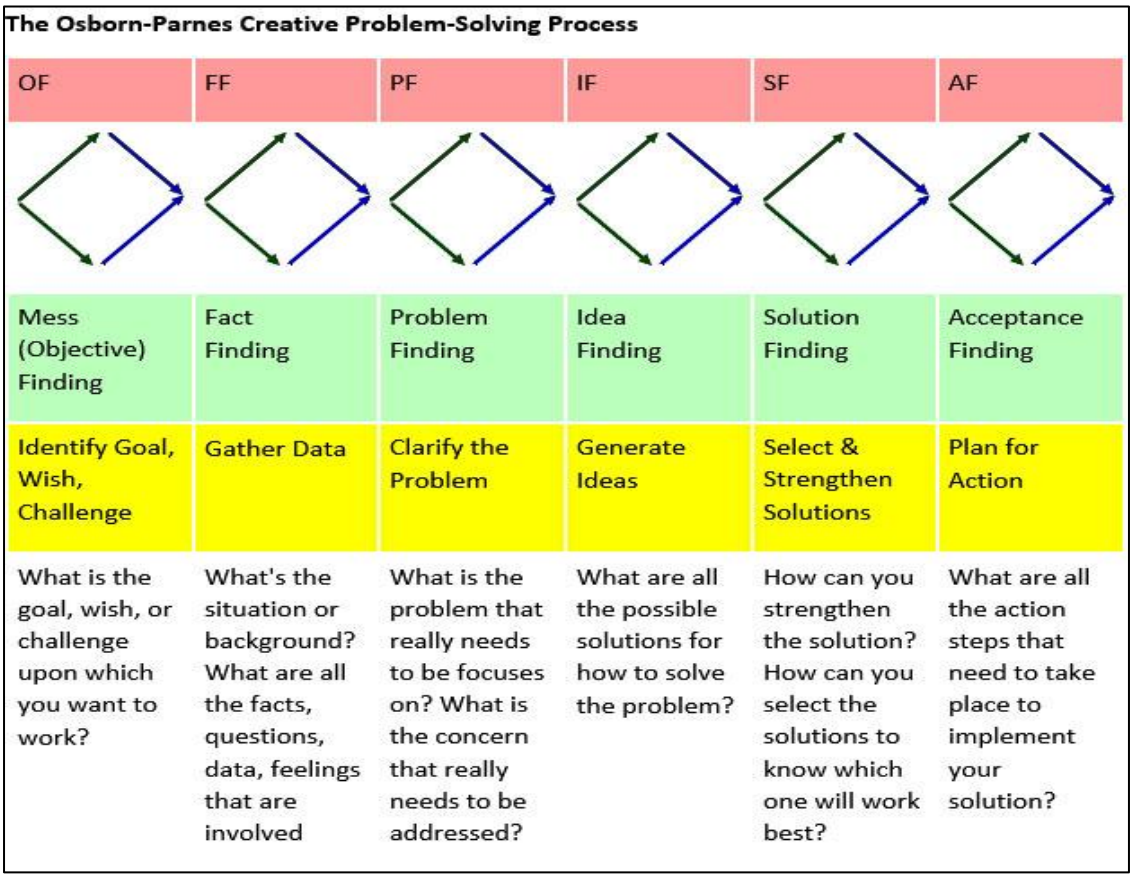


Figure 4. The Osborn-Barnes Creative Problem Solving process (Stevenson 2017).

VanPatter (2017) argues that the DDM's two cycles of activity is not an accurate reflection of how the creative process works, instead suggesting that the average innovation process contains at least six phases of convergent and divergent thinking. While the CPS model has a more extensive and open framework, the DDM covers similar thinking condensed into a compact model.

Gauhman (2018) critiques the DDM, claiming that the opportunity to pivot and rework only appears in the fourth quadrant, however this critique overlooks the importance of divergent thinking as a tool to rapidly generate ideas and solutions, discarding options that are not feasible in a form of agile thinking. Teams using this methodology may also need to acknowledge that the process can be repeated more than once, with each cycle resulting in a shorter process time (Norman 2013, p. 220). Gauhman (2018, n.p.) highlights the shift in our technological, cultural, and economic

environment and calls for more agile and flexible models to keep up with "a world where you can push code 10 times a day to your customers, pull a prototype together in a day and put it in front of users". Gauhman (2018) warns that endless theorising about potential solutions becomes an irresponsible use of time.

Nessler (2016a) has also criticised the DDM, believing it to be too abstracted and difficult to access for people who are new to the field. Accordingly, he 'revamped' the DDM to clarify its operation and implications (Nessler 2016a; see: Figure 5). This new iteration aimed to provide a more structured approach to understanding the model and identify substages for ease of use (Nessler 2016b).

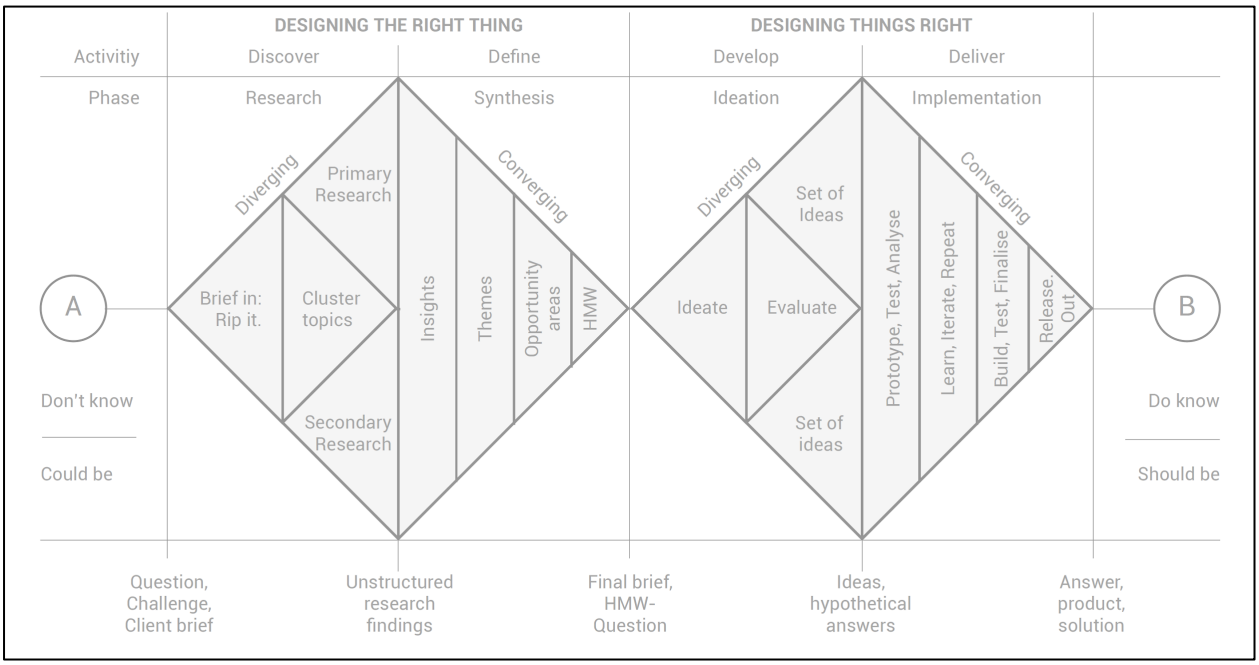


Figure 5. The Revamped Double Diamond v.2 (Nessler 2016b).

Nessler's meta application demonstrates the appeal of the DDM and highlights its flexibility, showing how this simple framework can be adapted to any field (Nessler 2016b).[4]

[4] While this "revamp" may appear to lose simplicity due to the amount of information included, it is just another iteration of the same basic framework applied to a particular problem.

2.4 Application of the Double Diamond Model to Game Design Research

The DDM is a participant-centered approach led by the designer, which can be applied to both academic research and game design. As described by game design theorists, Salen and Zimmerman (2004, pp. 40-41), "[sitting] at the centre of an exploration of games and meaningful play, [...] design is the process by which a designer creates a context to be encountered by a participant from which meaning emerges". The DDM is used as a framework to structure the thesis and accompanying creative work, as an example of practice-led research (see: Candy & Edmonds 2018; Candy 2006). Chapters Three and Four align with the DDM's Discover stage, while Chapter Five aligns with the DDM's Define stage by establishing which ideas are worth pursuing through a case study approach. The creative work aligns with the Develop stage by actively pursuing the ideas generated in the thesis. This creative work aids the development process of Chapter Six, which synthesises a set of hybrid game design principles that have been developed and tested by applying them to the creative work and refining them in order to 'deliver' the set of principles laid out in Chapter Six.

3. TABLETOP GAMES

The primary aim of this thesis is to provide an account of key design features of analogue/digital hybrid games.[5] The following chapter uses the Discover stage of the DDM[6] to explore tabletop games to address this aim. In 3.1, this chapter first looks at tabletop games as a creative industry. 3.2 considers the community supporting it in order to understand the consumers of these products. In 3.3 the chapter assesses existing game design principles for creating these products with specific focus on the 'lenses of game design' proposed by Schell (2008). This section will contribute towards identifying useful tools for analysing existing hybrid games in Chapter Five and designing the game prototypes in the accompanying creative work. As hybrid games are tabletop games that incorporate digital elements, this chapter gets us closer to understanding key features of hybrid game designs, which leads into Chapter Four.

3.1 The Tabletop Games Industry

The tabletop games industry is experiencing a renaissance, with global sales now estimated to be worth more than nine billion dollars (USD) annually (Graham 2016). This industry, described as a 'hobby' games market, is experiencing double-digit sale growth in the US (Griepp 2016), and this increased interest is unlikely to abate any time soon as Business Insider (2017) forecasts a nine percent continued annual growth from 2016-2022. Although considered a 'niche' creative industry, tabletop games have their own annual international awards ceremony - the *Spiel des Jahres* - held in Germany. The awards began in 1978 to highlight stand out games in the German market, and was created in response to the decline of game culture and critique, originating from the 'gamer's paradise' of the time: Great Britain (Werneck

[5] The specficis of Analogue/Digital hybrid games will be further explored and defined in Chapter Four.
[6] The DDM is used as a framework to guide the research (Discover), understand core design features of analogue/digital hybrid games (Define) and propose a set a hybrid game design principles for further scholarly research and development of hybrid games, that are tested in the accompanying creative work (Develop and Deliver).

2010). Around this time, the special interest magazine *Games & Puzzles* went out of business, and newspapers began removing columns which discussed games from their publications. "Since competition was not strong and caustic critics didn't have a publication platform anymore the world of traditional family and board games shrank to a limited selection at a rather poor level" (Werneck 2010, p. 1). The *Spiel des Jahres* created an opportunity for board games to be further accepted into family life and society, becoming embedded in the culture (Eskin 2008). It also had an impact over the quantity and quality of new games being produced as it gave designers and publishers an incentive to create new, original, quality games.

Being nominated[7] for this award is an indication of excellence in game design (Dalton 2017). Winners are determined by assessing the game concept, rule design, included materials and overall design (Spiel des Jahres 2018). The winner of the *Spiel des Jahres* does not receive a monetary award, but prestige. Sales of games which have won the *Spiel des Jahres* award increase dramatically. For example, *Hanabi* (Bauza 2010), the Winner of the 2013 Spiel des Jahres award, started with a limited print run of 1,000 copies before winning, and has since sold over one million copies (Wray 2015).[8]

3.2 Tabletop Gaming Community

The tabletop gaming community is vital to the creative industry of game designers. The approach in this thesis is derived from a theory of design, which views the consumer as a client.[9] Tabletop games form a 'niche' creative industry, aimed at a specialised client base: the tabletop gaming[10] community, which has a vibrant online and offline presence.

[7] To be considered for the award, games need to print an edition in German and be released between the beginning of the year prior until May of the current year.
[8] The *Spiel des Jahres* would be a fascinating topic for further research, with potential to synthesise an analysis of key design features of games which have won or been nominated for the award.
[9] An alternative approach would be to think about the community is through the culture and theories of play.
[10] This thesis uses the term 'gaming' over 'play' as it is approaching games from a design perspective. There is a rich history in game studies of scholars theorising play, and while these theories of play are important, there is no scope in this thesis as it is

The tabletop gaming community has access to a number of gaming conventions worldwide, including conventions specific to tabletop gaming, and pop culture conventions which also feature tabletop games. Conventions offer players an opportunity to discover more about various tabletop games through panel sessions, gaming sessions, and interaction with the community present. Board game cafes offer a physical space to play, and a selection of board games available for customers to enjoy.[11] These cafes entice patrons to "put down their phones and interact with fellow humans for a few hours" (Lutz 2017, n.p.), and integrate library practices with cafe culture to provide access to new players (Nordli 2018).

Consumers are less likely to purchase products they are unfamiliar with (Beal 2016), and as such, "small independents who have a very strong community around them" (Callahan 2014, p. 13) are using online and offline locations to introduce new games and drive the industry forward. The board game community has a major online presence through Western social media (Facebook, Instagram, Twitter, and YouTube) and websites like BoardGameGeek[12] (www.boardgamegeek.com). BoardGameGeek is considered the board game enthusiasts version of IMDb and is one of the largest and most used board game forums on the internet (Kritz *et al.* 2017, n.p.) with detailed information on 98,000 plus titles. The content is updated and submitted by the global user community (Chen 2013), however changes are monitored by a group of admins, making it a reliable source of information used by scholars, gamers, and game designers. BoardGameGeek alongside other websites such as Shut Up & Sit Down (www.shutupandsitdown.com) have become community resources, archiving reviews and information. YouTube channels, such as Geek & Sundry, hosted by Felicia Day and Wil Wheaton, attract an interest from around the world (Jolin 2016).

---

approaching games from the perspective of theories of design. As such the term 'gaming' better connects to games as a creative industry that is reliant on, but not neccesarily dealing with, the culture of play.

[11] While having board games can be a unique draw card for new visitors, the aim of these locations is to foster a community of players who want to meet regularly to engage with each other through games.

[12] BoardGameGeek is an online database and forum created in 2000 which hosts game reviews, discussion, rules clarification and player-generated content.

Game designers have also turned to the community as a way to fund the development of their projects through online crowdfunding websites like Kickstarter (www.kickstarter.com). Crowdfunding treats the consumer as a client, providing the option to pledge money for innovative projects and ideas (Blackwell 2015; Cook & Germain 2018). Funding for games on Kickstarter increased by nearly 30% in 2017, with tabletop games earnings up by $36 million (see: Figure 6).

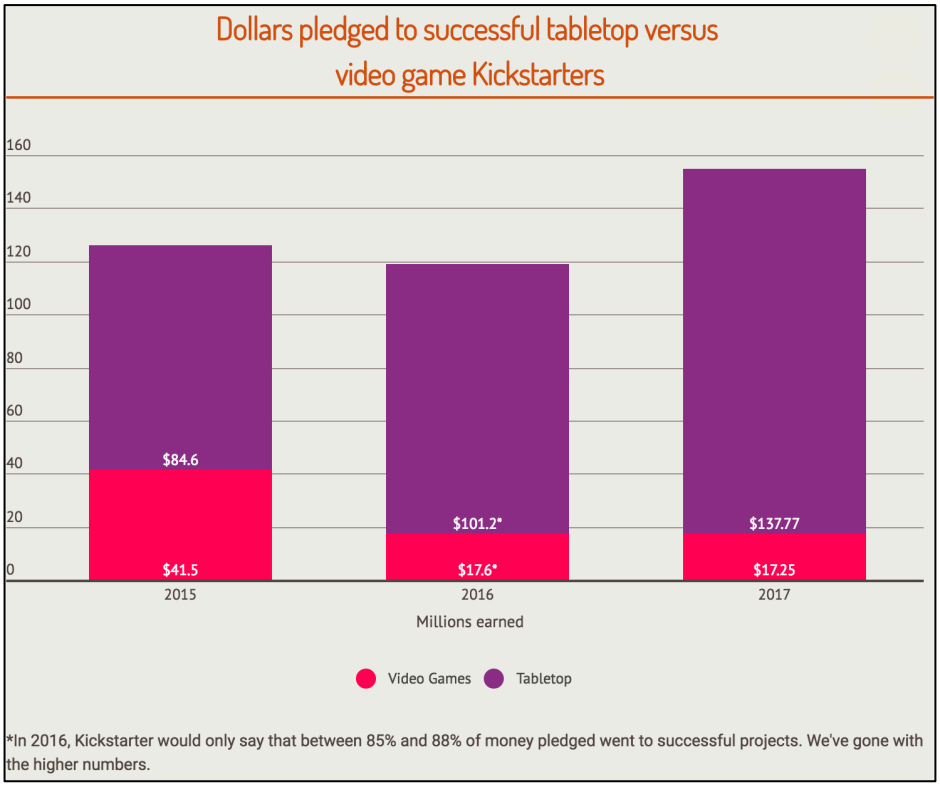


Figure 6. Dollars pledged to successful tabletop versus video games through 2017 (Hall 2018).

Jamey Stegmaier, whose eight successful crowdfunding campaigns have raised more than $3.2 million (Stonemaier Games 2018), believes that the amount of money raised on the website "is less important that the community of loyal fans the site has helped him cultivate" (Blackwell 2015, n.p.). Through crowdfunding, players are looking beyond mass-produced games, favouring indie game developers with niche game concepts and complex mechanics (Callahan 2014): "Crowdfunding puts the power of creation in the hands of the people; they get to vote with their money as to whether or not something will exist" (Steinberg 2015, n.p.).

3.3 Principles of Game Design

The following section examines a range of prominent game design principles useful for the creative practitioner. In 3.3.1, the chapter focuses on the role of a game designer and their relationship with the creative industry, while 3.3.2 considers the idea of iterative design and the process that must be undertaken to create an effective game design.

Game design is an enormous field - it encompasses both analogue and digital mediums, spanning across a number of media technologies, platforms and formats.[13] The term 'game design' is very much linked to the practice of digital game design in the public understanding (Trefry 2010), and this is reflected in the large amount of scholarly research in this field. While there is an extensive academic discourse around video games and emerging disciplines, there is very little research dedicated to tabletop games[14] despite clear market engagement with the industry and an ancient history of analogue gameplay associated with almost all cultures (Bell 1960).[15]

Tabletop games are often analysed in order to apply findings to other areas, such as Whalen (2003) who develops visual digital interfaces for collaborative group tasks around an interactive tabletop display, inspired by design structures of tabletop boards. As tabletop games have open systems laid out through a comprehensive rulebook, researchers also look at these artefacts to adapt and apply game design principles present in these analogue games to better understand digital game structures which are often more obscured (Zagal et al. 2006, Patrick 2013). Tabletop game research has also been used to analyse how these games can generate learning outcomes in both work and educational environments (Mayer & Harris 2010, Sari

[13] Common devices for digital games include smart devices such as mobile phones or tablets, computers, and dedicated gaming devices such as the *PlayStation*, *Nintendo Switch*, or arcade gaming systems.

[14] As analogue game design research is so under developed, there is essentially no research or published industry knowledge. Research regarding game design is largely industry based, shared through online networks such as blogs, facebook pages, and YouTube videos. Much of the information on experiences in tabletop game development is locked up insider information held by those making games.

[15] This rich history of analogue games will be further discussed in Chapter Four.

2003, Ghory 2004), since board games are, by nature, a problem-solving activity (Schell 2008, p. 36).

The following section focuses on works by Schell (2008), Salen and Zimmerman (2004), Trefry (2010), Fullerton *et al.* (2004), and Costello (2018).[16] Schell brings together core principles of game design for both digital and tabletop games in his book *The Art of Game Design* (2008). Schell presents a series of over 100 perspectives to consider during the design process, which he calls 'lenses'.[17] He argues that "Good game design happens when you view your game from as many perspectives as possible" (Schell 2008, p. xxvi), and suggests the lenses are a way to work through the entire process of designing a game from start to finish. This approach is valuable as it highlights the many different areas that must come together to create the final product (see: Figure 7). For expediency, this thesis is going to focus on a small sample set of key lenses.[18]

[16] This thesis aims to explore the crossover between analogue and digital which result in hybrid, tabletop games, and as such, these sources look at game design principles for both analogue and digital game design. Understanding the ways each separate industry approach game design contributes towards proposing hybrid game design principles in Chapter Six.

