Idea Network Visualisations

in

Game Jams & Roguelike Games

Xavier Ho

A thesis submitted in fulfilment of the requirements
for the degree of Doctor of Philosophy

Design Lab
Sydney School of Architecture, Design & Planning
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Statement of Originality

Author Declaration
This signature certifies that the thesis is of my own research. Where other materials and assistance are involved, due acknowledgement is made with clarity. No parts of this thesis is submitted for another degree or award. It is within the accepted maximum thesis length, and meets the University of Sydney research ethics, protocol 2013/982.

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Author Attribution Statement

This thesis comprises published conference and journal papers where I am the corresponding author and the main contributor of the research work. The section “Selected Publications” identifies each published work. At the beginning of each chapter containing published work, I provide attributions to the published work.

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Supervisor Declaration

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Name
Martin Tomitsch

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Date
30 September 2018
This thesis is dedicated to
many beautiful things that
inspired us

From who we were
to who we are
and who we will become

We are travelling
on a journey of discovery
full of curiosity

To create
many beautiful things that
inspire others
Acknowledgement

Countless people have been a part of my research journey to this point. All of them have my wholehearted, honest-to-earth gratitude and timeless appreciation. Thank you so much for helping me when I need you the most, celebrating those small wins and milestones, and giving me timely criticism when my mind wanders off paths. I am able to return to post because you are my guiding stars.

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To my mother and father, Li-Hua Lai and Lien-Fang Ho, thank you for supporting and encouraging me to get an education of my own.

To all my friends, thank you for your kind words.
This thesis aims to conceptualise ideas as a network via a curiosity-driven, reflective, research-through-design process as an approach to address how ideas are connected. It is inspired by John Guare’s *Six Degrees of Separation* phenomena in social distances, Mark Lombardi’s aesthetically handcrafted financial connection network art, and Eugene Garfield’s scientific citation index. It channels Ted Nelson’s notion of intertwingularity to describe the complex interrelations of ideas.

To achieve the aim, the thesis proposes and investigates *idea networks*. An idea network is systemic epistemology network. It is constructed by strategically observing, documenting, and validating sources of *inspiration* and *influence* from a chosen point of view, which sometimes contains multiple, conflicting perspectives. The current body of knowledge suggests ideas are connected, but does not yet offer how ideas are connected in a mechanised or visual structure that can be used by designers and researchers.

Specifically, the aim is achieved by using two domains within the field of game design, which frequently sees wild and improbable combinations of influences. First, it uses *game jams*, a type of game creation event where participants form teams to make games in a short timeframe, serving as a research environment for observing brainstorming and idea refinement. Second, it uses *roguelike games*, a subgenre of videogames that challenge the player with ‘permadeath’, serving as a knowledge domain for constructing real-world idea networks that span over four decades. To strengthen the conceptualisation of idea networks, it surveys a collection of brainstorming toolkits, as well as the motivation of *jammers*—game jam participants—to develop the design affordances of idea generation.

The thesis seeks to address the gap of idea networks, and contributes to the current literature on design research and games research through the lens of game jams and roguelike games. Idea networks, like citation networks, provides an advantageous utility to efficiently browse intellectually related creative works. Its contribution is structured in four parts:
1. **Structure of idea networks.** The structure of idea networks are conceptualised by examining a large collection of brainstormed game design ideas. Idea networks can provide an intertwined scaffold for organising and documenting creative works.

2. **Significant properties of idea networks.** Three cognitively significant and useful properties of idea networks are observed from reflecting on their designs and conceptualisations: aiding hierarchical and network thinking, intuitive browsing of ideas, as well as observing the small-world effect phenomena.

3. **Visualisations of idea networks.** Three visualisations of idea networks are created as the primary artefacts of research through design, illustrating the complex influence chains and providing many ways to navigate in. They also provide a cultural and temporal view into roguelike influences and roguelike games.

4. **Design insights extracted from idea networks.** Six design insights are generated by observing the dialogue among game developers who used idea networks: thinking in networks, insights on data consistency, insights on accessibility and usability, insights on visualisation preferences, exploring related games, and data contributions from the community.

   Idea networks serve the needs of many disciplines: that of the researcher searching for a starting point, that of the designer seeking new inspiration, that of the consumer exploring related creative works of interest, and that of the archivist documenting and presenting information in a structured way. Future directions hint at open research fields in their applications, translational research, and archival use.
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Selected Publications

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- Full paper as an entire chapter is preceded with an empty diamond containing a filled diamond (♦). Short paper that appear only as a part of a chapter is preceded with a filled diamond (◆). Extended abstract that makes up only a small portion of the chapter is preceded with an empty diamond (◇).

Conference Papers

Ho, X., Tomitsch, M. & Bednarz, T., 2014
How Are Ideas Connected? Drawing the Design Process of Idea Networks in Global Game Jam
Proceedings of the 4th International Conference on Meaningful Play, pp. 1–7

Ho, X., Tomitsch, M. & Bednarz, T., 2014
Game Design Inspiration in Global Game Jam
Proceedings of DiGRA 2014: What is Game Studies in Australia, pp. 53–56

Ho, X., 2015
Roguelike Universe: Drawing 36 Years of Roguelike Influence
Proceedings of DiGRA 2015: Diversity of Play, pp. 1–5

Ho, X., 2016
Tapping into the Gaming Community for Roguelikes

Ho, X., 2016
The Enlightened Jammer: Intrinsic Drives for Game Jam Participations *
Proceedings of the DiGRA 2016 National Symposium, pp. 1–9

Ho, X., Tomitsch, M. & Bednarz, T., 2016
Finding Design Influence within Roguelike Games *
Proceedings of the 5th International Conference on Meaningful Play, pp. 1–27
Ho, X., 2017
Evoking Inspiration for Game Jam Ideas ◆
*Proceedings of the Second International Conference on Game Jams, Hackathons, and Game Creation Events - ICGJ ’17.* ACM Press, pp. 6–9

Ho, X., 2018
Exploring Roguelike Games through Inspiration Networks ◇
*Proceedings of the 3rd Annual Australian Social Network Analysis Conference - ASNAC ’18*

**Journals**

Ho, X., Tomitsch, M. & Bednarz, T., 2015
Conceptualising Inspiration Networks in Game Design *
*Transactions of the Digital Games Research Association, 2*(1), pp. 36–66

Gough, P., Dunn, K., Bednarz, T., Ho, X., 2015
Art and Chartjunk: A Guide for NEUVis
*International Journal of Software and Informatics, 9*(1), pp. 61–72

**Invited Seminars**

Ho, X., 2014
Seeing Design
Darlington, New South Wales: *USYD Information Visualisation Studio Guest Lecture*

Ho, X., 2015
Social Distance of Idea Networks
Brisbane, Queensland: *QUT ACEMS Maths Seminar*

Ho, X., 2016
Design as Invitation to Interaction
Sydney, New South Wales: *UNSW Teaching Seminar Series*

Ho, X., 2016
Roguelike-like-like: How a niche computer game genre exploded
Melbourne, Victoria: *Nerd Nite Melbourne*

**Conference Panels**

Rewards and Motivations in Game Jams
*Proceedings of the First International Joint Conference of DiGRA and FDG*

**Exhibitions**

Lam, M. et al., 2014
_The Arcade_, Ho, X., curator
Sydney, New South Wales: *Verge Festival*
Ho, X., Weng, H. & Wilton, J., 2014

Golden Fleece
Sydney, New South Wales: MAKE CODE PLAY: Designing Interactive Futures

Edited Book

Ho, X. ed., 2014

Research Visions
Darlington, New South Wales: The University of Sydney
# Glossary

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<th>Definition</th>
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<td><strong>Creative work</strong></td>
<td>an artificial product that is regarded as novel, interesting, useful, or otherwise creative. Used as an umbrella term in this thesis.</td>
</tr>
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<td><strong>Game jam</strong></td>
<td>a <em>hackathon</em> where people make videogames. For a formal definition, see Section 2.3.</td>
</tr>
<tr>
<td><strong>Hackathon</strong></td>
<td>a risk-averse, opportunistic event in which participants form teams to learn and create something new in a limited time.</td>
</tr>
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<td><strong>Idea</strong></td>
<td>an observable outcome of a creative process. Used as an umbrella term for game design ideas, brainstorming contributions, and sources of inspiration.</td>
</tr>
<tr>
<td><strong>Idea network</strong></td>
<td>a connected network of ideas, linked by their sources of inspiration, common influences, and observable similarities. For a formal definition, see Section 8.2.</td>
</tr>
<tr>
<td><strong>Influence</strong></td>
<td>the capacity to have an effect on the character, development, or behaviour of someone or something, or the effect itself (Oxford Dictionary). Section 6.5 gives a measurement of influence used.</td>
</tr>
<tr>
<td><strong>Inspiration</strong></td>
<td>the process of being mentally stimulated to do or feel something, especially to do something creative (Oxford Dictionary). Section 5.2 offers a deeper exploration on the topic.</td>
</tr>
<tr>
<td><strong>Jammer</strong></td>
<td>participant of a game jam. For a longer discussion, see Chapter 4.</td>
</tr>
<tr>
<td><strong>Permadeath</strong></td>
<td>a roguelike game mechanic that dictates the player only have one life.</td>
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<tr>
<td><strong>Roguelike games</strong></td>
<td>a subgenre of videogames that feature procedurally generated environments and obstacles and by a consistent rule set, challenging the player to try repeatedly until they succeed. For an overview, see Section 2.4.</td>
</tr>
<tr>
<td><strong>Roguelike-like</strong></td>
<td>generally describing games that feature roguelike mechanics, but not all of them, and therefore are only partially roguelike, or inspired by roguelikes. Synonymous terminologies include: ‘roguelite’, ‘neo-rogue’, and ‘roguelike hybrid’.</td>
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Preface

“What inspired you?”

In my personal conversations with producers about their creative endeavours, they are universally familiar with their sources of inspiration. I observed game designers, filmmakers, songwriters, novelists, and many creators working in various other mediums exchanging the breath of inspiration. In my mind, I could draw a line from a creative work through its source of inspiration to an earlier creative work, and draw to a second source, a much earlier work. I could repeat this process until I have an intertwingled network of creative works.

This thesis demonstrates the epistemological benefit in conceptualising ideas as a network. There is a rich, phenomenal mindshare of inspiration and influence, but no one has yet conceptualised idea networks for design exploration and research. It is a study of the phenomena of ‘small-world’ idea networks, their meaning and structure, bound by tracing creative works and their accompanying text. In this thesis, I extend Oxford Dictionary’s standard ‘idea’ definition to be an observable outcome of a creative process. A focal point of this thesis is not a comprehensive framework of what ideas are, but instead what connects ideas together as a cohesive body of knowledge that can be studied.

A few colleagues have described my work as a “genealogy” of game ideas of sorts¹, since I chose game development as one case study to examine its idea network. Others have referred to my work as data visualisation of “influence or ancestry” of roguelike games, a genre of videogames on which I spent a couple of years investigating as part of this thesis. Both metaphors are delightful. I would like to describe this thesis as a curiosity-driven research to understand and design a useful structure to explore inspiration and influence as an epistemology network, which I propose as an idea network.

¹ Michel Foucault (1978) wrote extensively on ‘genealogy’ in the field of philosophy. His view on “seeking the truths about origins” is the same as my thesis: the exact opposite of origins, but to seek the discourse about the nonlinear occurrences of creative works (Foucault calls them ‘accidents’), which progressed a concept.
Introduction

Can ideas form a network by their common influences, and if so, what does it look like? This thesis is very much about understanding what an idea network might be. In this chapter, I outline the motivation for this blue-sky, curiosity-driven research. Because idea networks are by nature quite abstract, this research requires a form of concretisation of idea networks in a way that can be examined.

In Section 1.1, I present the motivation for idea networks, justifying the need for undertaking this research. Section 1.2 illustrates the overarching thesis aim and four research questions, describing their contributing boundaries for new knowledge. Section 1.3 gives a theoretical framing for the research methodology, offering the foundation for each chapter to situate itself. In Section 1.4, I outline the structure of this thesis, guiding the reader with summaries of each chapter with a streamlined narrative. Section 1.5 is a note on the thesis with publication format, opening the door to idea networks for the reader to peruse at their own pace.

1.1 Motivation

“Six degrees of separation.” This famous phrase describes the closeness of human social connections with each other. It originated from a stage play written by a U.S. playwright, John Guare, who aptly titled his work *Six Degrees of Separation* (1990). His stage play featured the story of the phenomena in social networks, and went on to win the North American theatre excellence of the highest honour, *Tony Award*, as *Best Direction of a Play*.

I was influenced by the concept of systems thinking, the idea that knowledge is intricately connected (Meadows, 2008). To manage it, we should treat it as such (Rubenstein-Montano et al., 2001). The ‘small-network’ effect (Guare, 1990) was observed among creative works, and seeing that was very encouraging and validating for me to pursue the topic. My conceptualisation was aided by understanding the citation network (Garfield, 1955), and the hand-drawn network art by the late American artist, Mark Lombardi (1996; 2000, Figure 1.1).
Initially, I conjectured that inspirations may form an idea network similar to *Six Degrees of Separation*, in the sense that ideas are plausibly closer to each other than we frequently thought. My conjecture was demonstrated by a filmmaker, Kirby Ferguson, in his online video series *Everything is a Remix* (2011). Ferguson placed strikingly similar works in music, fine art, or films side by side, and made his point. He used the term “remix” to signify that creative works and their ideas are copied, transformed and combined by others. The fluidness of idea transmission is the lens I employ to connect ideas as a network.

![Diagram of idea network](image)

Figure 1.1: Mark Lombardi was known for his network drawings, tracing news reports and streetwise information about financial movements. His hand-drawn diagrams have a kind of visual aesthetics known as perfect angular resolution (Duncan et al., 2010), and attracted many graph drawing scholars to imitate his style (Lombardi, 2000). Photography: Marc Wathieu, 2012, reproduced under Creative Commons License by-nc-nd 2.0.

However, a gap exists in the current body of knowledge about idea networks. It is quite cumbersome to describe an entire creative genre, and how the genre evolved over time in a concise format. What resource is out there that is efficient for tracing influences from one work to another, such as an idea network? The gap here is the lack
of understanding about how to approach the construction of idea networks, and how they might be used by others. This thesis fills that conceptual gap by ways of research through design (Zimmerman et al., 2007), and by reflective practice in design research (Grocott, 2010). In visualising inspiration as an idea network, we may discover novelty and curious design implications.

There is significant value to conceptualise and examine a creative field as an idea network. Idea networks offer practical utilities for scholars to trace a lineage or ancestry across time. Idea networks for public consumers can be a novel avenue to explore creative works by direct or indirect connections. Others frequently pointed out to me that a shopping recommendation engine could be built from idea networks. Idea networks depart from classifications, such as genres or tags, which provide a distinct utility to describe a collection of creative works.

Another motivation for undertaking this research is the lack of resources specialised for constructing idea networks. A particular challenge is the lack of repositories that particularly describe and record creative influences in general. Through the development of this thesis, I built tools to harvest what influences are explicitly recorded, and make the idea network accessible for design research and games research. The insights gained from designing the tools can feed into future research on how idea networks might be used by designers and interested readers (Björk et al., 2003).

1.2 Aim and Questions

This thesis aims to conceptualise ideas as a network. It formulates a process to collect data about inspiration in creative works, construct a network of creative works and their influences and inspiration, and visualise the idea networks for design and exploration. The thesis poses four research questions to achieve its aim:

RQ1. What are the structures of idea networks relating to shared influences?

RQ2. What significant properties can we observe from the structure of idea networks?

RQ3. How can idea network visualisations describe influence?

RQ4. What insights can designers extract through idea network visualisations?

RQ1. The first research question is concerned with gathering data in context that describe sources of inspiration clearly. However, sources of inspiration can be incomplex, mundane things, and “many simple things cannot be made explicit” (Eckert & Stacey, 2000). It is not trivial to collect a full view of an idea network. The research question needs theoretical approximations. In this thesis, I make the bold assumption that all
knowledge are connected (Popova, 2011), observing inspiration as a response to a creative idea (Thrash et al., 2010). Between two similar creative works, I can conceptualise an idea network from shared sources of inspiration, or common influences.

**RQ2.** The second research question is about meaning-making of idea network structures. Existing network analysis softwares, such as *Pajek* (Batagelj & Mrvar, 1998) and *Gephi* (Bastian et al., 2009) offer many powerful layouts for visualisation and tools for statistical analysis, but they are not concerned with constructing the network itself, nor with finding meaning within the network. To observe significant properties, we need to use “both the data about the structure of the network …, and the quantitative data about the strength of these connections” (Manovich, 2011, p. 37). Making sense of idea networks is a task that requires domain knowledge expertise, as there are no best network layouts for relational understanding (Purchase, 1998). To improve readability, network layouts can be designed to assist with comprehension (Kieffer et al., 2016).

**RQ3.** The third research question sets out to explore network visualisation layouts that are most suited to describe influences among creative works. I was inspired by the late American artist, Mark Lombardi (1996), whose handcrafted drawings used “circular arcs for edges and have a nice aesthetic placement for both vertices and edges” (Chernobelskiy et al., 2012). Another work that influenced my research direction is by Hummon and Doreian (1989), who identified the critical path of DNA theory development using a citation network that comprised 40 most influential papers at the time. Their work focused on clusters using linked lists, but does not utilise spatial dimensions in the visualisation. For part of the research activities undertaken, I posed to implement an open-source network layout in software, which can be reused for further studies.

**RQ4.** The fourth research question is interested in constructing and analysing idea networks for design exploration. Network analysis has been employed by many scholars to study the structure of social connections. To name two: Aragon et al. (2012) built a network of notable persons on Wikipedia using hyperlinks between biographical articles. Pirker et al. (2017) applied social network analysis on game jam participants, suggesting that tools for social networks can strengthen a community, understand dynamic group formation, and engage them to collaborate. In this research question, I extract insights from the responses of designers who have the domain knowledge about the idea network. By conceptualising the structure and meaning of idea networks, and utilising network visualisation layouts that aid comprehension into influences, idea networks can be a novel way to explore similar creative works.

This thesis makes a contribution to the current body of knowledge about conceptualising inspiration as idea networks. It presents a useful definition of idea
networks, offers a repeatable process to construct them, and explores how data visualisation can aid their comprehension. It also offers insights into how idea networks can be employed to investigate historical creative works as a connected narrative.

1.3 Methodology

Research through design (Zimmerman et al., 2007) is a design framework for practitioners in human-computer interaction and human-centred design, generating new knowledge by practicing design. It stems from research through art and design, an identifiable craft that repurposes a material or media “to do something no one had considered before” (Frayling, 1993, p. 5). This thesis establishes how to construct an idea network, conceptualises a definition, and investigates what insights designers can extract from it.

Idea network does not have an established research methodology. This thesis conducts research through design as a way of facilitating knowledge creation. It is guided with reflective design (Grocott, 2010), which channels the work of Donald A. Schön, also known as action research (1983). Action research emphasises the designer’s self-reflection as part of the design process, contributing internalised lessons and documenting them along the way. The design artefacts directly contribute to knowledge creation, and the iterative nature of the process enables refinement. In the context of this thesis, I am the designer of the idea network visualisations, learning about ideas and inspirations in the journey of undertaking research.

Curiosity-driven design, a term I adopted to describe self-directed research activities, has elements of unpredictability and generality in research findings (Calvert, 2006). Others have wrote about curiosity-driven research in areas including human resource development (Reio, 2012), a career in academia (Santoro & Snead, 2012), and supporting university technology transfer (Strandburg, 2005). It upholds the ideals of basic research. That is not to say that the research methods are unpredictable. Rather, the methodology originally designed has fundamentally changed since the start of my research journey. What is presented in this thesis is the summary of directions I have taken. The curiosity element remains a key ingredient to discovering subsequent research methods required to meet the objectives and the research aim.

The research protocol is approved by the University of Sydney Research Ethics Committee, protocol number 2013/982. The approved ethics protocol requires the recruitment to be done via distribution lists, general notice boards, interest groups, and

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2 The additional research ethics approved material is available at https://docs.google.com/document/d/1N5yFsycdO6gul6enrIGNrQoKnumyTCFsUli1Vej7N3Q
not recruiting directly one-on-one to avoid any impression of coercion. The protocol also requires that all physical data to be destroyed after making a secure digital copy, as well as that the digital copy must be stored for five years for research integrity and deleted after. In addition, all surveys and interview records must not contain personally identifying information.

In this thesis, I employed mixed methods that form the research methodology, whose development is guided by research through design. Table 1.1 presents the topics and methods present in each chapter, and the corresponding research questions.

Table 1.1: Thesis methods on research through design

<table>
<thead>
<tr>
<th>Topics</th>
<th>Chapter 3 &amp; 4</th>
<th>Chapter 5</th>
<th>Chapter 6</th>
<th>Chapter 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming affordances,</td>
<td>Idea network</td>
<td>Idea network visualisation</td>
<td>Idea network visualisation</td>
<td></td>
</tr>
<tr>
<td>intrinsic motivations</td>
<td>conceptualisation, visualisation</td>
<td>for domain knowledge</td>
<td>for design exploration</td>
<td></td>
</tr>
<tr>
<td>Tool review, surveys</td>
<td>Surveys,</td>
<td>Visualisation design</td>
<td>Visualisation design,</td>
<td></td>
</tr>
<tr>
<td>Methods</td>
<td>visualisation</td>
<td></td>
<td>surveys, discussions</td>
<td></td>
</tr>
<tr>
<td>Research Questions</td>
<td>RQ1, RQ2</td>
<td>RQ3</td>
<td>RQ4</td>
<td></td>
</tr>
<tr>
<td>Research Data</td>
<td>Brainstorming</td>
<td>Survey from one large</td>
<td>Online web scraping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tools, surveys</td>
<td>game creation event</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>from three game creation events</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

To design the construction, I conducted online surveys and developer interviews to aid data collection. Surveys and interviews are well-established methods for gathering perspectives and issues. They are also common in consumer journals for spotlighting game developers. I strategically asked designers about their ideas and related influences, and what other similar works exist. I also examined available tools especially created for brainstorming game design, and investigated the intrinsic motivations of game developers to participate in game creation events to unpack some of my assumptions about idea creation.
To conceptualise what idea networks are, I created purposeful visualisations that granted a new design perspective to the domain knowledge stakeholders (Bai et al., 2011). Data visualisation leverages our visual cognitive ability to relate information, and makes the abstract more concrete (Kirk, 2016, p. 22). I visualised idea networks to convey their purpose, and facilitated a resource for design exploration. By executing the visualisation design, this thesis identified the challenges and foundations that underpin the development of idea networks. The idea network visualisations produced in this thesis are also interactive artworks, available for anyone to browse and explore at their leisure.

To find out what insights idea networks can bring, I invited game developers to explore the visualisations and facilitated a discussion online. Observing these discussions granted a lens into their thought process on how idea networks may be used. They granted the insights I needed to design idea networks in my design practice.

In short, this thesis approaches the research aim with tools familiar to many practitioners in human-centred design: online surveys and post-event surveys, semi-structured interviews, data visualisation, and user studies. The research questions are designed to conceptualise real-world idea networks, to visualise and explore them, and what new insights can be gained from exploring the visualisations. The methodology fundamentally follows a research-through-design approach, with elements of reflective research, motivated and guided by my curiosity about idea networks. There were other activities that were pure practice in my journey, not pure research, such as participating in game creation events, hosting videogame exhibitions, and observing game jam participants. These activities exposed me to the different lenses of game design (Schell, 2014). Other scholars may use these activities as valid research activities.

1.4 Thesis Structure

This section outlines the chapters and contents, linking each of the research questions to corresponding chapters. In Chapter 2, I offer relevant background context and related works, defining the shape of the gap in the body of knowledge. Chapter 3 examines available brainstorming toolkits, techniques, and the design affordances of brainstorming toolkits, granting an understanding of how ideas are formulated. Chapter 4 investigates the intrinsic motivations for participating in game jams, shining light into the human side of collaborative brainstorming, and idea formation.

In Chapter 5, I present a conceptualisation of idea network, discussing its structure and significant properties from which to glean information. Chapter 6 refines the conceptualisation into a definition, introducing software techniques to collect data as its
research method, and proposes visualisations for the idea network. Chapter 7 broadens the coverage of the idea network generated in the previous chapter, and invites game developers to explore and discuss their experience with the idea network, extracting insights for design exploration.

In Chapter 8, I review each of the research questions, give a summary of the research findings, and conclude this thesis with its contribution to the existing body of knowledge. Table 1.2 lists each chapter and their overview, makes a note on published materials as appropriate, and describe the key research findings and the corresponding research questions.

<table>
<thead>
<tr>
<th>Table 1.2: List of thesis chapters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Introduction</td>
</tr>
<tr>
<td>This chapter introduces the thesis, a research journey about conceptualising idea networks, visualising them, and exploring them for new design insights. Its methodology follows research-through-design, reflective design research, and is curiosity-driven.</td>
</tr>
<tr>
<td>2 Background</td>
</tr>
<tr>
<td>The citation index, more commonly known as the citation network today, was a significant resource compiled by academic publishers. This background chapter introduces some of the related works, their challenges and significance, and illustrate a conceptual gap for idea networks in the current body of knowledge. It also introduces contextual background for grounding the case studies employed in this thesis, including game design influence, game jams, and roguelike games.</td>
</tr>
</tbody>
</table>

This chapter provides a literature review related to idea networks, and other background literature for the case studies. It identifies the gap in the body of knowledge which this thesis aims to bridge.

3 Brainstorming and Idea Associations
Commercial and free brainstorming toolkits are available in the market, and on the internet. This chapter introduces game jams, a time-limited game creation event, as a research environment. In that environment, we asked Global Game Jam 2017 participants about the ideas they decided on, and what techniques were used, as well as the brainstorming toolkits used, if any. With the survey of available toolkits and an understanding of what kind of brainstorming activities took place, the chapter presents a discussion of collaborative ideation as a networked activity.

This chapter is about understanding and unpacking the relationships between
brainstorming activities, and the associativity of ideas. It informs my conceptualisation of idea networks for this thesis.

Section 3.1 through to 3.4 are published as a part of “Evoking Inspiration for Game Jam Ideas”, in Proceedings of the 2nd International Conference on Game Jams, Hackathons, and Game Creation Events, San Francisco, 2017.

4 Intrinsic Drives for Game Jam Participants
Motivation is a visible component of inspiration, the act to do something creative after seeing something new and evocative. This chapter takes a deep dive into participants’ motivations for attending game jams. I analysed post-event surveys from two local game jams with 20 participants on their motivations for participating, and formed a qualitative model for encoding jammer archetypes. This finding answers why jammers participate in game jams, and contributes to the theory of inspiration along with the next chapter.

This chapter is about the theory of inspiration in the context of game development. The findings inform my research design for this thesis.


5 Conceptualising Idea Networks in Game Design
We formally introduce the theory of inspiration and idea networks, and their related literature in this chapter. Using Global Game Jam 2014 as a research environment, we surveyed jammers about their game ideas, how they changed over the course of the game jam, and what other creative works inspired them. We found that given a centralised theme, teams distributed across international sites and from diverse cultural backgrounds created similar game ideas and mechanics, and conceptualised an idea network from the dataset.