[17] The principles presented in *The Art of Game Design* (Schell 2008) and the *Deck of Lenses* (Schell 2014) are structured as non-scholary artefacts to assist game designers in making decisions relating to all aspects of game design. The lenses use scholarly thinking, applying it into a series of questions to consider for each aspect of the game, making it easily accesible for a broad audience.

[18] The purpose of these lenses is not to use them all at once, but rather to use them individually to offer different perspectives and understand the many different elements that factor into game design. A selection of lenses will be highlighted throughout this thesis where they are relevant to the discussion. These lenses will be especially useful in Chapter Five when it comes to analysing case studies, using them as a frame to explore the way the case studies have been designed.

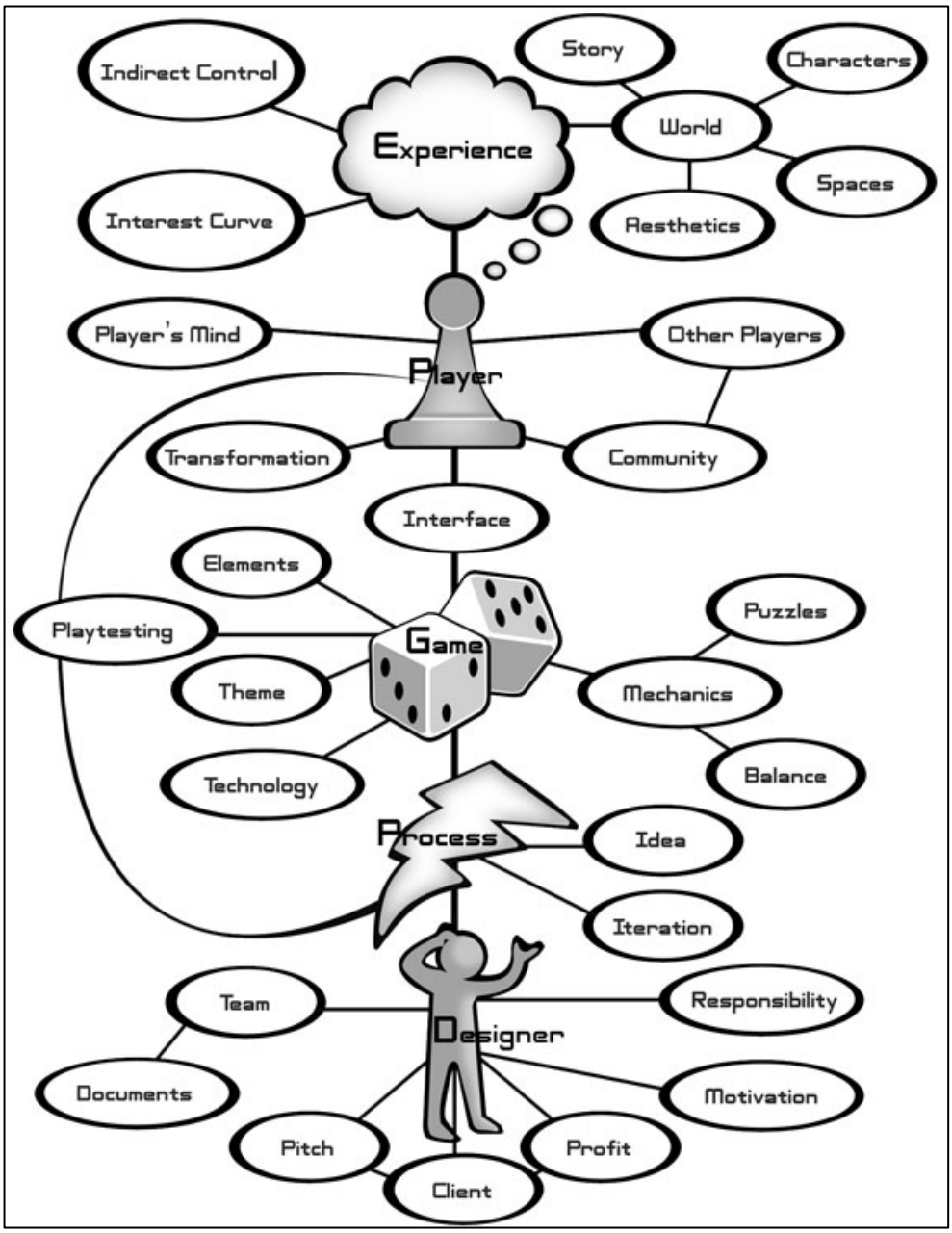


Figure 7. Web of Game Design Relationships from Schell (2008 p. 492).

Salen and Zimmerman's book, *Rules of Play* (2004), is a highly influential contribution to the principles of game design, which offers a unified model for looking at different types of games, both analogue and digital. Salen and Zimmerman (2004) offer a way of thinking about games as a whole, suggesting that iterative design is a vital play-based design process that is beneficial for every game designer. The section titled 'Unit 2: Rules', is particularly useful for thinking about game design, providing a perspective on rules that seeks to explore how these formal structures or mechanics

function and their relevance to game design (Salen and Zimmerman 2004, pp. 116-298).

Costello (2018) offers an approach to game design with a focus on rhythmic experience and considers how this is used to inform and structure the flow of a game. Rhythmic patterns are the pulse of a game, creating movement and variation within the formal structures of the rules. Bringing it to life and being able to experience these patterns "requires both perceptual attunement and a synchronisation of our attention, a process described by the term 'entertainment'" (Costello 2018, p. 7). Costello's (2018) focus on the design and experience of rhythm in play is used in Chapter Six as a way to frame flow between analogue and digital space in the proposed principles of hybrid game design.

3.3.1 Role of the Game Designer

Trefry (2010) and Fullerton *et al.* (2004) consider the role of the game designer, offering a practical guide of areas one must cover when designing a game. Although both authors focus on designing for digital games, their emphasis on the need for iterative design aligns with the processes suggested by Salen and Zimmerman (2004) and Schell (2008). "Game design is the art of creating the system and experience of the game," argues Trefry (2010, p. 15); this creative practice involves much more than solely writing up a set of rules to play with. "A game is a whole package" (Ernest 2011, p. 2) – a specific collection of components that, when operating as a complete unit, resonates and engages with the players. The game designer is responsible for drawing upon a range of different skills – creating the theme or concept, crafting the rules, choosing a graphical style, designing the visual interface, and selecting the material components – all to create a coherent game experience for the player which is both engaging and exciting (Baur 2012; Gary 2018).[19]

[19] The thesis addresses these elements through the Principle of Design Consistency in Section 6.6.

> The game designer envisions how a game will work during play. She creates the objectives, rules, and procedures, thinks up the dramatic premise and gives it life, and is responsible for planning everything necessary to create a compelling player experience (Fullerton *et al.* 2004, p. 1).

While the set of rules may seem like the most important feature of a game, it is only one part of an underlying system, and changes can be made to the experience and design without changing the formal structures of the game (Salen & Zimmerman 2004). The varying design spaces, whether it is rule design or graphic design, must all work towards the game as a whole, which is understood through the theme (Koster 2014; Harrigan in Hindmarch & Tidball 2010, p. 127). The elements must work together to create a seamless, authentically engaging experience. This flow possesses a rhythmic energy which generates progression through interactivity (Costello 2018, p. 115). Fullerton *et al.* (2004, p. 1) argue this interactive experience must be planned for, like an architect's blueprint or a screenwriter's script, ready to be set in motion by the players, which have their own unique rhythm (Costello 2018).

3.3.2 Iterative Design

"The process of game design is necessarily iterative, or looping" (Schell 2008, p. 79) – a game must go through many revisions and iterations to create the version which is fully realised. This iterative process links to the Define and Develop stage of the DDM, and Schell suggests that in order for a game to be 'good enough' it must be continuously reworked until it can pass through Lens #15: The Lens of the Eight Filters (Schell 2014; see: Figure 8), which focuses on the way the game operates, how players respond, and if the game can successfully make it to market. Once the game has passed through these filters and playtesters can interpret the game without the designer having to explain it, the game can then progress into the Deliver stage of the DDM to finalise the product ready for commercial release (Hindmarch & Tidball 2010, p. 108; Eskin 2008).

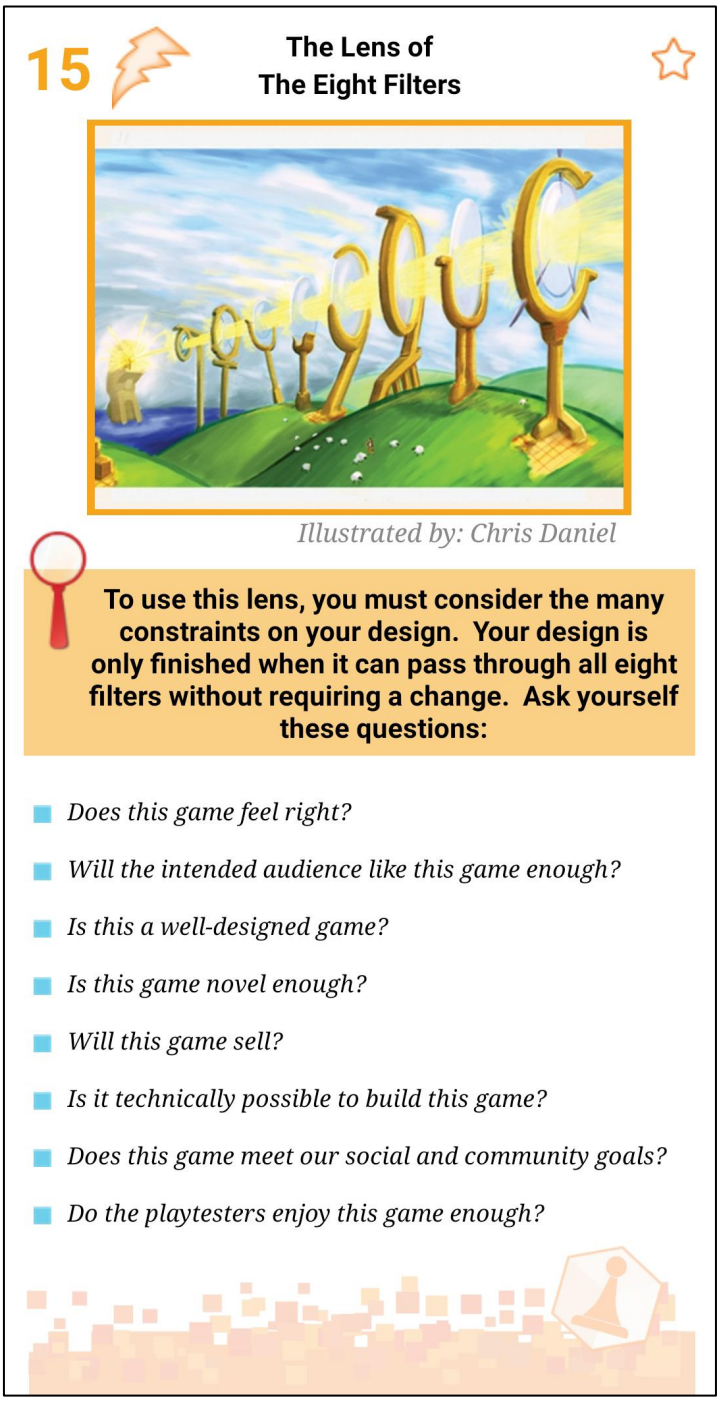


Figure 8. Lens #15: The Lens of the Eight Filters (Schell 2014).

Iterative design is based on the feedback loop between playtesting and prototyping, allowing design decisions to be made through evaluation and refinement in order to continuously improve the game (Salen & Zimmerman 2004; Gary 2018; Looney 2011; Schell 2008; Trzewiczek 2014a). Iterative design is valuable because it allows the designer to understand the experience associated with playing the game, something

which can be hard to grasp due to its intangible nature (Schell 2008). Giving the game idea a tangible form through prototyping allows designers to get a better understanding of how the game actually functions. With each iteration of the prototype this understanding will grow, refining it until it is ready (Fullerton *et al.* 2004). "Playtesting is the single most important activity a designer engages in" (Fullerton *et al.* 2004, p. 196) offering designers insight on how players experience the game and allowing them to assess the rhythms of its gameplay. This process is crucial as it helps find problems early on in the design process so they can be fixed, and ensures the designers are on the right track for making a good game (Schell 2008; Bagiartakis 2015; Gary 2018). As the design develops, the playtesters will also evolve – starting with the designer as they test the foundations of the game to ensure it is a playable object, and ending with the target audience to ensure that game fits the market at which it is being aimed (Fullerton *et al.* 2004; Trzewiczek 2014b). "Play it with different people, different groups, different levels of people" (Eskin 2008, p. 77) to determine what elements are successful, what elements aren't, and why. These insights are then used to understand how to re-iterate the game theme (Baur 2012; Woodruff 2011). Schell suggests the use of Lens #103: The Lens of Playtesting (Schell 2014), through which designers consider the why, who, where, what and how to determine which part of the game to focus on in each playtest (see: Figure 9).

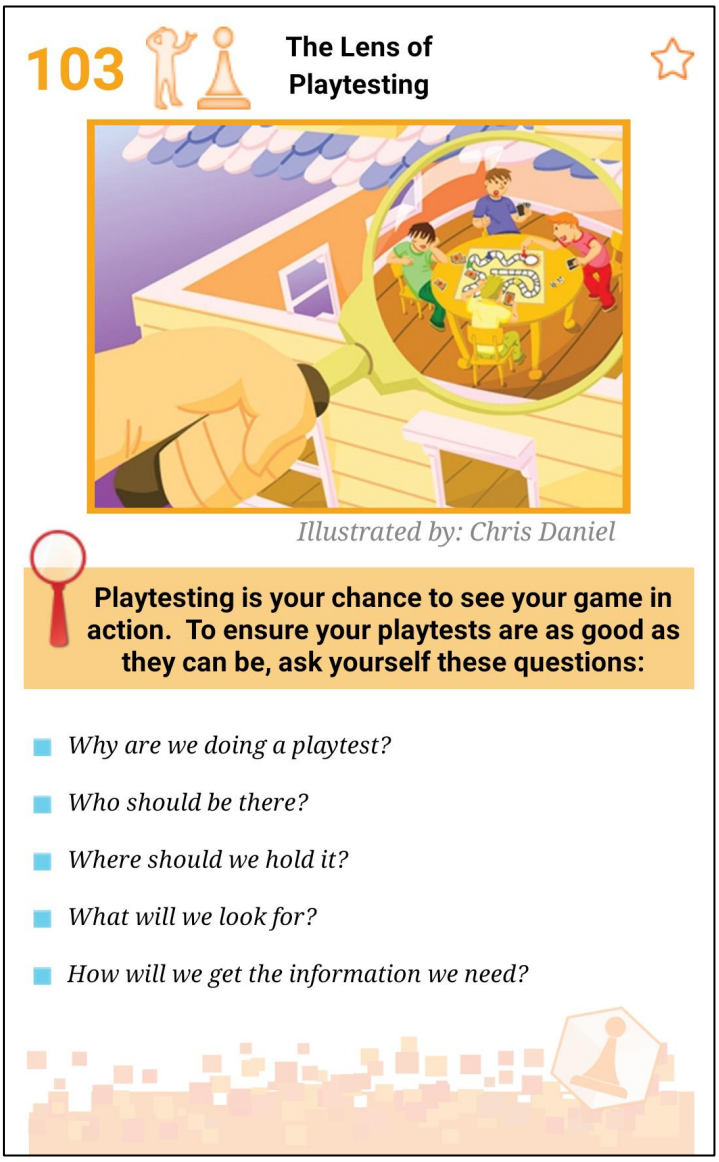


Figure 9. Lens #103: The Lens of Playtesting (Schell 2014).

The concept of iterative design occupies a central role in both the thesis and accompanying creative work. In Chapter Six, the iterative process is used to frame the hybrid game design principles – using it to understand that the principles may need to be considered more than once throughout an iterative game design process. In the accompanying creative work, iterative design is used to inform design decisions and discover critical insights about how the work is evolving.[20]

[20] The creative dossier outlines the process of creating *Ahoy!*, an original prototype game, highlighting where iteration has occurred and how the principles in Chapter Six have been applied to the project.

4. ANALOGUE/DIGITAL HYBRID GAMES

The primary aim of this thesis is to provide an account of key design features of analogue/digital hybrid games.[21] The following chapter uses the Discover stage of the DDM[22] to assess existing research on hybrid games, before narrowing the scope to clarify the hybrid game type this thesis focuses on. In 4.1, this chapter looks at the history of analogue games. Digital games are defined in 4.2, outlining the accelerated development which has led to the digital games we currently experience. 4.3 considers how both analogue and digital game elements can co-exist in analogue/digital hybrid games.[23] In 4.4, this chapter narrows the scope, looking specifically at the digital integration of mobile technologies through apps as a part of hybrid games. This section argues that the integration of apps with analogue games exists on a spectrum, ranging from low integration to high integration.

4.1 Analogue Games

Tabletop games are traditionally understood as non-digital experiences: one interacts with material components such as a board, deck of cards, dice, miniature figures and other physical items (Amelia Con n.d.) in a common area.[24] Tabletop games are ancient, with the earliest dice discovered dating back to 5000 BC (Rath 2014). Mesopotamian dice were made from flat sticks with one side painted, as well as four sided dice stones, while dice in Greece/Thrace were made from carved knucklebones, and the Picts carved dice similar to those in a modern *Dungeons and Dragons* set (Attia 2016; Hite 2016). The game *Senet* is believed to be the oldest board game in the world, dating back to 3500 BC (Orr 2011), which reveals how

[21] Hybrid games use elements of both analogue and digital games. This concept will be further explored and discussed in section 4.3.
[22] The DDM is used as a framework to guide the research (Discover), understand core design features of analogue/digital hybrid games (Define) and propose a set a hybrid game design principles for further scholarly research and development of hybrid games, that are tested in the accompanying creative work (Develop and Deliver).
[23] Defining hybrid games gets us closer to establishing core hybrid game design features in Chapter Five in order to synthesise a set of hybrid game design principles for further scholarly research and development in Chapter Six.
[24] Although solitaire modes exist, tabletop experiences are essentially communal.

Egyptians thought about the afterlife (Heaven 2016; Hite 2010; Hindmarch & Tidball 2010). *The Royal Game of Ur* dates back to Mesopotamia circa-2400 BC (The British Museum 2017) and the game spread widely to audiences in what are now Pakistan, Syria, Iran, Turkey, Cyprus and Crete (Heaven 2016). *Ludus latrunculorum*, played throughout the Roman Empire from 1300 BC, is one of the earliest known strategy games drawing upon military tactics (Attia 2016), and *Chaturanga*, played in India during the 7th century, was one of the first games to explicitly use a war vocabulary to describe moves (University of Virginia n.d.). Playing cards originated in China prior to 1000 AD, with documents as early as 868 AD describing "Princess Tong Cheng playing the 'leave game' with her husband's family, the Wei Clan" (Bicycle n.d., n.p.).

4.2 Digital Games

Digital games are not traditionally thought of as 'tabletop' experiences, but rather video or computer games that are played with a screen (University of Washington, 2005). Mobile and handheld consoles are considered to be 'personal' digital experiences rather than communally shared. As such, tabletop games and digital games have been traditionally distinguished by the medium in which they are played and the physical methods through which they are engaged.