This chapter answers RQ1, “What are the structures of idea networks relating to shared influences?” and RQ2, “What significant properties can we observe from the structure of idea networks?” It explores a corpus of ideas from Global Game Jam 2014 to formulate an idea network, noting its structures and significant properties. The process of research through design generates design implications that resolve these research questions.

This chapter is published in Transactions of the Digital Games Research Association 2(1), 2015.

6 Finding Design Influence within Roguelike Games
Roguelike games have a long history as one of the earliest computer videogames in the mid-1970s. We chose roguelike games as our second case study for its rich text data to
conceptualise idea networks, using data from online magazines, journals and discussion boards. This chapter also introduces a software method to collect data on the internet, and construct the idea network, as manually encoding them was proven too cumbersome and time-consuming. We propose a data visualisation to show influence of roguelike games over 45 years, and present a discussion on the cross-pollination of roguelike ideas across cultures and countries.

This chapter answers RQ3, “How can idea network visualisations describe influence?” It presents three idea network visualisations using data gathered from articles related to game development. The objective of the visualisations is to make influence visible for design research.

This chapter is published in the Proceedings of the 5th International Conference on Meaningful Play, East Lansing, 2016.

7 Exploring Roguelike Ancestry through Idea Network
The design influence of roguelike games, and its related genres, is crowdsourced in the RogueBasin wiki, available from their database. I included their dataset into the idea network, iterated on the data visualisations, and published them on the internet. The data visualisations are shared with game developers. This research surveyed their experience using the webpage, and asked them to rate their experience on qualitative scales. It also opened a channel inviting anyone to submit corrections and feedback, and engaged in online social network discussions about the project. From the survey data and encoding online discussions, I formed six design insights relating to the use of idea networks, as well as their design implications.

This chapter answers RQ4, “What insights can designers extract through idea network visualisations?” It expands the research artefact from the previous chapter, and presents the idea network visualisations to game developers for casual exploration. I observed how game developers discussed idea networks with each other online to investigate how idea networks might be used for design exploration.

An ‘extended abstract’ version of this chapter is accepted and pending publication in the Proceedings of the 3rd Annual Australian Social Network Analysis Conference, Canberra, 2018.

8 Conclusion
This chapter reviews and addresses the research questions, providing a summary table of the key findings and design implications. It offers the author’s reflection on the research methodology, and how it guided the author’s research journey. It concludes the thesis with four future directions going forward and the thesis contributions. This thesis contributes to the body of knowledge on design research and games research as a
Following the conclusion is a list of collected datasets as appendices where available. If the data is not openly available, I have included the name and contact details of the owners. Interested readers can request a copy from the data owners for research purposes.

Some chapters include open source software that I wrote as part of the research for this thesis. Links to the source code can be found in the appendix chapters. The data are all open access. I welcome anyone to download the dataset and build on this research, or reproduce my work to verify its integrity.

1.5 Thesis with Publication

Chapters that include published papers retain all of their original manuscript. The layout and formatting were redesigned to provide a more consistent reading experience. Specifically, the typography, margins, and column layouts have been replaced with the same design. I modified the in-text citation format to be author-year throughout this thesis, as it is conventional in the Digital Games Research Association (DiGRA). The numbering for tables and figures also have been realigned under their respective chapter numbers. Acknowledgements in each paper are summarised at the beginning of this thesis as part of the author attribution statement. Lastly, I unified the bibliography from each chapter, and included all of them following Chapter 8, “Conclusion”.

This thesis is a thesis with publication, as most of the chapters are already published, or contain manuscripts that have appeared in conferences or journals. Each chapter has a preamble to aid reading, connecting to the overarching narrative of this thesis. The thesis can be read from the first chapter to the last, or starting from the chapter that piques most attention. While each chapter will cover more in depth for its relevant prior works, I recommend to first read Chapter 2, “Background” for the key

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3 Except for two cases. One, where the statement has become out of date, such as pointing to a now-defunct resource. I include footnotes where applicable to reflect this. Two, minor typographical modifications for a smoother reading experience, in particular when published manuscripts are bridging into unpublished sections.

4 The University of Sydney publishes its policy on what constitutes a thesis with publication. It can be found in Section 12 of the Thesis and Examination of Higher Degrees by Research Policy 2015: https://sydney.edu.au/policies/showdoc.aspx?recnum=PD042014/374
concepts and their contextual discussions, and relevant literature, before reading subsequent chapters.
Background

An idea network is a systemic epistemology network. The ‘systemic’ part of the epistemology research process seeks to derive a knowledge forest from a chosen vantage point (Haynes, 2001, p. 36, cited in Houghton, 2009, p. 100). It is generated from strategically observing, validating, and recording inspiration, influences, and similarities of ideas. Designers can use idea networks for a purpose, depending heavily on their purpose, and the scope of their observation. The ‘epistemology’ part stems from two perspectives: one, the iterative approach of studying idea networks grounded in game design, which refines the research process for future scholars (Grocott, 2010); two, the documentation of interviews with and conversations among game designers (Lawson, 2004) that feed into the idea network.

I wrote this thesis for scholars in digital game studies as the primary audience in mind. This thesis plays to the strength to the diverse backgrounds of digital game studies, drawing from game jams, collaborative game-making, and roguelike games literature. For scholars unfamiliar with those fields, I endeavoured to cover sufficient background in this chapter, such that an experienced reader can read the rest of the thesis with little domain knowledge.

This chapter serves two needs for this thesis. One, it gives a historical view of preceding networks, starting with the citation index, leading up to the theoretical construction of an idea network. Two, it introduces contextual literature to game design influence, game jams and roguelike games, preparing the reader an understanding for the case study chapters, Chapters 3 through 7. As a whole, this chapter presents the broader motivation for undertaking this research.

In Section 2.1, I narrate a brief history of the citation index, grounding the focus for idea network. Section 2.2 provides a lens into game design through design influence, narrowing the thesis focus. In Sections 2.3 and 2.4, I briefly overview the existing research work and definitions on game jams and roguelike games, offering contextual knowledge for subsequent chapters and providing links for further reading. Section 2.5
concludes this chapter with a proposal for idea networks, identifying the gap in the body of knowledge which this thesis aims to address.

2.1 Citation Index: an Association of Ideas

Documenting precedents originated from necessity in the practice of law. It is most pertinent for lawyers to establish authority in court, and ensure their legal citations have not been overturned, or rendered obsolete by a higher court. Conducting a comprehensive search for relevant court cases is, understandably, a very costly exercise. Unlike many others in his time, Frank Shepard, thought of it differently. Shepard, an American citator, saw it as an entrepreneurial opportunity to make this legal sanity check more accessible to all legal practitioners.

Starting in 1873, Shepard’s company published, and frequently updated, a legal citation index that became known as Shepard’s Citations. It contained a list of U.S. court cases, marking each of their references with abbreviation for decisions such as reversed, or overruled (Adair, 1955, p.31). Shepard would hire law clerks to read through every court decisions and reports, and add to a comprehensive citation index for other law practitioners to reference as a business.

Fast forward to the modern day, there are many online services that provide listings on prior court citations, compiled by teams of law practitioners and their computing powers. This kind of service is not limited to the law. For academic researchers, there is a familiar and similar sibling, the scientific citation index (Garfield, 1955). In fact, Shepard’s Citations inspired Eugene Garfield to create a citation index for science, starting with medicine, and then, beyond:

“A former vice-president of [the Frank Shepard Company], William C. Adair, suggested in 1953 in a letter to Eugene Garfield that the citator principle of Shepard’s might be used as an indexing technique for medical literature. Garfield pursued the suggestion, creating the Science Citation Index and its progeny.” (Shapiro, 1992, p. 338)

When the scientific citation index was first created, it was the chemical index, the genetics index, the physical index, the biological index, and many more. It would be decades before a cross-disciplinary network is made available by machines. Early citation networks faced challenges such as prospective scholars searching with different terminologies and missing key papers. Another challenge was that interdisciplinary

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5 Shepard’s Citations was not the earliest known citation index. Bella Hass Weinberg (2004) documented a medieval Hebrew citation index, Mafeah ha-Derashot (“Index of Homiletics”). It is believed to be compiled by the 12th century philosopher, Maimonides.
papers were only indexed under one field, presenting a missed opportunity for scholars from other fields to discover these papers (Garfield, 1964, p. 650). These challenges were addressed by having a concise format for citations. Garfield (1967, p. 238) encouraged librarians to refer to the citation index from a well-cited paper, instead of searching by keywords.

Eugene Garfield (1955) subtitled the scientific citation index as an “association of ideas”, seemingly alluding to an idea network. Later, he would describe the academic literature as a “heavily cross-linked network” (Garfield, 1967, p. 239). For historians of scientific study, it provided a definitive starting point for research (Garfield et al., 1964, p. 241). Scholars who are topologically inclined studied just the structure of citation networks, such as the “co-citation network”, who and who both cited whom frequently (Small, 1973), or the “clusters and specialties” determined by computer algorithms, identifying which scientific fields exhibit high levels of activity (Small & Griffith, 1974).

For a selection of academic works using citation networks to study academic literature, see Garfield et al.’s report for the U.S. Air Force on the history of science (1964) with part of the network shown in Figure 2.1; Narin et al.’s (1972) visual presentation of interrelationships between scientific journal; and Hummon and Doreian’s (1989) study on the development of DNA theory with its critical path shown in Figure 2.2.

The conceptual advantage of the scientific citation index, as well as Shepard’s Citations, is granting a person the ability to quickly locate related critiques, or perform research in a field of study. In 1960, Gordon Allen demonstrated a bibliographic citation network, and it became a new way to study journal evolutions (Garfield, 1970, p. 134). Although the scientific citation index is limited to academic and wider publications, it has not seen formal adaptations among creative works in the industry.

Nearly half a century later, Mike Metcalfe⁶ (2007) proposed idea networking. Its use is not to study the evolution of scholarly ideas, but to facilitate a cross-linked structure to retrospectively record brainstorming sessions. Idea networking connects related subjects and contexts from a pool of brainstormed statements about a particular problem, framing the problem with visible idea clusters and bridging links. Its conceptual advantages are the same as the citation network: allowing stakeholders to visit the problem space efficiently, and identify critical problem areas that are highly connected.

Idea networking is designed to give wicked problems more clarity. Wicked problems are problems that cannot be fully specified due to constant change in requirements, 

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⁶ A personal anecdote about small-world networks: Mike Metcalfe was also inspired by the small-world social phenomena like I was. I only came across his work after I had already published papers about idea networks.
sheer complexity, or the many unknown unknowns (Buchanan, 1992). Wicked problems require appropriate managing of concepts to be tamed in the age of technology (Houghton, 2015). Idea networking proposes a ‘systems thinking’ approach to tame wicked problems by connecting brainstormed idea—collaborative extensions to what is known—together and show the problem in one view. In other words, it attempts to define a ‘problem frame’ through the lens of the stakeholders in order to facilitate the search for a viable solution. From brainstorming and idea networking, Metcalfe “hoped that [the emerging idea network results] are not as expected from the connections debated by the stakeholders” (2007, p. 148). It is from unexpected conflict of perspectives where new business insights are realised.

Figure 2.1: The top half of the Coincident Strong Citation Connections for papers in genetics, protein chemistry, nucleic acid chemistry, virology, and other unclassified works (Garfield et al., 1964, Network Charts 3). Reproduced with open public license

Like the scientific citation index, Metcalfe sees ideas as a network of associations. He notes the construction of idea network to be inherently implicit and creative, and that
the building process is idea synthesis (2007, p. 146). While Metcalfe’s proposal is useful for problem-framing, it is less intuitive for conceptualising connections in creative works. His idea networking method is, at its core, an exercise in information synthesis. It identifies what similar subjects and idea clusters form problem spaces. What it does not discuss is the underlying, often tricky aspects of idea associations, the ‘why’, and the ‘how’. Idea networking lacks other important dimensions for creative works, such as temporal, social, or cultural. To apply idea network to study the evolution of creative works, we need to strategically observe an activated form of knowledge transmission (Thrash & Elliott, 2004). Before I formally introduce the focus point of this thesis and state the gap in the current body of knowledge in Section 2.5, I will first discuss relevant contextual background works in which the thesis is situated to investigate idea networks, namely: game design influence, game jams, and roguelike games.

![Diagram](image.png)

Figure 2.2: The network that shows the development of DNA theory by linking 40 prominent papers by their citations (Hummon & Doreian, 1989, Figure 4). Reproduced with permission

### 2.2 Game Design Influence

Game design is a practice that, as creative practices do continuously, reinvents itself. From some of the earliest arcade hit videogames, *Pong* (1972), to a thrilling multiplayer
title, *Fortnite* (2017), and to some of the lesser known, independent games like *Save the Date* (2013), there seems to be an endless space and opportunity for action adventures, artful political messages, and reinvigorating design genres. This section presents game design from the design influence perspective. I shall first point to other works for broader historical reference. For works on a wide gamut of videogames and a detailed historical account, I recommend starting with Williams (2003) for his North American lens; Kent (2010) and Donovan (2010) for a longitudinal, ‘fast-forward’, museum-like curation style. For Australian video games, I recommend to begin with Knight & Brand (2008) for a brief timeline and report, and visit the *Play It Again* archive (Stuckey et al., 2013). For a collection of queer games and other games representing the under-indexed communities, see *Queerly Represent Me* (Cole et al., 2017) and the *LGBTQ Video Game Archive* (Shaw, 2017). The rest of this section draws from the works above, and from other scholarly works peripheral around game design influence to examine it.

Game design is a creative pursuit. In the context of this thesis, games are artful, creative expressions. Like art, a game reinforces some of its reality to its audience (McAllister, 2004, p. 144). Games are tightly linked with culture: the physical environment, the political landscape, languages, people, concerns, thoughts, the enjoyable moments, the troubled times, enabling scholars to “unpack the bidirectional influence of self and society” (Steinkuehler, 2006, p. 98). Games are made for a plethora of reasons, such as modelling familiar games enjoyed by the designer (Grzymkowski, 1998), discovering what they can achieve with a new library (Wichman, 1997), or designing an intelligent design tool (Cook, 2014). Games are created for a purpose, influenced by a specific, varying cause (von Ahn, 2006).

A game designer can be influenced by many factors, including the team, the audience, the game itself, the client, and the designer themselves (Schell, 2014, p. 4). This thesis focuses on two types of influence that are relevant to observing common patterns in game design. The first type of influence is the “recycling” of ideas. Game design ideas, particularly from the mainstream games industry are frequently recycled or borrowed directly from another mainstream title (Hagen, 2009; 2012). This is not surprising, as “[designs] are heavily borrowed from older work” (Popova, 2011). Game designs become popular ‘design patterns’, because they “facilitate the reuse of existing knowledge about successful solutions to common problems” (Kam et al., 2007), and it becomes an influential piece of work. The second type of influence is game inspiration. To the best knowledge of the author from reading many developer interview articles, notes, and making-ofs, when asked about their inspirations, game developers almost always are able to point to another game—or three—that influenced their work. Using roguelike games
(discussed in Section 2.4) for instance, Rogue was influenced by Adventure (Wichman, 1997); NetHack was influenced by various ports of Hack, and Rogue; SLASH'EM was influenced by NetHack,⁷ and so on. Game design is iterative and evolutionary by nature (Tschang & Szczypta, 2006). Game inspiration can be taken from nostalgia and elements of the past (Garda, 2013b; Stephan et al., 2015; Johnson, 2017). Successful game design inspirations would take the form of a genre, or subgenres (Jenkins, 2002, p. 128).

From a game designer’s point of view, a successful genre “combines the simple and the transcendent in a primal way” (Schell, 2014, p. 272). It attracts new and old players who enjoy each genre installment that gives them the feeling of being an expert with familiarity in design (Schell, 2014, p. 393). Players expect a genre to be stable, but also ever-changing, “tempered by innovation” (Apperley, 2006, p. 9). In film, a genre innovation is the clever reuse of popular images, elements of cinematography, and cultural media; but in games, the notion of genre is challengingly defined (Apperley, 2006, p. 7). A game genre is expected to evolve with technology, as in consoles and platforms (Apperley, 2006, p. 10). Genres are overloaded with definitions because of multiple, conflicting instances. For example, a ‘roguelike game’ is broad and encompassing, but lacks focus. The phrase ‘roguelike games from the 1980s’ carries more specifics, and is largely different from ‘roguelike games made in the 2010s’. More words can be added to pinpoint the exact variant of the genre, but then the succinct form of the genre—useful in discussions—becomes much more verbose to phrase.

The ability to describe exactly a specific game mechanic design is crucial in a collaborative team setting developing games. Organising and choosing from many variants of similar designs is part of the design challenge. The next section describes a popular game creation event format called game jams. When facilitated as a research environment, game design influence can be readily observed and documented in game jams for research (Fowler et al., 2013a; Deen et al., 2014). That said, from a scholar point of view, we can only examine design influences that have been documented by the designers first-hand, or by inferring them through the gamer community. In this way, the term ‘influence’ carries complex meaning and should be used with care. One is the inspiration that led to a certain design artefact; the other is an indirect precedent that shared some similarity and widely compared with, but not necessarily inspired a game.

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⁷ According to the homepage of SLASH'EM, it was a fork of NetHack: http://slashem.sourceforge.net/
2.3 Game Jams

This section provides a brief definition and overview of existing game jam research for context. Game jams are the study domain for Chapters 3, 4, & 5. I outline in Section 5.3 an in-depth motivation for using game jams for idea networks.

Game jams have been the subject of many studies, including: understanding the ‘indie’ game development culture (Reng et al., 2013; Turner et al., 2013), social network analysis (Pirker et al., 2017; Pirker et al., 2018), game development process (Zook & Riedl, 2013; Goddard et al., 2014), rapid prototyping and design process (Olesen, 2017; Barba-Guaman et al., 2017), and more recently, new design methods from using variants of game jam formats (Gaudl et al., 2017; Alencar & Gama, 2018) The ‘game jam format’ has also been deployed in classrooms to research ideation, motivation drivers, learning, and academic performance (Kultima & Alha, 2011; Fowler, 2016; Pollock et al., 2017; Grey et al., 2018). In short, game jam research has flourished into many branches of research.

In her paper, “Defining Game Jam”, Annakaisa Kultima examines 20 academic papers on the topic, and gives an extensive definition of what a game jam is:

“A game game is an accelerated opportunistic game creation event where a game is created in a relatively short timeframe exploring given design constraint(s) and end results are shared [publicly].” (Kultima, 2015, p. 9)

Game jams facilitate a hands-on approach to making games from scratch. Being relatively short—often under 48 hours—the event format offers an inclusive learning environment for both newcomers and experienced jammers, the term for game jam participants. For a historical discussion of the origin of game jams, see Preston et al. (2012). Kultima & Alha (2011) explored brainstorming in game jams with theme-related prompts, leading to more interesting results. Kultima (2015, p. 8) highlights the opportunistic aspects of game jams, noting that for some jammers they are for “creativity and innovation”, and for others they are about “learning and socialising”.

Although game jams reflect a miniature version of the games industry development process with intense time pressure and overworking, empowering spaces for creative experiences can be created with care (Kennedy, 2018, p. 17). For the first-time and returning jammers, their most common single goal is to gather together, and finish making a game (Zook & Riedl, 2013, p. 2). Game jams offer a condensed view into the brainstorming process (Fowler et al., 2013), ideal for studying idea networks. The mainstream and popular game jams are Global Game Jam and Ludum Dare.8 Another

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8 For more information about Ludum Dare, See Section 3.3.
notable game jam is 7DRL,⁹ which challenges jammers to make a roguelike game in seven days. A longer history of game jams, where it originated, and its significance to game studies is given in Sections 5.1 and 5.2.

### 2.4 Roguelike Games

This section offers a brief overview and a definition about roguelike games, a subgenre of videogames. Roguelike games are the study domain for Chapters 6 & 7. For a formal introduction to the historical evolution of the videogame Rogue (1980) and the various ‘roguelike’ terms, see Section 6.1.

Roguelike games have a long history as one of the earliest computer video games in the mid-1970s. Distributed with Unix systems, Rogue painted a world with letters and symbols, full of mystery and danger, and it quickly gained attention of many. The name, roguelike, was adopted on Usenet since 1993 as we know it today (Brewer, 2017).

What exactly makes a game roguelike was debated throughout the next decade. In 2008, the first International Roguelike Development Conference was held in Berlin. The participants came to an agreement for a first international definition. Roguelike games features include: ASCII graphics, turn-based, grid-based dungeon crawl hack and slash, randomly generated environments that changes at every level, and ‘permadeath’ (RogueBasin, 2008).

This definition would be later contested by Darren Grey, host of the popular community podcast, Roguelike Radio,¹⁰ who argued that ASCII is no longer relevant in modern day roguelikes, and that the whole definition is “used by pedants who ... stifle creativity and potential in the genre” (2013). He emphasised that definitions are used for excluding people into the community, and does not foster or encourage new designs. For him, roguelike games are “inherently replayable, capable of surprising the player on many playthroughs” (2013). What makes a roguelike game Rogue-like is not about what it contains, but the gameplay and feeling evoked from the complex interactions with the game and the player.

Roguelike games have diverged so much today from the classic roguelike gameplay that people have started calling some newer games ‘roguelites’ or ‘roguelike-likes’ (Hawkes, 2013; Brewer, 2017). The roguelike genre, broadly speaking, can be traced from videogames released throughout the last four decades. Games researchers examine the ‘roguelikeness’ trends (Garda, 2013a; Gonçalves Plá da Silva, 2015) and the use of ASCII graphics (Johnson, 2017), but most roguelike research are in the fields of procedural

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⁹ 7DRL stands for the ‘Seven-day Roguelike’ Challenge: http://7drl.com/

¹⁰ http://www.roguelikeradio.com/
generation (e.g. Ashlock et al., 2011; Smith et al., 2012; Smith, 2014) and videogame artificial intelligence applications (e.g. Scales & Thompson, 2014; Agis et al., 2015; Cerny & Dechterenko, 2015). The current understanding of roguelike games would benefit much from a design lens. In the next section, I will outline the motivation for creating an epistemological structure that can capture the evolution of roguelike games, as well as many other types of creative works by their design influence.

2.5 A Network for Creative Works

The state-of-the-art citation network does not facilitate recording of creative works and their design influence, but historians and researchers in the arts often find themselves needing to rebuild and amend such networks. Because design influence has no compact format or structure for indexable documentation, the mechanisation of it can be very challenging. Furthermore, while influence can be casually observed, influence is a difficult concept to pin down without the designer’s explicit attribution to their source of inspiration (Lawson, 2006).

Nonetheless, this thesis sets out to conceptualise a network for creative works with that limitation. When Garfield et al. (1964, p. 74-75) examined Isaac Asimov’s book, The Genetics Code, they drew citation networks from both the book itself, as well as from the cited papers. Their strategy was categorical, for example, strong (explicit citation) versus weak (drawn from personal communications). Idea network comprises nodes, which are creative works; and links, which describe influence. I take a similar strategy to qualify influence in Section 6.4. Inspiration is an intuitive relationship to use for idea networks, as the act of ‘being inspired’ implies a connection between old ideas and the new. Inspiration is useful to a designer. It acts as many things: context definitions, idea triggers, and anchors for structuring new design (Eckert & Stacey, 2000, p. 525). That said, since “everything can be a source of inspiration to a designer” (Eckert & Stacey, 2000, p. 524), we would need a strategy to build idea networks.

Shepard’s Citations is for practitioners of the law. Garfield’s scientific citation index is for academic scholars. I propose the idea network is for practitioners of arts and design, in the humanities and the industry. With the understanding that “all beautiful things” are connected in a network map (Kelly, 2011), that “everything is a remix”, adaptation, or recycled work (Ferguson, 2011), and that the stability of genres are “tempered by innovation” (Apperley, 2006), we may arrive at a cultural map of interlinked creative works. The function of idea networks is to quickly locate fringe, original, or a niche body of work relating to their first inception. “It is this function”, to borrow words from William C. Adair (1955, p. 31) writing about citation networks, “which it appears would be
of great value in other fields.” Practitioners in fields of creative pursuit may use idea network to expedite research when grounding their work.

Many questions naturally stemmed from this proposal. If we boldly accept that all knowledge is interrelated in some sort of intertwingularity (Nelson, 1987), what would that epistemic structure be like in a mechanised form? More than that, how would people use it? To investigate how idea networks are used, it follows that we must first conceptualise a structure to describe the diverse landscape of ideas. We need an understanding of the significant properties of idea networks to infer and gather clues about what it may be useful for. Following that, idea networks may benefit from data visualisations, such that their design influence can be illustrated in concrete terms, beyond text. Lastly, designers familiar with the domain knowledge need tools to explore idea networks, unpacking some of their assumptions about the domain, and beginning to trace history efficiently. The gap in the body of knowledge is the missing understanding of idea networks.
Brainstorming and Idea Associations

Preamble

This chapter is about understanding and unpacking the relationships between brainstorming activities, and the associativity of ideas. I have two reasons for choosing to do it. First, as a researcher using game jams for research, I needed a better understanding of how ideas are formed and used in this environment. Second, since brainstorming is inherently about associating existing ideas together to make new ones, the findings will help me unpack the underlying nature of idea network structures.

When I first set out to study idea networks, the focus of this research was on studying them in an environment where new ideas are generated in abundance. The environment was game jams, a collaborative event where participants gather to make a game, typically time limited to 48 hours or under. Game jams allowed me to observe and examine multiple brainstormings taken place, and investigate the associativity of ideas. I also had previously had the opportunity to participate in several other game jams myself, forming teams with friends and strangers alike. The discussion sections will show that the observed activities are similar to networking structures from the design affordance of brainstorming toolkits, as well as from the brainstorming activities that took place at Global Game Jam 2017.

In Section 3.1, I introduce the literature on brainstorming productivity and present brainstorming toolkits as designed strategies to organise unstructured brainstorming sessions, grounding the chapter aim and context. In Sections 3.2 & 3.3, I examine 21 brainstorming toolkits in total, listing card-based ones in 3.2, and online toolkits in 3.3. These two sections describe in detail the features and compositions of each toolkit, providing an overview of the affordances for synthesis and discussion. Section 3.4 draws from literature on brainstorming and links them to game jams, building a bridge between general brainstorming and game development brainstorming. Section 3.5 offers a synthesis of four design affordances of brainstorming toolkits, ranked by their complexity and function, bringing out the fundamental functions of brainstorming toolkit design. Section 3.6 surveys the participants of Global Game Jam 2017 about their
brainstorming activities and any tools used, investigating the human dimension of brainstorming. In Section 3.7, I use the research findings to argue that brainstorming is inherently leveraging the nature of idea associativity, giving a summary of the research implications. Section 3.8 briefly lists limitations of this work, pointing out the relatively small samples of two studies, and nonetheless justifying the indicative results and findings. Section 3.9 concludes this chapter with a review and a summary of the research findings, signalling idea networks as an open research field.

Section 3.1 through to 3.4 are published in “Evoking Inspiration for Game Jam Ideas”, in Proceedings of the 2nd International Conference on Game Jams, Hackathons, and Game Creation Events, San Francisco, 2017.