The prehistory of digital games involves many innovations and inventions, including the mathematical game of *Nim*, created by Dr. Edward Uhler Condon in 1940[25] (Chikhani 2015). Ralph Baer developed the *Brown Box* prototype in 1967, marking the development of the first commercial home game system, holding a variety of multiplayer programs on the system such as ping-pong, checkers, sports games, and target shooting games (Smithsonian n.d. a). This system was licensed to *Magnavox* and released as the *Magnavox Odyssey* in 1972, however the company saw it as a gimmick to sell televisions, not realising the potential for digital gaming to become

[25] While on display, it was played by about 50,000 people however the computer won 90% of the games (Chikhani 2015).

an independent industry – resulting in a commercial failure (Smithsonian n.d. b). *Atari* set the benchmark for large-scale gaming communities, creating a whole new industry around arcade games in 1972 beginning with the release of *Pong* (Chikhani 2015). The year 1973 marks the start of networked games with *Empire*, created for the PLATO system, adding a new social dimension to gaming which eventually lead to multiplayer online gaming that exists today (Lowood 2017). A new wave of home gaming consoles emerged in 1976 with the release of the *Fairchild Channel F*, followed soon after by the *Atari 2600 Video Computer System* (Lowood 2017). In the 1980's as personal computers (PCs) became domesticated, digital games made their way onto these devices[26] (Chikhani 2015). Mobile handheld games first appeared in the 1980's via *Nintendo* (Lowood 2017). Their release of the *Game Boy* console in 1989 resulted in an international best selling console (Lowood 2017). In 1997, *Nokia*, released the game *Snake* on their mobile telephone devices marking the beginning of mobile phones as portable handheld gaming devices (Lowood 2017). Portable smart devices like phones introduced the possibility of integrating games with existing inbuilt features of the device such as real-time location based tracking (GPS), messaging, and online interaction (Lowood 2017) and is the main way people play digital games today (Rogers 2014). Digital devices have created the opportunity for analogue games to be transposed into a digital environment, either competing against the computer (AI) or interacting with multiplayer modes (Mora *et al.* 2016). Indeed, there are a significant number of board games with digital versions available via the Android and Apple app stores. These digital recreations of analogue games will be further explored in 4.4.1.

[26] The processors in the PCs were more powerful compared to existing consoles, allowing players to engage with more complex game designs (Chikhani 2015). Computers also gave users the option to create their own games using BASIC code (Chikhani 2015).

4.3 Analogue/Digital Hybrid Games

Hybridity is the combination of two (or more) different elements. In nature, hybridisation can result in the new species of plants or animals, such as the liger - a cross between a lion and tiger (Kang 2014). In design it can be seen through invention in hybrid cars, which use both electricity and gasoline. Similarly, hybrid games combine analogue and digital elements to create a game that runs using both mediums. Hybrid games bring together the ancient and the new, the material and the computational, the communal space of the tabletop and the personal space of the screen device. Mandryk *et al.* (2002, p. 1) offer a general consensus, that hybrid games are a system which "leverages the advantages of both physical and digital media".

Across academia, hybrid games have been inconsistently defined. Lundgren and Björk (2003) refer to the hybrid space as Computer-Augmented Games, not limiting their definition only to tabletop games, but to any game where technology is used as a way to enhance the gameplay experience. Examples of this include utilising screens, customised game systems, and physical components with various electronic sensors to communicate with a digital system (Hjelm 2000; Björk *et al.* 2001, Cermak-Sassenrath *et al.* 2005). Booth (2016) uses the term hybrid to describe the media-based board games utilising VCR or DVD technology such as *Nightmare* (Tanner 1991; see: Figure 10), *Star Trek: The Next Generation* (Decipher, Inc. 1993; see: Figure 11) and *Indiana Jones DVD Adventure Game* (Russel 2008; see: Figure 12). This type of game dates back to the 1980's, using multimedia systems to "deal with the encroaching [of] electronic home entertainment [and] reflect [on] contemporary concerns of convergence media" (Booth 2016).

Figure 10. ***Nightmare*** **VCR board game (-RoG- n.d.).**

Figure 11. ***Star Trek: The Next Generation*** **Interactive VCR Board Game (Caolo 2015).**

Figure 12. Indiana Jones DVD Adventure Game (Moby Games n.d.).

Replacing game boards with tangible digital interfaces complimented with physical items placed on top of the screen has also been an approach for creating hybrid games (Magerkurth *et al.* 2003; Krause *et al.* 2014; Mora *et al.* 2016), as seen in *Weathergods* (Bakker *et al.* 2007; see: Figure 13). This set up is also useful for games where a board or map needs to change such as *Dungeons and Dragons* (Plunkett 2018; Sodhi 2015; see: Figure 14).

Figure 13. A group playing *Weathergods* on a tangible digital interface (Bakker *et al.* 2007).

Figure 14. Digital interface displaying Dungeons and Dragons map (Plunkett 2018).

Since many games require information only be known by certain players, some game researchers have suggested games incorporate handheld devices in addition to the table interface so that this information can be individually disseminated, which was tested in *False Prophets* (Mandryk *et al.* 2002) and *Undercurrents* (Bergström *et al.* 2010; see: Figure 15). This type of setup is sometimes referred to as 'pervasive gaming', and while these setups support a diverse range of games, Mora *et al.* (2016) comments that the system "confines interactivity to a touchscreen area" (p. 532), as such, size of the touchscreen can be a problem; if too small, the interactive space is difficult to access for all players, and if too big, the screen becomes a fixed object, unable to be easily moved.

Figure 15. A group playing *Undercurrents* (Bergström *et al.* 2010).

Rather than focusing on an interactive surface, Mora *et al.* (2016) proposes interactive tokens, shifting the central interaction from the board to the physical objects being played with, influencing the game "not only when they sit on the interactive surface, but also when they are manipulated over and around it" (p. 537) as seen in games like *Beasts of Balance* (Buckenham & Fleetwood 2016; see Figure 16), *Don't Panic*

(Mora *et al.* 2016; see: Figure 17), *Totti* (Heijboer & van den Hoven 2008; see: Figure 18), and *IncrediTable* (Leitner *et al.* 1999). Interactive tokens have evolved into toys used to save and unlock digital content in games (Tyni *et al.* 2013) such as *Lego Dimensions* (Traveller's Tales 2015; see: Figure 19) and *Skylanders* (Toys For Bob *et al.* 2016; see: Figure 20).

Figure 16. Beasts of Balance analogue tower and linked app (Stuart & Gray 2015).

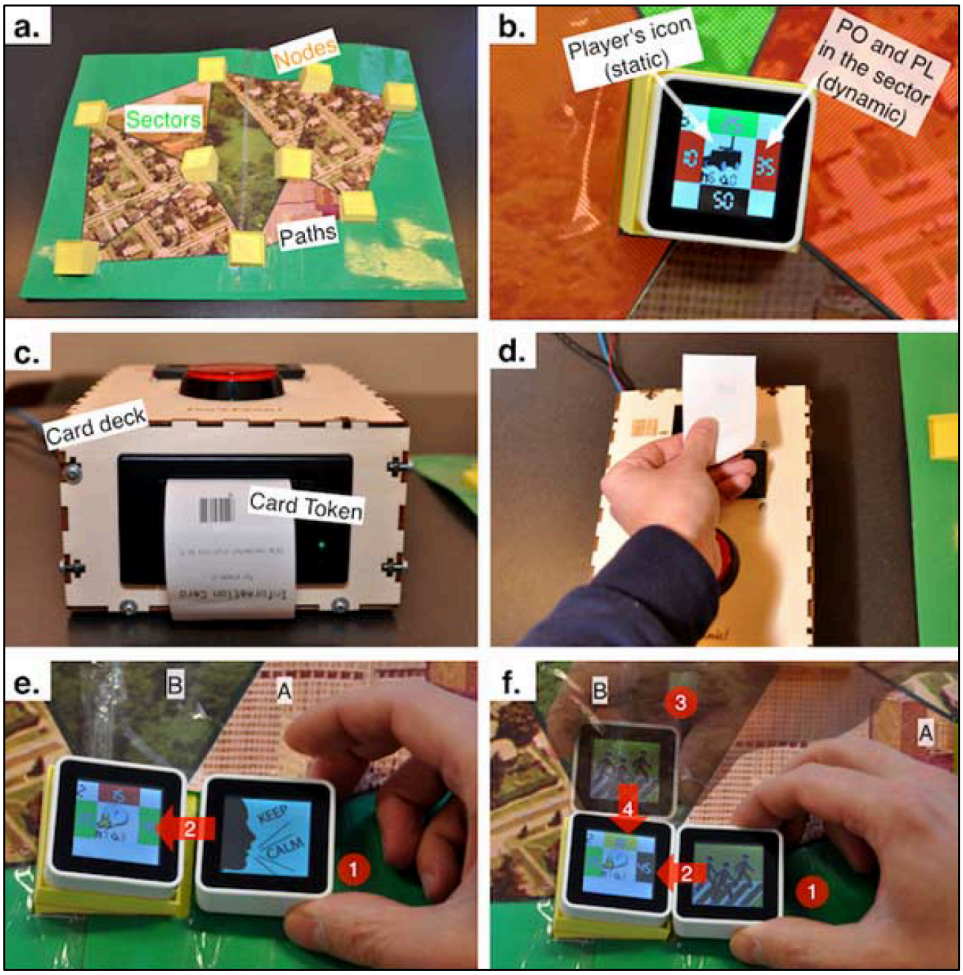


Figure 17. *Don't Panic* interactive tokens (Mora *et al.* 2016).

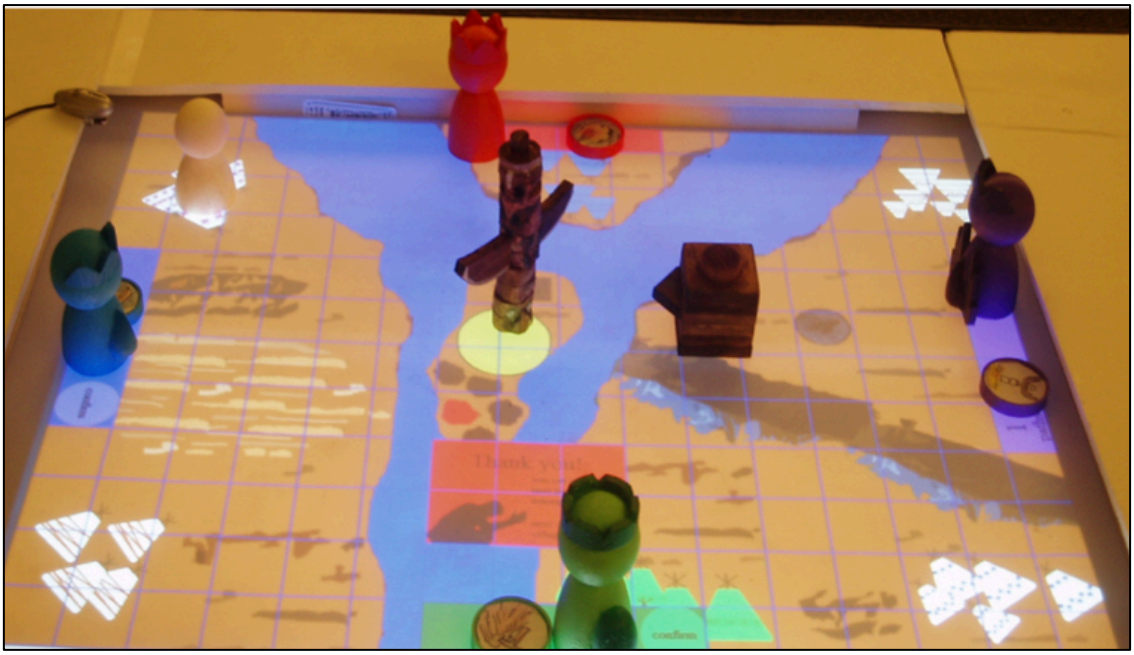


Figure 18. Interactive tokens in *Totti* (Heijboer & van den Hoven 2008).

Figure 19. Toys from *Lego Dimensions* placed on the USB toy pad to connect to the digital game (Wright 2016).

Figure 20. *Skylanders* portal loading the character into the digital game (McCormick 2014).

Kankainen and Tyni (2014) define hybrid games as any "tabletop game that in some meaningful way combines a computerized element into a traditional tabletop game experience" (p. 238), and consider electronically enhanced board games such as Electra (Sala Games 1910; see: Figure 21) and Code Name: Sector (Doyle 1977; see: Figure 22) as predecessors to modern hybrid tabletop games, such as those discussed in the case studies in Chapter Five.

Figure 21. *Electra* board (Golden Grave n.d.).

Figure 22. Code Names: Sector (Retroactive Vintage Games n.d.).

The industry is not well standardised, with each publisher using unique marketing terms for their digital-analogue crossover – including 'app-integrated games' (Fischer 2018), 'mixed media board gaming' (Martin 2017), 'combined games' (Rudy Games n.d.) or 'zAPPed edition games' (O'Brien 2012).

4.4 App Interaction with Tabletop Games

This thesis focuses on hybrid games which integrate mobile applications (apps) on 'smart' devices with tabletop gaming experiences.[27] As will be argued further in this chapter, hybrid games can be considered in terms of their digital integration, which exists on a spectrum, from low integration to high integration (see: Figure 23).

[27] Mobile applications allow digital interaction to move away from linear instructional models of VCR and DVD integrated games, as seen in *Star Trek: The Next Generation* (Decipher 1993) (Booth 2016).

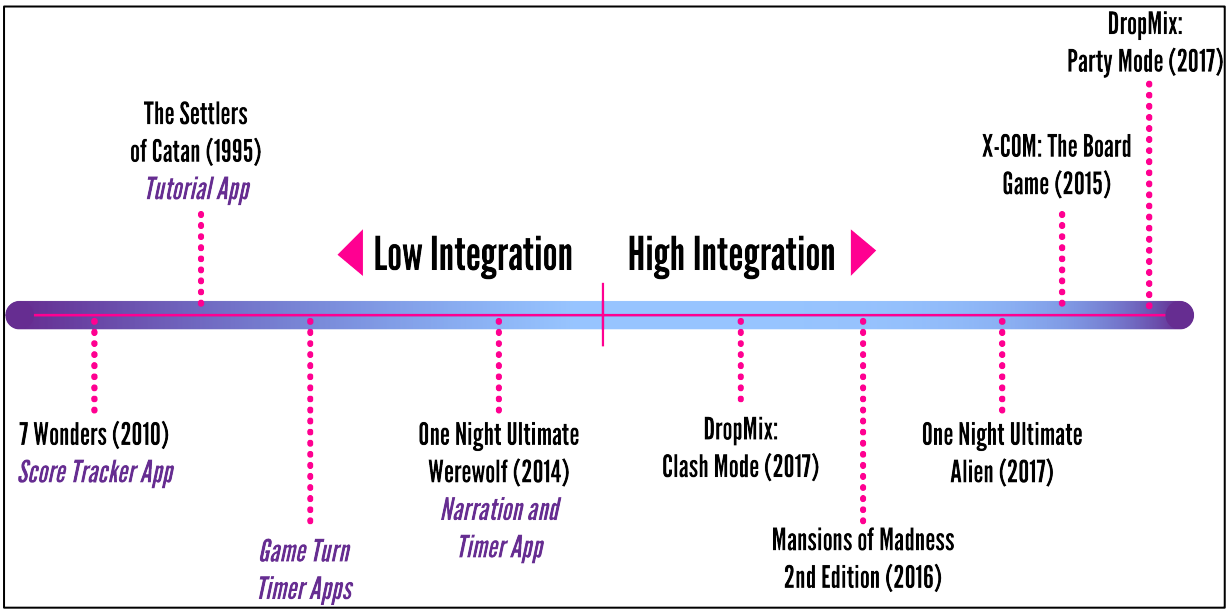


Figure 23. App interaction with tabletop games on a spectrum from low to high integration (image by author).

4.4.1 Digital Recreations

As mentioned in 4.2, analogue tabletop games can be transposed into digital environments. These digital recreations involve face-to-face interaction rather than screen-to-screen or shoulder-to-shoulder interaction (Mora, *et al.* 2016), allowing a group of users to engage in a single screen version of the board game. One digital recreation, *Small World 2*, (Keyaerts 2013) features 'pass and play' and 'face-to-face' settings for playing (see: Figure 24), resulting in a non-hybrid digital tabletop play experience (as transposing the full analogue elements of a traditional tabletop game does not of itself create a hybrid game - there is no integration between the analogue and digital components, only a transposition from one medium to another).[28] If shifting the medium in which a game is played from analogue to digital created a hybrid game, *Pong* (Alcorn 1972) might then be considered a hybrid of table tennis. This is not the case – *Pong* is a digital *interpretation* of table tennis, with no interaction between the analogue and digital versions. A hybrid game requires the

[28] The consideration of how a game is laid out on a table, to be sat around and interacted with, is replaced by consideration of user interface design and the best way to replicate previously-analogue components in a purely digital (2D) space which reduces the physical interaction to tapping on a screen.

analogue and digital components to work together, co-existing as an integral part of game-play.[29]

Figure 24. Screenshot of *Small World 2* play screen (Keyaerts 2013).

4.4.2 Low Integration, Additive Apps

'Additive' apps have low integration because, while these applications expand the game experience, they are not essential to the proceeding of play. The purpose of these apps is to streamline game sessions (Kankainen & Tyni 2014), influencing the rhythm and pace of the game; adding to the overall experience (Costello 2018). For example, game setup can be made simpler with additive apps. The *Dominion Kingdom Deck* (Hsu 2010) app assists players in managing and randomising the player experience (Kankainen & Tyni 2014). Digital game tutorials or walkthroughs, such as the *Catan Game Assistant* (Catan GmbH 2015), allow players to become familiar with new games in a simple, engaging manner without having to rely on their interpretation of the rulebook (see: Figure 25).

[29] Games with augmented reality elements such as *Pokemon Go!* (Niantic, Inc. 2018) also do not qualify as hybrid games. While the game encourages interaction with the environment through real-time location based tracking and an Augumented Reality overlap onto real space, they are entirely digital experiences, in which the physical becomes part of the digital through the camera and the screen.

Figure 25. Screenshots from *Catan Game Assistant*. On the left is the home screen, and on the right is the beginning of the tutorial for four players (Catan GmbH 2015).

Narration apps can structure scripted game elements (Calleja 2018) using rhythm to structure the flow of interactions in a game by spacing out events over a set period of time between narrated elements (Costello 2018). Narration may also be used to recount the actions necessary to progress the game, as with the *One Night* series and the corresponding *One Night Ultimate Werewolf* (Bezier Games 2018; see: Figure 26) app.

Figure 26. Screenshot from home screen of *One Night Ultimate Werewolf* app (Bezier Games 2018).

Additionally, low integration apps such as *Codenames Gadget* (Czech Games 2015; see: Figure 27) utilise time keeping functions, and apps like *Chwazi* (Gomes 2013) can randomly choose a player to start, while score trackers like *KeepScore - Score Keeper* (Lawson 2014) enables players to track points in real time. There are also a number of dice rolling apps which are activated by shaking the smartphone, adding a tangible feel to the digital experience (Kankainen & Tyni 2014).

Figure 27. Screenshots from *Codenames Gadget* showing home screen above and the in game screen with timer and key card displayed below (Czech Games 2015).

While all these apps streamline varying elements of gameplay, none of them are necessary to play the game. They can be considered an accessory or add-on to the original game, and therefore are examples of low integration between the analogue and digital media.[30]

[30] Accessorising is a powerful mode of consumption, it is one of the reasons why low integration apps are so popular, but it's also an important function of the games industry, which adds agency to the player's engagement by allowing them to expand and personalise their experience.

4.4.3 High Integration, Hybrid Apps

'Inbuilt' apps are fundamentally part of hybrid games, representing a form of high integration where the use of both analogue pieces and the mobile application is necessary for the complete game experience (i.e. the game will not function where one is not present). BoardGameGeek (2017) defines digital hybrids as games that have no analogue-only mode of play and requires an app, aligning with the idea that analogue/digital hybrids leverage both mediums (Mandryk *et al*. 2002, p. 1). According to these definitions, games with high integration apps are fundamentally hybrid games. The following chapter will examine three high integration hybrid games: *Mansions of Madness 2nd Edition* (Valens 2016); *One Night Ultimate Alien* (Alspach & Okui 2017); and *DropMix* (Hasbro 2017).

5. CASE STUDIES

This chapter uses the Define stage of the DDM to identify key design features, through a case study approach that focuses on analogue/digital integration. Additionally, this chapter considers ways in which these game designs align with a selection of game design principles proposed by Schell (2008).[31] In 5.1, this chapter examines *DropMix* by Hasbro (2017). In 5.2, the chapter turns to *One Night Ultimate Alien* (Alspach & Okui 2017) by Bézier Games, and in 5.3 it examines *Mansions of Madness Second Edition* (Valens 2016) by Fantasy Flight Games. The three games each use digital technologies, with different degrees of integration, to create a hybrid game experience.[32] This brings us closer to synthesising a set of hybrid game design principles for further scholarly research and development of hybrid games.