To maintain consistency with the original manuscripts, the following and future chapter contents are written with the plural first-person ‘we’. Preambles of each chapter are written with the singular first-person ‘I’ to reference the thesis as my personal research journey as a whole.
Abstract

Brainstorming is an important part of creative design, related to exploring the associativity of different ideas, and the combination of their parts. Many studies examined social interactions, productivity, techniques, and quality of brainstorming activities, but few reported the design affordances of brainstorming toolkits, and the relationship between idea associations and brainstorming. In this paper, we examined 21 brainstorming toolkits designed for creative brainstorming, grounded in game design. We synthesised 4 tiers of design affordances, and discussed their supportive qualities within a brainstorming setting. Next, we surveyed jammers—game jams participants—and asked them about their brainstorming activities, and the use of tools at Global Game Jam 2017. We found a large number of participants using traditional stationery to aid brainstorming, and a common usage of mind mapping and rearranging post-it notes. From the two studies, we discuss how idea associations are leveraged by brainstorming toolkits and activities, and conclude with a summary of the supportive affordances for brainstorming.

3.1 Introduction

Brainstorming is an active research area, in particular on its productivity (see Pauhus et al., 1993; Offner et al., 1996; Smith, 1998; and Clayphan et al., 2011). Brainstorming by itself is an imperfect process, subject to peer dynamics, and hampered by social issues such as social loafing, evaluation apprehension, and production blocking (Furnham & Yazdanpanahi, 1995). Unstructured and overly long brainstorming sessions can lead to groupthink, “a psychological drive for consensus at any cost that suppresses dissent and appraisal of alternatives in cohesive decision making groups”, which leads to poorer design decisions (Janis, 1972).

Structured rules, and active time-moderating are two techniques used to overcome these problems (Kultima et al., 2008). Brainstorming toolkits that incorporate random ideas and combination of unusual themes have humorous, wild results. We define brainstorming toolkits as ‘resources designed to facilitate and support quality idea generation in a collaborative setting.’ When everyone has goofy or fringe ideas, participants are less likely to reject risky ideas, and as such are more likely to create unique designs.

The literature review we will cover is by no means exhaustive on the subject of brainstorming. Past work on brainstorming toolkits describe them as sources of inspiration (Lucero & Arrasvuori, 2010; Lucero & Arrasvuori, 2013; Mueller et al., 2014), but in reality they work by imposing design constraints on their participants (Kultima &
Alha, 2011). The more specific the design constraints are, the more they can “elicit more
gameful outcomes” (Goddard et al., 2014). These design constraints become “enablers for
the creation process” (Kultima et al., 2008), granting clearer directions to everyone
involved, and help participants focus on their creative tasks. Brainstorming is an
iterative process of “transforming, combining and adapting elements” of previous work,
as well as drawing from other phenomena (Eckert & Stacey, 2000, p. 524).

In this paper, we are exploring game jams as a research environment (Deen et al.,
2014). Game jams are timeboxed events in which participants gather to make games. Our
work aims to investigate how ideas emerge as an associative, networked relationships.
Our research questions are: “What affordances do brainstorming toolkits provide”, and
“what is the relationship between brainstorming and idea associations?”

Game jams are often used interchangeably with ‘hackathons’, because they share a
similar format: creating something within a limited time. Participants, called jammers,
gather together to brainstorm and make a game in this informal collaborative event.
Game jam as a research environment offers a magnified view into the game design
process for researchers to study ideas from start to finish (Deen et al., 2014). In the
authors’ anecdotal experience in game jam participations, game jams vary from event to
event, some focus on team forming and intensive production, while some promoted more
relaxing, social environments to explore creative ways of game-making.

The roots of game jams can be traced back to Indie Game Jam in 2002, and then in 2006
at Nordic Game Jam, two of the first major game jam events. It provided a collaborative
space where “people [are] willing to help other teams as needed ... to solve problems. It’s
often a learning experience ... with people specifically experimenting with new
technologies or ideas” (Locke et al., 2015). The void of prizes remove the extrinsic
motivation for competition. In addition, jammers are not tackling real-world
problems—as it is often the case with hackathons—but instead creating their own games
around a central theme. These themes add constraints around jammers for their game
design challenge (Zook & Riedl, 2013).

Game jam themes are designed to be open-ended and ambiguous (Goddard et al.,
‘compressed development processes’ ..., [and] being able to go through different steps of
game development in a short period of time” is one of the key reasons game jams are
attractive to researchers.

We chose 21 toolkits with a focus on creative thinking that can be applied to game
design. This was intended not only to provide a broader frame of thinking—more than
idea generation—but also to aid idea growth in the process. Toolkits were sampled from
existing literature specifically applied to game jams or hackathons, and from search engine results. We made three passes. In each pass, we examined literature that proposed new brainstorming toolkits to support collaborative ideation. For the search engine terms, we used related terms like ‘brainstorming tools’, ‘ideation’, ‘game jams’, and ‘hackathons’. In the third pass, when we did not find any new brainstorming toolkits, we deemed the search sufficient.

The next two sections will examine the utility of brainstorming toolkits, and discuss how they support collaborative brainstorming below. We divided them into two groups based on their media: card-based, and online random generators.

3.2 Card-based Toolkits

There are many card-based toolkits\(^{11}\) available to inspire game developers. General-purpose card-based toolkits, not intended for making games, include S.C.A.M.P.E.R., Oblique Strategies, and IDEO Method Cards. They switch on the ‘what if?’ mindset, offer alternative strategies to overcome mind blanks, and ask participants to think outside of the box. They keep participants with design strategies in mind, and encourage them to try out different strategies when one falls short. Table 3.1 describes each of the brainstorming toolkits we examined, and gives a sample of the available prompts in them, briefly illustrating the intent of each brainstorming toolkit and their use.

Other card-based toolkits intended for game design include Grow-a-Game, the Values at Play Framework, Thinkpak, ThinkCube; Verbs, Nouns, and Adjectives (VNA), GameSeekers, GameBoard, and PLEX Cards. These toolkits tend to converge towards creating a goal that would define the game itself.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.C.A.M.P.E.R.(^{12}) (Osborn, 1953; Eberle, 1971)</td>
<td>7 general strategies designed to promote out-of-the-box thinking.</td>
<td>Substitute, Create, Amplify, Modify, Put to other use, Eliminate, Rearrange or Reverse</td>
</tr>
</tbody>
</table>

\(^{11}\) For clarity, in-text citations for each brainstorming toolkit are collated in Tables 3.1 and 3.2.

\(^{12}\) While S.C.A.M.P.E.R. is a set of general strategies, we collect it here because they can be printed onto cards, and randomly drawn to challenge thinking, as proposed by Osborn (1953) to employ in classrooms.
<table>
<thead>
<tr>
<th>Tool Name</th>
<th>Description</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oblique Strategies</strong> (Eno &amp; Schmidt, 1975)</td>
<td>A deck of 22 strategies to be drawn at will to provoke novel ways of thinking by process. The latest edition is the 5th, published in 2001.</td>
<td><strong>List the qualities it has. List those you'd like. Back up a few steps. What else could you have done?</strong></td>
</tr>
<tr>
<td><strong>IDEO Method Cards</strong> (IDEO, 2003)</td>
<td>Empathy tool cards divided into four categories, Learn, Look, Ask, and Try. Each card has a title, “how”, and “why” to facilitate usage.</td>
<td><strong>Guided Tours: Accompany participants in spaces relevant to the project. This helps people recall their values.</strong></td>
</tr>
<tr>
<td><strong>Values at Play Framework</strong> (Flanagan et al., 2005)</td>
<td>A design process with three iterative phases: Discovery, Translation, and Verification.</td>
<td><strong>Do system features afford activities that support identified values?</strong></td>
</tr>
<tr>
<td><strong>Thinkpak</strong> (Michalko, 2006)</td>
<td>56 cards using the SCAMPER principle and nine design strategies for creative thinking.</td>
<td><strong>Can you make it do more things? Can you find more uses? Increase functions? Get a higher performance level?</strong></td>
</tr>
<tr>
<td><strong>ThinkCube</strong> (Sampanthar, 2007)</td>
<td>88 idea cards, 88 keyword cards with a definition a visual thesaurus, and 24 verb cards to mutate them.</td>
<td><strong>Story: Legend, Adventure, History, Tale.</strong></td>
</tr>
<tr>
<td><strong>GameSeekers</strong> (Kultima et al., 2008)</td>
<td>4 decks: red cards, subjects or abstract themes; purple cards, black and white patterns; green cards, game genres or social aspects; blue cards, game mechanics.</td>
<td><strong>A row of black lines, a photograph of a woman in snow, time management, simplify.</strong></td>
</tr>
<tr>
<td><strong>GameBoard</strong> (Kultima et al., 2008)</td>
<td>A board of 11 card slots, and two decks. Core cards with mechanics and themes, and Gameplay cards with structure, feature, and special cards.</td>
<td><strong>Players take turn to play cards and ask each other to explain how it fits the game they are creating.</strong></td>
</tr>
<tr>
<td><strong>PLEX Cards</strong> (Lucero &amp; Arrasvuori, 2010)</td>
<td>22 categorial cards with keywords, a brief description, and 2 photographs. 2 instructional cards.</td>
<td><strong>Exploration: investigating an object or a location</strong></td>
</tr>
<tr>
<td><strong>Tangible Interactions Framework: The Card Brainstorming Game</strong> (Hornecker, 2010)</td>
<td>4 categorical cards inspired by the tangible interactions framework, each with a question, subcategory, and a picture.</td>
<td><strong>Can users be proud of skilled body movement? Can they develop skills overtime?</strong></td>
</tr>
</tbody>
</table>
### Verbs, Nouns, Adjectives (VNA)

(Kultima & Alha, 2011)

- 3 decks of cards with high-level, distinct categories to stimulate shared ideas. Different versions can be tailored for a theme.
- Rotate, Bogey, Glimmering

### Exertion Cards

(Mueller et al., 2014)

- 4 categories of cards that include the Responding Body, the Moving Body, the Sensing Body, and the Relating Body, with degrees varying from 'a little' to 'a lot'.
- To what extent is physical risk considered? To what extent are physical movements mapped to the virtual world?

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To use any of the toolkits, participants draw and play a card and then decide what it means in the context of the design process. Using toolkits this way is like a game in which there are no winners, and participants are “trying to reach the status of ‘idea dictators’” (Kultima et al., 2008). Most toolkits provide items, rules, and detailed descriptions to participants, although no groups play the same way. These toolkits are primarily designed for group play to encourage sharing ideas, but they can also be used with a single player. Some toolkits are available online in its entire set of cards, laid out in A4 or letter pages, making it possible to “print and play”. A few toolkits, like Thinkpak and ThinkCube, are only available with a commercial purchase.

#### 3.3 Online Random Idea Generators

There are many online random idea generators that offer random items at the click of a button, which we include as brainstorming toolkits with similar affordances. For instance, *Ludum Dare* is one of the world’s largest online game jams, receiving 2,867 entries in December 2015. Toolkits like *Ludum Dare Game Idea Generator* build their idea database from its entries. In this way, ideas enter a lifecycle generated from generators, and jammers are the writers of these ideas.

Other online toolkits specifically designed to inspire new combinations of mechanics and gameplay include *Boardgamizer, Orteil’s Game Idea Generator, and Gigster*. They usually provide random combinations of ideas in various categories. For example, *Gigster* provides random generation in five categories: themes, genres, core aesthetics, objectives, and design challenges. It can randomise one category at a time, or randomise all five. Participants can also keep one or more categories and randomise the others,

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13 http://ludumdare.com/
narrowing down ideas they are looking for. Boardgamizer generates a game mechanic, theme, victory condition, and design constraint. The list of online random idea generators is given in Table 3.2. It is by no means exhaustive judging from the number of results discoverable by search engines.

Table 3.2: List of online random idea generators surveyed

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insanity Jam Game Idea Generator(^1^4)</td>
<td>Randomly fills out a sentence by genre, player action, and a possible secondary factor. Genre can be fixed by the user.</td>
<td>A trivia game where you can never escape indecision.</td>
</tr>
<tr>
<td>The Video Game Name Generator(^1^5)</td>
<td>One button to generate a videogame title. Templates change between adjectival nouns and “nouns of nouns.”</td>
<td>Monty Python’s Banana Gladiator, Combat Sniper</td>
</tr>
<tr>
<td>Boardgamizer(^1^6)</td>
<td>Provides mechanics, two themes, a victory condition, and a hidden constraint which can be revealed with an additional button.</td>
<td>Mechanics: Dice Rolling. Theme: Encounter, Extreme Sport. Victory: Solve a puzzle/mystery. Constraint: Must use paper money</td>
</tr>
<tr>
<td>Random Game Jam Theme Generator(^1^7)</td>
<td>Randomly picks one of over 2,000 suggested ideas from Ludum Dare to the Berlin Mini Game Jam</td>
<td>Decision dilemma, Electricity</td>
</tr>
<tr>
<td>Orteil’s Game Idea Generator(^1^8)</td>
<td>Single click to generate a mashup of game mechanics. There is a toggle “sanity” for darker results.</td>
<td>A student project where you paint portals through social engineering.</td>
</tr>
<tr>
<td>Cowface Games Ludum Dare Theme Generator(^1^9)</td>
<td>Randomly picks a suggested theme from Ludum Dare, shortlisted by the community. Results are presented as</td>
<td>Time Limit, Simulism, Descent</td>
</tr>
</tbody>
</table>

\(^1^4\) https://alamantus.gitlab.io/GameIdeaGenerator  \\
\(^1^5\) https://www.videogamenia.me/  \\
\(^1^6\) http://www.boardgamizer.com/  \\
\(^1^7\) https://cjanssen.bitbucket.io/themegen/  \\
\(^1^8\) http://orteil.dashnet.org/gamegen  \\
\(^1^9\) http://www.cowfacegames.com/handytools/ludum-dare-theme-generator

48
a Google link per Ludam Dare tradition.

**Cowface Game Idea Generator** \(^{20}\) Populates a list of game titles from “Notable Games” in Ludam Dare entries, genres, Ludam Dare themes, and nouns. User can choose a number of results from each category. Results are presented as a Google link.

**Streaming Colour Studios Game Idea Generator** \(^{21}\) Mashes a description, two game genres, and a location.

**Gigster** Generates five categories with accompanying art: theme, genre, core aesthetic, objective, and design challenge. Offers one button to generate all five, one at a time, and options to swap out single categories.

*Command, Persistence, Gratuitous Space Battles, Spore*

*Fast-paced, word game combined with rhythm game, set on a farm.*


Using a random idea generator does not mean committing to its results, because users can keep hitting buttons or customise randomisation factors until they get something they like. They are free to visit every corner of the knowledge bank until something clicks with their minds from idea generators.

The strength of digital tools is the ability to hold much, much more content than its physical counterpart. Two thousand items are considered as a small database, and many databases hold tens of thousands of entries. Printing them on cards would be prohibitively expensive. Distributing them, even more.

### 3.4 Qualities of Brainstorming Toolkits

Elements of brainstorming toolkits design are interdependent to their human factors: what makes these tools work in collaborative settings, and how people brainstorm with them (Dalsgaard et al., 2017). The all-too-familiar blank canvas problem, during which we are searching for a starting point, is alleviated by clashing many new

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\(^{20}\) http://www.cowfacegames.com/handytools/game-idea-generator

\(^{21}\) http://www.streamingcolour.com/blog/game-idea-generator/
Brainstorming toolkits enhance social dynamics by defining the social contract of idea exchange to better structure collaborative thinking (Kultima et al., 2008, p. 9). Random ideas are “surprising stimuli which force the player to think outside the box thus resulting in ideas that would not necessarily otherwise emerge” (Kultima et al., 2008, p. 14). A person may draw random words from different categories, and attempt to describe a game based on what they turned up (Hansson, 2014).

Game jams promote focus, low risk, and skill mastery (Grace, 2016), and they “[advance] technical work varies across technical domain, community structure, and expertise of participants” (Trainer et al., 2016). Brainstorming toolkits can offer consecutive, serendipitous encounters much quicker than normal conversations, hastening idea generations with risk-averse mindsets. Every team is like a themed restaurant where chefs work together around some central ingredient; or as Lehrer (2012) put it, writing about creative thinking: “the metropolis is like a sonic blender; every street is a mix tape.” Well-structured brainstorming toolkits make jammers think about relations between subjects in hand, instead of the most obvious solution (Lucero & Arrasvuori, 2010). The tension of random ideas and game rules create an equal contribution opportunity for everyone to participate, a factor for success in collaborative learning and design. In other words, the collaborative design process and tension mimics that of collaborative gameplay (Brandt & Messeter, 2004).

3.5 Affordance of Brainstorming Toolkits

Brainstorming toolkits are efficient for generating a large number of ideas in a short amount of time, because they leverage idea relationships to leap from one idea to the next. Efficient idea creation is an affordance of brainstorming toolkits. Donald Norman (1999, p. 38-40) talks about design affordance, the relationship between the human and the object, and what can be accomplished by their interactions.

In this section, we examine the affordance of brainstorming toolkits using existing literature. The examination method is as follows. By reading the reports of how participants used brainstorming toolkits (Kultima et al., 2008; Hornecker, 2010; Kultima & Alha, 2011; Lucero & Arrasvuori, 2013; Mueller et al., 2014), we have an understanding of the brainstorming toolkits’ utilities. Equipped with that understanding, we searched in the literature on what is considered as a ‘good’ or ‘well-structured’ brainstorming activity (Pauhus et al., 1993; Rossiter & Lilien, 1994; Landis et al., 2008; Rawlingson, 2017), and link them to the utilities of brainstorming toolkits. Then, we reflect on the complexity in as a brainstorming facilitator, and produce four tiers of affordance
different ideas, clashing them to create something new. This is often done through group introductions of new ideas, with a hint to combine them with other new ideas. (Lilien, 1994). The primary use is surprise, an emergence of wild and interesting quantity of ideas is often necessary to produce higher quality ideas later (Rossiter & Lilien, 1994). The identifying element of generating is a random function—like drawing a card from a shuffled deck of cards—from which an independent idea is introduced into the mix. More independent quantity of ideas is often necessary to produce higher quality ideas later (Rossiter & Lilien, 1994). The primary use is surprise, an emergence of wild and interesting combinations (Saunders, 2002). At this tier, the brainstorming toolkit only offers introductions of new ideas, with a hint to combine them with other new ideas.

Transforming. Brainstorming toolkits can provide means to transform and combine different ideas, clashing them to create something new. This is often done through group

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<tr>
<td><strong>Affordance</strong>: Produces at random a subject or an event to evoke new ideas.</td>
<td><strong>Affordance</strong>: Combines, adapts, or modifies an existing idea to create new ideas.</td>
<td><strong>Affordance</strong>: Facilitates limitations on the boundary, context or scope to refine new ideas.</td>
<td><strong>Affordance</strong>: Provides a structured format, and assist a brainstorming lead or moderator, for generating higher quality, rounded, and validated ideas.</td>
</tr>
<tr>
<td>“Go for quantity, ignore quality”; individuals should generate the initial ideas (Osborn, 1953; Eberle, 1971); 6 principles of brainstorming as proposed by (Rossiter &amp; Lilien, 1994)</td>
<td>S.C.A.M.P.E.R (Osborn, 1953; Eberle, 1971); 6 principles of brainstorming as proposed by (Rossiter &amp; Lilien, 1994)</td>
<td>Set quotas on ideas and a time limit (Tatsuno, 1990, cited in Smith, 1998); various design constraints (de Bono, 1985; Normal, 1999); boundary dimensions (Mueller et al., 2014)</td>
<td>Iterate, refine, and validate ideas based on feedback (Flanagan et al., 2005); recommendations for better brainstorming by (Landis et al., 2008); break down barriers to creative thinking prior to brainstorming (Rawlinson, 1986)</td>
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**Figure 3.1: Affordance Tiers of Brainstorming Toolkits**

**Generating.** At the heart of every brainstorming toolkit is the generation of ideas, whether it is a new object, event, theme, location, or an abstract concept. The identifying element of generating is a random function—like drawing a card from a shuffled deck of cards—from which an independent idea is introduced into the mix. More independent quantity of ideas is often necessary to produce higher quality ideas later (Rossiter & Lilien, 1994). The primary use is surprise, an emergence of wild and interesting combinations (Saunders, 2002). At this tier, the brainstorming toolkit only offers introductions of new ideas, with a hint to combine them with other new ideas.
dynamics (Rossiter & Lilien, 1994). Applied creative strategies such as S.C.A.M.P.E.R. (Osborn, 1953; Eberle, 1971) concentrates solely on the transformation of ideas. It is especially crucial in a game jam setting, because when more than 20,000 groups of people are brainstorming with the same central theme to come up with games ideas, chances are that some of the first five ideas will be the same as another groups’ ideas. Unlike generating, which is about producing a broader idea spectrum, transforming is about altering existing ideas to create deeper ideas that are normally improbable to realise, or randomise.

**Constraining.** Toolkits can impose constraints by adding a context or description. Other toolkits set limitations, such as a time limit, to engage a more focused kind of participation (Tatsuno, 1990, cited in Smith, 1998). They seek to define concrete background stories of the ideas at hand, or adding a boundary dimension to the idea itself (Mueller et al., 2014). Even though adding an idea is a constraint in and of itself, the intention here is expansion by constraints (de Bono, 1985). Unlike transforming, which is concerning with coming up with deeper ideas that are more unique and improbable to randomly encounter, constraining is about reaching a clearer definition, adding refinements. It is about asking the why, the how, but not the what-if.

**Guiding.** Structured brainstorming toolkits can guide brainstorming members on the same journey. As we discussed in the introduction, the reason for having a structure is to produce higher quality results, for unstructured brainstorming sessions can lead to dangerous groupthink (Janis, 1972). Structures incorporate iterative steps and building on the previous phrase to validate ideas and their use (Flanagan et al., 2005). They resemble the three phases of creative problem-solving process originally proposed by Osborn (1953): fact finding, idea finding, and solution finding. In Creative Thinking and Brainstorming, J. Geoffrey Rawlinson (1986, p. 86) proposes a similar procedure that he argues as “the right way to introduce brainstorming to a group”: identify barriers to knock them down, brainstorm with a neutral example, and tackle the live problem. Structured brainstorming sessions also provide specific roles, and rules of play, giving every member instructions to work together (Landis et al., 2008). Unlike constraining, which seeks to impose constraints for more specific outcomes, guiding is about giving as

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22 This is one of Giselle Rosman’s favourite reminders at game jams. Rosman is the organiser of the Independent Game Developers Association, Melbourne Chapter (IGDAM), and the executive producer of Global Game Jam 2017.

23 Lawson (2006) goes into detail on the differences between internal and external constraints. In the brainstorming context, however, we only deal with internal constraints, that of the designer.

24 A notable game is Microscope RPG (Robbins, 2011), a role-playing game that builds on a structured brainstorming session to facilitate a playable game solely based on iterative, generated story content.
much instructions for the brainstorming moderator as possible, and ensuring the session is on track.

Each tier is a subset of the next tier, meaning that if a brainstorming toolkit satisfies tier 3, it automatically satisfies tier 1, and 2. We do not mean that a brainstorming toolkit on a lower tier is less effective than a toolkit on a higher tier. Here, higher tier refers to a more complex ruleset that has been designed to facilitate a more structured brainstorming process. When using lower tier toolkits, experienced members will tend to fill in roles that provide a higher affordance tier wherever possible. Examples include transforming, people handle related ideas together and quickly to identify similar themes (Hornecker, 2010); constraining, people write down brainstormed ideas in layouts of lists and maps to keep an idea structure (Clayphan et al., 2011); and guiding, people remind each other the purpose of the brainstorming, and the “importance of professional skepticism” (Landis et al., 2008). Table 3.3 lists each brainstorming toolkit we examined by their affordance tiers.

Table 3.3: Our examination of brainstorming toolkit affordance tiers

<table>
<thead>
<tr>
<th>Tier</th>
<th>Brainstorming toolkits</th>
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<tr>
<td>1. Generating</td>
<td>ThinkCube, Insanity Jam Game Idea Generator, The Video Game Name Generator, Boardgamizer, Random Game Jam Theme Generator, Orteil’s Game Idea Generator, Cowface Games Ludam Dare Theme Generator, Cowface Game Idea Generator, Streaming Colour Studios Game Idea Generator, Gigster</td>
</tr>
<tr>
<td>3. Constraining</td>
<td>IDEO Method Cards, VNA, GameBoard, Exertion Cards, Tangible Interactions Framework: The Card Brainstorming Game</td>
</tr>
<tr>
<td>4. Guiding</td>
<td>Values at Play Framework</td>
</tr>
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</table>

We found that physical, card-based toolkits provide more complex functions, and had higher tiers of affordance. However, this does not mean that online tools are limited by their medium, and they could be more developed to facilitate higher tier affordances. Our observation shows that online generators harbour a much larger pool for fetching a random idea. Online generators have design gaps to learn from physical, card-based toolkits. We only examined brainstorming tools catered for game design ideas, and our
search turned up many random generators. We argue that there is opportunity for online brainstorming toolkits to develop more functions to facilitate useful, structured brainstorming sessions.

On the lower two tiers, brainstorming toolkits offer a number of ways to support individuals developing many ideas quickly, and they tend to generate better ideas in groups (Landis et al., 2008). We found some brainstorming toolkits that support organisation of the generated ideas. The more ideas are thrown into the collective ideation process, the higher likelihood of resulting in higher quality, refined ideas (Clayphan et al., 2011; Siangliulue et al., 2015). People employing brainstorming toolkits are more likely to encounter new ideas outside of their collective knowledge, and be challenged by new ways of thinking (Halskov & Dalsgaard, 2007), and foster a more creative culture (Goddard et al., 2014; Kultima, 2015).

On the higher two tiers, brainstorming toolkits impose design constraints to provide guidance. Design constraints can increase focus, and narrow down potential pathways of new ideas (Zook & Riedl, 2013; Kultima et al., 2016). Constraints can produce more interesting game design, and make a better game jam experience (Kultima, 2015). Well-imposed constraints can elicit more gameful outcomes (Goddard et al., 2014). Wild scenarios and improbable boundaries do not obstruct creativity. In fact, they appear to foster creativity and boost “unconventional ways around a problem, perspectives on a story, and fundamentally interesting and novel designs” (Belman et al., 2011).

In short, we have presented our own analysis and synthesis of toolkits that are designed to facilitate brainstorming. In the following section, we will describe our survey study asking about brainstorming activities, an analysis of our findings, and discuss the linkage to idea networks.

### 3.6 Game Jams and Brainstorming

We conducted a survey following one of the world’s largest game jam events, Global Game Jam 2017, held on 20-22 January of that year. As part of the global survey, we asked participants, “Did you use any tools to brainstorm for ideas? If so, how did you use it.” This question was collated with the global survey administered by the Global Game Jam organisers. The survey was made available online to all jammers 3 weeks after the event. Participation in the survey was completely anonymous, and entirely voluntary with no extrinsic rewards. The purpose of the overall survey was to record their experience to improve subsequent game jam events. A list of the Global Game Jam 2017 survey questions is included in Appendix A, however we should note that we only were granted access to responses to Question 13 and 14 for the purpose of this study.
According to the Global Game Jam published statistics, the 2017 event attracted 36,401 jammers across 701 jam sites from 95 countries. 1,925 jammers responded to the Global Game Jam 2017 survey, with a total of 812 jammers responding to our question about brainstorming. The corpus we collected had 17,792 words in total. We encoded for brainstorming techniques, names of brainstorming toolkits and any other tools, websites, collaborative activity descriptions, self-reflections on idea developments, and writing utensils. Survey respondents are referred only by a unique ID number, like ‘5187197465’. For simplicity, we use the last 4 digits of their IDs with a prefix, like ‘P7465’, when quoting responses from specific participants.