5.1 DropMix

DropMix (Hasbro 2017) is a music-themed hybrid board game designed by Hasbro in collaboration with Harmonix, the developer of the musical rhythm console games Guitar Hero and Rockband. *DropMix* operates through a deck of cards, each representing musical excerpts, which are embedded with Near Field Connectivity (NFC) chips.[33] These cards are placed on top of the game board - a piece of electronic hardware - which communicates the cards' location, the specific song it represents, the instrument sample that is played, and how prominent the musical excerpt will appear in the 'mix'.[34] This information is transmitted to the connected

[31] The lenses in this chapter were selected by first reading *The Art of Game Design* (Schell 2008) to understand the how the lenses fit into the process of design. The games were then assessed in order to understand how they worked. After this, the *Deck of Lenses* (2014) was searched in order to pull out lenses specific to the case studies.

[32] Even though all the games have high integration with the digital components, the analogue elements are increasingle complex as the studies evolve, requiring the app to handle more with each game. Starting with a simple analogue component in *DropMix*, we then progress to a *One Night Ultimate Alien* with medium complexity, followed by *Mansions of Madness Second Edition*, with high complexity.

[33] This is interesting as the game uses analogue pieces, that is, the deck, to communicate electronic information through NFC chips, creating the digital mix of songs played through the device hosting the *DropMix* app (Hasbro Inc. 2018).

[34] This informs the Principle of Interface Blindness in 6.5

DropMix app (Hasbro Inc. 2018) operating on a smart device, where it plays the musical excerpt associated with each card (see: Fishleg Studio 2017).

Figure 28. Anatomy of a *DropMix* card (image by author).

The combination of familiar card game mechanics with NFC chips creates high integration with the digital app: the app provides an audio dimension that is not normally found in analogue game experiences. Each card uses visual signifiers to communicate the digital information associated with the NFC chip in a way that players are able to easily interpret (see: Figure 28). Schell (2008, p. 222) argues "the goal of an interface is to make players feel in control of their experience". The designers of *DropMix* have done this by taking into consideration ways to map the information being transmitted to the app, answering the questions proposed in Schell's Lens #60: The Lens of the Physical Interface (Schell 2014; see: Figure 29). The way *DropMix* has been designed answers this lens in such a way as to give the player nuanced control over the musical mix created, comparable to that of a DJ and much like the audio producer who 'mixes' the multiple tracks recording during a studio session. These visual signifiers create a link between the analogue and digital

components, allowing those playing to understand how these two mediums work together to create the overall game. This helps inform the Principle of Design Consistency in 6.6.

Figure 29. Lens #60: The Lens of the Physical Interface (Schell 2014).

There are three different modes of play for *DropMix*: Freestyle, Clash, and Party.[35] Each presents a different way to play the game, and as a result, the technology takes on different roles in each mode. In turn, this answers the questions in the Lens of Physical Interface (see: Figure 29) in three different ways, examined in detail in the following sections.

5.1.1 Freestyle mode

The Freestyle mode lets players mix songs like a DJ.[36] This mode resonates with Schell's Lens #17: The Lens of The Toy (Schell 2014, see: Figure 30) by offering a unique experience tied to the music theme without a competitive goal. The music controls the rhythm of the game on two levels: firstly, the music creates a core rhythmic structure, and secondly, the flow of the play is controlled by placement of cards which introduce synchronous changes to the mix "using repetition and combination to build complexity" (Costello 2018, p. 90). As such, the primary use of the technological integration in Freestyle mode is to bridge the experience between the theme and placement of the cards, bringing the play experience to life through the manipulation of creating physical musical mixes broadcast digitally through the app. Players are able to understand the musical aspects of the game through the cards they are placing on the board using the consistent visual design elements.

[35] Having the opportunity to update and patch the digital components of the game at any point in time is an advantage to hybrid games. Since the completion of this thesis, *DropMix* has since added a fourth mode – Puzzle mode – which will not be addressed in the analysis of this case study.

[36] This type type of play is what Roger Caillois (2001) describes as 'paidic' play or paidus, which is akin to sandbox or playground play where there are no set rules for winning, only basic concepts which structure open ended play with implicit win states (Jensen 2013). In the case of *DropMix* Freestyle, the implicit win state would be to create a mix which satisfies the person playing.

Figure 30. Lens #17: The Lens of The Toy (Schell 2014).

5.1.2 Clash Mode

The Clash mode introduces a competitive element, enabling players to compete against each other either one-on-one or in teams of two, as with traditional card games and multiplayer digital experiences. Unlike the Freestyle mode, rules are introduced determining what areas of the game board cards may be placed, based on the colour and 'level' coding of each card (see: Figure 28).[37] In order to get ahead in the game, players must activate the DropMix button in order to remove cards from the board and points from the opposing team. This triggers the app which selects the cards to be removed from the board, using the digital component to create uncertainty about how this mechanic will play out and how many points will be taken away, forming a key design feature of hybrid games. This power given to the algorithm in DropMix also gives new players a chance to meaningfully compete, taking into account Lens #43: The Lens of Competition (Schell 2014, see: Figure 31). This key design feature of giving control to the app the outcome of certain events informs the synthesis of section 6.2: the Principle of Unpredictability.

[37] The aim of Clash mode is to be the first team to reach 21 points, with blue, green, yellow and red cards valued at its corresponding level (see Figure 28), while multi-coloured Wild, and White FX cards are valued at 4 points each. This means that the scores are often close, and in order to get ahead, teams may need to hit the DropMix button to attempt to clear the board of their opponents cards, leaving the app to decide which cards are cleared.

43

The Lens of Competition

Illustrated by: Elizabeth Barndollar

Competitive games can satisfy the basic human urge to determine who is the most skilled. Use this lens to ensure that people want to win your game. Ask yourself these questions:

- *Does my game give a fair measurement of player skill?*
- *Do people want to win my game? Why?*
- *Is winning this game something people can be proud of? Why?*
- *Can novices meaningfully compete at my game?*
- *Can experts meaningfully compete at my game?*
- *Can experts generally be sure they will defeat novices?*

Figure 31. Lens #43: The Lens of Competition (Schell 2014).

The technology plays multiple roles in this mode, starting with a low integration app tutorial that teaches the rules to players. The game box itself does not come with a physical rulebook; instead, *DropMix* takes advantage of low-level integration using interactive app-based tutorials. These tutorials use the visual communication design of the game to create a clear understanding of the rules with minimal effort (see: Figure 32). Using the app to locate the rules is a key design feature of hybrid games, and this is used to synthesise the Principle of Tutorial Integration in 6.7.

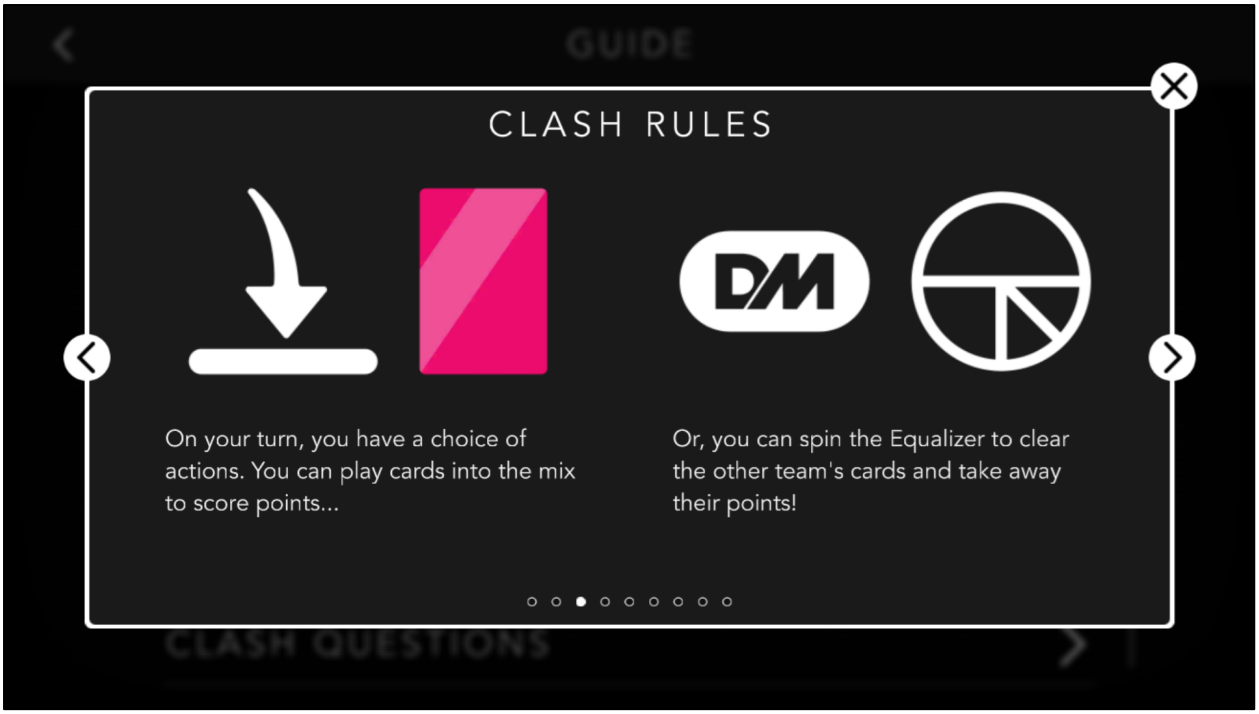


Figure 32. Screenshot of *DropMix* Clash Rules Tutorial (Hasbro Inc. 2018).

DropMix brings the high integration to the surface through the thematic use of creating live musical mixes. This feature is connected to the caretaking aspects of the game, which offers a medium level of integration by tracking and displaying scores, highlighting turns, and prompting actions at any given moment (see: Figure 33). Having the app track gameplay information is a key design feature, minimising the role gamers need to play in remembering rules, score counts, and so on. This role the app takes on informs the recommended principle of Balancing Chores in 6.4.

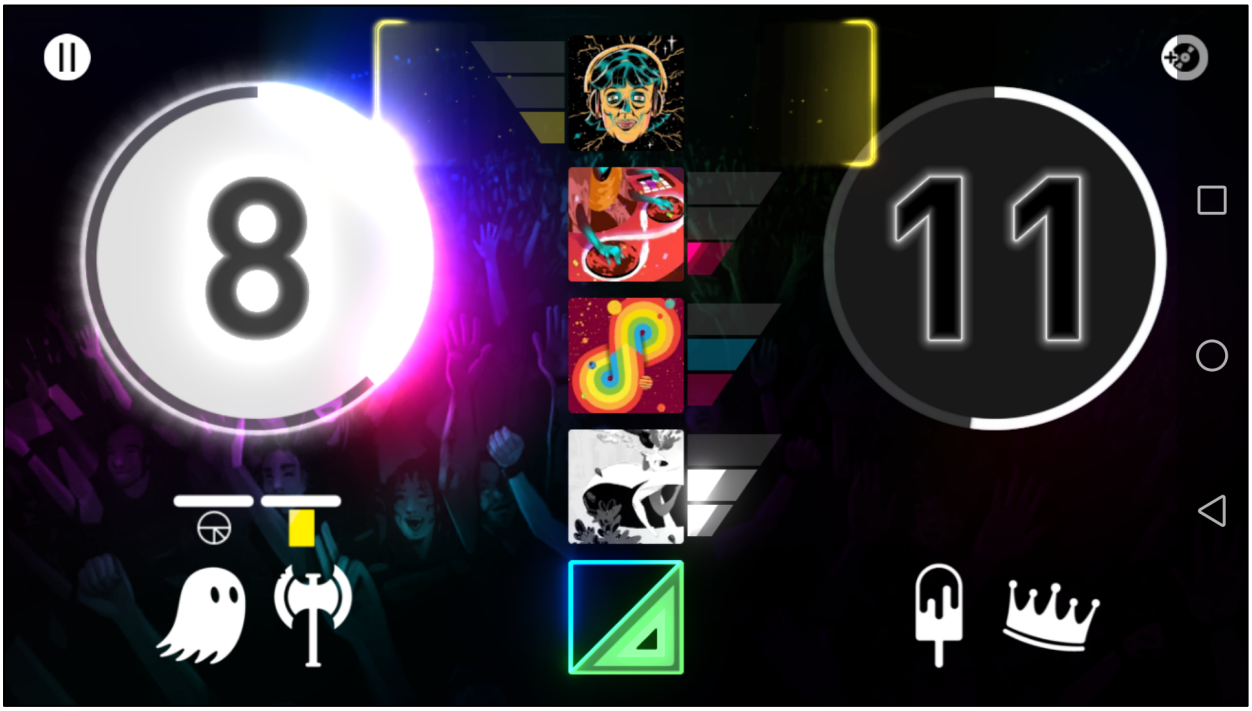


Figure 33. Screenshot of *DropMix* Clash Mode Digital Interface showing team scores and player turns (Hasbro Inc. 2018).

Additionally, the app also takes on the role of referee, using the information transmitted to the board via the NFC equipped cards to ensure players are making legal moves. This high integration of app and analogue design is a key feature of successful hybrid design, which informs the Principle of Interface Blindness discussed in section 6.5.[38]

5.1.3 Party Mode

The Party mode introduces structured player cooperation, enabling up to five players to battle the app's algorithm, working as a team to place certain card types as quickly as possible to fulfil 'requests from the crowd'. As seen in Schell's Lens #44: The Lens

[38] Although the app has the ability to track the validity of a move, the blind interface must trust that all players are doing everything else correctly, such as taking turns in the correct order, and not swapping cards between team mates, which is common to analogue games. While this can mean that players may accidentally play out of order without penalty or even skip a teams turn all together resulting in a score for the opposite team, this can also allow for the development of 'house rules', something which is not often associated with digital games due to the restrictions which result in a digital algorithm enforcing the rules and therefore increasing player agency.

of Cooperation (Schell 2014, see: Figure 34), communication is an essential part of cooperative games, however the Party mode makes this more challenging by introducing a timed element. While this mode of play is high integration as it tracks the placement of cards and utilises the thematic creation of live mixes, the main rhythmic structure of the mode is punctuated by a lower intensity, medium integration timer function. Players are all trying to complete the same task, however the quick pace removes the opportunity for in-depth planning, forcing quick decisions in order to obtain the most points, often at the cost of strategically saving certain cards for later. This rhythm of play shifts in this mode. Rather than following the patterns of the musical rhythm and using that to guide the player on player interaction and placement of cards, the game takes on a mechanical rhythm of play as the gamers are required to play their cards within a set amount of time, rather than at their own leisure. The focus here becomes less about the musical exceprts accompanying the card, but rather the physical action of playing the card before the timer runs out. The key design feature here is the mechanic of trying to beat the app, using the timer to make it more difficult to win. This informs the synthesis of the recommended hybrid design principle of The App as Antagonist in 6.3.

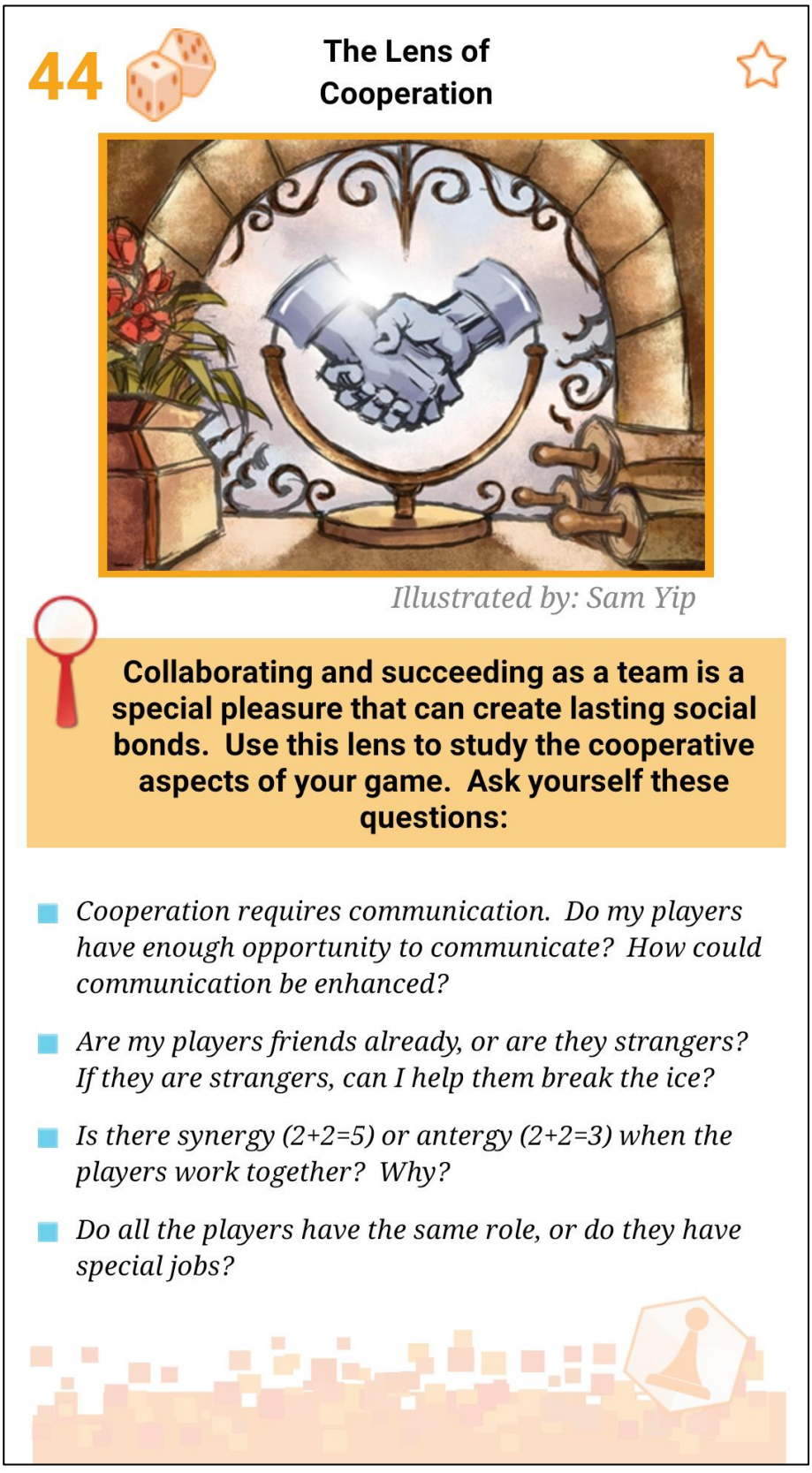


Figure 34. Lens #44: The Lens of Cooperation (Schell 2014).

5.2 One Night Ultimate Alien

One Night Ultimate Alien (Alspach & Okui 2017) is a multiple team, co-operative deception game. This title is the fourth of five *One Night*-style games released by Bézier Games to date,[39] and follows a similar play style to its predecessors. However, there is one key twist: the game includes high integration 'dynamic roles'[40] – many of the characters have multiple associated actions and the app determines which action the character must enact each game.[41]

The goal for players is to meet the unique win condition which applies to their character (see: Figure 35). This game utilises asymmetric characters, in that each character has a different role and associated abilities. Players must use the two phases of play – the night phase and the voting phase – to determine which characters are on their team, in order to persuade a majority vote for someone on the other team(s).

[39] The fifth release: *One Night Ultimate Super Villains* (Alspach & Okui 2018) includes one character with a dynamic role, offering hybridity similar to *One Night Ultimate Alien*, however the game has a much lower reliance on hybrid game dynamics, instead relying on additional affects each character triggers during the vote phase to create a new game dynamic.

[40] The combination of analogue and digital components fit together to make a successful hybrid - physical cards give players something to hold, shuffle and tangibly interact with, while time management, and action progression are managed by the app - offering not only a hybrid analogue/digital machine but also a unique analogue/digital hybrid experience.

[41] It should be noted that there are a few optional components which can be used with *ONUA* such as extra characters, additional randomised events, and the ability to alter the percentage of chance for each randomised event. These extras were only made available to those who initially backed the game when it was released on Kickstarter, and as a result, this analysis will not be taking into consideration these extra components as they are not available to all players of the game. Instead this case study will focus only on the characters available in the box, and default settings for randomised events.

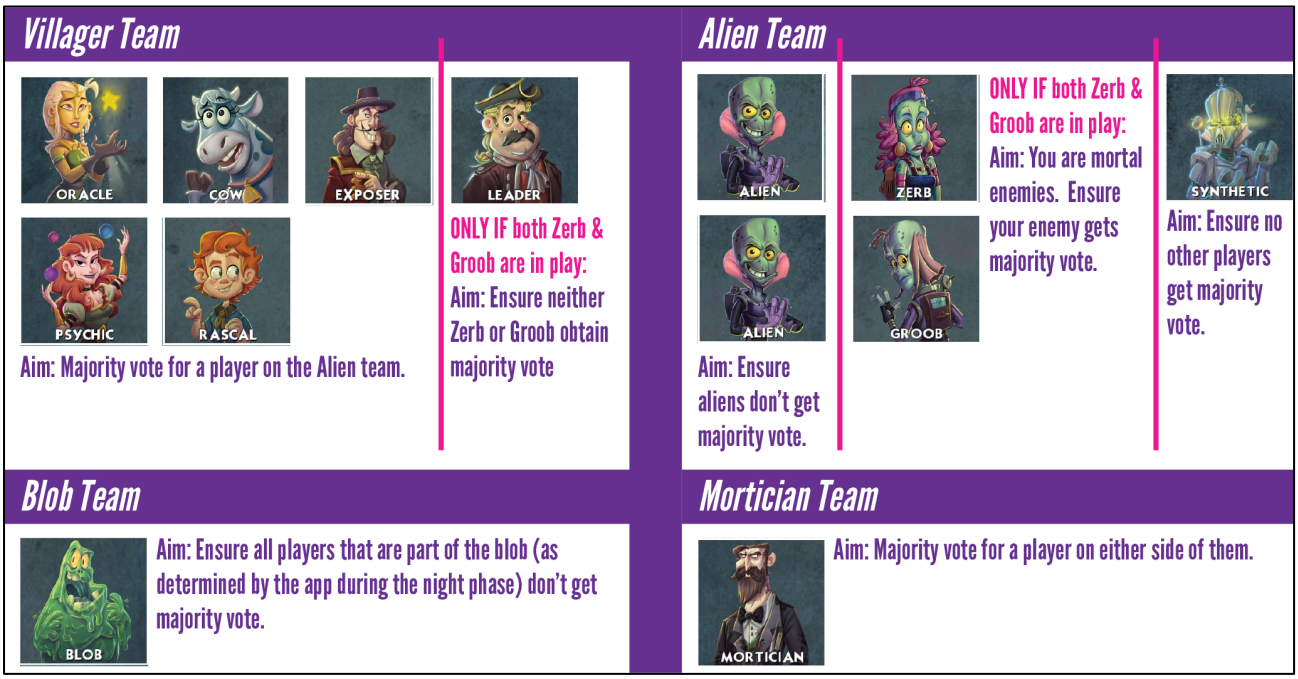


Figure 35. *One Night Ultimate Alien* teams and aims associated with each character (image by author).

5.2.1 Dynamic Roles

The inclusion of dynamic roles is an example of high integration hybrid game design. Characters are impacted by a set of randomised instructions which differ game to game, often limiting obtainable information through number markers, offering players a choice of changing or obtaining information from odd or even cards, or from players next to them (see: Figure 36). The use of revealed information is a key design feature of hybrid games, allowing users to interact with a slightly different experience each game. *ONUA* generates flow in these randomised events through repetition and fluctuating combinations – a player is familiar with the selection of actions with which the character may be presented, but must be willing to adapt as different permutations reveal themselves (Costello 2018). This results in a game which is interesting and challenging for players of different skill levels aligning with Lens #37: The Lens of Fairness (Schell 2014, see: Figure 37). This key design feature of revealing information as the game progresses informs the recommended principle in 6.2 of unpredictability.

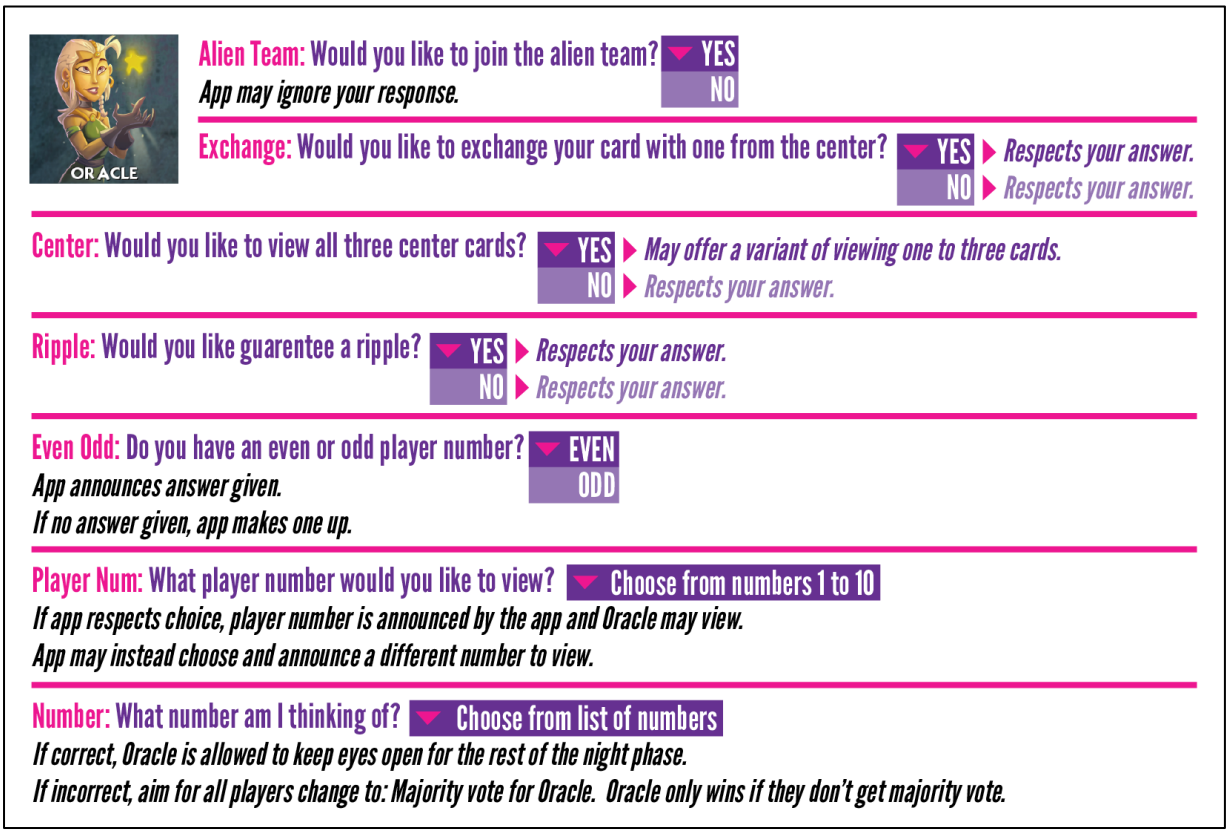


Figure 36. All possible dynamic role actions for Oracle in *One Night Ultimate Alien* (image by author).

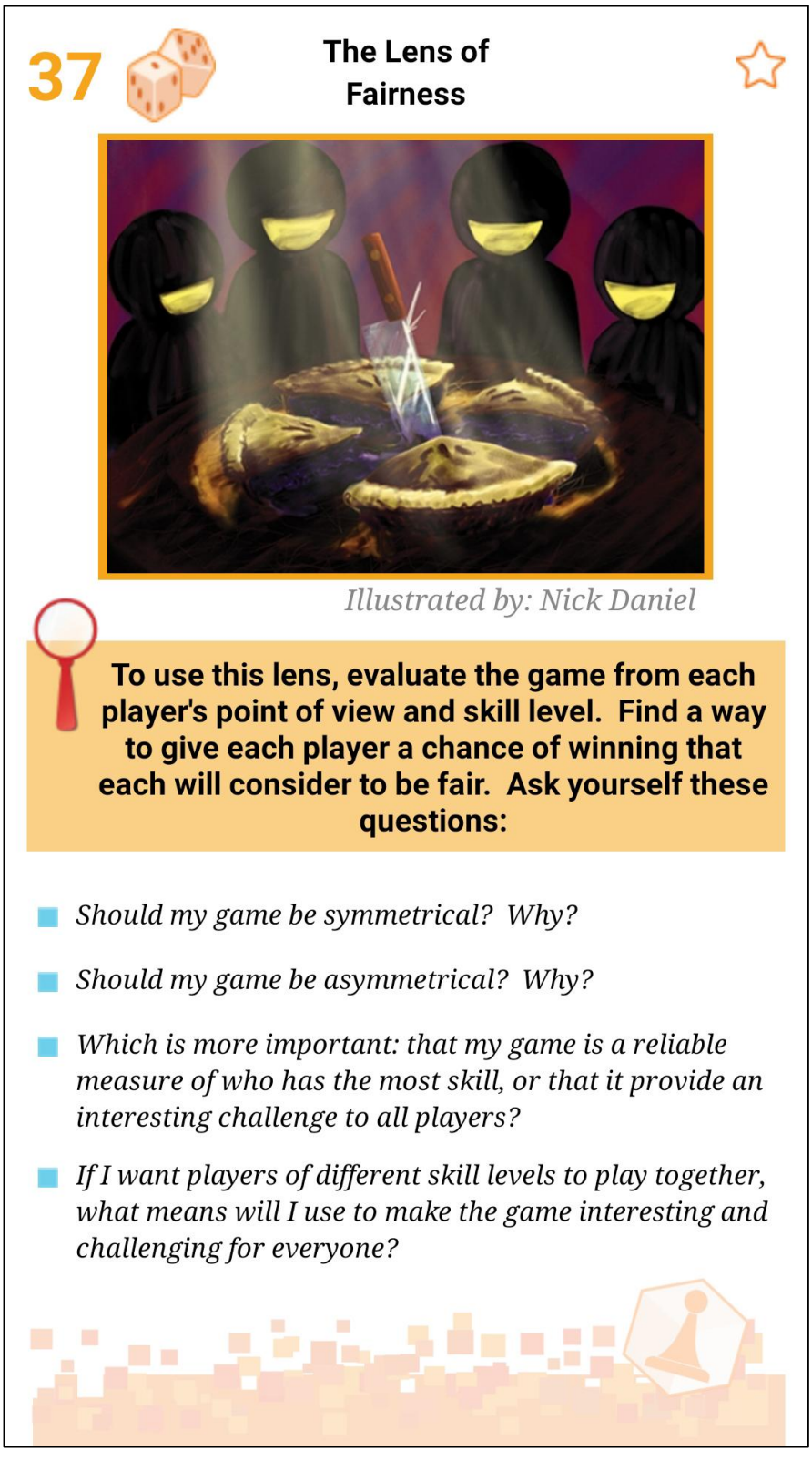


Figure 37. Lens #37: The Lens of Fairness (Schell 2014).

As *ONUA* is the fourth *One Night* release, having more than two teams also helps to combat tactics developed in earlier releases. This prompts new challenges to determine who can be trusted, as each person wants a different group of people alive or dead. This aligns well with Lens #37: The Lens of Fairness (Schell 2014, see: Figure 37), as it gives old and new players different challenges to overcome. These teams become of even greater advantage with the use of dynamic roles, as some of the actions are derived from roles in previous editions. Having teams gives players a new context to use these mechanics in, changing the way they must be played. An example of this can be seen with the Rascal's troublemaker effect, where they can exchange cards with any two players with numbers lower than them (see: Figure 38). This mechanic first appears in the first game of the *One Night* series, associated with the Troublemaker card. This version of the mechanic however limits the players it can be applied to, resulting in new techniques to be used.

Figure 38. The Rascal with a randomised troublemaker action (Bezier Games 2018).

When a dynamic role appears, the app announces which action the character has been assigned. As the app is blind, users have to manually input information regarding decisions which affect the directions given by the app (see: Figure 36), and the app will often announce the selected choice. This results in all players gaining some information about which players have potentially been affected by which actions, while challenging the player acting out the character action to make a wise choice with the limited options available. This provides a challenge to all skill levels (see: Figure 36). As all hybrid games operate across the two mediums, there will always be times where the status of one space is unknown to the other because of the affordances of crossing between a coded and non-coded environment. How each game responds to these limitations is key to the design, and informs the recommended principle of Interface Blindness in 6.4.

5.2.2 Ripple Mechanic

The key design feature mentioned earlier which reveals information as the game progresses also manifests in the 'Ripple' mechanic. Although dynamic roles affect all players differently (with some roles not considered dynamic at all), the Ripple mechanic differs as it is able to affect all parties, giving any player the chance to potentially learn more information by viewing other cards, changing existing information through card switching, or gaining additional power with an extra vote during the final phase. The use of randomisation here continues to balance challenge and skill (see: Figure 36), as players affected by the Ripple are known to everyone, and must then decide whether to truthfully reveal the extra information they have obtained or not. The game to game variation between character roles and inclusion of Ripples aligns with the Lens #4: The Lens of Surprise (Schell 2014, see: Figure 39). Each randomised element adds a layer of unpredictability, leaving players unsure of what choices will need to be made game to game leading to a high sense of

replayability. The continued use of this key design feature is used to inform the Principle of Unpredictability in 6.2.

Figure 39. Lens #4: The Lens of Surprise (Schell 2014).

5.2.3 Accomodating Dynamic Rule Changes

A key feature of hybrid games is the ability to incorporate the rules into the app. As the instructions are constantly changing due to the nature of dynamic roles, the app must be high integration, directing players through the actions they must perform as the game progresses. The physical rulebook is useful at the start for determining who is on which team, and what a character's aim is, however the high integration of auditory instructions creates a streamlined process for playing the game – it gives players one less task to remember. The way the rulebook is incorporated into the *ONUA* app informs the Principle of Tutorial Integration in 6.7. Rather than just reading a set of standard instructions, the developers use a key design feature of hybrid games, giving the app some personality. Adding in flavour text relevant to the game theme and sarcastic remarks amongst the instructions, gives the impression that the app is on its own team and just wants to watch your group struggle. This key design feature informs the recommended principle of the App as Antagonist in 6.3.

ONUA balances the asymmetrical, dynamic roles (addressing Lens #37: The Lens of Fairness, see: Figure 37) by limiting how long each game goes for to a maximum of 10 minutes per round, aligning with Lens #27: The Lens of Time (Schell 2014, see: Figure 40). As this timed element is operated through the app, players are able to use the technology to control just how long each game lasts, resulting in a game which isn't too long or short, depending on player skills and abilities. Having entire games capped at 10 minutes also ensures that no player is stuck in one role for too long, allowing them to quickly learn different ways to approach the game. Having the app control and keep track of the time is a key design feature and assists in controlling the flow of the game, ensuring a vote is conducted whether all players are ready, and taking away the responsibility of the gamers to track this feature. This feature informs the recommended hybrid design principle of Balancing Chores in 6.4.

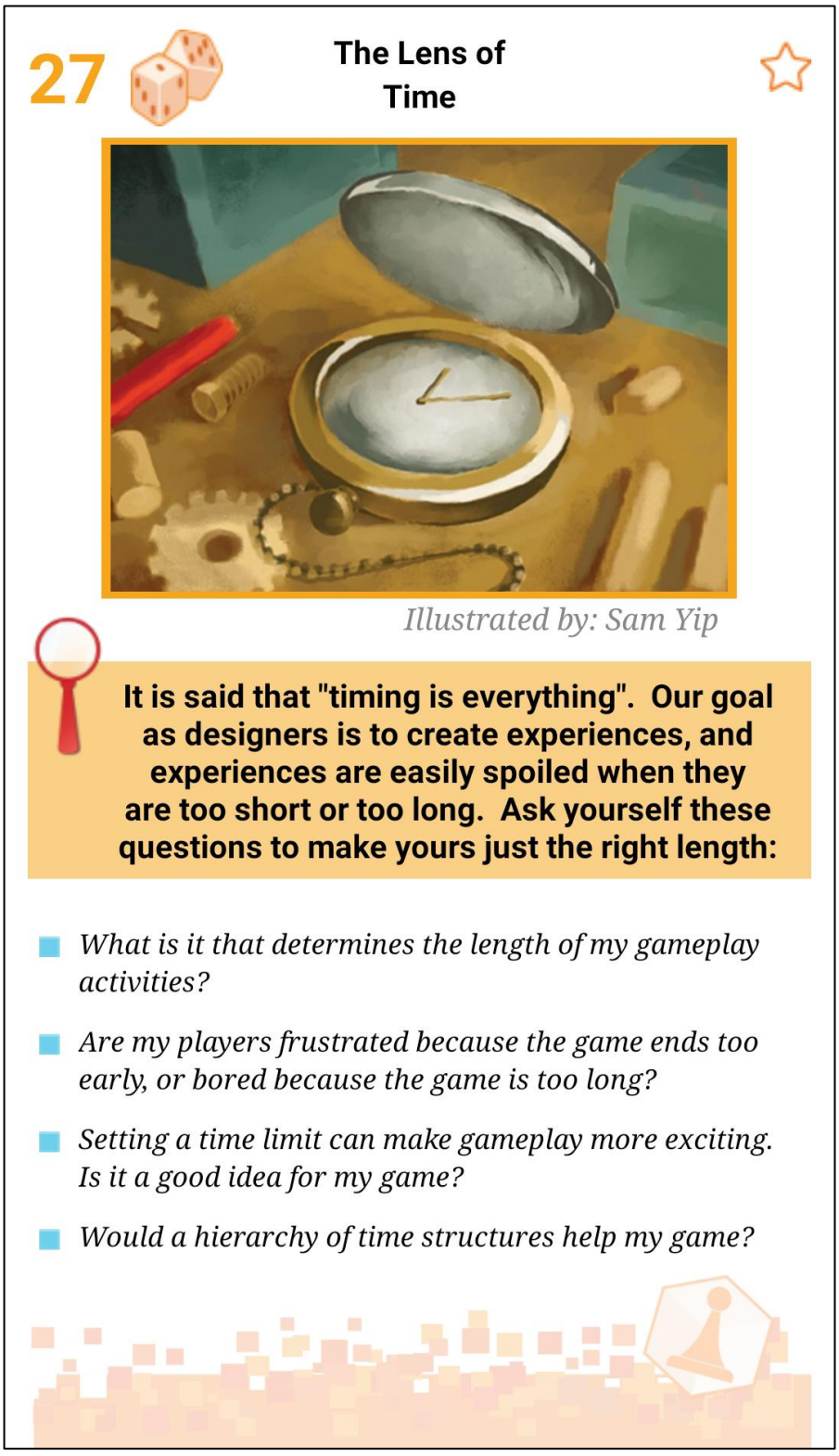


Figure 40. Lens #27: The Lens of Time (Schell 2014).

5.3 Mansions of Madness Second Edition

Mansions of Madness Second Edition (Valens 2016) is a cooperative strategy game published by Fantasy Flight Games. Players take the roles of investigators in 1920's Arkham, exploring haunted mansions within the Lovecraftian universe in order to solve a presented mystery. The game consists of two phases: the investigator phase, where each player has two actions to either move, explore, search for clues, trade with players, or attack encountered monsters; and the mythos phase, where the app generates game effects for players to react to. The app might cause new monsters to appear, or create conditions that deal damage to players. The aim of the game is to successfully complete the investigation, and the scenarios that are undertaken to reach this end-state change depending on the generation of narrative elements during the playthrough.

It should be noted that the hybrid game - *Mansions of Madness Second Edition (MOMSE)* - is a successor to a complete analogue experience in the *Mansions of Madness First Edition* (Konieczka 2011). Since its release, *MOMSE*, has outsold *Mansions of Madness First Edition (MOMFE)*, with its success resulting because of the way the high integration app solved issues present in the analogue-only first edition. The following analysis will focus on the differences between the analogue-only first edition and the hybridised second edition, considering how these changes solved issues present in the original gameplay.

5.3.1 Cooperative Play

MOMSE highlights that hybrid game design can alleviate problems associated with human error, minimise chores and aid in delivering rich and complex story worlds with which all players can engage easily. This aligns with Lens #104: The Lens of Technology (Schell 2014; see: Fig. 41), as the second edition identified where the first edition fell short and how technology could be used to bridge this gap.