To assist with the data analysis, we manually corrected typos in the participants’ recording of tool names, and replaced similar tools with different names by the same name. For example, we considered ‘blackboard’ and ‘whiteboard’ as the same tool in our analysis, since they offer very similar affordances. There were two Japanese and one Portuguese responses translated into English in preparation for the data analysis.

The frequency count, as shown in Figure 3.2, was done by examining the frequency of tool names. Names included frequency of bigrams and trigrams, meaning two or three words appearing side by side, to account for phrases like ‘sticky notes’ and ‘pen and paper’. In our survey results, we were surprised by the amount of improvised stationeries (e.g. pen and paper, whiteboards, blackboards, sticky notes, notebooks, and blank cards, including pencils, markers and other writing utensils) being used in brainstorming activities. Words with little contextual meaning, such as ‘the’, ‘a’, and ‘then’ are excluded from frequency counting. Some jammers reported more than one tool in their responses, in which case we count once for each tool.

474 (58%) out of 812 respondents mentioned traditional stationery. Digital tools account for 63 (7%) out of all counts, mostly found in the long tail. Of great relevance for the design of future toolkits was that many participants reported using both a traditional tool, and also using a digital tool like Trello for assigning to-do lists and keeping track of ideas. This resulted in the total number of tools found being larger than the total number of survey respondents.

A variety of more general tools were used: project management (Trello), writing (Google Docs, Twine), finding inspiration (Pinterest, Flipchart, Spotify, Youtube), communication (Slack, Facebook, Discord), visual development (Photoshop, Piskel, Gimp), and prototyping (Unity, Flash, GameMaker). Real-time collaboration tools like Google Docs and Trello were more popular than the others.

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25 https://globalgamejam.org/history
26 https://trello.com/
Goddard et al. (2014) noted that experienced jammers, especially those already working in the games industry, are familiar with structured brainstorming sessions, and are comfortable with collaborative work using traditional tools. As such, we expected to see many different brainstorming techniques being used in conjunction with these tools.

Mind mapping was the most frequently mentioned brainstorming technique. Jammers reported that they played word association games, drawing links between similar ideas from each team member, or organised their thoughts using mind maps. Three respondents reported that they created mind maps as a group, and linked related ideas together. They primarily used mind maps as a technique to record ideas, and as ideas came in, they are connected with adjacent ideas. P7430 said that their group used “two brainstorming techniques: telling out loudly our ideas, and mind maps.” P1014 wrote that they “listed all the ideas that passed our mind map, and decided to choose from them depending on how fast we could finish them ... and are they even acceptable as a game or not.”
Sketching was reported by 39 respondents. They sketched out ideas visually and shared them with the team. They organised sketched ideas on different papers, or in close proximity to other similar ideas. Two reported that sketching was how they explained their ideas to their teams. P9359 wrote that “a whiteboard and marker were used to write and sketching plans for the game we were making, as well as a checklist for things that needed to be done.” P0981 was specific in describing how they used a blackboard and chalk: “mainly only to explain the concepts, not to organize the ideas.” P7902 also sketched with a similar intent: “whiteboard to list potential ideas, sketching to explain ideas where needed.”

According to Trainer et al. (2016), many people think of sketching as visual design methods, but in brainstorming they are often used as visual aid to explaining what the ideas are about, granting others a shared perspective. Sketching is a ‘low-fi’ activity, suitable for concentrating discussion in structure and feature, less on look and feel of the polished version (Landay & Myers, 1995; Lawson, 2006). Leaving out the details of ‘how’ features are presented, but emphasising what features are available can lead to a more creative discussion (Wong, 1992).

The most reported activity was some form of ‘talking’, by 47 respondents. To better understand what participants labelled as ‘talking’, we looked for other activities mentioned together with ‘talking’. Out of the 47 respondents, 5 of them reported ‘talking out loud’ to each other, engaging in what they commonly label as ‘verbal brainstorming’. 4 reported they talked and talked, and had to reason with each other until they agreed on the details. 12 others reported that they discussed using pen and paper, on the whiteboard, or with sticky notes. P4825 recorded in vivid detail: “[We used] many small 3M cards to write down and collect ideas from every jammer in our team for 10 minutes, and [displayed] them together on whiteboard to talking with [each other], trying to find the most interesting idea that we all want to make.”

Rearranging ideas using sticky notes was a favourite with many jammers. Four respondents reported that they ‘throw ideas on paper’ and passed it to their teammates for feedback. Participants used sticky notes in combination with other techniques like mind maps, and voting for their favourite ideas as a group. P4113 recalled that they “stuck partial ideas on the wall and talking them connecting together and shaping the idea.” P9054 wrote a similar ideation method: “[We wrote] key phrases related to the theme on bits of paper for five minutes. [At the end, we compared] with fellow group members to see which things we have in common that can be the core of our game idea.”
3.7 Idea Associations in Brainstorming Activities

As previously noted in Section 2.1, ideas are associative by nature. Brainstorming activities leverage that nature to expand the possibilities of ideas. Associated ideas can be connected by their sources of inspiration that acts as a supporting structure, aiding comprehension and organisation of thinking. In this section, we will briefly discuss the relationship between brainstorming and idea networks, drawing from findings of the two studies presented in this paper.

Through design affordances of brainstorming toolkits, we observed some of the ways ideas are structured in brainstorming activities. First, there is the wild combinatorial nature of clashing two ideas together, enabled by generating affordance of brainstorming. Second, ideas can be progressively developed by transforming them, such as reversing roles, exaggerating effects, or negating it for opposite effect as seen in S.C.A.M.P.E.R. Third, mind mapping supports the associative structure of ideas by visualising the core idea, and its related offsprings, and offering a useful way to organise them. Fourth, post-it notes can be rearranged to bring closer ideas together into clusters, labelling them under the same category. All of the above affordances assist team members in developing a networked structure of combinatorial ideas that can be understood by everyone else.

The four affordance tiers of brainstorming toolkits we proposed in Section 3.5 do not directly contribute to the question of idea associations. Brainstorming toolkits are designed for idea generation, and supporting the way collaborative idea generations work. Rather, this paper shows that design affordances of brainstorming toolkits align with the associative nature of ideas. The goal for the four affordance tiers of brainstorming toolkits is to inform design and reuse. Readers interested in using a brainstorming toolkit for brainstorming activities can be better educated by the varying complexity of functions the toolkits provide. Designers interested in creating new brainstorming toolkits can take away the fundamental understandings in their support functions.

In Section 3.6, we reported the tools used, and the ways ideas are organised during brainstorming activities that took place at Global Game Jam 2017. We saw jammers favouring traditional stationeries for brainstorming, for their flexibility and simplicity of use. However, we speculate that the short (48 hours) nature of the event meant that jammers may favour tools that everyone involved is familiar with, which may exclude more complex toolkits and frameworks. Another reason may be that participants were not aware of commercial or free brainstorming toolkits available to them. A third reason
may be that the overhead of teaching another team member a new brainstorming activity is too high for most teams. This is not a critique of more high-fidelity tools, but rather a reflection of technology and tool adoption at game jams. We acknowledge the limitation of our survey methods, and this may be investigated further in a future work.

The results indicate that there is a low adoption rate for brainstorming toolkits. Existing literature has focused on how brainstorming toolkits can empower game design (Flanagan et al., 2005; Kultima et al., 2008; Lucero & Arrasvuori, 2010; Belman et al., 2011; Kultima & Alha, 2011; Lucero & Arrasvuori, 2013; Mueller et al., 2014), but we could not find research about a low adoption rate of brainstorming toolkits. This highlights a gap in existing literature and provides opportunities for further research investigating the barriers for the adoption of brainstorming toolkits.

3.8 Limitations

We presented two studies into how ideas association structures can be conceptualised using brainstorming activities. This paper is a preliminary work to show that idea associations form naturally from where they are conceived. Our work is non-exhaustive, and is drawn from brainstorming activities oriented around game development. Examination of idea associations still remain an open research area.

Both of our studies are on a relatively small scale, and may not reflect the actual brainstorming toolkits affordances and the game jam population. We only surveyed 21 toolkits related to game development, noting that there are hundreds of tools out there for brainstorming generally. Our Global Game Jam sample of 812 (2.2%) out of the total 36,401 participants covers a small percentage. We may have missed the population who employed brainstorming toolkits in practice.

3.9 Conclusion

We presented two studies on brainstorming toolkits and brainstorming activities to examine their design affordances and constraints to support collaborative ideation, and the nature of idea association. In the first study, we surveyed 21 brainstorming toolkits appropriate for generating new game designs, and from the findings we proposed four tiers of design affordances for brainstorming toolkits, ranked by their complexity and function. We listed each brainstorming toolkit in the corresponding tiers, and drew from the literature to support their affordances. These tiers of design affordance can inform others in choosing existing brainstorming toolkits, and designing new ones.

In the second study, we conducted a post-event survey in Global Game Jam 2017, asking jammers about their brainstorming tools, activities, and how they used the tools.
in the activities. The results show a high adoption in simple stationery, like pen and paper, which indicates a low adoption in brainstorming toolkits specifically designed for idea generation activities. Nonetheless, we observed many hybrid use of tools together with stationery combined with collaborative technologies like Trello and Google Docs, signalling a need for generic idea sharing and arrangement platforms.

We discussed how these brainstorming toolkits and activities are related to the associative nature of ideas. Idea association structures are critical for defining, understanding, exploring, and creating new ideas in the existing landscape, because these structures are designed to aid comprehension and the support of thought. Research of idea associations and their structures remain an open problem. Our findings frame a new understanding about brainstorming not just as a process, but as a generative and organisational activity that leverages and supports idea associations to create networks of new ideas.
Intrinsic Drives for Game Jam Participants

Preamble

In the previous chapter I examined brainstorming toolkits and their affordances surrounding collaborative game design. This chapter examines the intrinsic (i.e. within self) motivations of game jam participants, or jammers. It draws from both psychology studies literature, primarily Thrash and Elliot (2004), and from game studies literature through studies of why people make games. I developed an intrinsic motivation model based on the theories of inspiration, reward salience, and expert attainment. To test the model, I observed two other game jams and recruited 20 participants there. In the survey and interviews, I asked about ideas they came up with, works referenced for inspiration, and if there are other similar works, encoding their responses with the model.

This chapter was included in the thesis because it informed and grounded idea networks in a game development context for subsequent chapters. By itself, it is a weak model because of the limited sample I accessed to encode and devise the model. The limitations are described before the conclusion of this chapter. Nonetheless, it was still useful as a bridging chapter to understand the intrinsic motivations for making games, to give a more holistic understanding of game design inspirations.

In Section 4.1, I give an overview of existing game jam literature, justifying the need for qualitative methods for this chapter. In Section 4.2, I describe three alternative theories for modelling intrinsic motivations, and then describe how my model serves a different need. Section 4.3 outlines the research method and the encoding process for testing the proposed model. Section 4.4 reports what the study observed, namely abstraction, prototyping, and iterative development. Section 4.5 formally introduces the proposed model, demonstrating their synergy with the encoding process. Section 4.6 concludes this chapter with a review and summary.

This chapter is published as “The Enlightened Jammer: Intrinsic Drives for Game Jam Participations”, in Proceedings of the DiGRA Australia National Conference, Melbourne, 2016. Parts of this chapter were adopted from what was originally in Chapter 5 for better readability and content bridging.
Abstract

We present a qualitative model which can be used to encode open-question data gathered from game jam participations. Previously, the literature has focused on aggregated quantitative results, which left a gap in qualitative research, in particular methods for understanding game jam participations. Our model that we call ‘enlightened jammer’ comprises three pillars of intrinsic drives: inspiration, reward salience, and the mode of deliberate practice. From the three pillars we form nine attributes, which can be used to encode game jam questionnaires, interviews and self-reported surveys. In this paper we outline the motivations for a qualitative model, disseminate the nine attributes, and discuss our observations after encoding questionnaires from participants in two game jams. Additionally, we propose a set of seven archetypes summarised by the enlightened jammer model for understanding game jam participatory patterns.

4.1 Introduction

Game jams have become a worldwide phenomenon. The time-limited format makes them suitable to experiment with novel game ideas at very little risk, and they have proved to be quality environments to meet like-minded game developers from all ranges of experience (Pirker et al., 2016). For similar reasons, game jams make popular scenarios for research opportunities, including learning about the software prototyping process (Musil et al., 2010), constructing a playful learning environment (Goddard et al., 2014), and facilitate locations for research through design (Deen et al., 2014).

Previous scholarly works related to game jams participation and motivation have a focus on demographic data and background. Reng et al. (2013) reported a high number of participants in Nordic Game Jam who would return the coming year, the reason being that they love to meet people with similar interests and skills, exchange ideas, and work with them to produce games that feel refreshing. Zook and Riedl (2013) examined Global Game Jam participants with a goal-driven lens, which they divided into personal, player-oriented, and system level goals. Their participants expressed a vested interest in making games for the sake of making games, trying new mechanics, and doing it for the player enjoyment. Steinke et al. (2016) linked motivation with the age of participants, and found the highest two factors were to have fun, and to network with others. In addition to networking, Fowler (2016) also found that game jams serve as an excellent environment for stimulated learning, which has a strong synergy with Pirker et al.’s (2016) results, as game jams used for practicing the process of prototyping. However, the current literature on game jams largely report qualitative aggregations of skill ratings,
background knowledge and experience. There is a significant research opportunity in using qualitative methods specifically designed for encoding individualistic motivations in game jams, in which this inquiry is an attempt.

Game designers often conform their work into an established genre in the market, such as a ‘first-person shooter’ or a ‘side-scrolling platformer’, and borrow familiar elements from other games, real-life activities, or historical events (Hagen, 2009). A study in a previous Global Game Jam found that primary source of inspiration came from the theme, popular gameplay mechanics, other videogames, and game genres (Zook & Riedl, 2013). Hagen (2012) coined the term lodestars27 to describe the ‘designed player experience’, the collection of typical mechanics and the desired set of challenges in game design. In Hagen’s view, game design can be seen as a combination of recycled ideas, and this process of recycling is to take a group of lodestars into the game design, toss out the ones that don’t fit, and bring in new lodestars until the game design is complete.

We first proposed a pilot model at the First Joint International Conference of Digital Games Research Association and Foundation of Digital Games (DiGRA-FDG) panel. The model was well received by the panel audience. In this paper, we discuss an initial analysis using the model on two post-game-jam questionnaires, and present the complete description of the qualitative model that we call the enlightened jammer.

4.2 The Enlightened Jammer Model

In constructing the enlightened jammer, we focused on the jammer themselves as we are interested in their perceived intrinsic drives. There are other adequate theories worth examination as alternative models, we should note: the self-determination theory (Ryan & Deci, 2000), intrinsic and extrinsic motivations (Benabou & Tirole, 2003), or from a pedagogical perspective, the effects of collaborative learning (Dillenbourg, 1999).

Ryan and Deci construct a spectrum of motivation levels, from not motivated, extrinsically motivated, to intrinsically motivated. It builds on the concept of social and personal well-being, asserting that an intrinsically motivated individual is ranked the highest. Benabou and Tirole discuss the contrasted concepts of intrinsic and extrinsic motivation with a hidden cost, using economical perspectives to measure their effectiveness. Both of these models are well-equipped to measure the levels of motivations, the rewards that drive them, and their potential impacts on individuals.

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27 Previously at DiGRA Australia, our submission used an incorrect term, ‘lodestone’. The authors regret making that error and have made the amendment in this chapter.

However, we argue that they are ill-suited to discuss the horizontal spectrum of individual temporal, emotional, and practical reflections. We want to closely examine the intrinsic part of the motivation model, connecting actions, reactions, and the specific context for them. Especially when these actions in context describe themselves in the present and past tenses, the feelings evoked throughout are all crucial to register motivation. Dillenbourg observed on the positive impact of collaborative learning, which can be adapted as an extra pillar of the enlightened jammer model. Yet, our dataset in the study, as we will describe in the next section, comprises solely of many individuals’ self-reported responses, and are not suited to examine the impacts of collaborative learning as a whole.

We pose the research question, ‘what intrinsic drive do individuals possess for attending game jams?’ in particular individual intrinsic drives. Our line of inquiry is formed on the basis of prior experience, reward-driven motivations and self-confidence affected by individual personalities, i.e. inspirational attributes (Thrash & Elliot, 2003), reward salience (Thrash & Elliot, 2004), and the mode of deliberate practice for expert attainment (Ericsson et al., 1993). We refer to these three intrinsic drives as the three pillars of the enlightened jammer.

Game jams support as well as require room for much creativity in their development, usually surrounding a consistent theme through the jam provided by the organisers. These themes, combined with participants’ existing ideas and exchanging their insights, are the key activities of inspiration as described by Thrash and Elliot (2003; 2004) from the psychology studies. Inspiration can also be evoked by nostalgia, which increased self-reported motivation levels (Stephan et al., 2015). Thrash and Elliot went on to suggest that a second key player of motivation is the vision of attainable objectives and goals. As goals become much clearer, they feel easier to do, and pose less friction on motivating people to do them. Indeed, the inner thought of ‘I can do this’ and its following actions are one kind of observations of jammers seeing attainable goals. Lastly, by proxy the virtue of attending game jams is a type of practice. We see recurring attendances as a type of deliberate practice, facilitating an environment for building participants’ existing skills and knowledge to develop their games.

For research in game jam contexts, Turner et al. (2013) reported that their game jams have since offered amateur, ‘semi-professional’, and professional leagues to tailor for the differences in skill levels. They also provide assistance in cross-learning within the leagues themselves, as well as across leagues. Many studies on game jams focused on the potential for better learning outcomes. Preston et al. (2012) found that jammers on average have better academic performance than non-jammers, and that attending game
jams are perceived as beneficial for improving skills, which also corresponds to Fowler et al.’s (2013b) finding. Reng et al. (2013) described game jams as “an important learning space with characteristics known from communities of practice.” Scholars agree that game jams are a great environment for learning the process of game development as a team. In short, with inspiration, reward salience, and a healthy dose of self-prescribed deliberate practice come the enlightened jammer.

The enlightened jammer inquiry model comprises a set of basic assumptions of why game jam participants attend game jams. It can be employed on a number of qualitative results, such as free-text response surveys, interviews, and self-reported questionnaires. To answer our research question, we construct from the three pillars a series of nine attribute-based lenses, which then can be used to encode responses and test our assumptions. They are:

- **Transcendence**: attendees have a vision they want to achieve, which may be acquired before or during the jam;
- **Evocation**: attendees are driven by an external influence to participate, such as social or personal factors;
- **Motivation**: attendees have pre-existing internal reasons for participating, which could be found before or during the jam;
- **Extraversion**: the extent of willingness attendees exhibit to approach a new idea, not to be confused by the extraversion versus introversion personality spectrum;
• **Positive emotionality**: the degree of positivity attendees exhibit when approached by new ideas, which can affect them to take different actions, especially in a team;

• **Impulsivity**: the varying amount of time attendees spend before trying out new ideas, and how often they approach them and how long (or short) ideas stay in the prototyping process;

• **Attendance**: the frequency of game jam attendances, referring to returning attendees and their perceived impact of attending game jams on their careers;

• **Pre-existing knowledge**: the breadth and depth of skills, insight and practiced methods attendees bring to the table when participating in a time-limited event;

• **Immediate feedback**: the feedback loop that occurs frequently during a game jam, especially when a team is open for playtesting, and the new insight they obtain for trying different things.

### 4.3 Game Jam Questionnaire Encoding

To test these nine attributes about the enlightened jammer, we conducted two studies with the participants of two Hectic Games Jams, nowadays known as North Shore Institute (NSI) game jam, which are both 48-hour game jams that took place over weekends. The game jam originated from two game design graduates who wanted to bring game jams into their local institution, and ran game jams on a regular basis. They had the school’s support, and funded themselves for the most part. The two game jams were three months apart, and saw roughly half returning participants. All participants received a link to fill out an online survey at the end of the jam, and were encouraged to respond before they leave the site. For those who left early, we opened the survey for two weeks after each jam. From both events we received 20 (out of approximately 60 jammers) self-reported questionnaire responses, discarding incomplete responses, and conducted two individual interviews with participants who indicated interest in a follow up session. The questionnaire is designed to focus on the game jam games, and not about the participants themselves. We wanted to take a reflective approach by asking the participants to recall what it was like to work on the games, the ideas they exchanged, and the paths they entered to complete the jam. We also asked if the game itself had any similarities with existing commercial games. Finally, there was an open question for anything the participant would like to share in the questionnaire.

After we received questionnaire results, they were encoded with the enlightened jammer model. The process is as follows. For inspiration, we looked for external influences (transcendance, motivation, and evocation), explicit game ideas or ideologies, and specific game mechanics or genre influenced the participants borrowed in
(transmissions of ideas, see Thrash & Elliot, 2004). For reward salience, we looked for expressed desires (impulsivity and extraversion), strong feelings—both positive and negative—piqued by accomplishments (positive emotionality), and self reflections that indicated visions of attainable goals (manifests of reward salience). For deliberate practice, we sought after explicit actions taken during the jam (practice-in-attendance), any mentions of tools or assets used (existing knowledge), and the insight, knowledge gained and also feelings they felt during development (immediate feedback). In instances where multiple encodings may apply, actions have more weight than ideas, as they are physical manifestations that have taken place. We then choose the most appropriate encoding. The actual process of encoding itself was done by highlighting phrases in three different colours, one for each main category. We chose green for inspiration, red for reward salience, and blue for deliberate practice. Our encoded document from the study is shown in Figure 4.2.

4.4 Observations From Game Jams

In this section, we highlight two common observations and one notable response that were recorded in our questionnaire, showing similar themes and variations of activities game jam participants got into. In the next section, we will take a look at the occurrence (or the lack of) each pillar of the enlightened jammer, and propose a set of seven archetypes that may grant some insight into understanding different participation patterns. The highlights in our observations are:

Figure 4.2: Screenshot of our questionnaire summary at the end of the encoding process

**Observation: clash of abstract ideas.** We asked the question, ‘what kind of idea did your team come up with?’ Participant 9 from Hectic Games Jam #2 told us their secret combo:
“... I like the idea of the flying whale because it seemed so illogical, and I liked the idea of the mimic because the enemy was pretty scary. I really enjoyed creating the level as well, I think it ended up being more interesting than just a tile based level or one generated procedurally.”

They are not the only participant to combine two ideas (flying whale and mimic) into one game design concept. In fact, nearly every participant answered that they took the one idea and something completely different and wild, and put them together in the same game. Some participants took more logical steps to ensure their idea combinations would make more sense. Perhaps due to the limited time in game jams, and the general little consequence of releasing a game jam game, participants are more likely to try out unique combinations of themes and objects.

Observation: prototyping with new ideas. We asked ‘are there games out there that are similar to [your game]?’ Most people did, including Participant 6 from Hectic Games Jam #1 described their idea:

“The game can be seen to be quite similar to a classic kind of hill defense game. But due to the game mechanics of being able to throw balls at a wall / touch the wall to kill enemies it made it unique. The style / story and characters I was going for something unique so tried out a new style and utilized pixel art and digital painting in photoshop.”

As expected, everyone was able to name at least a couple of games that are similar to the game they made. What was interesting was that not only participants named the games or mechanics that were similar and how similar, but also they were indirectly prompted to justify and say how their game was unique. In this case, the physical interaction of throwing a ball made a hill defense game unique. We were able to learn both the similarity and dissimilarity of their games from the response.

Observation: iterative game development. This excerpt came from the ‘what else would you like to tell us more about your game’ question. Participant 11 at Hectic Games Jam #1 said:

“... due to time constraints [my game] became a single (very hard) boss battle. ... Developing it was really satisfying ... So then when I got people to playtest it... they gave me feedback. I would fix that and show it to them again until that feature was as close as perfect as it could.”

This was noted because out of the twenty participants they were the only one to report that they had time to playtest their designs, and for iterating from feedback. Most other participants expressed that the lack of time was a major factor, and ‘running out of time’ was frequently seen throughout the questionnaires. This particular participant was
more experienced and had published games in the past, and they were able to make time for playtesting and polishing their game.

4.5 Patterns and Jammer Archetypes

In the second section of our discussion, we propose a set of seven archetypes for the jammers. Archetypes are useful for initially understanding what an individual potentially might be like, and is good at painting broad strokes. We synthesised our observations into the following archetypes, which can be utilised for comparison analyses for studies in other game jams or similar events. These archetypes may also be deployed to encourage participation and develop new skills in game jams, such as teaming up with different archetypes, or use them to fill in gaps. We present the three pillars of the enlightened jammer with our colour-coded shorthands: green (G) for inspiration, red (R) for reward salience, and blue (B) for deliberate practice. Each one of the seven archetypes is described by one or more recorded instances of encoding.

- **Idea generator:** G only. Idea generators go through many ideas, but either do not yet possess the determination to see them through, or lack the skills to complete them in time. They seem to enjoy trying out different things. They also tend to be jammers new to the whole thing, or students coming to the jam.

- **Optimistic visionary:** R only. Optimistic visionaries feel more strongly about the game jam, and their recollections tend to surround different visions of the games they had, and the achievements they reached. They are often driven by external rewards like completing a milestone they came up with during the development process. They tend to be students and learners.

- **Practical developer:** B only. Practical developers like to talk about what they tried, what didn’t work, and what worked well in the end. They follow a set of routine that have already been established by past attempts, and they tend to be programmers.

- **Idea producer:** G and R. Idea producers appear to be much experienced idea generators, and they have the vision and feel to go with it. They often discuss their ideas in unexpected ways, and they like to talk about personal bugbears and what to avoid in their game idea. They tend to be experienced jammers.

- **Experienced developer:** G and B. Experienced developers have many ideas accumulated in their brain and on paper, and they are more likely to have made games in the past. They are usually specialists in a team, such as artists and musicians, and some programmers too. They can talk about not only what didn’t work and what worked, but also speculate what might not have worked if they had tried it, and what may have worked if they did try something else.
- **Prototype explorer:** R and B. Prototype explorers are not afraid of trying new things. They act fast and fail fast, discarding away ideas that did not work. They often report iterative development and express the reasons they think why something did not work out, and what they tried instead. They tend to be generalists.

- **Enlightened jammer:** R, G and B. Enlightened jammer have built up practical experience from the past, came with ideas fully loaded and may brainstorm more of them. They like to talk about what they really want to do in the future. Enlightened jammers tend to exhibit mentor-like personalities, likely to be the most experienced person on the team, and they can tackle a speciality that they are good at while helping others out.

These seven archetypes should be used with a caveat in that they may be overly general, as they are derived from a limited set of 20 participants’ responses. We propose them here for three reflected implications and for discussion. First, the model may be useful to group jammers who are from different archetypes, so that their personality may complement each other in different strengths.29 Second, we noticed each participant has their own routine, of how to do things. When they are stuck, it could be useful to propose in the direction of a pillar that they haven’t exhibited strongly yet. Lastly, we would like to note that an enlightened jammer is not necessary an expert in game development, but someone who has implemented ideas, can speculate accurately which paths will likely lead to a finished and playable game jam build, and someone who can and likes to mentor others in the jam. All in all, These archetypes exhibit different intrinsic drives (e.g. exploring prototypes and new ideas, versus focusing on the production of the game) for participating in game jams, and they can resonate or complement each other well.