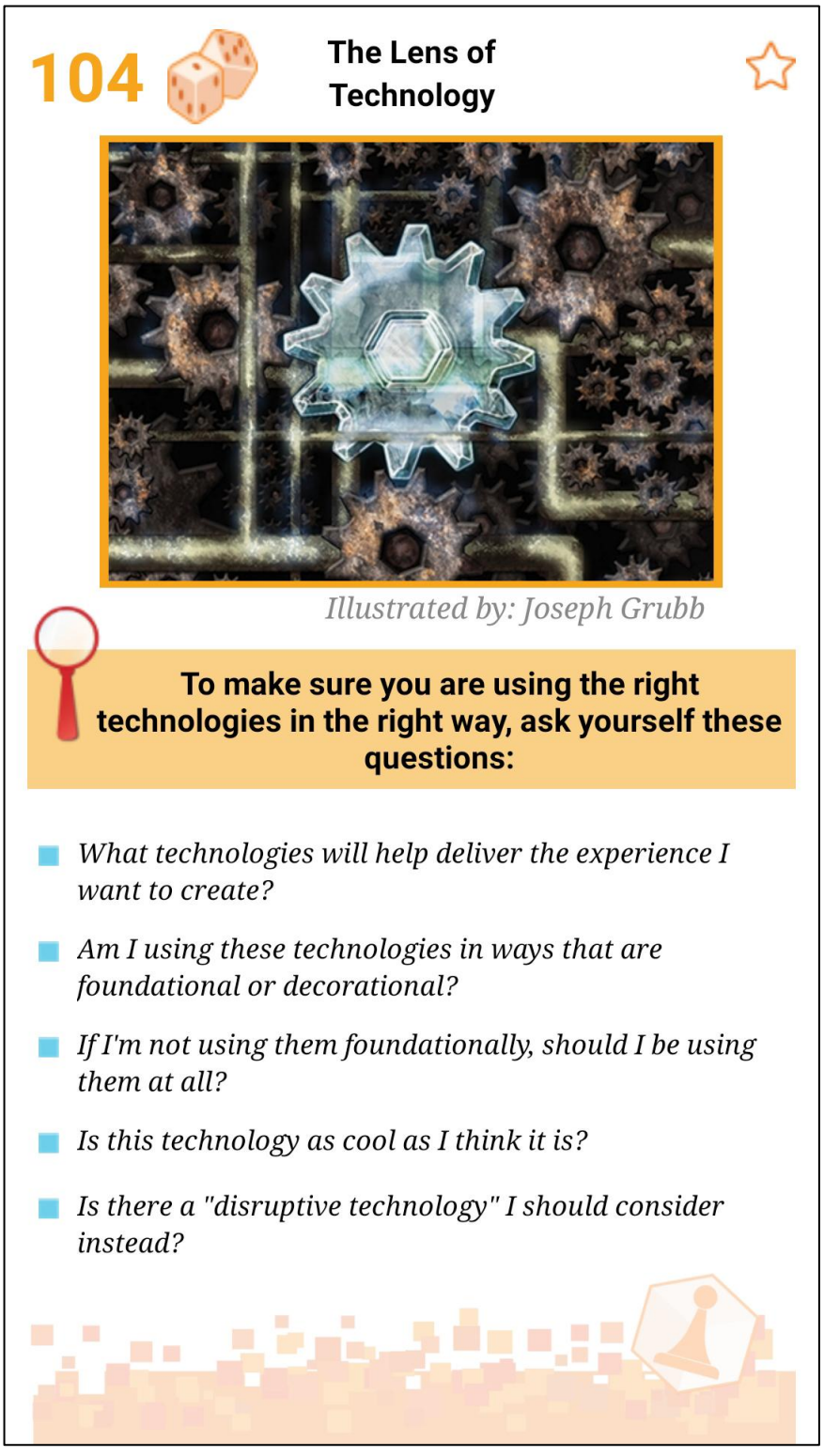


Figure 41. Lens #104: The Lens of Technology (Schell 2014).

MOMSE removes the role of the 'keeper'[42] present in the first edition, replacing them with the high integration app. This transforms the way players engage with the game from a one-vs-many system into a fully cooperative game experience and enhances the rhythm of the game experience. In the first edition, the keeper role was filled by one player who controlled the flow of the game. Like the Dungeon Master in *Dungeons and Dragons*, this one person was responsible for making the game work – a huge task with a large associated workload, often resulting in errors during set up that could ruin an entire game. In the second edition, placing an app in control reduces the scope for human error. The app conducts the game tempo, with interaction from the gamers resulting in a smoother flow (Costello 2018). The key feature here is the way the algorithmic functions of the app digitise many of the chores from the first edition including room generation and tracking monster health, which helps ensure the game pace progresses consistently. This key feature helps to inform the recommended principle of Balancing Chores in 6.4. Digitising the game master role also gives all players the opportunity to play the game together against the app, a key feature of hybrid game design, rather than forcing one player to control the technical aspects and assume the role of the antagonistic force. The app as an oppositional force informs the Principle of App as Antagonist in 6.3.

5.3.2 DISCOVERY

One of the shortcomings of the First Edition was the lack of a sense of discovery. This is partially a result of the medium in which it was made (Wardrip-Fruin in Hindmarch & Tidball 2010, p. 135). Analogue games are by default transparent: they come in a box with all available pieces to create scenarios, and in order to even begin the game, players need to understand how all the rules work. Digital games however, are opaque: players don't have all the information until it is revealed to them (Fischer 2018). How game designers respond to these two different mediums is a key feature

[42] Or game master

of hybrid games, and this informs the recommended principle of Information Opacity in 6.1.

In the Second Edition the hybrid system includes mechanics that deal with transparent components such as the game map, player information and dice rolls. In the analogue space, players are able to share information, make decisions and move around the board, while the app is in charge of opaque elements – ranging from narrative branches and story events to monster actions – revealing these as the game progresses (a key design feature of hybrid games), and maximising the experience of discovery. While the game offers five core scenarios, the app is able to generate the story in different ways by combining branching scenarios, monster types, events and puzzles, while protecting players from managing this complexity themselves. These different permutations create texture and rhythm which results in a movement between the known and the unknown, establishing patterns which allow the gamer to understand what possibilities exist, while leaving enough unknown to create tension and excitement (Costello 2018). This aligns with Lens #84: The Lens of the World (Schell 2014; see: Fig. 42), offering multiple stories for players to discover. While the overall goal remains the same, the path taken changes with the scenario presented by the app resulting in a different way to play each game. This key design feature informs the recommended Principle of Unpredictability in 6.2.

Having the complexity moved from the analogue to the digital also means that the initial barrier of understanding the game is greatly reduced. This is seen most clearly in the rulebooks for each version – the rulebook for the first edition contains 26 pages and consists mostly of text, with imagery used sparingly to highlight relevant game pieces or offer an example of how to enact a particular rule (Fantasy Flight Publishing, Inc. 2010; see: Figure 43). In comparison, the second edition rulebook only consists of 20 pages, with imagery more commonly included to highlight examples of how to enact particular rules, while also supporting the gothic visual narrative of the game (Fantasy Flight Publishing, Inc. 2016; see: Figure 44).

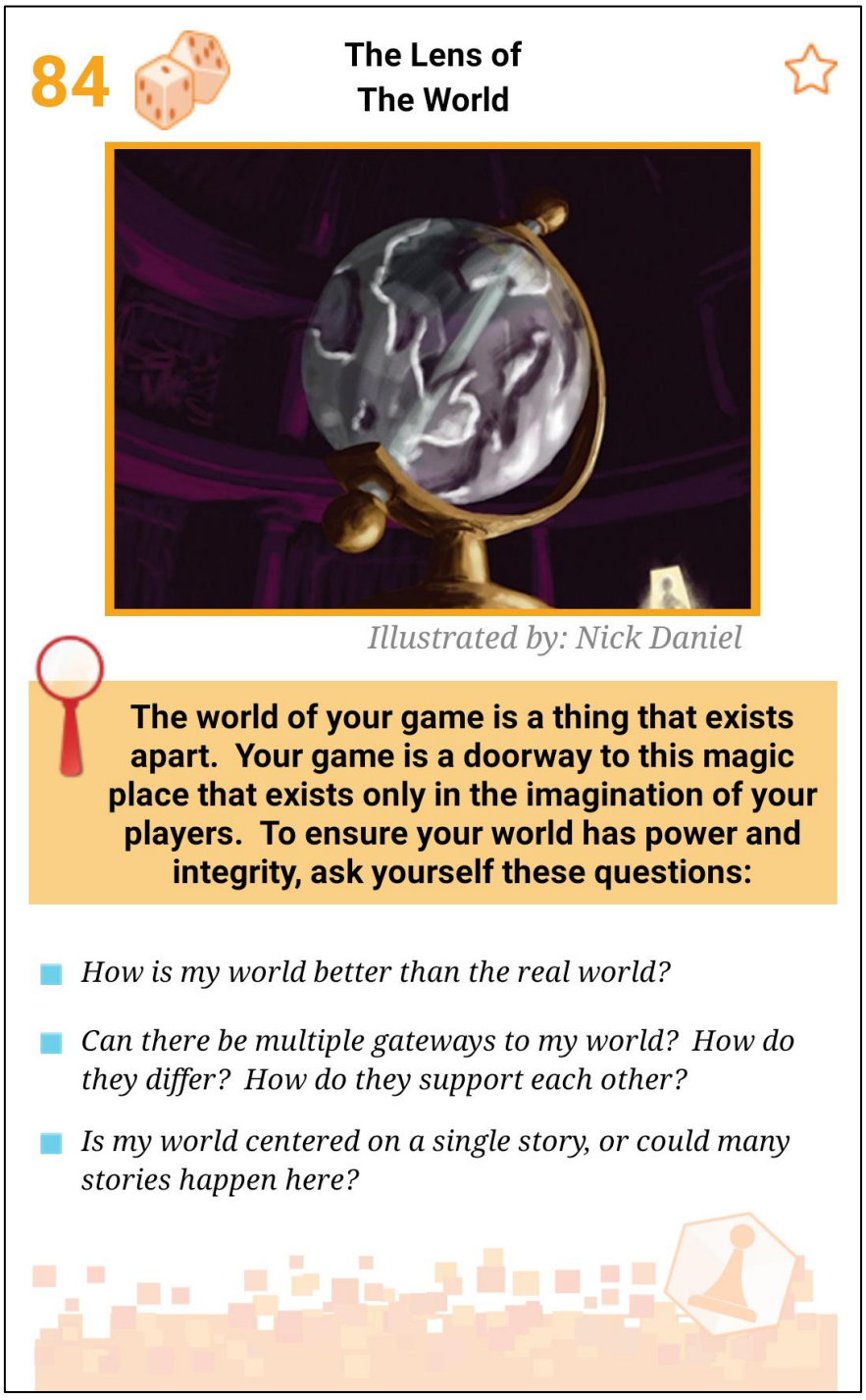


Figure 42. Lens #84: The Lens of The World (Schell 2014).

Core Rules

This section describes core concepts not previously discussed, including attribute tests, casting spells, and using Mythos and Objective cards. The rules for puzzles and combat are discussed later (starting on page 17).

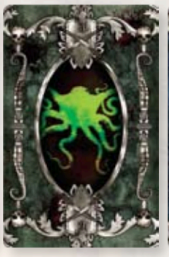
Monsters

Investigators are frequently plagued by monsters, which attack them and carry out the nefarious plans of the keeper.

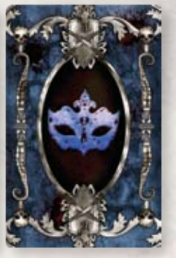
Monster Classes

Although there are many different types of monsters (cultists, witches, zombies, etc.), there are only three classes of monsters (humanoid, beast, and eldritch). Each monster belongs to one of those classes, and its class is indicated by the color on the upper right corner of its monster token. Beast monsters are brown, eldritch monsters are green, and humanoid monsters are blue. Each monster class has a matching Combat deck of the same color that is used when the monster is involved in combat (see "Combat" on page 21).

Beast



Eldritch



Humanoid

Named Monsters

Occasionally, a story will place a monster into play that has a specific name and special significance to the story. These named monsters follow all normal monster rules, but must be marked (by placing a horror token on them) so that players can tell which monster is the named monster.

Some named monsters have more health than what is printed on their monster token (for example: in a four player game a monster that has "+2 health per investigator" would add 6 to its health value). In this situation, players may need to place damage tokens adjacent to the monster figure in addition to in the hook on its base. These damage tokens act as if they were also in the base's hook.

Special Note: Cult leader monsters are *not* considered to be cultists for the purposes of card effects and abilities.

Sample Tokens

Some Objective cards require the keeper to accumulate a number of sample tokens. The keeper can use the "Take Sample" Keeper Action card against an investigator to have a monster gain a sample token. Monsters cannot transfer sample tokens or drop them anywhere other than on the altar. When a monster with sample tokens is killed, all its sample tokens are discarded.

Feature Markers

During setup, the Investigator Guide may have investigators place a number of room feature markers in specific spaces of the game board. These markers have varying effects, and interact with monsters and investigators in different ways.

The full details for using these markers are found in this section.

Altar Feature

These feature markers are used by the keeper as described on specific Keeper Action cards (such as "Take Sample" and "Summon Worshippers"). Certain Objective and Event cards may also interact with rooms that contain an altar feature marker.

Barrier Feature

These feature markers represent pieces of furniture that investigators can use to temporarily block a door.

An investigator may spend his Action Step to either move a barrier in his space onto a door in that space (place it partially over the door), or move it from the door back into the space. Once a barrier is on a door, investigators and monsters may not move through the door. A monster trying to move through this door has a chance to potentially remove or destroy that barrier (see page 23).

Barriers may not be moved out of their starting spaces.

Camp Fire Feature

These feature markers can be used for two purposes.

Spread Fire: The keeper may place fire status effect tokens in this room by using the "Spread Fire" Keeper Action card.

Destroy Corpse Markers: When in the same space as a camp fire, an investigator may spend an action to discard any number of corpse markers that are also in his space.

Corpse Feature

These feature markers are placed on the game board by the "Raise Dead" Keeper Action card. The keeper may be able to replace these markers with zombie monster figures.

When an investigator moves out of a space containing a corpse marker, he may drag it with him into his new space. Doing so does not cost him any additional Movement or Action Steps (but he may only drag *one* corpse marker when he moves).

A corpse marker is discarded if it is ever in a room that is on fire (see "Status Effects" on page 15). Corpse markers can also be discarded if investigators throw them into a camp fire (see "Camp Fire Feature" above).

Figure 43. Page 12/26 from *Mansions of Madness First Edition* rulebook discussing core rules including Monsters, Sample Tokens, and Features (Fantasy Flight Publishing, Inc. 2010).

Features

Features represent noteworthy furnishings or environmental effects that investigators can interact with or that affect how an investigator can interact with his surroundings. All features are square tokens. Interacting with a feature does not require the app.

Barricades

A Barricade allows an investigator to block a door to prevent monsters from getting through. As an action, an investigator in a space containing a Barricade may move the Barricade against a door or move the Barricade away from the door it blocks.

Investigators and monsters cannot move through blocked doors. However, a monster can destroy a Barricade that blocks its path.

If a monster attempts to move through a blocked door, it rolls a number of dice equal to its brawn. If it rolls two or more success results (), the Barricade is discarded and the monster moves as normal. Otherwise, the monster does not move.

Darkness

Darkness hinders an investigator's ability to resolve skill tests and puzzles. An investigator in a space containing Darkness cannot spend Clues to convert dice results or perform additional puzzle steps.

Each investigator in or adjacent to a space containing a *Light Source* or Fire ignores the effects of Darkness.

Fire

Fire spreads and can damage investigators and monsters. Whenever an investigator moves into a space containing Fire or performs an action in a space containing Fire, he suffers one facedown Damage.

Whenever a monster starts its activation in a space containing Fire or moves into a space containing Fire, it suffers one damage.

As an action, an investigator may attempt to extinguish the flames by testing his agility (). For each success result () he rolls, he may discard one Fire token from his space or a space he moves into if he moves as part of his second action or later in the round.

At the beginning of each mythos phase, fire spreads. If one or more spaces contain Fire, place one Fire token in a space adjacent to a space that contains Fire.

Secret Passages

An investigator or monster in a space containing a Secret Passage can move to any other space containing a Secret Passage as if those spaces were adjacent.

16

Figure 44. Page 16/20 from *Mansions of Madness Second Edition* Rulebook discussing Features (Fantasy Flight Publishing, Inc. 2016).

The gothic visual style of the Lovecraftian universe, connected to the discovery generated through the revelation of complexities as the game is played, relates to Lens #94: The Lens of Atmosphere (Schell 2014; see: Figure 45). These two components work hand-in-hand to create a sense of foreboding about the unknown world that lies ahead. Music is also utilised in the app to further push the atmosphere of the game, adding an additional rhythmic element to the game with a haunting, ambient soundtrack, which prompts players to sense "the vastness of the universe and the relative fragility of humanity," (Smith 2011). Having the theme permeate the analogue space, from rulebook to game pieces, and digital space, through visual imagery, sound effects, and mechanics is a key design feature of hybrid games, which informs the Principle of Design Consistency in 6.6.

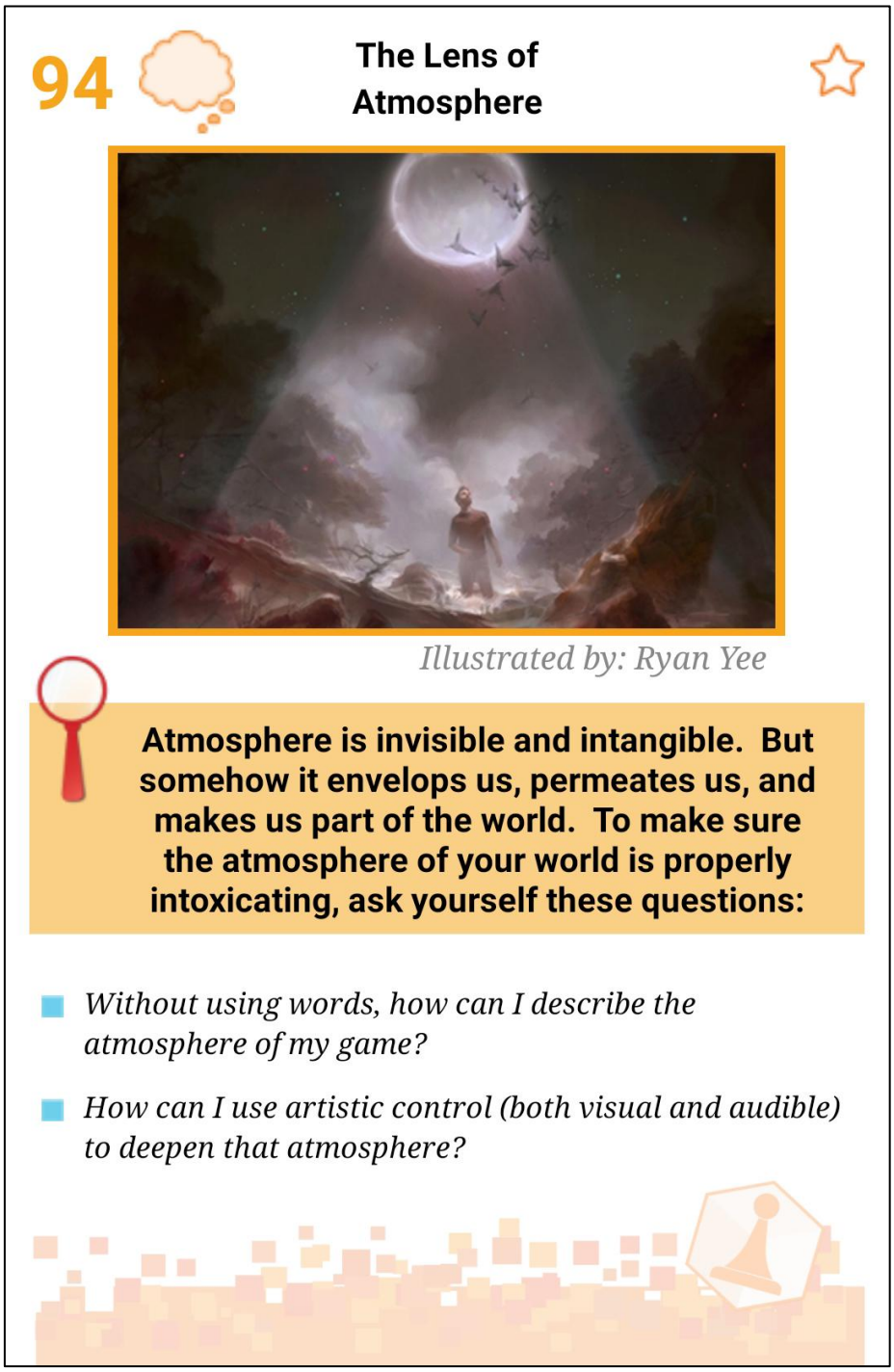


Figure 45. Lens #94: The Lens of Atmosphere (Schell 2014).

6. HYBRID GAME DESIGN PRINCIPLES

This chapter uses the Deliver stage of the DDM[43] in order to propose a series of hybrid game design principles, emerging from the key features of hybrid game design identified through the three case studies in Chapter 5. The proposed principles have been applied to the accompanying creative work, considering how they can be applied to an existing analogue game to create a new hybrid edition, and used to guide the initial conceptualisation of an original hybrid game.

These principles seek to show rich analysis and research, exploring hybrid game design in a comprehensive way. Taking inspiration from Schell's design lenses, each principle is summarised with a design question to guide the game designer in testing it.

The principles have been aligned to the stages of the DDM. The first three principles focus on underlying mechanics and structure of a hybrid game, and are best applied in the Define stage of game development (in which a prototype is developed). Principles four and five focus on the overlap between the analogue and digital components of the game, and are best applied during the Develop stage (where playtesting occurs). The final two principles focus on presentation elements – considering the best way to leverage both analogue and digital components to deliver a unifying experience (aligning with the Deliver stage).

6.1 Principle of Information Opacity

Hybrid games work across two fundamentally different spaces. As noted in 4.3.2, the analogue space is inherently transparent: the game information is available and must be processed before play. Conversely, digital games possess an opaque quality, as the technology is able to obscure information until players need to know it (Fischer

[43] The DDM is used as a framework to guide the research (Discover), understand core design features of analogue/digital hybrid games (Define) and propose a set a hybrid game design principles for further scholarly research and development of hybrid games, that are tested in the accompanying creative work (Develop and Deliver).

2018; Wardrip-Fruin in Hindmarch & Tidball 2010, p. 135). These two components must work together for a successful hybrid game design. When successfully synthesised, the physical and the digital can rhythmically syncopate the flow of turn taking, manipulation of physical objects and information discovery during the game experience. The Principle of Information Opacity can be used to assess the internal structures or mechanics of the game to determine whether it should be controlled by the analogue or digital game space.

To test this principle, the game designer asks the question: does the mechanic perform optimally if the player knows everything before play begins, or can the app be used to reveal the information during play?

6.2 Principle of Unpredictability

Algorithms are present in both analogue and digital games, however in digital games, the app becomes a 'co-operator'. As a co-operator, the app can leverage randomisation to produce unpredictable events in the gameplay[44] and provide a higher degree of replayability. These events should be organised around predictable gameplay elements in order to create rhythmic tension. As Costello (2018, p. 140) suggests "such familiar and satisfying moments of repetition can also provide a stability that makes it possible to create a layer of instability". The use of the key design feature of randomisation exists with the DropMix button in *DropMix* (see: 5.1.2), which results in the app choosing which cards are removed from the board; the use of Dynamic Roles and Ripples in *ONUA* (see: 5.2), which result in unknown actions to be completed by players; and scenario combinations in *MOMSE* (see: 5.3.2), which result in different paths taken each game to reach the end goal.

To test this principle, the game designer asks the question: do the analogue and digital algorithms work synchronistically to provide enough variation through randomisation to sustain interest?

[44] Pure randomisation is rather difficult to achieve, however pseudo-randomisation can prove to be just as effective. The goal of introducing randomised elements is simply to create circumstances that are unpredictable.

6.3 Principle of App as Antagonist

High integration apps are able to prompt players and present challenges, effectively acting as an antagonist. This algorithmically determined persona can be assigned a personality (connected to difficulty levels), fostering an emotional connection and helping players to "feel their way into a work" (Costello 2018, p. 88). The app directs the narrative, allowing for a rhythmic flow as players make decisions and respond to the scenarios presented by the app. The Principle of Design Consistency (see: 6.7) should be considered when assigning a personality to the app in order to ensure the narrative presented by this personality aligns with the theme of the game to create a coherent flow.

This principle can be used both for cooperative and competitive circumstances. Cooperative circumstances are seen in *DropMix* Party Mode (see: 5.1.3) where the app encourages players to beat the timer and play cards as quickly as possible. In *ONUA*, the app creates divisions amongst players by prompting characters to make decisions in relation to other players. *ONUA* also uses thematically consistent text prompts to generate a 'devious' persona (see: 5.2). In *MOMSE*, the app acts as the 'keeper', bringing the players closer together in a cooperative manner to overcome app-directed challenges (see: 5.3.1).

To test this principle, the game designer asks the question: how can the app foster an emotional connection to the game?

6.4 Principle of Balancing Chores

Each game has a set of 'chores' the players must perform in order for the game to progress.[45] In many cases it is possible to automate these tasks through a high integration app. While this can reduce player tasks and minimise associated human error, it can also decrease the "awareness of other's [sic] actions" (Xu *et al.* 2011, p. 8)

[45] Chores can sometimes disrupt the flow of play and become onerous to execute. Examples of chores include: setting up the game; keeping track of scores; rolling dice to determine outcomes; shuffling cards; keeping time; tracking player moves; etc.

resulting in a lower engagement with the game. Having an app automate chores can structure the rhythm of play, ideally alternating between peaks and troughs of attention to the gameplay status (Costello 2018). The key is to create a balance between chores and meaningful interaction, reducing tedious processes (Lee 2018). As such, it is beneficial to think about the principle of balancing chores alongside the Principle of Information Opacity (see: 6.1). For example, the *DropMix* app displays the game score, whose turn it is and tracks legal moves, notifying players when a card is unable to be played (see: 5.1.2). *ONUA* uses an in-app timer to ensure the games are short (see: 5.2). *MOMSE* uses the app to minimise initial set up time, and to track health points of characters and monsters (see: 5.3.1).

To test this principle, the game designer asks the question: does automating this task make it easier for the player to engage in the game, or result in the app 'playing the game' and reducing opportunities for players to make meaningful choices?

6.5 Principle of Interface Blindness

When hybridising analogue and digital mediums, game designers must anticipate the limitations of the app to track activity in the analogue space (Fischer 2018). The app can only respond to circumstances from the information it knows. As such, game designers must consider what the app needs to know and how the app will obtain that information. These considerations are more than just practical limitations of app design, as they will determine the rhythm of the game experience: "the decisions a designer makes about what is essential to a given moment combine to create the rhythmic trajectory of a work" (Costello 2018, p. 115). Inputting information into the app can become a tedious chore if information is constantly needed, and as such this principle should be considered alongside the principle of balancing chores (see: 6.4), to ensure the game does not become a data entry task.

DropMix shares the analogue information with the app using NFC chips to transmit data (see: 5.1). Although the app is able to track most information including card

data, scores, whose turn it is, and move validity, it must trust the players are doing everything else correctly such as taking the turns in the correct order and not swapping cards amongst teammates (see: 5.1.2). *ONUA* requires a low amount of manual input to give the app answers to questions presented (see: 5.2; see: Figure 37). Comparatively, *MOMSE* requires larger amounts of information to be given to the app, however this is because the app is handling a larger amount of chores.

To test this principle, the game designer asks the question: what information does the app need from the analogue space and how is this communicated to the digital medium?

6.6 Principle of Design Consistency

"When people buy a game they notice it first because of its visual appearance. Then they look at the subject matter" (Zappaterra 2004, p. 17; see also: Hindmarch & Tidball 2010, p. 46). To create a cohesive game experience, the visual communication of the analogue and digital mediums must work together effectively: "[t]he way your audience is swept in by a beginning influences how they will respond to the way the rest of the work unfolds" (Costello 2018, p. 88). A game's theme, mechanics, artwork, music, sounds and physical components create a narrative for the game world, and if one element is inconsistent between the analogue and digital spaces, it can be a jarring experience for players and disrupt the rhythm of the game.

DropMix uses visual signifiers through iconography to create links between the analogue and digital components and drive a greater understanding of how the game works (see: 5.1). *ONUA* utilises the same character icons in the app and on the analogue cards to easily identify the required components. The app's auditory announcements further the narrative of the alien world using relevant flavour text. Additionally, these announcements alongside the preset timers guide the pace of the game (see: 5.2). *MOMSE* uses Lovecraftian visuals to bring to life the 1920's gothic

horror theme (see: 5.3.2). The flow of the game is structured by starting with the player turns before turning to the app to generate new monsters or scenarios.

To test this principle, the game designer asks the question: do all elements of the game work together to communicate the same experience?

6.7 Principle of Tutorial Integration

The key to good design of high integration app-based tutorials is minimalism: successful hybridised games provide players with a minimal amount of information in a minimal amount of time in a way that requires minimal effort (both for the player and designer), while still allowing the player to access the full richness of the game (Selinker 2011; Hindmarch & Tidball 2010, p. 89-90, 92-95).

For example, *DropMix* uses an interactive tutorial to guide players through the game the first time they open the app (see: Figure 32). Additionally, the app also gives access to video playthroughs of each game mode and a list of FAQs (see: 5.1.2). *ONUA* uses aural instructions of character actions to inform players[46]. To hear the actions associated with a particular character, players press a character icon on the home screen of the app. Additionally, these instructions are delivered while the game is running as each character is prompted to take their turn. This is not a replacement for a rulebook – it does not share the specific dynamics of teams – however players need to remember far less content to play the game (see: 5.2). *MOMSE* does not include a tutorial in the app, however the instruction booklet contains less detail about play compared to the instructions from the analogue-only editions. This is because the app hides a large amount of the game's initial complexity by guiding players through the experience of the game (see: 5.3.2).

To test this principle, the game designer asks the question: how can the app be used to communicate the operation of the game in the simplest way possible?

[46] Auditory instructions help reduce chores for players, giving them less to remember, while increasing accessibility, making it easier for players with visual disabilities to engage with the game.

CONCLUSION

This thesis explores analogue/digital hybrid games, identifying key design features present in three case studies of highly prominent hybrid games and synthesising a set of design principles for future research and development of hybrid games. The first chapter introduced the thesis while Chapter Two outlined the design thinking of the DDM, which structured the analytical framework employed in the thesis and was used to guide research (Discover), understanding of core design features of analogue/digital hybrid games (Define) and proposing design principles that were applied to the accompanying creative work (Develop and Deliver).

Chapter Three used the Discover stage to consider tabletop games as a creative industry, and the associated community of consumers, introducing Schell's design 'lenses' for analogue and digital game design. Chapter Four continued the Discover stage to define analogue and digital games, looking at the history associated with these different game types and narrowing the scope to look at the hybridisation of apps on a spectrum ranging from low integration to high integration.

Chapter Five used the Define stage of the DDM to examine prominent hybrid games, employing Schell's 'lenses' to identify key features of hybrid game design. The final Deliver stage of the DDM was achieved in Chapter Six to propose a set of recommended hybrid game design principles. These principles have been applied to the accompanying creative work and present opportunity for future research and development of hybrid games. This research could be practice-based, generating a series of hybrid games based on the recommended principles in Chapter Six, to analyse their effectiveness. Or it could take on the form of practice-led research, applying these principles to a broader sample set of hybrid game designs in to see if other games are already demonstrating these principles.

REFERENCES

-RoG- n.d. 'Nightmare: The Horror VCR Board Game!', *I-Mockery*, viewed 23 September 2018, <http://www.i-mockery.com/halloween/bag/nightmare-atmosfear-vcr-board-game.php>

Allen, T 2016, 'The Double Diamond Design Process in Innovative Education', *Jump Start*, 25 April, viewed 17 September 2018, <http://www.jumpstartproject.com.au/blog/2016/4/25/the-double-diamond-design-process-in-innovative-education>

Amelia Con n.d., 'What is Tabletop?', Amelia Con, viewed 16 April 2018, <http://www.ameliacon.com/special-events/tabletop-gaming/what-is-tabletop/>

Attia, P 2016, 'The Full History of Board Games', Medium, viewed 23 July 2018, <https://medium.com/swlh/the-full-history-of-board-games-5e622811ce89>

Bagiartakis, V 2015, 'So you want to be a game designer, huh?', in I Trzewickzeck (ed.), *Boardgames That Tell Stories 2*, Portal Games, digital version acquired by Humble Bundle, pp. 156-163

Bakker, S, Vorstenbosch, D & van den Hoven, E, Hollemans, G & Bergman, T 2007, 'Tangible Interaction in tabletop games: studying iconic and symbolic play pieces', in *Proceedings of the international conference on Advances in computer entertainment technology*, ACE '07, Salzburg, Austria, 13-15 June, viewed 22 March 2018 <http://www.elisevandenhoven.com/publications/bakker-ace07.pdf>

Baur, W 2012, *Complete KOBOLD Guide to Game Design*, Open Design LLC, Kirkland, WA.

Beal, C 2016, '3 reasons consumer-driven communities will change the retail game in 2016', *The Future of Customer Engagement and Commerce*, 2 February, viewed 17 September 2018 <http://www.the-future-of-commerce.com/2016/02/02/retail-consumer-driven-communities/>

Bell, R. C. 1960, *Board and Table Games from Many Civilizations*, Oxford University Press, London.

Bergström, K, Jonsson, S & Björk, S 2010, 'Undercurrents: A Computer Based Gameplay Tool to Support Tabletop Roleplaying', in *Proceedings of the 2010 International DiGRA Nordic Conference: Experiencing Games: Games, Play, and Players*, DiGRA Nordic '10, Stockhold, Sweden, 16-17 August, viewed 22 December 2017, <http://www.digra.org/wp-content/uploads/digital-library/10343.50118.pdf>

Bicycle n.d., A History of Playing Cards, viewed 23 July 2018, <https://www.bicyclecards.com/article/wild-widow-poker-5/>

Björk, S, Falk, J, Hansson, R & Ljungstrand P 2001, 'Pirates! Using the Physical World as a Game Board', in *Proceedings of IFIP TC13 Conference on Human-Computer Interaction*, Interact 2001, Tokyo, Japan, July, viewed 22 February 2018, <https://pdfs.semanticscholar.org/57a0/a0f7a6c2ccbec57feb237ea7c4fb1b27d36a.pdf>

Blackwell, JR 2015, 'Chesterfield native raises $1.8 million in Kickstarter campaign for new board game' *Richmond Times-Dispatch*, 6 November, viewed 22 September 2018, <https://www.richmond.com/business/local/article_6c9e9edb-cfa1-5e7d-9ef3-e957e15d4142.html>

BoardGameGeek 2017, 'Digital Hybrid, App Required', Board Game Geek, viewed 12 April 2018, <https://boardgamegeek.com/boardgamefamily/41489/digital-hybrid-app-required>

Booth, P 2016, 'Board, game, and media: Interactive board games as multimedia convergence', *Convergence: The International Journal of Research into New Media Technologies*, vol. 22, no. 6, pp. 647-660.

Business Insider 2017, 'Global Board Games Market - Strategic Assessment and Forecast 2017-2022', *Business Insider*, 25 September, viewed 9 April 2018, <http://markets.businessinsider.com/news/stocks/global-board-games-market-strategic-assessment-and-forecast-2017-2022-1002528260>

Calleja, G 2018, 'Design Diary 2 - Boardgame Narrative', *Mighty Boards*, 27 March, viewed 23 July 2018, <https://www.mighty-boards.com/blog/design-diaries/design-diary-2-boardgame-narrative>

Callahan, K 2014, 'Across the board', *New Hampshire Business Review*, vol. 36, no. 9, pp. 1, 12-13.

Candy, L 2006, 'Practice Based Research: A Guide, CCS Report: 2006-V1.0 November, University of Technology Sydney, viewed 17 October 2018, < https://www.creativityandcognition.com/resources/PBR%20Guide-1.1-2006.pdf>

Candy, L & Edmonds, EA 2018, 'Practice-Based Research in the Creative Arts: Foundations and Futures from the Front Line', *Leonardo,* vol. 51, no. 1, pp. 63-69.

Caillois, R 2001, *Man, Play, and Games*, University of Illinois Press, USA.

Caolo, D 2015, '021: Star Trek games', *Board Games Weekly*, viewed 23 September 2018, <http://boardgamesweekly.com/2015/01/20/021-star-trek-games/>

Cermak-Sassenrath, D, Faust, M & Rosch, H 2005, 'AirKanoid - Visual Presentation vs. Physical Proximity in Mixed Reality Entertainment Applications', *Proceedings of PerGames 2005*, Munich, Germany, 11 May, viewed 20 February 2018 <http://www.pervasive.ifi.lmu.de/workshops/w3/papers_2005/airkanoid.pdf>

Chen, M 2013, 'From New Players to Fervent Hobbyists: BoardGameGeeks Unite!', in *GLS conference 9.0*, Madison, WI, 12-14 June, p. 479.

Chikhani, R 2015, 'The History of Gaming: An Evolving Community', *Tech Crunch*, 1 November, viewed 23 July 2018, <https://techcrunch.com/2015/10/31/the-history-of-gaming-an-evolving-community/>

Cook, M & Germain, S 2018, *Kicking It: Successful Crowdfunding*, Stone Box Press, USA.

Costello, BM 2018, *Rhythm, Play and Interaction Design*, Springer International Publishing, Cham, Switzerland.

Dalton, D 2017, 'What is the Spiel Des Jahres? - The Biggest Award in Board Gaming', Geek & Sundry, viewed 28 May 2018, <https://geekandsundry.com/what-is-the-spiel-des-jahres-the-biggest-award-in-board-gaming/>

Design Council 2007, *11 Lessons: managing design in 11 global brands*, Design Council, viewed 14 April 2018, <https://www.designcouncil.org.uk/sites/default/files/asset/document/ElevenLessons_Design_Council%20(2).pdf>

Design Council 2015a, 'The Design Process; What is the Double Diamond?' *Design Council*, 17 March, viewed 6 February 2018, <https://www.designcouncil.org.uk/news-opinion/design-process-what-double-diamond>

Design Council 2015b, *Innovation by Design*, Design Council, viewed 9 April 2018, <https://www.designcouncil.org.uk/sites/default/files/asset/document/innovation-by-design.pdf>

Ernest, J 2011, 'The Game Is Not The Rules', in M Selinker (ed.), *The Kobold Guide to Board Game Design*, Open Design LLC, Kikland, WA, pp. 2-6.

Eskin, B 2008, 'Extraordinary Meeples', *Print*, Vol. 62 no. 3 pp. 72-77.

Fantasy Flight Publishing, Inc. 2010, *Mansions of Madness Rules of Play*, Fantasy Flight Games, viewed 24 September 2018, <https://images-cdn.fantasyflightgames.com/filer_public/ad/39/ad394c78-5b46-494d-a1f2-60776f83038c/mansionsofmadnesslores.pdf>

Fantasy Flight Publishing, Inc. 2016, *Mansions of Madness Second Edition Learn to Play*, Fantasy Flight Games, viewed 24 September 2018, <https://images-cdn.fantasyflightgames.com/filer_public/48/f4/48f426c2-b365-43be-abdd-03b2a55eb38d/mansions_of_madness_second_edition_learn_to_play.pdf>

Fischer, A 2018, 'Board Game Design Day: Mansions of Madness' 2nd Edition: Postmortem of an App-Integrated Board Game', presentation at the Game Design Conference 2018, San Francisco, CA, 19-23 March, viewed 4 April 2018, <https://www.gdcvault.com/play/1024916/Board-Game-Design-Day-Mansions>

Fishleg Studio 2017, 'Play Together - Dropmix [Part 1]', *YouTube*, 22 October, viewed 22 September 2018 <https://www.youtube.com/watch?v=BKteAUGUWxk>

Fullerton, T, Swain, C & Hoffman, S 2004, *Game Design Workshop*, CMP Books. San Francisco, CA, USA.