### 4.6 Conclusion

In closing, we have presented a qualitative model that we call enlightened jammer. The model comprises three pillars of intrinsic drives: inspiration, such as novel ideas and borrowed concepts; reward salience, the state of mindset that tells them ‘I can do it’; and someone who frequently attend game jams and other game development activities, someone who practices deliberately to improve their own skills and learn new things. Out of these three pillars we listed nine attributes that describe the enlightened jammer, and seven archetypes derived from encoding self-reported questionnaires completed after game jams. We found that enlightened jammers are not only more likely to be experienced in game development, but also are more likely to mentor and help others.

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29 Especially if they are attending their first game jam.
We hope the model will serve as a useful tool for future scholars to study intrinsic drives for participating in game jams, and their effects on the overall results.
Conceptualising Idea Networks in Game Design

Preamble
In this chapter, I formulate a process to construct an idea network based on the jammers’ descriptions of their ideas. My construction method is akin to Metcalfe’s idea networking (2007), but with a distinction. Metcalfe’s method is focused on problem framing, whereas my method is grounded to identify idea relationships. The idea network visualisation was handcrafted, inspired by the late American artist, Mark Lombardi, who employed arcs with strong aesthetic quality and high readability. The core concept of this chapter is to apply “systems thinking”, or “thinking with networks”, to ideas, and their relationships with each other.

To reiterate the definitions given in Chapter 2, ideas are treated as an observable outcome of a creative process, such as an element of game design, a game as a whole, a borrowed mechanic, a particular motivation or reasoning behind a design, and so on. They are observed through the creation process of the game jam. As game jam games are not commercialised at the start, I was only working with influences from the ideation point of view, as well as their connections to the overall game jam theme. The next two chapters broaden the definition of idea networks into commercial games in the roguelike genre, which allows me to draw from concrete design influences documented in interviews and online resources.

In Section 5.1, I lay out the scope of the chapter using a discussion on the moment of inspiration, clearly defining the research interest. Section 5.2 explores the theory of inspiration, alluding to a conceptualisation of idea networks. Section 5.3 examines the intersection of game jam research and idea networks, illustrating the interest and need for this research activity. In Section 5.4, I describe the research aim and method, grounding the analysis by the survey data, and listing the idea relationships I observed. Section 5.5 presents the findings as a Lombardi-style idea network visualisation, and lists the principles for designing the visualisation. Section 5.6 follows the presented idea network visualisation to discuss idea clusters, giving a summary of the idea network. In Section 5.7, I discuss some of the limitations of my method, how they might be overcome,
and talk about what I learned from designing this idea network. Section 5.8 concludes the chapter with a brief summary, and hints at potential future works.

This chapter answers RQ1, “What are the structures of idea networks relating to shared influences?” and RQ2, “What significant properties can we observe from the structure of idea networks?” It explores a corpus of ideas from Global Game Jam 2014 to formulate an idea network, noting its structures and significant properties. The process of research through design generates design implications that resolve these research questions. Specifically, this chapter frames ideas as a connected corpus, and through that lens we have an initial understanding of what insights idea networks may bring to designers.

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\(^{30}\) The original paper coined the synonym and term, “inspiration network”. For a consistent reading experience of this thesis, I replaced it with a newer term, “idea network”.

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Abstract

This paper examines the concept of inspiration and proposes a design process for idea networks using survey data from Global Game Jam. Global Game Jam is a 48-hour game development event that invites anyone to participate worldwide. The study illuminates the presence of the famous ‘six degrees of separation’ effect in these idea networks, leveraged to model ideations as related concepts, identifying four major lodestars. It follows research through design, embodying the body of knowledge in the idea network as a design artefact. Idea networks offer a novel way to discover game genres that have not yet been formally recognised, but have displayed a large influence. The findings offer three design implications: an understanding gained by “thinking with networks”, the ability to identify emerging game genres, and the support for intuitive, visual browsing of ideas. Formalisation of idea network poses an open field for research.

5.1 Introduction

Creation of new ideas has been described under many synonyms and related case studies: the ‘aha!’ moment (Gruber, 1981), insightful problem solving (Metcalfe & Wiebe, 1987), incubation (Smith & Blankenship, 1989), and stroke of insight (Taylor, 2006), to list a few. Vandenbosch et al. (2001) provide a summary of different theories. It’s notable that all theorists agree good ideas could come to us at any moment. To find the optimal moment for good ideas, Csikszentmihályi and LeFevre (1989) proposed their theory of flow, which suggests we perform at an optimal level when the tasks at hand require a certain degree of skills and provide an ample challenge.

Crites (1971, p. 291) remarked in his article, The Narrative Quality of Experience, “the forms of cultural expression are not historical accidents.” The way people speak and the choice of diction are always linked with cultural context, the time and the place from which the language was expressed. In that premise, game development and game culture are no exception to Crites’ observation. Genre is the style of expression; mechanisms, the dictionary. Since cultural change is gradual and combinatorial in nature (Popova, 2011), ideas are reused, combined, adapted, remixed, twisted, flipped, and perhaps another hundred more ways (see Jenkins et al., 2018). Just as modern science builds on existing knowledge and theorems, human creativity, too, builds upon inspiring ideas to fashion.

This article explores game design ideas generated from brainstorming activities. It is not a theoretical piece on why ideas exist (e.g. Ronald et al., 2010), nor how ideas are generated (e.g. Tschang and Szczypula, 2006; Hagen, 2009, 2010; Kultima & Alha, 2011), but what ideas are created, used, and how they are connected by their source of
inspiration. We pose the research question, “What are idea networks in game design?” and specifically, “What idea networks can be found in Global Game Jam?”

The theoretical basis is that there are no truly original game designs. We do not mean that no designs are novel, but states that no designs or design ideas are wholly original, which is to say they must have an origin of inspiration. If an idea is truly original, there would be no familiar ground or indication for communicating the idea, alienating its audience in the process. Hence, an idea must be inspired: there must be an external source of illumination, beyond the self (Thrash & Elliot, 2003). In the sense “everything is a remix” (Ferguson, 2011), we see that ideas are reused, combined, connected. We think of ideas as a connected network.

Game jams have become popular. A community-driven database shows that at least five game jams are on concurrently worldwide. Some jams run on a regular basis. For example, Ludum Dare (Latin meaning “to give a game”) runs in April, August and December each year. Oh Game Jam, an online game jam that has no rules, ran annually until 2017. Global Game Jam, which our study draws its data from, takes place each January. Game jams are usually guided by a central theme. Competing teams have to make games from start to finish within a time frame. One Game A Month events runs every month for the whole month. For Global Game Jam, the time limit is 48 hours.

Due to the short nature of Global Game Jam, games that come out of it are usually simple prototypes with a single focus. This makes them ideal for accessing a clear picture of creators’ brainstorming and design processes. However simple games may be, game design is a multidisciplinary craft, including (usually all of) visual art, computer programming, sound design, and gameplay design (Preston et al., 2012, p. 59). In order to work with these skill sets, game jam participants must make quick decisions efficiently and effectively in the game jam. Participants often work in a waterfall fashion (Arya et al., 2013, p. 37), which is to say jammers have little time for design iterations. Ideas are sometimes generated quickly using experimental toolkits with observed learning outcomes (e.g. Kultima et al., 2008; Kultima & Alha, 2011).

The evolution of culture is an ever-turning wheel; no human decisions or actions will stop it from turning. Human activities motivate only its direction. We laid out our research interest in the nature of idea evolution and how that can be applied to game studies. In the following section, we will describe the implicit assumption underlined in

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31 In the original published paper, I pointed the reader to CompoHub, but it has since become defunct. The most popular community-maintained website that hosts a timeline graph of what is on the calendar is now at itch.io (https://itch.io/jams).

32 Clicking on “rules” on the Oh Game Jam website shows “fuck rules”.
the connectivity of ideas, the diverse sources of inspiration, and the phenomenal small-world effect (Watts & Strogatz, 1998). The section after documents our research methodology to examine Global Game Jam design inspiration, and a section following with findings and implications for discussion.

5.2 The Implicit Idea Network

In the timeless piece, *Music and Moonlight*, Sir Arthur O'Shaughnessy captured the concept of inspiration beautifully (revised with modern punctuations):

“A breath of our inspiration is the life of each generation: a wondrous thing of our dreaming—unearthly, impossible seeming. The soldier, the king and the peasant are working together in one, till our dream shall become their present, and their work in the world be done.”(O'Shaughnessy, 1874, pp. 2-3)

The definition of inspiration has not changed much for over a century. The English word ‘inspiration’ originally meant to take in “divine guidance”. It stemmed from Old Latin *inspirare*, meaning “to breathe in” (Harper, n.d.). In modern English, getting inspired can mean having a “sudden brilliant or timely idea” (Oxford Dictionaries, 2013).

We coin the term *idea network* as a cluster of connected ideas with similar sources of inspiration. A network is a set of nodes with links that connect them. Because networks can be very heavily connected, they are sometimes called complex networks. Complex networks have been used to model citation networks (Garfield, 1955; Price, 1965; Hummon & Doreian, 1989; Vazquez, 2001; Albert & Barabási, 2002, p. 7), blogospheres (Adar & Zhang, 2004), design networks (Eckert & Stacey, 2000; Grace, 2011, p. 19), Wikipedia networks (Schönhofen, 2006; Zlatić et al., 2006; Brandes et al., 2009; Massa, 2011; Aragon et al., 2012) and births and deaths (Schich et al., 2014), to name a small percentage of the works available.

The concept of an idea network can be traced back to Garfield’s (1955) citation network. It was first proposed to ease the search of previously published literature and provide a critical system to rank the value of contributions. One decade later, Price (1965) showed that citation networks could be used to catalogue journals and classify research papers. Many researchers followed citation networks. Hummon and Doreian (1989) investigated the formation of the DNA theory and identified the critical path of theory coming into existence. They did so by constructing citation networks on 40 of the most cited papers. Adar and Zhang (2004) used hyperlinks in blog posts to construct a network around blogospheres and used their data to derive a ranking system. It is worth noting that half a century since its birth, Garfield’s pioneering work in 1955 was reprinted in

Around that time, online platforms attracted much attention in using networks as a model for research. *Wikipedia* provided implicit networks of collaborative authorship in different languages (e.g. Zlatić et al., 2006; Brandes et al., 2009), allowing scholars to identify authors’ social structures (e.g. Massa, 2011; Aragon et al., 2012). These implicit networks are not artificial but naturally occurring (Adar & Zhang, 2004). In contrast, *LinkedIn*’s professional networks and *Facebook*’s friendship graphs are explicit networks, connecting profiles in a system. A network snapshot is static, whereas a changing network over a period of time is considered as dynamic or temporal (Schich et al., 2014).

Thrash and Elliot (2003) painted the theory of inspiration with three characteristics: transcendence, motivation, and evocation. Transcendence describes the event in which we see a better vision of what is possible, but does not yet exist. Motivation illustrates the aspiring momentum, a feeling that drives us to do something new. Evocation depicts the action we take as a result of being inspired, and that inspiration must be external, beyond the self. Thrash and Elliot (2004, p. 958) followed up to define the nature of inspiration as a transmission of ideas. There has to be source of inspiration (“being inspired by”) and a destination (“inspire to do”).

The transmission of knowledge is the implicit link in an idea network. With a sufficient selection of ideas, we can see a small network forming, an evolution of ideas taking place. Through social extensions we may observe the famous ‘small-world network’ theory, made popular by the film *Six Degrees of Separation* (Guare, 1990; Watts & Strogatz, 1998). The theory states that if we know someone who knows someone else, who knows someone else, and so on, the furthest distance of social connections on average is six. Since ideas are constantly being shared between individuals, we argue that idea networks must also be part of the small-world phenomena, and the findings should present small clusters of ideas.

An idea network is an epistemology model with two elements: an idea (or a manifest thereof) and a link that describes knowledge transmission taking place. Elements can be textual, such as the *Global Game Jam* survey data used in this study, but idea networks can be extended to encompass pictorial, aural and other records. We borrow Vandenbosch et al.’s (2001, p. 109) systematic definition, a “concept or plan formed by mental effort” to describe an idea. In addition, we also consider an idea manifest, such as a game, also as an idea, since the manifestation often embodies the idea itself. They can be physical, lately in more digital and virtual forms. As designer Chimero (2012, p. 50) wrote, a design artefact “is often a physical form, such as a poster, brochure, pottery, painting, or sonnet,
but also includes the choices that alter a work’s context and placement. Increasingly, [artefacts] are becoming less physical, and may take the form of an application, website, or even an experience.”

Metcalfe (2007) explored the construction of connected ideas extensively in his work. In order to aggregate responses from ethnographic data, he organised the data into affinity diagrams, which are groups of notes that share a topic (see Beyer & Holtzblatt, 1999) and drew links intuitively between affinity groups to form a problem network. He framed the problem space using that network, noting the ‘six degrees of separation’ small clusters. He does not specify how he drew the connections, except using a designer’s intuition, but remarked the problem network “needs to be about 10–15% of connections compared to nodes, else the resulting network becomes too cluttered” (2007, p. 146).

Hagen (2009) examined 25 games published in Sweden in the first decade of the 21st century to find out which parts are “recycled” in these games. He found idea recycling from the same domain (e.g. from games in the same genre or from the genre itself), from narrative and visual art (e.g. films and books), from human activities (e.g. competitive sports or playful events), and from technology and artifacts (e.g. academic research and experimental prototypes). However combined, innovation tends to happen when the source of inspiration is borrowed from a more distant domain than the more dominant one. In some cases, the compounded ideas could turn out to be more effective than the sum of its parts (Tschang & Szczypula, 2006).

5.3 Global Game Jamming

Turner et al. (2013, p. 1) praised game jams to have “become an important rite of passage and baptism event, an exploration space and a central indie lifestyle affirmation and community event.” To Turner et al., game designers are artists who create works, or games, whose focus is not about the commercialisation of the outcome, but the process of experiencing the creation of a game in a social context. Other motivations exist as well, including learning a new tool (Fowler et al., 2013b), collaborate in a team environment for self-improvement (Preston et al., 2012), or to be plain, “Getting a chance to make a game with other awesome people in a very short time” (Reng et al., 2013).

Yamane (2013) examined one of Japan’s Global Game Jam site and found the promotion of prototyping was a strong motivation for participants to try it out. The 48-hour duration of game jams fosters quick thinking and decision making, and often the best way to evaluate a decision is to make it and find out. This kind of learning by design practice echoes El-Nasr and Smith’s (2006) suggestion that modifying, or modding a game
could produce positive learning outcomes. In other words, implemented ideas are favoured over ideas that are merely present on paper.

An inspiration connects in new ideas, and the types of connection of ideas are plentiful. Observed connections from the survey are displayed in Table 5.1. In this process, it is crucial to have an open mind, to think of idea connections as a diverse event and experience that could come in any flavour, and broadening the possibility of new discovery. To adapt these concepts with a domain, for example, game design, we considered both the type of event and the type of ideas. “Making a voxel sandbox game like Minecraft” could be a ‘genre assimilation’, for instance, and “porting our shooter game from PC into mobile touch screens” could be ‘title translation’.

<table>
<thead>
<tr>
<th>Idea connection</th>
<th>Example observation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Similar Origins</strong></td>
<td>“Most teams, including mine, ended up boiling the theme down to the idea of ‘perspective’” [P1695].</td>
</tr>
<tr>
<td><strong>Assimilation</strong></td>
<td>“It’s very similar to the game that won [another competition]” [P99].</td>
</tr>
<tr>
<td><strong>Reference</strong></td>
<td>“Like American McGee’s take on Alice, Through the Looking Glass reinterpreted the tropes of Mario from the perspective of a drug addict . . .” [P1488].</td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td>“The idea . . . started forming naturally along the way, and before we knew it we were all talking about [the same idea] . . .” [P1291].</td>
</tr>
<tr>
<td><strong>Evocation</strong></td>
<td>“I just built a game I wanted to play” [P603].</td>
</tr>
<tr>
<td><strong>Transcendence</strong></td>
<td>“New idea came up when another member joined that had much more sense with theme of jam . . .” [P83].</td>
</tr>
<tr>
<td><strong>Refinement</strong></td>
<td>“Our scripts collectively threw somewhere around 800 compiler errors at us . . . so we quickly printed out all of our cards . . . and switched to a physical game format” [P1531].</td>
</tr>
<tr>
<td><strong>Combination</strong></td>
<td>“We all had different interpretations but eventually agreed upon an idea that was a combination of several we had come up with” [P505].</td>
</tr>
</tbody>
</table>
**Adaptation.** Place into a different problem domain. “We tried to come up with an idea involving the theme, but since none was found, we started crafting a game that was later adapted to fit the theme” [P1081].

**Reuse.** Refurbish for a similar purpose. “[The theme] matched a pre-existing idea” [P144].

**Transmediation.** Transform an idea into another form of medium. “It was a game based on [a novel character] and how he saw things differently than his partner” [P1731].

Not only are idea networks qualitative, such as a description of a game and its source of inspiration, but they are also quantitative, for example, how many game are similar to it (counting the number of assimilations), and how well received is the title (counting the number of audience reach), if such data is present. By using the numeric relations between ideas, we can begin to see a general understanding of the idea space via the network itself, and interact within it. This interactive understanding helps the design researcher frame the problem space (Schön, 1983; Grocott, 2010). These qualitative data are implicit to a network, as it depends on the size of the network itself as well as the density of connections, but the trend is immune to the varying windows and size; the more data is input into a network, the more definite the result becomes (Garfield, 1955).

5.4 Constructing Idea Networks

Our research aim is to understand what a game design idea network is. Global Game Jam survey data serve as a corpus. Connected ideas form clusters, hinting at potential trends. We follow a variant methodology of Zimmerman et al.’s (2007) research through design, in combining Schön’s (1983) and later Grocott’s (2010) reflection-in-action methodology. This separates our research from an ethnographic study; our result is primary the design artefact itself. In brief, the design artefact (the idea network) embodies our knowledge of research, and this knowledge can enable other scholars in their research. More importantly, our design process can be applied and repeated as a design methodology in future studies.

After Global Game Jam 2014 came to completion, a survey was administered by the Global Game Jam Research Community (2014). We proposed to analyse a portion of the survey, which aligns with our research aims in understanding the ideation process at game jams. We obtained university ethics approval and received data from the Global Game Jam Research Committee for analysis. Each individual record was identified by numeric identifiers and could not be traced back to the original respondent. A second
numeric identifier was provided to link respondents together from the same participating team.

Games that come out of Global Game Jam are small in design scope and often focused in a single type of gameplay. Participating jammers are given a central theme to incorporate into their games, this year’s theme being “We don’t see them as they are, we see them as we are.” Global Game Jam 2014 gathered 23,198 game developers across 488 jam sites from 72 countries to make a game in 48 hours, with 4,290 games submitted. The relative simplicity in game design and the size of the competition makes an ideal source to study an idea network for a time-constrained event. At the end of the jam, a 60-question survey was sent out to all the participants, and 1,815 respondents were recorded. Participants gave consent to share their data for research purposes.33

According to the survey report, the average Global Game Jam 2014 participant was 25 years old with a bachelor’s degree and has published between 2 to 3 games in the past. 72% of the teams were formed at least partly before the jam, and 67% of the respondents developed new connections and worked with someone they did not know before. While the average participant reported the theme was only “somewhat” inspiring, they also reported general satisfaction (3.9 out of 5, n=1,671), enjoyed their game jam experience (4.3 out of 5, n=1,689) and had a lot of fun (4.5 out of 5, n=1,681). Participants strongly indicated that they would participate again next year (4.6 out of 5, n=1,684). Not every question required an answer, hence the difference in the total number of recorded data.

We employed a mixed method to analyse our data set (n=1,815) and separated qualitative and quantitative questions. Not all questions were required. Respondents rated the theme “somewhat” inspiring (3.1 out of 5, n=1,346), even though they considered the theme “a lot” (3.8 out of 5, n=1,343). Qualitative data (n=1,356) were free-response answers to open-ended questions regarding their brainstorming process, how they used their theme, and if they changed their idea halfway through the jam.

The theme for Global Game Jam 2014 was “we don’t see things as they are, we see things as we are.” Jammers worked in groups and brainstormed with time constraints in mind. In our findings, one respondent recalled vividly about their brainstorming session: “The theme ... made us think about perception and opposing worldviews. Early on in our design discussions we agreed that we wanted the core mechanics to express some sort of idea related to these ideas. Through word association, we brainstormed a lot of different

33 These data were derived by the Global Game Jam from a survey conducted following the 2014 Global Game Jam. The Global Game Jam specifically disclaims responsibility for any analyses, interpretations, or conclusions.
possible thematic directions for our game, then narrowed those down based on design risk, implementation risk, and personal [preferences and interests]” [P1585].

Most teams worked the theme into their game design, but many of them expressed that the theme was “somewhat vague” and “offered no clear restriction”. We hypothesise this was because themes from previous years were more concrete; for example, in 2011, “Extinction” was the theme and in 2013, “Sound of a heartbeat”. This year’s theme was relatively more abstract. For the most part, the theme was considered during the game design stage. One respondent summarised how the theme was used: “The theme seemed pretty vague, but it did trigger the initial idea for our game. In the end, the theme was neither a huge help or a huge hindrance. It certainly wasn't essential to our game, but it was certainly identifiable in our game” [P131].

Some participants used brainstorming techniques such as word association and mind mapping, both of which generate idea networks. Ideas were written down freely at the start, and the best ones are decided usually by voting. One respondent recorded, “We mixed [our ideas] together and had an anonymous no-judgement voting on ideas. The top three ideas were re-voted upon to determine the best idea for the theme” [P1021].

Gradually, ideas that were implemented would be favoured over the ones that aren’t. Jammers were pressed for time, and so if an idea didn't work in implementation, it would be quickly scraped and be replaced by another one. One respondent recalled, “We started by brainstorming what the theme even meant. Then we used a thought-map to narrow down the ideas. We then did quick tech prototypes of our top ideas to see which was viable, before making a final decision” [P1092].

The free-response data was encoded by tagging phrases which signify or represent an idea, for example, a game design idea, a thought process that could generate ideas, or an object that could inspire other ideas, as outlined earlier. The tags were in nature the type of idea itself, for example, “brainstorming”, “change of mind”, and “frustrations”. After a sizeable set of tags was created, we began to construct an affinity diagram (Beyer & Holtzblatt, 1999) and grouped similar ideas together. We limited ourselves to a two-tier affinity diagram to preserve the balance between generalisation and details. When a response contained multiple key phrases that signified different ideas or processes, we treated them as separate ideas in our affinity diagram. While this lengthened the research process, it ensured each idea stood by itself.

In the meantime, the authors manually performed keyword extraction for each record. We later used these keywords to construct the links between ideas, so we chose to identify subcategories that are more concrete. For instance, one response was “In our game, you can transform between a child and an adult. The child sees the world in a
certain way, the adult sees the world in another way” [P48]. The main idea here was ‘transformation’, and the subcategories were ‘adult’ and ‘child’. To prevent idea boundaries from becoming too blurry to be of any value, we merged identical (or at least sufficiently similar) ideas into one, saving ourselves from more work later. For instance, we considered ‘transformation’ and ‘change perspective’ as the same category, and there were many games which employed that idea.

After the encoding was complete with an affinity diagram, we started by picking one column and place it on the canvas. We chose to place the diagram in a circular fashion and only employ arcs, similar to that of Lombardi’s (1996) diagrams. To construct the connections, we placed ideas that share the same tag closer to each other, and drew a line between two ideas that shared the same subcategory. This process was repeated until the column was exhausted, and we picked a relatively similar column and repeated the process until the affinity diagram was exhausted. To keep the idea network on topic, we excluded records that weren’t directly related to ideation or brainstorming. For example, “technical issues” was one of the omitted columns. Figure 5.1 shows our result using a subset of our dataset (n=178), a sufficient number of samples such that small networks could be observed.

5.5 Visualising Inspiration as a Network

The human eye is observant in recognising patterns and focal points. For instance, if we were to examine the most parodied games in the mobile space of 2014, we might be able to pick up popular game titles upon visual inspection of a network, and understand the dense and sparse areas of the data space (Auber et al., 2003). A visual representation of a network has an effect on human audience and induce appreciation (Judelman, 2004), provides hints and reference (Holmquist & Skog, 2003; Manovich, 2011) and it supports the process of data analysis (Keim, 2002; Stasko et al., 2008). The aesthetics of the network drawing could aid in understanding of sequential events (Twidale & Nichols, 1996), reinforce memorability (Borkin et al., 2013), and uplift the potential for interdisciplinary works (Samsel, 2013). To make the process more accessible to researchers and analysts, many have continued to maintain an initiative in the area of network visualisation software (e.g. De Nooy et al., 2005; Reas & Fry, 2005; Viegas et al., 2007; Bastian et al., 2009; Bostock et al., 2011), which has fostered a rich field of visualisation research and encouraged many interested individuals to explore datasets.
Visualisation created from idea networks have also been explored as an object of art. Lombardi (1996) in particular expressed the events of financial exchanges and the entities involved as curvature drawings of network graphs by hand. His drawing style often followed a series of aesthetic arcs and expressed a strong sense of direction by the dynamics of lineflow, and they are an inspiration to our network visualisation. Many scholars have worked on algorithms in attempt to reproduce its aesthetics (e.g. Duncan et al., 2010; Chernobelskiy et al., 2012; Eppstein, 2013). This chapter is not an algorithmic instruction to computerise the act of drawing, but to conceptualise the elements of drawing and exemplify the meanings of elements within the drawing itself.

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34 The full resolution of Figure 5.1 is available at https://raw.githubusercontent.com/Spaxe/papers/master/Conceptualising%20Inspiration%20Networks%20in%20Game%20Design/Figure-1-print.png
To effectively design a visual drawing of an idea network, we must first find a visual metaphor appropriate for the message. Rather than a generic drawing, a visual metaphor “in aesthetic perception and its objects is more conspicuous, salient” (Aldrich, 1968, p. 75). Datasets may have natural metaphors that are inherently visual or sequential, for example, geographic and time (e.g. Raper, 2012; Schich et al., 2014) and flight numbers (e.g. Krebs, 2002). The style of visualisation also has an impact on the level of insight that could be observed (Vande Moere et al., 2012). At any rate, idea networks do not have a direct mapping to any intuitive spatial representations. The challenge, then, is the quest to define a visual metaphor suitable for the data space, optimised for understanding and free exploration.

One major principle for the ease of exploration is a planar drawing, that is to say, the lines do not cross each other unless the intersection is a connection (Masucci et al., 2009). Good examples surround our daily lives; for example, maps of metro public transportation would be terrible if the train lines had crossings that were not an interchange, incorrectly presenting travel information and causing great inconvenience (Hong et al., 2006). For the graph to be obvious at first glance, it must follow that principle.

Secondly, graphs that contain too many nodes would look too crowded, overloading the audience with indistinguishable information. This may be used to display density, such as using transparency and overlaying multiple transparent layers to emphasise heavier areas of data (Vande Moere et al., 2012), but as far as network visualisations go, they lead to too much clutter. Fortunately, idea networks, like many others, are likely to display features of small-world networks (Watts & Strogatz, 1998), as clusters of grouped, inter-connected nodes would form. Auber et al. (2003) leveraged this characteristic and proposed to reduce information by re-representing a cluster of nodes as one parent node, in effect generating a hierarchical display, progressively revealing information based on the semantic zoom. Google Maps implements an excellent example of progressive display. After all, we live “in an age of information overload” (Roland & Bawden, 2012, p. 226).

5.6 Finding Insight from the Idea Network

Using the idea network in Figure 5.1, similar ideas are identifiable by the ‘islands’ they visually form. Some ideas are more or less a unique outlier and have only a couple of connections. One idea was a lone wolf: “The theme was very abstract and we made use of it in an abstract way” [P66]. Reflecting the “somewhat” rating of the theme, some respondents reported the theme “did not influence the creativity process much beyond
the initial night” [P40] and they “didn't try too hard to integrate [the theme] during development” [P84]. Contrasting that group, there is another cluster of responses which reported positively about using the theme. These jammers not only “brainstormed possible interpretations and related game themes” [P21] but also “used the theme to influence the gameplay and environment design” [P185]. One team said “the theme was the surprise at the end of the game :D” [P206].

From the islands we found many jammers played with the idea of ‘player interpretations’. Many teams took the theme in developing the art direction for their games. One team created “different art renditions of the same place to reflect the different perspectives of the different characters” [P217], while another team focused on the perception of the player, deriving “concepts using alternate perceptions and alternate worlds where you are seen as you are meant to be by others” [P120]. It is interesting to note that some jammers reported “people tend to find faces, tools, vehicles out of the shape of other daily things” [P76], for example, perceiving “inanimate objects as real, living things just like us . . . like a baby girl who perceives her toys (car, submarine, dinosaur, pony, etc) to be like living creatures that can fight each other” [P196], finding “power sockets [which look like] human faces” [P209], in effect, they allowed the players to “explore perception primarily through metaphor” [P46].

The gameplay from ‘changing perspectives’ and ‘transformation’ was described by one respondent to be “the most obvious path” in making the games [P164]. To start, one jamming team “required the player to transform into different sizes with different abilities and see things differently” [P175]; another game allowed the player to “shift from an adult state to a child state, changing the world based on whether the avatar was an adult or a child” [P218]. This type of game design forced the player to “change what [the characters] are … to change your perspective” [P85]. In order to proceed further into the game, the player must take on another perspective or role, switching between game avatars.

When jammers considered cooperative or multiplayer options, the theme inspired the concept of ‘hidden information’. When the game reveals different information to each player, it introduces dynamic and conflict, or the need to trust each other. One respondent recalled, “Trust was a big part of the mechanics. If trust managed to completely disappear, the game would end,” because in the game “each character could see dangers in the level the other character could not” [P81]. Another team with a similar idea designed their game levels such that “two people could only see parts of the hazards and had to talk each other so they could both exit.” They also recollected experiencing
great humour when one player deliberately lied to the other, causing their avatars to die [P115].

There were also games which changed based on the players’ actions, for which we call them ‘reactive games’ here, for example, in one game, “the player becomes what kills it as the predator” [P204], allowing the losing party to gain some upper hand by taking a comparatively stronger form with a chance for revenge. The games may also shift depending on the aggressiveness of the player, for instance, when a player acts nicely, the non-player characters and the environment also acts friendly and serene; however, if the player chooses to act aggressively throughout the game, they will encounter similar reactions during the game. The actions could either be “stopping to help NPCs or collecting personal powerups,” which “changed the environment and end of the game” [P147].

5.7 Discussion on Limitations and Design Implications

We note three design implications learned from game design idea networks. The first is an understanding gained by “thinking with networks”. The design process to construct an idea network is a traversal of networks in nature, which assists our understanding in the connectivity of ideas. In our experience, it was more efficient to start drawing with the larger clusters, as they will provide a healthy number of connections at the start. The designer has more than just the idea network as well; we gained insight from the initial process of constructing the affinity diagram, providing us a high-level overview and a new perspective. By identifying subcategories of ideas, we had a second, more implicit layer of understanding on the domain of game design ideas. It is this process of reflection-in-action that illuminates insight in our research (Schön, 1983; Grocott, 2010). The idea network which embodies the connection of ideas can also be distributed to others, transmitting understanding visually.

From the idea network we observe the small-world effect. The visual drawing suggests ideas are indeed inter-connected. Since idea networks have connectivity, the second design implication offers an ability to identify emerging game genres, such as ‘player’s interpretation’, ‘changing perspective’, ‘transformation’, ‘reactive games’ found in the dataset. The idea network allows us to examine the existing relationship between ideas and idea formations, telling a visual story of the construction of ideas. However, as ideas become many, the visualisation becomes too small to read given a fixed-size display, for example, a 24-inch computer monitor. On the other hand, When printed as contemporary or information art in a physical environment, audiences will read a picture up-close when they are presented as tall as themselves (Rav-Acha et al., 2005),
which also may inspire curiosity. Digitally, we could support the action of ‘zooming’ by attaching an interaction with the mouse scroll to see up close, or implement multi-scale visualisations (Auber et al., 2003).

The third design implication is that idea networks support intuitive, visual browsing of ideas. The visualisation allowed us to examine the body of knowledge intuitively, retrieving and comparing ideas at ease to formulate a formal understanding. If our data set was linked with the games themselves, we have a two-dimensional graph: one in idea-idea connectivity and one in idea-game connectivity. This would enable an audience to browse existing Global Game Jam games not only by title, genre, country, keywords, but also the similarity in idea, design, process, and output. The potential for this application is a future work of our research roadmap.

This study is limited to the scope of Global Game Jam 2014, and with a survey participation rate at only around 7.5% of the total participants (1,815 out of 23,198), our data could not fully represent the population. While the image of the entire network could be extremely interesting to some, we feel the portions which we have compiled into an idea network provide ample room for inspection. Secondly, the survey was administered in English, and naturally it may have excluded many jammers from the ability to reply. In the future, perhaps an international study comparing different cultures speaking different languages could be of interest. Because the dataset is only compiled from a survey, the result can only be derived from the jammers’ self-reflection. There is therefore an opportunity to conduct an ethnographic study on-site. We also do not know how the ideas evolved throughout Global Game Jam, because most participants only responded to how their final product used the theme; few noted how the ideas were changed.

5.8 Conclusion

We proposed an array of contextualised idea connections from Global Game Jam participants, and examined them for common sources of inspiration. Our design process generated a graph drawing that we coin an idea network, which supported our investigation in understanding the relations of ideas. The design of an idea network suggests that the small-world effect does indeed exist in it, and the visualisation allows us to retrieve insights relatively quickly, given the understanding gained from constructing the network itself. Global Game Jam has been a great opportunity to investigate the ideation and brainstorming processes in game design, and thanks to the 48-hour time constraints, the ideas developed were relatively simple and well focused. Our findings also suggest that given both idea-idea relations and idea-game relations, one
can find similar games with related sources of inspiration. Future work of our research includes formalising the drawing and design process of an idea network, employing a computer-assisted program to quicken the network generation process, investigating the properties of an idea network and what other insights we may extract from it through user studies, and the application for historical exploration.
Finding Design Influence within Roguelike Games

Preamble

This chapter describes a research-through-design process that led to the idea network visualisations. It provides a layperson’s introduction to roguelike games, a subgenre of videogames with over four decades of history. I chose roguelike games to construct idea networks precisely for its rich and established historical content. In the previous chapter, I explored idea networks by inspirations of similar origins, or motivation factors. In this chapter, I will explore a roguelike idea network, connecting roguelike games by their design influences.

By ‘design influence’, I meant only for the documented, observable inspiration and community comparisons. It is important to note, as I will in the chapter and the next many times, that not all influences are knowable, not even from the designers themselves. Therefore, the study of design influence is constrained by what was intentional, purposeful, or clearly borrowed from a cultural context.

In Section 6.1, I introduce a brief history of roguelike games, highlighting the focus for this chapter. Section 6.2 gives an overview to the subgenre term ‘roguelike’, setting the background context. Section 6.3 expands the subgenre into other subgenres such as ‘roguelike-like’, ‘neo-rogue’, and ‘roguelite’, and define the terminology used in this study. In Section 6.4, I set the research lens on the phrase design influence, introducing and grounding the research aim, and the research method. Section 6.5 describes the research-through-design process, listing the steps I took to gather and analyse data. Section 6.6 displays the influence arcs diagrams, showing the primary findings and designs. Section 6.7 offers a temporal visualisation of roguelike influence. Section 6.8 plots each roguelike game on a chart of influence versus time, detailing the findings. In Section 6.9, I describe the limitations of this study, and how they may be overcome. Section 6.10 concludes this chapter with a summary, and gives two design implications.

This chapter answers RQ3, “How can idea network visualisations describe influence?” It presents three idea network visualisations using data gathered from articles related to game development. The objective of the visualisations is to make influence visible for
design research. To answer this research question, I explored the visual design of idea networks, using the dataset available to me to formulate it.

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Abstract

Our work takes the view of videogames as a collection of creative ideas, acting as design influence which shapes future games. We examine a popular game genre, roguelikes, from which games found their roots in early stages of the Internet. Our aim is to investigate design influence within the roguelike genre. To achieve this aim, we wrote a script to collect not only data about roguelike games, but also infer the direct connections between them. We achieved this by using search engines to locate interviews and post-mortem articles, and automated an analysis by frequency of game appearances and their public metadata. To disseminate the results, we employed a series of data visualisations in order to illustrate roguelike influence over the years. Our contribution from this study is twofold: first, connecting roguelike design influence spanning over thirty years using a simple metric, summarised in four different types of visualisations; second, an open-source visualisation tool to investigate design influence in roguelike games, which can be generalised for media studies exhibited on the wider Internet.

6.1 Introduction

In a post-mortem, the creators of Rogue (1980) wrote, “We really enjoyed ‘Adventure’. ... what we wanted to do was create a game we could enjoy playing ourselves” (Wichman, 1997). At the time, tabletop game Dungeons & Dragons (1974) was already prevalent among American college gamers and a wild success. In Rogue, players venture into a dungeon to retrieve an artifact, overcoming monsters and obstacles along the way. Wichman loved this idea of ‘dungeon crawl’ so much that he and others brought the concept to life, sparking a series of new videogames for decades to come.

External influence is a common theme in emerging gameplay. The case for Pong (1972) was a series of complex calculations for its time to bring table tennis to the oscilloscope, extended from the concept of Unix command line tool ping (Pias, 1973). Tschang and Szczypula (2006) proposed the notion of videogames as a collection of creative ideas. In their view, studying videogames is done by examining the ideas featured by videogames, through which we can understand the origins and processes of game design. Jenkins (2002) stated evolution of game design is no accident; Hagen (2012) argued that “new ideas” are simply ideas used in ways they have never been used before. New designs are shaped by ideas in the past. Karsdorp and van den Bosch (2016) saw storytellings as “the implicit formation of a network of stories, in which links between stories represent pre-textual relationships.” Our work builds on networked concepts through the lens of videogames and the surrounding text scraped online. Section 6.5,
titled “Research Through Design: Sourcing Connections” describes our research method.

The history of videogames has been laid in many books (e.g. Donovan, 2010; Kent, 2010; Goldberg, 2011; Melissinos & O’Rourke, 2012), but none examines the concept of idea evolution and influence of game design throughout a genre over the course of videogame history. We use the term “genre” loosely as a fluid concept videogame categorisation, in this case, we refer to the roguelike genre as a collection defined by the Wikipedia community. A brief review of the roguelike genre is discussed in the next section.

The aim of this study is to investigate the evolution of roguelike games within the popular media. Our line of inquiry is constructed to identify design influence. Roguelike genre is one of the most popular game genres in the 80s and 90s (Garda, 2013), yet the number of games in the genre is relatively small, which makes it suitable for studying design influence. Our design process is also published as a visualisation tool for future game scholars. Before we describe our methodology and findings, we will briefly discuss the history of Rogue.

6.2 From Rogue to Roguelikes

The first version of Rogue was distributed via Berkeley Standard Distribution, more widely known as BSD (Wichman, 1997), which made it available on computers worldwide. There being no other games like it at the time, Rogue grew in popularity rapidly. Later, games began to build on Rogue’s mechanics: Hack (1984) and later NetHack (1987) expanded its monsters and inventories of wonders. Angband (1990) offered one hundred levels of randomly generated dungeons. Because of the striking resemblance to their tributing ancestor, the collective genre became known as roguelikes.

Across cultural borders, roguelike games later proved to be successful. Japan saw the release of Torneko no Daibōken: Fushigi no Dungeon (English title: “Torneko's Great Adventure: Mystery Dungeon”) (1993), and it was popular among Japanese gamers. The name Mystery Dungeon was coined as its series title, inspired by the nature of randomly generated dungeons. The co-creator, Koichi Nakamura noted Rogue as an inspiration from his developer colleague (Parish, 2012).

The notion of nostalgia eventually grew mainstream in the Western world as people collected old hardware and created emulators (Garda, 2013a) to enjoy the operating systems like Atari, which have not been sold for over a decade by the time. As the

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55 Wikipedia has an ongoing effort to document a complete list of roguelike and 'hybrid' roguelike games in one page: https://en.wikipedia.org/wiki/List_of_roguelikes
development of *NetHack* continued by its community, roguelike deviations emerged. *Diablo* (1996) and its successors were geared with random loot generation systems without enforcing permanent death. The series would last for over two decades with an addictive gameplay. The genre continues to evolve as the name ‘roguelike’ became an overarching category.

### 6.3 Contention of Naming Roguelike Genres

The term ‘roguelike’ became blurred as newer games adapted the core mechanics and altered them. In 2008, the community ofroguelike developers gathered at the *International Roguelike Development Conference* in Berlin (*RogueBasin*, 2008). They defined factors which made a game roguelike. We list the main two factors: ‘random environment generation’ and ‘permadeath’. That is to say, a roguelike game starts with a new set of environment components, which may be dungeon layouts and corridors, valuable items, and monsters. Also, when player death occurs (for example, tripped and fell into a deep pit), the game records it permanently in save files, classically in the form of high scores. Next time the game is launched, it generates a new environment and new challenges.

There is a niche community online who defines roguelikes conservatively as games that feel like *Rogue*, incorporating more elements such as grid-based, turn-based gameplay (*RogueBasin*, 2008). In the broader media and digital distribution platforms, the term ‘roguelike’ is more or less a catch-all term for games that provided random environment generations.

Blurring the genre borders further, indie games such as *Spelunky* (2008), *FTL: Faster Than Light* (2012), *Darkest Dungeon* (2016) are no longer turn-based, but instead top-down or side scrolling, and retain randomly generated environments. This new wave of roguelike-like games is known as hybrid roguelikes on *Wikipedia*, also known as roguelite as these games may not feature permanent deaths (Hawkes, 2013; Cook & Colton, 2014). Garda (2013b) coined the term, neo-rogue, to capture a “rediscovery of essentials of the Rogue game design … favor the roguelike trend.”

The rest of the paper refers to “roguelike” as the a collection of itself and sub-genres, roguelike, roguelite, and neo-rogue.

### 6.4 Influence and Motivation in Design

Recorded as early as in the thirteenth century, influence was, in astrology, an invisible energy or force emanated from “the stars that acts upon one's character and destiny.” *Influentia*, or “in-flow” in medieval Old Latin, describes water flowing into

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36 This definition has been disputed by Darren Grey. See Section 2.4.
something as a visual metaphor. *Oxford English Dictionary* defines ‘influence’ as the capacity to shape “character, development or behaviour” through wealth or charisma, but game creators—programmers, artists, designers, musicians, and so on—often have varying motivations for creating videogames.

In the context of our study, the distinction between ‘influence’ and ‘motivation’ is important. In psychology studies, influence is perceived by their subjects, whereas motivation is observed by driven actions. Influence is a creative energy that shapes the outcome of an event or action; motivation is the energisation of behaviour that can produce creative outcomes (Elliot, 1997; Thrash & Elliot, 2003). In behaviour theory, influence is the external energy that transmits between individuals; motivation is internal to an individual (Thrash & Elliot, 2004).

The notion of *influence* is an idea that follow a path of transmission, such as from person to person, or a creative work to person, and so on, often synonymously known as an “inspiration”. Influence describes the source of inspiration seen by an outcome. *Design influence*, therefore, describes the source of design inspiration.

Our research aim is to form a design approach to find design influence in roguelike games. Drawing upon implicit networks (Karsdorp & van den Bosch, 2016), our research objective is to visualise design influence as a network of videogames. Design influence is embedded in games and elements of game design. To find roguelike influence, this study follows a research-through-design approach (Zimmerman et al., 2007).

6.5 Research Through Design: Sourcing Connections

Research through design was originally developed to serve research practitioners in art and design, and later formalised by interaction designers and researchers. Its methodology emphasised design as a research methodology, not into the design itself (Frayling, 1993). In this mode, we drew ideas from “art, design, science, and engineering, in an attempt to make aesthetically functional interfaces” (Zimmerman et al., 2007) to trace influence in roguelike games. This interface informed us as researchers, and through reflective and iterative research practice (Grocott, 2010) we came to an understanding about roguelike influence. Within the context of roguelike influence, our research problem was framed, “how are roguelike games influenced by one another?”

We based our list of roguelike games of research interest from *Wikipedia*. Our method found over 1,000 entries which served to be our corpus, which we sourced through a Python script (see Appendix C). Not all games have a page entry, and some games were incorrectly listed as roguelike games due to its open and collaborative nature. After filtering out the list for roguelike games, we had a list of over 80 games, their developers,
platforms, and the years in which they were released or published. This number may seem small, but compared to the ‘list of every videogame made’ by a Pastebin community member aliased “DATA_BASER”\textsuperscript{37}, the list is barely a fraction of the commercial games released. However, for the purpose of developing a design approach to understand design influence, this provided a good starting point.

Our script implements the following data collection process. To trace design influence with over eighty roguelike games, we turn to the Internet and its rich knowledge pool. There are countless articles and websites published to date about games, reviews, interviews, postmortem articles, developer diaries, community questions, and so on. We sourced articles from \textit{DuckDuckGo},\textsuperscript{38} a free, popular search engine to collect articles of interest. The automation for searching roguelike articles saved a tremendous amount of time.

Our script found articles published in established game journals like \textit{Gamasutra} and articles published by the game developer themselves. Results that are not text-based, such as \textit{Youtube} videos, were excluded from this study, as the complexity to process video or audio was beyond our resources. All results that were not in English were also excluded, but we would like to expand this study to include other languages, and influence of cultures like the Japanese culture. Within the webpages we collected, sidebars and comments were also excluded to focus on the main article body.

Keyword spotting (Cambria & White, 2014) is a naïve algorithm that simply detects the presence of key phrases and counts their frequency of appearance. In our study, we are interested if there are other game titles mentioned in the articles, and keyword spotting serves our purpose well. Our hypothesis is simple: if two game titles are mentioned together in the same article more often, they are likely to be more similar to each other.

Taking into consideration the year the game was made, we can infer the direction of influence through time. A game from the past can influence another in the future, but the reverse is impossible. Therefore, we can say a game likely has design influence on another game, if they are mentioned together often online, and we know it came before. To be precise, our program does not know if the two games truly are connected, but the frequency of titles coming together is a good approximation from our exploration. Our study hopes to serve a foundation for more precise discussions, and dealing with a large quantity of games.

\textsuperscript{37} The original list of every videogame collected by DATA_BASER can be found at http://pastebin.com/EuxZMbWT

\textsuperscript{38} http://ddg.gg

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Initially, we laid individual games in a force-directed layout\textsuperscript{39}, but the number of overlapping lines proved to be too erratic for reading. After listing the components (game title, platform, developer, release year) separately, we realised that the graph could be organised chronologically. This realisation led to the layout of the design influence diagram, which we began to explore the connections across time between roguelike games.

6.6 Roguelike Influence Diagram

Figure 6.1 is the influence diagram of *Angband* (1990) and its design influence inferred by the method above. Drawing arcs from game to game connects across time is reminiscent of Heinlein’s science fiction work with time travel\textsuperscript{40}. The horizontal axis is the year of release, and the arcs denote an influential relation between two games in those two years. The titles of the relations are not visible in influence diagrams for the sake of clarity, but later visualisations of the same data include titles. Thicker arcs are influences related to the game in focus; thinner arcs are the rest of the dataset.\textsuperscript{41}

We chose to draw arcs above if the other game title is in-genre, as in a roguelike game; or below for out-of-genre, as in all other genres, such as platformers, role-playing games, first-person shooters, and so on. This separation allows us to differentiate games that primarily have influence within the roguelike genre itself. Figure 6.2 shows two examples of primary in-genre influences. These games are more likely to be representational games in the roguelike genre, as their primary influences are from within the genre itself.

Conversely, Figure 6.3 lists two examples of primary out-of-genre influences. These games are more likely to be in the neo-rogue category, or a hybrid roguelike game. They tend to take elements from other genres, such as in the case of *FTL: Faster Than Light*, spaceship resource management and real-time movement control schemes. These games tend to be more refreshing and draws new audience into the roguelike genre. Additionally, the influence diagram shows the past and future relations. The vertical line denotes the year the game in interest was made. This line divides relative time into the past and the future to its left and right. With the four quadrants visually separated, we developed the genre-influence matrix as a supplementary legend for reading the influence diagram.

\textsuperscript{39} An example of a force-directed layout is found in the D3.js gallery: http://bl.ocks.org/mbostock/4062045
\textsuperscript{40} From a Twitter conversation between my colleague, Andrew Rock, and myself: https://twitter.com/andrew_rock/status/555715758722801664
\textsuperscript{41} For an interactive version of all the diagrams, the original generated data visualisation is archived at https://spaxe.github.io/roguelike-universe/versions/1.0.0/index.html
For games that feature more upper-left quadrant arcs, they are both representative of their own genre, and take influence from within the genre itself. On the other hand, games that feature primarily bottom-right quadrant arcs are more influential of future games out-of-genre. We name this diagram genre-influence matrix, shown in Figure 6.4, a companion legend to read influence diagrams. Many games lie somewhere in between the spectrums, and it is useful for game scholars at a glance to see where each game falls within.

Figure 6.1: Angband (1990) influence arc diagram generated by our study

6.7 Genre-influence Matrix
Taking Figure 6.2 for example, *Torneko no Daibōken: Fushigi no Dungeon* (1993, left) on the left is an influential game in-genre which, considering all the *Mystery Dungeon* series and sequels, did pretty well. *Ancient Domains of Mystery* (1994) was both representative and influential in roguelike genres, with a couple of influences out-of-genre. The genre-influence matrix presents a quick glance of where the influences are from.

Influence diagrams are suitable for showing one game and its influences, but showing many games at the same time it becomes cluttered to see. To overcome this problem, we take the two dimensions, genre, and time influences to map roguelike games
on a two-dimensional plane. The resulted scatter plot, *genre-influence map*, is presented in Figure 6.5.

6.8 Genre-influence Map

Points near the top have influence from in-genre; bottom, out-of-genre. In the same way, points near the left are influenced more by its past, while points near the right influence more of its future. For readability, we omitted 20 titles whose labels overlapped. The full data set is available in Appendix C.

These points start at the centre of the map, and for each design influence arc in a quadrant (see Figure 6.4 for example), we shift the point towards that quadrant (either upper-left, upper-right, bottom-left, or bottom-right). The result was initially crowded in the middle and sparse on the outside, which made reading difficult. To space out the points for readability, we relaxed each point’s distance from the centre, and removed overlapping labels manually. Our algorithm always fits the points to the plot boundary.

![Figure 6.4: The genre-influence matrix](image)
Rogue is on the most upper-right corner of the genre-influence map, being one of the earliest games to carve the genre itself. Nearly all the games in the upper-right quadrant are classic roguelikes. We were surprised to see the *Mystery Dungeon* series in that space as well. Towards the upper-left there are more modern takes on roguelikes, for instance *Dungeons of Dredmor* (2011) and *FTL: Faster Than Light* (2012). We also see classic-like roguelikes in that space, such as *Super Lotsa Added Stuff Hack - Extended Magic (SLASH 'EM)* (2006) and *Brogue* (2009) which were influenced by their ancestor roguelikes, aim to bringing back the retro feel (Garda, 2013a). On the bottom half of the map we see more hybrid roguelike and neo-rogue (Garda, 2013b) games, taking into elements of resource gathering and building, or inventory management from roleplaying games. Games in the
middle appear to be arguably more well-known games, having influences in both in-genre and out-of-genre varieties.

Finally, we plotted the influence timeline, as shown in Figure 6.6, based on the year each game was published. We kept the same horizontal placement, and shifted the verticals. This resulted in a mostly right-to-left, up-to-bottom flow. Because early games that mostly influence within its small genre of games, and newer games are exposed to influences many more varieties, this right-to-left flow fits our expectations. For clarity, we removed influence that spanned over fifteen years between two games, and manually shifted a handful of games to avoid label overlapping. We also omitted games that did not have any connections for the sake of conciseness. This influence timeline is by no means completely accurate, but our method is suitable for larger samples of games, which come cheaply with little addition of time thanks to software automation and data visualisation.

6.9 Limitations

There are some limitations to this approach. For a study on roguelike influence, it would have been unreasonable for a small team to read through all articles related to 85 roguelike games, let alone designing a tool that could compute hundreds more. We chose to use scripting to alleviate the workload, which comes with limitations with soft constraints and hard constraints.

Soft constraints are parameters we have set in place. The script does not compute two titles made in the same year, even if there are multiple articles mentioning both, as it would not be obvious which one is the influencer. For games that are undergoing years of development and releases, such as NetHack, we used the initial year of public release, which can introduce minor errors for relating data points. All data computed so far are in English, and games made in Japan, such as the Mystery Dungeon series, may have many unexplored links in this study.

Hard constraints are limitations in the nature of the method used. It is impossible to perfectly prove that one game has influence on another unless the creators themselves stated so. There are also design influences that the creators cannot put into words in second-hand descriptions. We used keyword spotting and the frequency of game titles to calculate the possibility of influence, truncated most of the tail and used only very frequently appearing pairs. By avoiding game catalogues and webpages of a list of videogames, and focusing on interviews, post-mortems, and developer diaries, we can only minimise the possibility of error, and not mitigate it entirely. Furthermore, this style of tracing cannot necessarily be directly tied to actual design influences.
Figure 6.6: The roguelike influence timeline
Additionally, our plotting and graphing methods, while flexible and scalable, are prone to producing complicated graphs. We addressed this to some extent by removing and shifting some labels in both Figure 6.5 and Figure 6.6 to avoid overlapping labels, but further iterations are needed to optimise the graphs’ legibility. The lines can also overlap, making it difficult to read so of the connections, such as the centre vertical line in Figure 6.6. This issue could be improved in future iterations through replacing straight lines with curves.

6.10 Conclusion

In closing, we have presented a design approach to understand design influence in the roguelike genre. Our aim is to investigate design influence within the roguelike genre. Using Internet search engines and keyword spotting in online articles, this approach can be generalised for other genres of work in games, and potentially media studies in general.

There are two implications emerging from the point of view of this study. First, influence is an often-spoken-about point in a design discussion, but rarely a topic of scholarly investigation. Second, influence is differentiable from motivation, as influence is an external energy which shapes another event’s outcome. Motivation is, in relative terms, an internal energy to an individual driving that event of creative process. There have been many works on motivation and games (e.g. Arya et al., 2013), but only little scholarly work on influence in at least two degree distances. We hope our work contributes a new angle to game studies through the lens of design influence.