Gardiner, E 2014, 'Are behavioural science and design the building blocks of innovation?', *Behavioural Design Lab*, 14 April, viewed 12 April 2018, <https://www.behaviouraldesignlab.org/behavioural-science-design-building-blocks-innovation/>

Garry, B 2018, 'What's Behind The Success of Tabletop Gaming?', *Zatu Games*, 15 March, viewed 20 August 2018, <https://www.board-game.co.uk/success-of-tabletop-gaming/>

Gary, J 2018, *Think Like A Game Designer: The Step-by-Step Guide to Unlocking Your Creative Potential*, Aviva Publishing, Lake Placid, NY.

Gauhmann, L 2018, 'Ditch the Double Diamond', *Elsewhen*, 10 April, viewed 17 September 2018, <https://medium.com/elsewhen/ditch-the-double-diamond-7e7b5ded36a9>

Ghory, I 2004, 'Reinforcement learning in board games' in *Department of Computer Science*, University of Bristol

Golden Grave n.d., 'History of Hybrid Games', *Golden Grave*, viewed 23 September 2018, <http://www.goldengrave.com/historyofhybridgames/list.php>

Graham, L 2016 'Millennials are driving the board games revival' *CNBC*, 22 December, viewed 9 April 2018, <https://www.cnbc.com/2016/12/22/millennials-the-board-games-revival-catan-pandemic.html>

Griepp, M 2016, 'Hobby Games Market Nearly $1.2 Billion', *ICv2*, 1 August, viewed 9 April 2018, <https://icv2.com/articles/news/view/35150/hobby-games-market-nearly-1-2-billion>

Hall, C 2018, 'Tabletop Games are Exploding on Kickstarter, Video Games are Flat', *Polygon*, 2 Jan, viewed 22 September 2018, <https://www.polygon.com/2018/1/2/16842204/tabletop-games-are-exploding-on-kickstarter-video-games-are-flat>

Hartog, P 2016, 'Quick steps through the Double Diamond', *YouTube*, 24 June, viewed 17 September 2018, <https://www.youtube.com/watch?v=i2sI5R1-qCo>

Healy, E 2009 Viewed on 27 May 2018, <http://ephealy.com/bgg_media_kit.pdf>

Heaven, D 2016, 'When the Die Was Cast', *New Scientist*, pp. 70–71

Heijboer, M & van den Hoven, E 2008, 'Keeping up appearances: interpretation of tangible artifact design', in *Proceedings of the 5th Nordic Conference of Human-Computer Interaction*, NordiCHI 2008, Lund, Sweden, 20-22 October, viewed 22 September 2018 <http://elisevandenhoven.com/publications/heijboer-nordichi08.pdf>

Hindmarch, W & Tidball, J 2010, *Things We Think About Games*, Gameplaywright, LLP, MN, USA.

Hite, K 2010, 'A Random History of Dice' in W Hindermarch (ed.), *The Bones: Us and Our Dice*, Gameplaywright LLP, pp. 4-24.

Hjelm, SI & Browall, C 2000, 'Brainball - using brain activity for cool competition', in *Proceedings of 1st Nordic Conference of Human-Computer Interaction*, NordiCHI 2000, Stockholm, Sweden, 23-25 October, viewed 20 February 2018, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.526.7325&rep=rep1&type=pdf>

Jensen, GH 2013, 'Making Sense of Play in Video Games: Ludus, Paidia, and Possibility Spaces', *Eludamos. Journal for Computer Game Culture*, vol. 7, no. 1, pp. 69-80.

Jolin, D 2016, 'The rise and rise of tabletop gaming', *The Guardian*, 25 September, viewed 17 September 2018 <https://www.theguardian.com/technology/2016/sep/25/board-games-back-tabletop-gaming-boom-pandemic-flash-point>

Kang, M 2014, 'Hybridization and introgression', Salem Press Encyclopedia of Health, Research Starters, EBSCOhost, viewed 29 May 2018.

Kankainen, V & Tyni, H 2014, 'Understanding Smart Device Tabletop Games' in *18th International Academic MindTrek Conference: Media Business*, Management, Content & Services, Tampere, Finland, 4-7 November, viewed 8 April 2018, <https://dokupdf.com/download/understanding-smart-device-tabletop-games-_5a01e2cad64ab2b9bd7d5288_pdf>

Kerr, A 2006, *The Business and Culture of Digital Games*, Sage Publications, London, UK.

Koster, R 2014, *A Theory of Fun for Game Design*, 2nd Edn, O'Reilly Media, Inc., CA, USA.

Krause, R, Haase, M, Hatscher, B, Herzong, MA & Goutrié, C 2014, 'Overcoming the Gap Between Digital and Analogue Board Games - The Ditag Prototype', in *Proceedings of 7th International Conference on Game and Entertainment Technologies*, MCCSIS 2014, Lisbon, Portugal, 15-17 July, viewed 20 October 2017, <https://www.researchgate.net/publication/273001789_Overcoming_the_gap_between_digital_and_analogue_Board_Games>

Kritz, J, Mangeli, E & Xexéo G 2017, 'Building an Ontology of Boardgame Mechanics based on the BoardGameGeek Database and the MDA Framework' in *Proceedings of SBGames 2017*, Curitiba, Brazil, 2-4 November, viewed 27 May 2018, <https://www.sbgames.org/sbgames2017/papers/ArtesDesignFull/175272.pdf>

Lee, T 2018, 'Friction', *Press.Exe Invincible Ink*, 9 September, viewed 10 September 2018, <https://press.invincible.ink/friction/>

Leitner, J, Haller, M, Yun, K, Woo, W, Sugimoto, M, Inami, M, Cheok, AD & Been-Lirn, HD 1999, 'Physical Interfaces for Tabletop Games', *ACM Computers in Entertainment*, vol. 7, no. 4, article 61, pp. 2-21.

Looney, A 2011, 'How I Design a Game', in M Selinker (ed.), *The Kobold Guide to Board Game Design*, Open Design LLC, Kikland, WA, pp. 34-41.

Lowood, H 2017, Electronic Game, *Encyclopædia Britannica*, viewed 23 July 2018, <https://www.britannica.com/topic/electronic-game>

Lundgren, S & Björk, S 2003, Game Mechanics: Describing Computer-Augmented Games in Terms of Interaction, in *Proceedings of Technologies for Interactive Digital Storytelling and Entertainment*, TISDE 2003, Darmstadt, Germany, 24-26 March, viewed 10 January 2018, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.100.6888&rep=rep1&type=pdf>

Lutz, A 2017, 'Mission: Board Games opens its community chest on Johnson Drive', *The Pitch*, 1 February, viewed 8 July 2018, <https://www.thepitchkc.com/arts-entertainment/article/20850676/mission-board-games-opens-its-community-chest-on-johnson-drive>

Magerkurth, C, Stenzel, R & Prante, T 2003, 'STARS - A Ubiquitous Computing Platform for Computer Augmented Tabletop Games' in *Video Track and Adjunct Proceedings of the Fifth International Conference on Ubiquitous Computing*, Ubicomp 2003, Seattle, Washington, USA, 12-15 October, viewed 20 October 2017, <http://reflaction.info/wp-content/uploads/stars-ubicomp_platform_for_tabletop_games_2003.pdf>

Mandryk, RL, Maranan, DS & Inkpen, KM 2002, 'False Prophets: Exploring Hybrid Board/Video Games', in *Extended abstracts of the 2002 Conference on Human Factors in Computing Systems*, CHI 2002, Minneapolis, Minnesota, USA, 20-25 April, viewed 20 February 2018, <https://www.researchgate.net/publication/221517975_False_prophets_exploring_hybrid_boardvideo_games>

Martin, T 2017, 'Another Roll of the Dice: How board games escaped the family table and became a billion-dollar business', *New Statesman*, 20-26 January, pp. 52-54.

Mayer, B & Harris, C 2010, *Libraries Got Game*, American Library Association, USA.

McCormick, R 2014, 'The Hugely Popular 'Skylanders' Figurines Will Soon Work on Tablets', *The Verge*, 12 August, viewed 23 September 2018, <https://www.theverge.com/2014/8/12/5993967/skylanders-trap-team-coming-to-tablets-in-october>

Moby Games n.d., 'Indiana Jones: DVD Adventure Game Covers (DVD Player)', *Moby Games*, viewed 23 September 2018, <https://www.mobygames.com/game/dvd-player/indiana-jones-dvd-adventure-game/cover-art/gameCoverId,433331/>

Mora, S, di Lorento, I & Monica, D 2016, 'From interactive surfaces to interactive game pieces in hybrid board games', *Journal of Ambient Intelligence & Smart Environments*, vol. 8, no. 5, pp. 531-548

Naiman, L 2011, 'Design Thinking as a Stategy for Innovation', *Creativity at Work*, viewed 15 October 2018, < https://www.creativityatwork.com/design-thinking-strategy-for-innovation/amp/>

Nessler, D 2016a, How to apply a design thinking, HCD, UX or any creative process from scratch, *Medium*, weblog post, 20 May, viewed 14 April 2018, <https://medium.com/digital-experience-design/how-to-apply-a-design-thinking-hcd-ux-or-any-creative-process-from-scratch-b8786efbf812>

Nessler, D 2016b, How to rethink the Design process, fail, reflect and iterate, *UXDesign*, weblog post, 17 August, viewed 9 April 2018, <https://uxdesign.cc/how-to-fuck-up-the-design-thinking-process-and-make-it-right-dc2cb7a00dca>

Niedderer, K, Ludden, G, Clune, SJ, Lockton, D, Mackril, J, Morris, A, Cain, R, Gardiner, E, Evans, M, Gutteridge, R & Hekkert, P 2016, 'Design for Behaviour Change as a Driver for Sustainable Innovation: Challenges and Opportunities for Implementation in the Private and Public Sectors', *International Journal of Design*, vol. 10, no. 2, pp. 67-85.

Nordli, B 2018, 'Get More Than Games at Your Friendly Local Games Store', *Rewire*, 16 January, viewed 8 July 2018 <https://www.rewire.org/living/friendly-local-game-store/>

Norman, D 2013, *The Design of Everyday Things*, Basic Books, USA.

O'Brien, T 2012, 'zAPPed board games hand-on', *endgadget*, 12 February, viewed 12 April 2018, <https://www.engadget.com/2012/02/12/zapped-board-games-hands-on/>

Orr, G 2011, 'The Timeline: Board Games', *Independent*, 31 August, viewed 23 July 2017, <https://www.independent.co.uk/arts-entertainment/the-timeline-board-games-2346370.html>

Oxford Dictionary 2018, *Analogue*, viewed 22 September 2018, <https://en.oxforddictionaries.com/definition/analogue>

Patrick, F 2013, *Developments in Current Game-Based Learning Design and Deployment*, Information Science Reference, Hershey PA, USA

Plunkett, L 2018, 'Animated Dungeons & Dragons Boards Look Like The Future' *Kotaku*, 21 May, viewed 22 September 2018 < https://www.kotaku.com.au/2018/05/animated-dungeons-dragons-boards-look-like-the-future/>

Purdy, E & Popan, E 2016, 'Design thinking', *Salen Press Encyclopedia*, Research Starters, EBSCO*host*, viewed 20 April 2018.

Rath, R 2014, 'The Royal, Seed, and Supernatural History of Dice', *The Escapist*, 21 August, viewed 23 July 2017 <http://www.escapistmagazine.com/articles/view/video-games/columns/criticalintel/12141-The-History-of-Dice-and-The-Oldest-Dice-in-the-World>

Retroactive Vintage Games n.d., 'Retro Review - Code Name Sector by Parker Brothers 1977', *Retroactive Vintage Games*, viewed 23 September 2018, <http://www.retroactive-vintage-games.com/games-articles/retroactive-code-name-sector.asp>

Rogers, S 2014, *Level Up! The Guide to Great Video Game Design*, 2nd edn., John Wiley and Sons, Ltd., West Sussex, UK.

Rudy Games n.d., 'Leaders: A Combined Game', *Rudy Games*, viewed 12 April 2018 <https://rudy-games.com/leaders/en/>

Salen, K & Zimmerman, E 2004, *Rules of Play*, The MIT Press, USA.

Sari, ER 2003, 'Exploring Design Through Game', in *Proceedings of 33rd Annual Frontiers in Education*, FIE, Boulder, CO, 5-8 November.

Schell, J 2008, *The Art of Game Design: A Book of Lenses*, Elesvier Inc. Burlington, MA, USA.

Schell, J 2014, *The Art of Game Design: A Deck of Lenses*, 2nd edn, Schell Games, Pittsbutgh, PA.

Selinker, M 2011, 'Writing Precise Rules' in Selinker (ed.), *The Kobold Guide to Board Game Design*, Open Design LLC, Kikland, WA, pp. 90-98.

Smith, P 2011, 'Re-visioning Romantic-Era Gothicism: An Introduction to Key Works and Themes in the Study of H.P. Lovecraft', *Literature Compass*, vol. 8, no. 11, pp. 830-839.

Smithsonian n.d. a, Video Game History, viewed 23 July 2019, <https://www.si.edu/spotlight/the-father-of-the-video-game-the-ralph-baer-prototypes-and-electronic-games/video-game-history>

Smithsonian n.d. b, The Brown Box, 1967-68, viewed 23 July 2018, <http://americanhistory.si.edu/collections/search/object/nmah_1301997>

Sodhi, R 2015, 'Dungeons & Dragons and Settlers of Catan with Projection Mapping' *PMC*, viewed 22 September 2018, < http://projection-mapping.org/dungeons-dragons-projection-mapping/>

Spiel des Jahres e.V. 2018, *Spiel des Jahres Award*, viewed 28 May 2018, <https://www.spiel-des-jahres.com/en/awards>

Stevenson, H 2017, 'The Origin of Brainstorming', *Cleveland Consulting Group, Inc.*, 24 August, viewed 14 April 2018, <http://www.clevelandconsultinggroup.com/articles/brain-storming.php>

Steinberg, S 2015, 'Crowdfunding: The Hottest New Way to Raise Money', *Parade*, 12 June, viewed 22 September 2018, <https://parade.com/404244/scott_steinberg/crowdfunding-the-hottest-new-way-to-raise-money/>

Stonemaier Games 2018, 'Jamey Stegmaier', *Stonemaier Games*, viewed 22 September 2018, <https://stonemaiergames.com/about/jamey-stegmaier/>

Stuart, K & Gray, K 2015, 'The 25 Most Anticipated Video Games of 2016 - Dishonored 2, Uncharted 4, XCOM 2 and more' *The Guardian*, 30 December, viewed 23 September 2018, <https://www.theguardian.com/technology/2015/dec/30/video-games-2016-dishonored-2-uncharted-4-xcom-2>

The British Museum 2018, 'Collection Online', *The British Museum*, viewed 22 September 2018, <http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=8817&partId=1>

Trefry, G 2010, *Casual Game Design*, Elesvier Inc. Burlington, MA, USA.

Trzewiczek, I 2014a, 'Are You Designing A Game? You Better Have Vlaada Chvatil In Your Testing Group!', in I Trzewiczek (ed.), *Boardgames That Tell Stories*, Portal Games, digital version acquired by Humble Bundle, pp. 37-40.

Trzewiczek, I 2014b, 'Heart On The Pitch 2', in I Trzewiczek (ed.), *Boardgames That Tell Stories*, Portal Games, digital version acquired by Humble Bundle, pp. 69-70.

Tyni, H, Kultima, A & Mäyrä, F 2013, 'Dimensions of Hybrid in Playful Products', *Academic Mind Trek '13*, Tampere, Finland, 1-4 October, viewed 12 April 2018, <http://doi.acm.org/10.1145/2523429.2523489>

University of Virginia n.d., 1a. A Brief History of Wargaming, viewed 23 July 2018, <http://faculty.virginia.edu/setear/students/wargames/page1a.htm>

University of Washington 2005, Definitions, *Technical Communication 498, Digital Games*, viewed 23 April 2018, < http://faculty.washington.edu/bkolko/games/definitions.shtml>

VanPatter, GK 2017, Understanding What Was Missed, *LinkedIn*, weblog post, 31 July, viewed 14 April 2018, <https://www.linkedin.com/pulse/understanding-what-missed-gk-vanpatter/?published=t>

Werneck, T 2010, The Impact of the Award "Spiel des Jahres" on the Development of the Board Games Market in Germany, in *Proceedings of Board Game Studies*, Board Game Studies XIIIth Colloquium, Paris, 14-17 April, viewed 2 July 2018, <https://www.vilaweb.cat/media/continguts/000/055/359/359.pdf>

Whalen, T 2003, *Playing Well with Others: Applying Board Game Design to Tabletop Display Interfaces*, Dalhousie University, Canada.

Woodruff, T 2011, 'It's Not Done Till They Say It's Done', in Selinker (ed.), *The Kobold Guide to Board Game Design*, Open Design LLC, Kikland, WA, pp. 99-105.

Wray, C 2015, 'SdJ Re-Reviews #35: Hanabi', *The Opinionated Gamers*, 29 December, viewed 2 July 2018, <https://opinionatedgamers.com/2015/12/29/sdj-re-reviews-35-hanabi/>

Wright, S 2016, 'Professional Esports Players Try to Play Lego Dimensions', *Tech Girl*, 13 September, viewed 23 September 2016, <https://techgirl.co.za/2016/09/13/professional-esports-players-try-play-lego-dimensions/>

Xu, Y, Barbra, E, Radu, I, Gandy, M & MacIntyre, B 2011, Chores Are Fun: Understanding Social Play in Board Games for Digital Tabletop Game Design, in *Prooceedings of the 2011 DiGRA Interational Converence: Think Design Play*, DiGRA '11, Hilversum, The Netherlands, 14-17 September, viewed 16 February 2018, <http://www.digra.org/digital-library/publications/chores-are-fun-understanding-social-play-in-board-games-for-digital-tabletop-game-design/>.

Zagal, J, Rick, J & Hsi, I 2006, 'Collaborative Games: Lessons learned from board games', *Simulation & Gaming*, Vol. 37 no. 1 pp. 24-40.

Zappaterra, Y 2004, 'Your Move', *Design Week*, vol. 19, no. 43, p. 17.

List of Cited Games

Alcorn, A 1972, *Pong*, arcade game, Atari.

Alspach, T & Okui, A 2017, *One Night Ultimate Alien*, board game, Bézier Games.

Alspach, T & Okui, A 2018, *One Night Ultimate Super Villains*, board game, Bézier Games.

Bauza, A 2010, *Hanabi*, card game, Asmodee.

Buckenham, G & Fleetwood, A 2016, *Beasts of Balance*, hybrid board game, Sensible Object.

Decipher 1993, *Star Trek: The Next Generation - Interactive VCR Board Game*, VCR board game, Decipher Inc.

Doyle, R 1977, *Code Name: Sector*, board game, Miro Company & Parker Brothers.

Hasbro 2017, *DropMix*, board game, Hasbro.

Konieczka, C 2011, *Mansions of Madness: First Edition*, board game, Fantasy Flight Games.

Russel, S 2008, *Indiana Jones DVD Adventure Game*, DVD board game, Hasbro.

Sala Games 1910, *Electra*, board game, FPR & Sala Games.

Tanner, P 1991, *Nightmare*, VCR board game, J. W. Spear & Sons.

Toys For Bob, n-Space, Beenox, Vicarious Visions 2016, *Skylanders*, digital game, Activision.

Traveller's Tales 2015, *Lego Dimensions*, digital game, Warner Bros. Interactive Entertainment.

Valens, N 2016, *Mansions of Madness: Second Edition*, board game, Fantasy Flight Games.

List of Cited Apps

Bezier Games 2018, *One Night Ultimate Werewolf*, version 4.1.3, mobile app, Bezier Games.

Catan GmbH 2015, *Catan Game Assistant*, version 2.2, mobile app, Mayfair Games.

Czech Games 2015, *Codenames Gadget*, version 1.4.4, mobile app, CGE digital.

Gomes, I, S 2013, *Chwazi*, version 2.6, mobile app, Ivan Seidel Gomes.

Hasbro Inc. 2018, *DropMix*, version 1.8.3, mobile app, Hasbro Inc.

Hsu, J 2010, *Dominion Kingdom Deck*, version 1.3.3, mobile app, Jerry Hsu.

Keyaerts, P 2013, *Small World 2*, version 2.5, mobile app, Asmodee Digital.

Lawson, N 2014, *Keep Score - Score Keeper*, version 1.5.1, mobile app, Nolan Lawson.

Niantic, Inc. 2018, *Pokemon Go!*, version 0.119.2, mobile app, Niantic, Inc.