Roguelike games are multifaceted in their own right. Elements of game design such as mechanics, gameplay, storytelling, immersiveness, and challenges are not yet part of our investigation, but we wish to include them as we are able. As part of the effort in creating design tools for game studies researchers and open research, we have open sourced our tool described in Appendix B and C. We hope to see users adopting our tool and providing us feedback to iteratively improve upon our tool.

To visualise roguelike design influence, we have proposed the design influence diagram as a visualisation and design tool for game designers and researchers. This diagram shows position quadrants of in-genre, out-of-genre, past, and future influence quickly. It is complimented by the genre-influence matrix, which expresses the type of influences in the diagram. For a view of all titles in the spectrums, the genre-influence map scatters the titles onto the landscape with an automatic fitted view. Lastly, the influence timeline arrays each title up-to-bottom and draws the influence lines for a clear, in-genre view of connecting influence between games.
Future work includes user studies in using our proposed design tool to evaluate its effectiveness and inclusion of more variety of keywords, such as player emotions and descriptive adjectives. Broader domains other than roguelike genre can also be used to evaluate our tool. Our work is persistent on the Internet for future scholars to adopt and use freely.
Exploring Roguelike Ancestry through Idea Network

Preamble

This chapter overviews the scope expansion of the roguelike idea network as presented in the previous chapter, from 85 to 639 roguelike games. It includes a user study to investigate what new insights can be gained from exploring idea networks. This study places idea networks in front of game developers, and seeks to understand and evaluate the usefulness of idea networks in exploring roguelike ancestry from observing the interactions and dialogues of roguelike game developers.

In Section 7.1, I illustrate the historical significance of NetHack (1987) as a narrative introduction to examining roguelike influence from the perspective of game archaeology, grounding my research methodology as research-through-design. Section 7.2 details the anatomy of an idea network, specifically the construction of the roguelike idea network, using web scraping to approximate some of the missing details, and giving the method of data collection. Section 7.3 provides the design context of idea network visualisations, offering descriptions for each visualisation which was part of the user study. In Section 7.4, I describe the online user study, recruitment, and the instructions given to participants, outlining the study method. Section 7.5 presents the main study findings from roguelike game developers who explored idea network visualisations, answering the research question. Section 7.6 discusses limitations of this study and the design implications I have learned, generalising the research findings from a perspective suitable for an idea network on other creative works. In 7.7, I conclude this chapter with a brief summary and review, and outline some of the future works.

Through presenting the idea network visualisations to game developers for casual exploration, this chapter addresses RQ4, “What insights can designers extract through idea network visualisations?” I observed how game developers discussed idea networks with each other online as a way to investigate how idea networks might be used for design exploration.

An ‘extended abstract’ version of this chapter is accepted and pending publication in the Proceedings of the 3rd Annual Australian Social Network Analysis Conference, Canberra,
2018. I have written this chapter in preparation for a full paper submission in a related conference or journal.
Abstract

Idea networks are inherently illustrative in the domain knowledge they seek to capture. They provide pathways to retrace known paths, and to explore the unknown. In the area of game archaeology, there are as yet no tools for exploring related influences. In this study, we conceptualised an idea network of 639 roguelike games, using data collected from RogueBasin as well as collectively online, and conducted an online user study for designer insight. Study participants explored three idea network visualisations that support exploration of design influence, accompanied by a brief historical context of roguelike games, and our design process of visualisations. The study uncovered 6 classes of insights from game developers: thinking in networks, insights on data consistency, insights on accessibility and usability, insights on visualisation preferences, exploring related games, and data contributions from the community. The study is limited by the data sources available about design influences, acknowledging that idea networks are only a partial representation of the full picture, which cannot be known. However, it showed that even a partial idea network can be useful for exploring the ancestry of roguelikes and their design influences. It also showed how idea networks facilitate knowledge sharing through online conversations and new lines of inquiry.

7.1 Introduction

NetHack (1987), a classic ASCII-based roguelike, is probably the oldest videogame that still receives updates today, counting nearly 31 years of development. There are contenders for claiming the longest running game to receive new updates, but none come close to NetHack. Ultima Online (1997), a popular MMORPG, celebrated their 100th release update in June, 2018; the game is now 21 years old. Diablo II (2000) received ports in 2016 for supporting Windows 7 and MacOS 10.11, dating the latest release to be 16 years old. NetHack still runs in computer terminals. It retains a strong fanbase in a market flooded with waves of visually stunning games. This remarkable achievement is celebrated by a brilliant gameplay that takes years to master. NetHack is maintained by a distributed team of developers around the world, hence its name.

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42 As of writing this paper, the latest stable release, NetHack 3.6.1 was published on 27 April, 2018. Even if we overlooked the fact that NetHack did not have updates between 2004 and 2014, but only saw compatibility fixes for Macintosh, NetHack 3.6.1 is still nearly 31 years old since the initial release.

43 MMORPG stands for “Massively Multiplayer Online Role-Playing Game”.

44 “Ports” is a software terminology, as in “porting the software from one system to another.”

45 https://www.nethack.org/common/info.html#Common
Game archaeology is a growing field of research. Roguelike games—NetHack being just one example in thousands—share an entwined history (Wichman, 1997) with the distribution of open source software and the increasing availability of the internet. Their long-standing establishment and rich contributions to game design provides an open book into the development of videogame history.

Game historians rely on three primary means to do research and exploration, commonly in combination for maximum effect. First, there is playing analysis through hands-on gameplay as a research methodology (Aarseth, 2003), giving an accurate account of the player experience, a personal encounter with the gameplay. To access older, out-of-production games, historians turn to game archives, or obtain a copy from the occasional good-will donation through an advertisement seeking rare games. Guins (2014) follows several iconic game machines, such as the coin-op arcade, into their after-shelf lives, including repurposing and game emulation.

Historians may also choose to examine video recordings of past gameplays (Lowood, 2011, p. 10) to gain accounts of other player perspectives, a significant resource available for free in the era of live streaming and video recording. YouTube and Twitch are two popular platforms for hosting player-created content. Players share the enjoyable moments of gameplay, while seamlessly documenting videogames from cover to cover. For many out-of-production games, examining them may necessitate accessing video records.

Lastly, reading the dialogue between game developers and the fanbase, as well as the dialogue within the fanbase itself is an extended form of player analysis, a study from the fan perspective (Stuckey, 2017). This style of study brings the collective player experience into focus, granting a satellite point of view on both the geopolitical effects of videogames, and the personal meaning that was brought into day-to-day lives of the players over a period of time.

All three methodologies frame research on the player experience: the researcher as the player, video content creators as the player, and the fan community as the player. In this paper, we present a novel game archaeology resource for exploring a large collection of roguelike games arisen from a systemic, research-through-design process (Zimmerman et al., 2007). We frame the research not on the player, but on design influence. Game developers and the fan community are the influence citators. Our

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66 For classic Australian videogames, the Play It Again project (http://www.ourdigitalheritage.org/archive/playitagain/) by Stuckey et al. (2013) documents many Beam Software productions. For international videogames, the Internet Archive maintains a Classic PC Games collection (https://archive.org/details/classicpcgames).
research method collects records of design influence to construct a systemic epistemology network of associative roguelike influence as a network, which we call an idea network.

We have previously published a preliminary study to construct a smaller roguelike idea network. This paper is a follow-up study that offers three major additions. One, we expanded the dataset from 85 roguelike games to 639 roguelike games. Two, we improved the accessibility and readability of the idea network greatly. Three, we engaged with game developers on social media to discuss idea networks through data visualisations, and ran an online survey in parallel.

Throughout this chapter, we refer to ‘game developers’ and ‘game designers’ as anyone who makes videogames regardless of their discipline: designers, programmers, artists, technicians, writers, managers, producers, quality assurance, testers, and administrative staff involved in making a videogame. This chapter aims to investigate knowledge generated from the interactions of game developers and idea networks. It seeks to answer the research question, “what insights can designers extract through idea network visualisations?”

7.2 Roguelike Idea Network

This chapter follows a research-through-design framework, investigating the research question by way of designing something that can be examined formally (Zimmerman et al., 2007). As such, the manuscript is self-documenting about the design process. In the next two sections, we will describe the roguelike idea network and the design process, and then outline the user study and findings in subsequent sections.

An idea network describes associated influences on creative works. It follows a systemic epistemology approach: strategically observing the similarities, documenting sources of inspiration, and validating invisible, unconscious influences within a wider culture (Haynes, 2001). We selected roguelike games to construct an idea network for their rich, textual history available on the internet. During the construction process, we defined two kinds of influence in the roguelike idea network: known and inferred influences.

Known influences are explicitly recorded by game developers, either directly or indirectly. Developers are universally familiar with reading or talking about other

47 See Chapter 6, “Finding Design Influence within Roguelike Games”.

48 Because everyone involved would have a stake in influencing the design and development of the game.

49 We have written about the expansive influence of Rogue in Section 6.2; Garda (2013b, p. 60-65) offers a layperson overview about roguelike games.
people’s sources of inspiration. We searched for known influences on the *International Roguelike Database* (IRLDB),\(^{50}\) whose data is synchronised from the developer- and fan-contributed wiki, *RogueBasin*.\(^ {51}\) Each record in our data collection includes a game title, website link, project status, release date, last updated date, developer names, game themes, list of known influences, and a link to the *RogueBasin* wiki entry. More detailed description of the data can be found in Appendix D. Due to the nature of user-contributed wiki entries, some games have no information about their influences at all. To fill in missing information, it would be too time-consuming to interview each developer in person to cover a growing set of roguelike games. For completeness, we filled in approximations by using inferred influences.

Inferred influences are calculated by how often two games appear together in the same article. The calculation process deviates from the previous study, so we shall describe it at length. The inferred influences were calculated for every roguelike game, using Python and *Jupyter Notebook* (Kluyver et al., 2016) for reproducible research.\(^ {52}\) We separate games into three categories: *roguelike*, *roguelike-like*, and *other*. The list of roguelike games is obtained from *IRLDB*, except for *Diablo* (1996) and *Spelunky* (2009), which we labelled appropriately as roguelike-like games. Recognising that genres are fluid concepts, and difficult to pin down, we used the “Hybrid Roguelike” section on *Wikipedia*\(^ {53}\) as the basis for the list of roguelike-like games. It is sufficient for the purpose of research on idea network. For the other games, we sourced the list of games\(^ {54}\) from a user aliased “DATA_BASER”, who curated a list of every videogame title.

Automated link discovery was done by utilising the search engine, *DuckDuckGo* to find online articles on developer interviews, diaries and notes, post-mortems, and historical discussions for each game. Websites that are clearly game catalogues and how-to tutorials are excluded by a subsequent filter. We also automated discovery of matching *Wikipedia* entries to each game.\(^ {55}\) Next, the main article content of each online article was downloaded, storing a total of 3,900 webpages. They were stored under each associated game title as our corpus. This process disregards sidebars and navigation menus, strips

\(^{50}\) https://forums.roguetemple.com/irldb/

\(^{51}\) *RogueBasin* (http://roguebasin.roguelikevelopment.org) has a field called “Influence” for each roguelike listed in the wiki.

\(^{52}\) Source code for the web scraping and influence calculations can be found at https://github.com/Spaye/roguelike-universe

\(^{53}\) https://en.wikipedia.org/wiki/List_of_roguelikes#Hybrid_roguelikes

\(^{54}\) This is the same list used for the study in Chapter 6.

\(^{55}\) Python has a 3rd party library, aptly named *wikipedia* (https://pypi.org/project/wikipedia/), that lets you interface with it.
away any decorative styling, and ignores any audio or video content, since the script is not able to recognise content from sounds or pictures, only text.

With the prepared corpus, we proceeded to match videogames from each online article. Our algorithm only considered a match for exact names in the article, not abbreviations or short titles. This conservative approach minimises false positive matches. We kept a tally of match frequencies, and chose a manual cutoff of top 5 most frequently mentioned games as inferred influences. While this approach cannot guarantee an accurate picture of influences, the chosen cutoff was sufficient to distinguish games that have influences from non-roguelike games, or mostly from other roguelike games. A deeper discussion on the accuracy of the dataset is given in Section 7.5.

The above collected dataset is published on GitHub, a free hosting service popular for open source software. GitHub also hosts the latest design exploration of the idea network visualisation, and forms a part of our research method to engage game developers. In the next section, we will describe the visualisation design process.

7.3 Design Exploration

A network comprises of nodes and links. One way to visualise a network is to draw a dot for each node, and connect them. At the inception of the research project, there were 85 roguelike games and their inferred influences. The initial network used the visualisation library, D3.js (Bostock et al., 2011) to perform layout computation and drawing. Figure 7.1 shows a screenshot of the initial roguelike network.

We coloured each roguelike by the decade in which it was released. In the midst of green points in Figure 7.1, it can be observed that NetHack influenced games decades apart. For example, NetHack is built on variations of Hack (1984), which was influenced by Rogue (1980). It influenced Dungeon Crawl Stone Soup (2006), and Spelunky (2009). The directionality of arrows is determined by the release date. Though not captured in this work, cyclic influences may exist, since roguelike developments span decades.

Figure 7.2 shows the next iteration of the roguelike influence diagram. It was created with the drawing library, Processing (Reas & Fry, 2005) for the accessible text and shape drawing utilities. The colour encoding was retained for each game. Influence connections to non-roguelike games were added, presenting in a series of overlapping arcs. In the prototype, moving the mouse from left to right shows a different roguelike game and its influence arcs. The horizontal axis is the release year.

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56 For example, Dungeons of Dredmor, instead of “DoD”.
57 For example, Anoxic Depths: Caves of the Yendori, instead of just Anoxic Depths, a smaller but different game.
Figure 7.1: Screenshot of the first roguelike network in the initial analysis

Figure 7.2: Prototypes of the roguelike influence arc diagrams. Top row, from left to right shows Rogue (1980), NetHack (1987), and Falcon's Eye (2000), a GUI for NetHack. Bottom row, left to right shows Pokemon Mystery Dungeon: Explorers of Time (2007), and Spelunky (2009)
Roguelike and non-roguelike influences are separated by the horizontal axis: arcs above the axis are roguelike influences, and arcs below the axis are non-roguelike. This gave us the idea of dividing the arcs of influence into 4 quadrants: in-genre, out-of-genre, from the past, to the future, which was investigated in the previous study, shown in Figure 6.4. This was when colours were removed in earlier design explorations (see Figure 6.1 for an example), since the horizontal axis serves the purpose of displaying the release year. In Figure 7.2, we were working with up to 85 roguelike games and their inferred influences.

In this study, there are 639 roguelike (and roguelike-like) games in the dataset. We not only have their inferred influences, but also the known influences as well. In preparing the data visualisations, the Processing prototype was ported to D3.js. All 639 roguelike games and their influences are overlaid and drawn in Figure 7.3, showing NetHack as the selected game as an example. Games can be selected from a dropdown input (see Figure 7.6). Nearly every year since NetHack's release, there is at least one game reported to have been influenced by it. Every influence is listed below the diagram as interactive hyperlinks that can bring another game into focus, showing its influence arcs for exploration. On the website, visitors can also hover over an influence arc to see which two games it connects.

We plotted the genre-influence map (Figure 7.4) and the roguelike influence timeline\(^\text{59}\) (Figure 7.5) on all 639 games, with major accessibility improvements. For the genre-influence map, the problem was the cluttered drawing near the centre. Instead of choosing to omit games as it was the case in the previous study, we grouped overlapping games together.

\(^{58}\) According to RogueBasin, many roguelike game creators explicitly state NetHack as one of their influences.
\(^{59}\) See Section 6.8.
Figure 7.3: Screenshot of the NetHack’s influence arc diagram in Roguelike Universe

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60 The original figure numbers from Roguelike Universe are included in the screenshots for cross-reference.
The genre-influence map, as shown in Figure 7.4, is a scatterplot that draws each game in one of the 4 quadrants. The position depends on the total influences of the game: to other roguelikes, or non-roguelikes, and to the future, or the past. Its focus is to show which games are more influential (further to the right), or more representative (further to the left), and showing relative influences more in roguelikes or non-roguelikes (further to the top or bottom). The bigger the dots are, the more games there are in that position. On the website, visitors can hover the mouse pointer over, or click on one point to show every game title on that point.

![Genre Influence Map](image)

Figure 7.4: Screenshot of the genre-influence map produced in this study

We redesigned the roguelike influence timeline, shown in Figure 7.5. In the previous study, it had two issues. One issue was that the horizontal axis did not have much meaning—they were calculated from the genre-influence map about time—when the vertical axis was time itself. Another issue was that many games lined up in a perfect

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61 See Figure 6.6.
vertical line, and it was not discernable whether an influence was for the next point, or actually connected a point in the middle.

To overcome the first issue, we designated the horizontal axis to be time, same as every other diagram presented here, and chose the number of games connected by influence as the vertical axis. To eliminate any confusing information about the second issue, we listed every influence below the diagram, and drew clear lines between games only from the one selected. Furthermore, roguelike games are separated from roguelike-like games, presenting the final visualisation in a scatterplot with a stacked y-axis.

Figure 7.5: Screenshot of the roguelike influence timeline produced in this study, showing known and inferred influences for PernAnghand (1999), which later became Tales of Middle Earth due to copyright infringement similar to the fantasy novel series, Pern
In Figure 7.5, Major roguelike influences create visible “spotlights” in the roguelike influence timeline. *Rogue, NetHack, Angband, Ancient Domains of Mystery,* or *ADOM* (1994), *Brogue* (2009), *Tales of Maj’Eyal* (2010), and *Diablo* (1996) are all spotlights, shining onto the masses of newer roguelike games, guiding the gameplay and tradition mechanics.

We encouraged webpage visitors to contribute and fill in missing data. Above the roguelike influence arc diagram, we listed the record about the developer, project website, and the release date; the data visualisation also encouraged corrections by providing a direct link to the *RogueBasin* entry itself for viewers to contribute. An example of the missing data contribution message prompt is shown in Figure 7.6.

![Screenshot of Cogmind (2015) selected, showing metadata about the game, and a prompt to contribute to any missing data](https://spaxe.github.io/roguelike-universe/)

On the webpage, below each figure shows three links: one to share on social media, a second to a feedback form hosted on Google Forms, and a third to download the data used to generate the visualisation. This data download is specific to the visualisation itself; it offers the calculated attributes, and metadata that describes itself. A detailed description of the data structure is listed in Appendix E. We posted the idea network visualisations online publicly, and began to conduct the user study.

### 7.4 Online User Study

The online user study took place on a public webpage titled *Roguelike Universe: Visualising Influence.* Interactive data visualisations of Figure 7.3, 7.4, 7.5, and 7.6 are available for visitors to explore. They are accompanied by a brief history of roguelike games, how the data was collected, and what each of the idea network visualisations represent.

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The study seeks what new understanding and insights can be gained when game developers explore idea networks, and to observe the dialogue between developers. It involves data collection from an online survey asking about the idea network exploration experience, and from the social media observing the dialogue between game developers talking about idea networks.

Participants for the study were recruited from 4 International Game Developers Association (IGDA) groups and two roguelike development groups on Facebook; tweeting from our personal Twitter account; and from RogueTemple forums, the discussion site for RogueBasin. We also reached out to the hosts of Roguelike Radio, a popular podcast for the roguelike community made by roguelike game developers, who shared the online user study on Reddit. The study ran for three weeks.

Participants were instructed to spend 5 to 15 minutes with the idea network visualisations, and then fill out the online survey, or leave a comment. During the study, we watched for data corrections and feedback about the visualisation in general, and updated the website accordingly. Our intention was to gradually improve the idea network visualisations and work with the roguelike community to seek comments regarding design influence, and the use of idea networks from a game developer's perspective.

7.5 Findings

From the study we received 14 survey responses, 40 Reddit comments, and exchanged several personal communications with roguelike game developers on Twitter and Facebook. Data from the findings were grouped into three analyses. First, we asked the participants in the survey to rate their experience with the idea network. Next, we encoded the open-ended survey responses and Reddit comments, synthesising for similar kinds of responses and grouping them together until the comments were exhausted. Lastly, we set aside personal communications with game developers who reached out to us as anecdotes, acknowledging some of the design implications of idea networks.

Out of the 14 survey participants, 12 were male and two chose not to disclose their genders. Their ages ranged from 16 years to 44 years old, median age of 33.5 years, and the standard deviation is 7.7 years. Ten participants were game developers or students studying game development, two were not involved in game development in any way, and two chose not to disclose their professions. A diverse range of game development

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63 www.reddit.com/r/roguelikes/comments/96sjzz/a_visualisation_of_roguelike_ancestryinfluence
64 Roguelike game developers are male-dominant, a limitation of this study.
skills reported include: programming, web design, Android, software quality assurance, administration, technical writing, data analysis, and generalist.

In the survey, participants were asked to rate their experience using the idea network visualisations on five qualitative spectrums: boring—interesting, confusing—clear, lacking—useful, slow—responsive, and inaccurate—correct. Responses were recorded on a 5-class scale. Most participants, at least 13 out of 14, rated the idea network visualisations interesting and responsive. Half of the participants reported the idea network to be correct. 8 out of 14 participants reported neutral between lacking and useful, but the other six leaned towards useful. There was no clear consensus on whether the visualisation was confusing or clear, with five participants leaning towards confusing, and six leaning towards clear. Figure 7.7 shows a chart of their qualitative experience ratings using the idea network visualisations.

![Figure 7.7: Qualitative experience of the idea network reported from the online survey](image)

Analysing Reddit comments was a post-design realisation. We noticed a high engagement on the Reddit thread. Roguelike developers commented on various aspects of idea networks. The ongoing dialogue resembled a deeper conversation on design influence, on similarities in different games, and speculating where the traces of ideas came from. Game developers expressed their own preferences on the visualisations, and discussed with each other what they learned. In the survey, participants were asked about what they liked and disliked about the idea network visualisations, and what can be improved on.
The discussions on Reddit were combined with the survey open-ended responses as part of the encoding process, which we carried out. The encoding schema looked for insight and mentions of actions stemmed from using idea networks. This study refers to ‘insight’ as new knowledge learned, change of perspectives, and speculations extrapolated by game developers in dialogues from their existing body of knowledge.

Developer insights were gathered from discussions making references to the idea network, or discussing roguelike games based on the idea networks and their own personal knowledge experience. We made two passes to encode responses, and a third time to check for any ambiguities, combining categories as appropriate. At the end of the encoding process, we generated six insights from game developers using idea networks. They are: thinking in networks, insights on data consistency, insights on accessibility and usability, insights on visualisation preferences; exploring related games, and data contributions from the community.

Thinking in networks. Many participants found it interesting to visualise the design influences between known roguelike variants. One participant said it was “interesting to see how the Moria/Angband variants are interrelated.” Another pointed out that “backward influences” may exist, because many roguelike games are in ongoing developments, noting that “games like ADOM or NetHack may have taken inspiration from a plethora of much younger games.” A game developer, who worked on Cogmind, commented on its inferred influences, “[Roguelike Universe] identifies DoomRL as a strong inferred influence, though I hadn't played or seen it back then. I did, however, play AliensRL as one of my first roguelikes and that may have been an unconscious influence. In hindsight, the two are somewhat similar in fundamental style.” Four other comparative comments on design influence were also made by others about various roguelike games.

On data consistency. One developer, who worked on ArchiveRL, expressed a concern on the ambiguity between inspiration and what they called “de-influence”, that a game intentionally distances itself from another game, a topic coincidently explored briefly by Juul, “anti-inspiration” (2016). The Cogmind developer replied, pointing out another naming ambiguity, noting “the graph shows it's a [known influence] that Cogmind influenced the new 2018 Battletech, although that entry on RogueBasin was referring to Battletech, the original tabletop game.” Other developers added, saying that alpha, beta, stale, and 7DRL games should also be included in the dataset, but did not

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65 https://archive.org/details/ArchiveRL.7z
66 7DRL Challenge, also known as the 7-Day Roguelike Challenge (http://7drl.com/), is an online annual event in which anyone is invited to submit a roguelike game made during a 7-day period.
come to a conclusion on how a 7DRL game should be differentiated from its expanded version. One person pointed out that some roguelike games are developed for more than ten years, and acknowledged the difficulty to visualise such a long development lifespan.

**On accessibility and usability.** Participants found certain visualisation features less accessible or obscure. One person mentioned that they only found out later the ability to hover over arcs and view game titles, which made exploration easier. A few commented on font sizes being too small, and some inferred influences are repeated as known influences, both of which we acknowledged and fixed during the study period. The main comments on accessibility came from the survey, where participants expressed the desire to distinguish “more interesting” influences. One response wrote that they “would’ve liked to see stats on the game that takes the most or the least inspiration.” A couple of comments picked up on the open data, expressing that “it’s a great dataset to work with,” and another said “it would be interesting to see [other developers’] take on this dataset.”

**On visualisation preferences.** Although we did not ask to compare differences in different idea network visualisations, participants expressed different opinions on whether the influence arc diagram or the influence timeline was more useful. One person wrote that they did not see what new information the influence map provided over the influence arc diagram. Conversely, another person liked the influence map, realising how it was created, saying “visualisation also showed relative positioning based on mentions, that's really cool.” On the other hand, a third respondent wanted more types of visualisations, writing that “it might be nice to see a heatmap or assign a weight to the strength of the influence, or build influence chains to see a game's influence-tree.”

**Exploring related games.** There were very clear agreements in what made exploring the idea network useful. Participants liked to click on related game titles, which led them to a list of other game titles to explore. Two people wanted to try related roguelike games because they were curious about them. For example, one wrote that “I don't expect it to be great, but I think I'll give this Scrap game a try just to satisfy my curiosity.” As participants shared their knowledge about design influences, comments were seen visibly from exploration, praising it was “really cool to explore, neat project.”

**Data contributions from the community.** This insight came only from personal interactions between roguelike game developers and myself on Twitter and Reddit. For example, the Cogmind developer commented earlier about the naming ambiguity for the game Battletech, which we corrected. They noted our correction, and edited their comment on Reddit. Another developer who worked on MidBoss (2014) reached out to us on Twitter, saying they were pleasantly surprised that their game was on the list. They
asked how they could contribute to missing influence, to which we wrote back, “You can contribute directly to the RogueBasin wiki.” The next day, RogueBasin and Roguelike Universe were both updated with new information that was not there before, contributed directly by the MidBoss developer themselves. A second memorable example was from the developer for HyperRogue (2011), who pointed us to a series of five blog posts they wrote, detailing every influence that went into the game. We included them in our dataset.

7.6 Limitations and Design Implications

Idea networks capture and index moments of inspiration, many parts unknown and elusive to the designer themselves. This chapter showed that partial idea networks can be useful for exploration, gaining insights that serve a purpose, and that they open doors to new, curious lines of inquiry. The design method we took to examine idea networks and their usefulness in generating insights is through data visualisation, to make the abstract more explicit. This research has explored potential uses for idea networks that may resemble influences in other creative works. In this section, we will discuss some of the design implications of idea networks on the designer’s retrospective, our reflection of the idea network itself, and discuss what design implications the insights generated from the user study has. Before that, we will acknowledge the boundary of this study, and describe its limitations.

There are two main challenges in designing an idea network: data collection, and the mechanism used to present information in a useful way. There are much more nuanced meanings behind every inspiration. Even language itself can be too limited to describe the spark. The nature of structure-free text makes automated meaning-finding analysis a challenging task. On top of that, there is no central repository that tracks the fluid occurrences of ideas, influences, and inspirations. To study idea networks, it was natural that we leveraged an existing partial database, and filled in inferred approximations with online discourse, such as the roguelike idea networks presented in this paper. Regardless of the network chosen to study, we acknowledge that the dataset is only likely to be representative of a creative domain, and not encompass every small, but equally important, detail. We also acknowledge that there is a new roguelike game emerging into the market on a weekly basis\(^7\), adding a temporal challenge to the construction of idea networks. That said, RogueBasin holds much promise to record roguelike influences, as are the community maintaining it. Idea networks will benefit much from future studies using a different kind of data source, integrating the research findings from this chapter.

\(^7\)Steam, the largest PC games marketplace, sees 1 new game with the ‘rogue-like’ tag every week. See https://store.steampowered.com/search/?sort_by=Released_DESC&tags=1716&filter=topsellers
Some participants in the study mentioned alternative visualisations, such as an ‘influence-tree’, and the ability to arrange the idea network by significant statistics. They are good ideas. One future work logically to pursue after this paper is to build, as far as the data can give you, a full picture of the roguelike idea network in a ‘zoomable’ view. Another future work is to build specialised tools and give other developers to extend on. Some practical considerations are the potential cognitive overload displaying over 600 games in one view, providing a navigation mechanism for the viewer, and identifying a good layout without clutter. Chernobelskiy et al. (2012) presented an aesthetic drawing layout inspired by the late American artist, Mark Lombardi, but the layout is force-directed, not ordinal. That is to say that the layout does not utilise ordinal axis and scales, such as the chronological release dates of roguelike games. A hybrid layout may be designed to get the best of both worlds.

Design implications of idea networks are tightly linked to the insights extracted by the designers. Idea networks provide efficiency indexing—similar to the citation index (Garfield, 1955)—of related design influence in creative works. For roguelike game developers, they could trace influence from their own game to its predecessor, which they reported, to its predecessor, and so on, until the origin influence is reached, the idea at its first inception. Throughout this process of discovery, as recorded by the user study, there is also the parallel process of critical self-examination of influences. In a conversation context with other game developers, the process of self-examination becomes cross-examination, which then becomes knowledge sharing. The result is knowledge contribution back to the idea network itself, recorded via dialogue.

7.7 Conclusion and Future Work

We have presented a roguelike idea network of 639 games, including their design influences to other roguelike, roguelike-like, and non-roguelike games. This idea network of design influence is supported by three visualisations: the design influence arc, the influence map, and the influence timeline. We conducted an online user study to investigate what insights can be extracted by roguelike game developers. Through observing discussions among game developers, we generated six classes of insights. They are: thinking in networks, insights on data consistency, insights on accessibility and usability, insights on visualisation preferences, exploring related games, and data contributions from the community.

Idea networks are a tool of research and for research, of design and for design. Roguelike game development has a rich history spanning over 40 years, but idea networks are potentially applicable beyond roguelikes. Nonetheless, while idea networks
of design influence only represents a part of the known and documented influences, this study has shown that a partial idea network can generate new insights through design exploration.

Future work includes a potential system that can generate idea networks with little human intervention. Such system should encompass appropriate rectification and correction procedures. Another type of future work is to explore alternative data visualisations of idea networks, searching for an efficient display for both leisurely exploration and scholarly research.
Conclusion

The thesis is concerned with idea networks and their significance via a curios-driven and reflective, research-through-design methodology. It aims to conceptualise idea networks using game jams and roguelike games as its study context, and lifts the design insights in a more general way that can be applied to other fields of creative pursuit. The research methodology chosen for the thesis is an iterative approach: each study provides research insights that would improve the next one, and the design is carried out for the purpose of knowledge creation.

As the thesis focal point, I propose idea networks as a network of creative works. An idea network is a systemic epistemology network, constructed by strategically observing, documenting, and validating design influences from a broader view. It provides an exploratory mechanism to efficiently discover creative works that are socially and culturally interlinked. Idea networks can serve the needs of many disciplines: that of the researcher searching for a starting point, that of the designer seeking new inspiration, that of the consumer exploring related creative works of interest, and that of the archivist documenting and presenting information in a structured way.

During the time undertaking research for this thesis, I investigated the design affordances of brainstorming toolkits, and the intrinsic motivations for game developers to participate in game creation events. The investigations equipped me with domain understanding, and informed the research methodology. It involved research through designing the construction process, structure, visualisation, and reflecting on the design exploration aspects of idea networks in game jams and roguelike games. This chapter presents a summary of the findings and addresses the research questions.

In Section 8.1, I address each of the research questions with a review of the design implications and insights. Section 8.2 presents a concise definition for idea networks for future academic discourse and research. Section 8.3 reflects on the research methodology taken for the thesis, noting the journey from a design and personal perspective, which may be useful for others looking to embark on a similar journey. Finally, in Section 8.4, I discuss the limitations of the thesis as a whole, identifying new gaps, research
opportunities, and closing the thesis with a its contributions to the body of knowledge on design research and games research.

8.1 Addressing the Research Questions

In Section 1.2, I outlined the research aim and the four research questions that motivated this thesis. For a concise reference, Table 1.1 listed each chapter with the research methods used, corresponding research questions, and the research data. The aim of this thesis was to conceptualise ideas as a network. It fulfilled the aim by strategically investigating influences and inspirations in game design, linking different game ideas in a systemic epistemology network of influence. It was through the process of reaching the research aim that the research questions were addressed. In Table 8.1, I review each proposed research question and give a overview of address, followed by a detailed summary.

<table>
<thead>
<tr>
<th>RQ1</th>
<th>What are the structures of idea networks relating to shared influences?</th>
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<tr>
<td>RQ1</td>
<td>I propose idea networks to be connected by similar subjects (undirected networks), sources of inspiration and design influence (directed networks). They naturally form clusters of similar ideas. Similar ideas are common even when teams from culturally and geospatially diverse backgrounds are given a central theme.</td>
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| RQ2 | What significant properties can we observe from the structure of idea networks? |
| RQ2 | By examining ideas reported in Global Game Jam 2014, I observed hierarchical and network thinking, the social phenomena of the 'small-world' effect, and that idea networks can support intuitive visual browsing of related ideas. Idea networks offer a cultural and temporal dimension to the exploration of ideas in addition to usual means of classifications, such as titles and genres. |

| RQ3 | How can idea network visualisations describe influence? |
| RQ3 | By gathering and calculating inferred influences of 85 roguelike games, I designed three influence diagrams and one accompanying legend. They are the influence arc diagram, an artful visualisation of design influences accompanied by the genre-influence matrix to divide each influence arc into four quadrants; the genre-influence map, a qualitative scatterplot of relative influences both in- and out-of-genre; and the roguelike influence timeline, a time versus total influence network plot of individual roguelike titles. |

| RQ4 | What insights can designers extract through idea network visualisations? |
| RQ4 | I expanded the roguelike idea network to a total of 639 titles, and used both known and the calculated inferred influences for an online user study with game developers. From |
the user study, the results indicated size classes of design insights: thinking in networks, insights on data consistency, insights on accessibility and usability, insights on visualisation preferences, exploring related games, and data contributions from the community. The design implications were two: the tightly-linked nature of idea networks and the domain which they situate, and the self-examination nature of designer dialogues arisen from using and exploring idea networks.

**RQ1.** This research question was about understanding the structures of idea networks. In Chapter 5, I conceptualised idea networks by examining the theory of inspiration (Thrash & Elliot, 2003; Thrash & Elliot, 2004; Thrash et al., 2010), and extended existing literatures through a networked approach (Metcalf, 2007; Houghton, 2009). Ideas were represented by certain outcomes, such as videogames stemmed from brainstorming ideas. The conceptualisation was strengthened by Chapter 3 & 4, in which I examined the design affordances of brainstorming toolkits, and the intrinsic motivations of game jam participants. Building on that conceptualisation, I constructed and visualised (Lombardi, 1996) an idea network manually by encoding the Global Game Jam 2014 survey results until saturation. The visualisation revealed what I called ‘idea islands’, or clusters of ideas that shared similar synopses (Metcalf, 2007; Hagen, 2009; Hagen, 2012). This was significant, because ideas were all generated individually and separately in small teams from thousands of jammers all over the globe based on the same theme. In an idea network structure, nodes are individual idea expressions (statements) or manifestations (creative works), connected by common subjects and context, and by shared influences and inspirations. Connections can be undirected, or directed (Reka & Barabási, 2002). Chapter 5 explored undirected connections in idea networks. Additionally, Chapters 6 & 7 explored directed connections.

**RQ2.** This research question was concerned with observable properties of idea networks which are useful and significant to note. In Chapter 5, I noted three design implications stemming from undertaking the research on Global Game Jam 2014 idea networks. They were: hierarchical and network thinking, the ‘small-world’ effect, and the intuitive support of browsing ideas. Network thinking is derived from systems thinking about creative works (Gruber, 1988; Rubenstein-Montano et al., 2001). Network thinking leverages the associativity of ideas, and how ideas are combined, adopted, and reused (Tschang & Szczyypula, 2006). Hierarchical thinking (Grace, 2011) leverages the complex cognitive ability to group similar instances and retain them in the mind. Idea networks naturally form ‘idea clusters’ (Hagen, 2009; Hagen, 2012), providing varying levels of
perspectives for consumption. The small-world effect (Guare, 1990; Watts & Strogatz, 1998) was observed in all idea networks constructed in this thesis. As the social phenomena of small-world networks suggest, like friendships, ideas may be closer to each other than we realise (Guare, 1990). I also showed that idea networks can support intuitive browsing of related creative works in Chapter 5, and later again in Chapter 7, allowing the viewer to formulate an understanding of the big picture at ease. Its structure reduces information overload (Roland & Bawden, 2012). In addition to title of the work, creator, genre, country, and other means of classifications, idea networks offer social and temporal dimensions to the browsing affordance, including influences, similarities in design, creative process, and output.

**RQ3.** This research question is about designing suitable data visualisations to illustrate ideas and their influences (Harper, n.d.). In Chapter 6, I calculated the dataset of inferred influence for 85 major roguelike games (Hawkes, 2013; Garda, 2013a; 2013b; Johnson, 2017) spanning four decades. The design explorations (Reas & Fry, 2005; Bostock et al., 2011) were described in Sections 6.5 and 7.3. Dataset was then used to create three diagrams: the *influence arc diagram* (Figures 6.1, 6.2, 6.3, and 7.3), the *genre-influence map* (Figures 6.5 and 7.4), and the *roguelike influence timeline* (Figures 6.6 and 7.5). First, the influence arc diagram represents each roguelike influence with an arc, starting and ending on the titles’ release years along the horizontal axis, artfully displaying the roguelike influence. The chart is accompanied by a legend called *genre-influence matrix* (Figure 6.4), dividing each influence arc into four quadrants: representative, influential, in-genre, and out-of-genre. Second, the genre-influence map plots each game title in one of the four quadrants based on their influences, showing a qualitative view of their relative influences. Lastly, the roguelike influence timeline plots each game as a dot on two axes: time and relative total influence. It connects the dots by their individual influences to each other, illustrating the full view of roguelike design influence in a chronological layout. Each one of the diagrams are fully interactive as a web-based data visualisation, and the data is open access, with an open source code base.

**RQ4.** This research question seeks the potential insights that could be extracted by designers using idea networks. In Chapter 7, I expanded the scope of the roguelike idea network to 639 games, including major, alpha, beta, and variants of major roguelike games. I set out to address this research question by ways of research through design (Zimmerman et al., 2007), observing the dialogue among designers (Stuckey, 2017). The chapter also overviews iterations of the three diagrams that first appeared in Chapter 6. From inviting game developers to explore the idea network visualisations and their discussions about using them, I identified six insights from the game developers. They
are: thinking in networks, insights on data consistency, insights on accessibility and usability, insights on visualisation preferences, exploring related games, and data contributions from the community. Reflecting on the design process (Grocott, 2010) and the design insights, two design implications came out of the study. The first design implication is that idea networks are tightly linked to the domain in which they are situated, offering an expedited searching mechanism until an idea of its kind is found at its first inception. The other design implication is that using idea networks enable a critical self-examination of their own knowledge, evaluating the assumptions about creative works and influences, and improving the accuracy and coverage of the idea network as a result.

8.2 Defining Idea Networks

Concise statements for idea networks were developed based on this thesis and the conceptualisation as a whole. The intention for including these statements here is to encourage academic discourse, and not to draw a boundary to exclude future extensions and amendments. Interested readers can use this definition to develop the body of knowledge on idea networks further.

On the definition of an idea network:

Definition

An idea network comprises creative works that are interrelated.

Construction

An idea network can be constructed by strategically observing, documenting, and validating sources of inspiration and similar influences in creative works. Creative works are the network nodes. Relationships of nodes are described by their influence.

Advantage

An idea network enables the efficient lookup of interrelated creative works, tracing an idea to the first inception.

Affordance

An idea provides an associative scaffold to structure and organise creative works beyond the usual means of classification, such as genres or tags.
8.3 Reflection on the Research Methodology

Throughout the time period carrying out this research topic, I frequently came upon fresh ideas that could change the thesis drastically. Most of them were put in the backburner, because they would not address the research questions about idea networks. The only constant thing in my research journey was the research methodology: research-through-design (Zimmerman et al., 2007), reflective design research (Schön, 1983; Grocott, 2010), and curiosity-driven research (Strandburg, 2005; Reio, 2012; Santoro & Snead, 2012).

This thesis is fundamentally a kind of translational research (Woolf, 2008) in the sense that it brings the approaches in design research into games research for knowledge generation, and lifts the findings back as design implications. Research-through-design, a widely used research paradigm used in human-computer interaction research, recognises the value of designing digital interfaces as a research process. Reflecting on using it, I would say the design particulars in the paradigm suited this thesis. One challenge I faced in conversations with other scholars while undertaking this research for this thesis was to explain idea networks in simple terms. Using visualisations as an example is often a good conversation starter for me. Consciously separating the design from research allowed me to carry out design work for a purpose, and research work for knowledge generation with crystal clarity.

What research-through-design and reflective design research have in common is generating a reproducible process for design research (Schön, 1983; Zimmerman et al., 2007). This thesis, as a whole, presents an overarching design process and theory about idea networks, and others can follow the same design process to reproduce a similar kind of research, for instance, idea networks for children’s literature. The knowledge presented in this thesis came from three sources: the current literature on game development and game ideas, conversations with other designers, and hands-on designing idea networks about game design influence. The thesis benefited greatly from me carrying out the design, which granted me the design insights and encouraged more internalisation of design influences and idea networks, in addition to the surveys and user study. Throughout the thesis, I strived to describe the design explorations in detail, so that others may follow my design process.

Why was this thesis approached with a curiosity-driven research mindset? The answer to that question is the same answer to the question asking me, “how can you get a job out of your thesis?” and the answer is “To satisfy my curiosity.” In my mind,

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68 I write from multiple instances of personal experience.
pursuing a research thesis is dedicating time and efforts aside to pursue an intellectually satisfying topic. It is a luxurious choice and privilege that not everyone have the opportunity to pursue, and it involves some elements of luck. One year into my research journey, after the thesis topic is set on investigating idea networks, I participated in Global Game Jam 2014 and completed their post-event survey. I saw the questions in the survey asking about ideas and tools. I paused and thought, I must get in touch with their research committee to collaborate on the dataset. That fateful email exchange set me on the path of examining games in games research as the study domain. I love my research topic and have never regretted taking it, which was also another element that kept my curiosity alive.

8.4 Limitations of this thesis

One aspect in this research methodology that I could have done differently is the approach to data collection. From a digital heritage point of view, idea networks can potentially serve as a exploration tool for digital museums and archives. This approach requires a rigorous historian and archivist training, extensive reading of a particular topic, and a large amount of patience for manual data entry. As a software engineer background, I wanted to bring my digital skill sets into the thesis, and I found that writing software using existing datasets was more appropriate to apply my coding skills, whilst still being able to conceptualise idea networks and achieve the research aim. Had I come from a different training, I may have approached this thesis with an archivist mindset.

A part of the difficulty in making this thesis is balancing the research scope of idea networks curation and visualisation. If I had more time, I could spend another 6-9 months gathering data, and significantly extend the research domain. On the other hand, I would have liked to spend another 9-12 months iterating on the visualisations of idea networks, drawing from data sources available to further our understanding of idea networks as a concrete concept. While I could not spend more time on doing either, my supervisors and I were content with the work that went into making this thesis thus far.

I also recognise that there are many opportunities to engage with more literature, for instance in systems thinking, game design, game archaeology, design thinking, and so on. Such is the nature of a multidisciplinary research project, that I could draw from many sources and never find the end of the rabbit holes. I hope what I have presented here is a concise rendering of my research journey that let me to this point. Where I was able, I provided links to further reading and related studies.
In the next and final section, I will present some of the possibilities that can take this research to the next level, and conclude this thesis with its contributions to the body of work on design research and games research.

8.5 Future Directions

*Roguelike Universe*, the web page created for investigating roguelike influence and idea networks, will likely outlive the chapters that conceived it (see Appendix D). At the time of writing, I have already considered the necessary future additions that will go into the roguelike idea network. However, further work on *Roguelike Universe* would add greatly to the understanding of the roguelike videogame subgenre, and not to idea networks research.

Research on idea networks is an open field. The first direction towards a general idea network is to apply the conceptualisations presented in this thesis onto another field of creative pursuit, or a collection of creative works. While I remained as general as possible when constructing idea networks, I indicated in Chapter 7 that idea networks are tightly linked to the domain. It would be essential to apply idea networks as an approach to study another field, unpack the design affordances and insights, and contribute back to the body of knowledge on idea networks. This would be an application of idea networks research.

Another application onto idea networks is to apply methods of evaluation from citation and legal networks onto idea networks, borrowing from graph theory (Reka & Barabási, 2002; Raper, 2012; Karsdorp & van den Bosch, 2016). This approach would allow us to address questions such as “what was the critical path to develop a particular popular technique used throughout a creative field?” and “given a set of influences and metrics, how similar are two creative works?” Unlike scholarly impact or legal weight, this set of evaluation would benefit the design of new tools, assisting the users in novel exploration mechanisms with evaluative metrics. It would be a suitable computer science topic for research, and not in design.

The third direction going forward is to create a metadata standard for storing ideas, creative works, influences, and the sources of information (Roland & Bawden, 2012; Stuckey et al., 2013). When Eugene Garfield started the scientific citation index (1955), the citation format was relatively compact. They could—and did—exhaustively go through every major publication and link their references, with the help of computers. With idea networks, constructions are not so simple. Influences and inspirations are often described in a prose or conversational format, and there is no repository able to support this kind of storage. It is important to keep in mind that some influences are...
unknownable, or cannot be traced. The two research questions needed answers are, what format of idea networks are conventionally viable in the highly connected information network era, and what factors can increase usage to ensure the information is captured? This approach would be a suitable digital heritage research topic.

The fourth direction is to take idea networks to the screen. As some of the participants reported in the study in Chapter 7, it would be interesting to explore other types of idea network visualisations that describe beyond the current designs. For instance, an ‘influence-tree’ layout that links across branches of idea developments, or an interactive filtering system that ranks creative works based on the influence structure, and show the most influential works as an entry to exploration. Network visualisation is an established field of research (see Batagelj & Mrvar, 1998; Manovich, 2011; Kieffer et al., 2016), and many tools exist for creating data visualisations (e.g. Reas & Fry, 2005; Bastian et al., 2009; Bostock et al., 2011). Novel idea network visualisations may open new doors in research the affordances of idea network visualisations.

In closing, this thesis proposed idea networks as an exploratory resource to structure creative works and design influence. The proposed conceptualisation was situated in game jams and roguelike games in games research. The results indicated that the design implications and process can be generalised to study in other fields. It contributed in the body of knowledge on design research and games research as a conceptualisation of idea networks: their structure, significant properties, visualisations to describe influence, in particular roguelike games, and from exploring idea network visualisations, new design insights.
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Appendix A

List of Global Game Jam 2017 Survey Questions

Note: the survey was instrumented by Global Game Jam 2017 organisers. We were only granted responses to Q13 and Q14 for the purpose of our study. Thus, no effects from other questions, including demographic effects, could be found.

1. Was your GGJ site located in USA, Brazil (Brasil) or Canada?
2. Please select your Global Game Jam location.
3. How do you identify yourself?
4. What is your age?
5. What is the highest degree or level of school you have completed?
6. If currently enrolled, mark the previous grade or highest degree received?
7. Rate (1-5) your skill at the following: Art production, Audio production, Game design, Game production, Programming, Writing
8. Please indicate (Likert scale) your level of agreement with the following statements about GGJ.
   a. I liked the theme this year
   b. I am satisfied with my overall experience
   c. I liked the 2017 diversifiers
   d. I liked the keynote video
   e. I felt connected to the GGJ community around the world
9. Please indicate your level of agreement with the following statements about your local jam site.
   a. My jam site organizers and volunteers did a good job
   b. My jam site was well organized
   c. I felt comfortable and safe at my jam site
   d. Volunteers where helpful at my jam site
   e. I hope to return to the same jam site next year
10. Did your site have (yes/no)?
    a. Mentors
    b. Guest Speaker
Technical Workshops
Contact details on-site in case of emergency
Security
Food catered
Quiet place to rest
Transportation to and from the jam site
Open 24 hours
Computer hardware
Audio equipment
Dedicated virtual reality area
Prizes and awards
Audience choice voting
Judging by actual referees or individual judges

11. How many people were on your team? (include yourself)

12. Please indicate your connection to the people on your team (choose one).
   a. I had met never before with the team until GGJ
   b. I had met never before with at least one of the members on the team
   c. I knew half of my team and met the other half at GGJ
   d. I knew all or almost everyone on the team
   e. I work or jammed before with almost everyone on the team

13. Did you use any tools to brainstorm for ideas? If so, how did you use it.

14. What was your favorite moment in GGJ?

15. Where you at GGJ as a … (choose one)?
   a. Attendee
   b. Volunteer
   c. Organiser

16. How many times have you participated in any jam?

17. Would you participate in GGJ again?

18. How could GGJ be improved for you next year?

19. How could your local jam site be improved for you next year?

20. Do you have any comments you want to leave for GGJ Global? Everything is completely confidential.
Appendix B

Roguelike Universe (Chapter 6)

Our visualisation tool, collectively named Roguelike Universe, is open source and available on GitHub for anyone to download and use: https://github.com/Spaxe/roguelike-universe.

For the complete list of influence diagrams for all 85 roguelike games and over 1,000 article entry examined in this study, the interactive diagrams are available as part of Roguelike Universe webpage: https://spaxe.github.io/roguelike-universe/versions/1.0.0/index.html.⁶⁹

The Boolean structure used to collect relevant webpages in this study is as below:

“<game title>” AND <developer> AND game AND (interview OR mortem OR history OR develop)

Appendix A originally appeared in the same paper for Chapter 6, “Finding Design Influence within Roguelike Games.”

⁶⁹ Also see Appendix C for the latest version.
Appendix C

Roguelike Universe (Chapter 6): Corpus and Source Data

The data collection method for Roguelike Universe (Chapter 6) is listed in Appendix A. This can be useful for other scholars to examine, adopt, as well as providing data for reproducible research. It took a few days to run the automated web scraping, so we also provide the complete corpus that has been downloaded.

The archived corpus and source data can be found at https://github.com/Spaxe/roguelike-universe/tree/digra-fdg-standalone/data.

On GitHub in the repository, the following files are our sources:

- **data/Data Collection.ipynb** - Python script used to scrape the Internet for relevant articles
- **data/games.json** - a comprehensive list of videogames
- **data/roguelikes.json** - roguelike games included in this study
- **data/corpus.json** - article content extracted by our script used in this study
- **data/roguelike-relations.json** - a list of computed relations using our methodology

Appendix B originally appeared in the same paper for Chapter 6, “Finding Design Influence within Roguelike Games.”
Appendix D

Roguelike Universe (Chapter 7): Data from the International Roguelike Database

The reader is welcome to visit the latest Roguelike Universe, created and designed for Chapter 7 at https://spaxe.github.io/roguelike-universe/.


As of writing this thesis, the most recent data download we made was on 21 August, 2018, using this exact search link: https://forums.roguetemple.com/irldb/index.php?i=47e013c.

The date output format was “yyyy/mm/dd”, which requires manual override. The data include roguelike games that are “alpha”, “beta”, “stable”, “major”, “unknown”, and “Angband variants.” It returns the following fields: “website”, “type”, “release date”, “update date”, “developer”, “theme”, and “influence.” The table is sorted alphanumerically by game title before being exported.

Keen explorers will notice that the data contains numerous errors, especially on the date fields. We consistently see invalid dates like “2005/86/93”. Our estimate is that nearly 100 games have invalid dates. Fortunately, most of them had at least a valid year, which is used.

We manually cleaned up the dataset by two items. The first item is to remove influences that were not games at all, even though some are quite specific (such as “J.R.R. Tolkien’s Middle-Earth”), they are not in scope of the roguelike idea network; and remove influences that were non-specific (such as “horror movies”). The second item is to remove games that did not have a valid release date or a valid update date at all for consistency in the visualisation.

The hand-cleaned version, along with the notes, can be found online here: https://docs.google.com/spreadsheets/d/1cUmwMHQQWkPTh-89L9QDVc25QOCAHjqvZYOufzmQOk/edit
Appendix E

Roguelike Universe (Chapter 7) Data Structures for Downloading

*Roguelike Universe* has an open data license, Creative Commons Non-Commercial 3.0. It is our intention to give permission to give the data publicly for anyone to use and reuse in a non-commercial context, as the original data is also in the open domain, hosted on *RogueBasin*.

As of writing this thesis, the data download is generative live in the web browser. While this means that a direct link to the data is not possible, it does mean that the data downloaded is exactly the same as the visualisation shows. In the future, a direct download link is possible with the help of a web hosting service outside of *GitHub*.

Each download is in JavaScript Object Notation (JSON) format. It has two fields, “metadata”, and “data”. The metadata will look something like this for every download:

```
"metadata": {
  "author": "Xavier Ho",
  "email": "contact@xavierho.com",
  "author_website": "https://jumptoglide.com",
  "github_website": "https://github.com/Spaxe/roguelike-universe",
  "project_website": "https://spaxe.github.io/roguelike-universe",
  "license": "Unless otherwise specified, Creative Commons Non-Commercial applies",
  "license_url": "https://creativecommons.org/licenses/by-nc/3.0/",
  "acknowledgement": "RogueTemple and RogueBasin contributors",
  "download_date": "2018-09-18T10:02:28.199Z"
}
```

The data structure is specific to the visualisation. In the *influence arc diagram*, the data is an array of influence objects, for example:

```
"data": [
  {
  
  }
```

---

70 [http://json.org/](http://json.org/)
In the *genre-influence map*, the data is an array of game titles, and their positions on the map, for example:

```
"data": [ 
  {
    "title": "3059",
    "x": 1,
    "y": 7
  },
  {
    "title": "3069",
    "x": -5,
    "y": 7
  },
  ...
]
```

In the *roguelike influence timeline*, the data is an array of games, its metadata, and influences, for example:

```
"data": [ 
  {
    "Name": "100 Heroes: Shopkeeper of Doom",
    "Status": "alpha",
    "Released": "2012-01-01",
    "Updated": "2012-01-01",
    ...
  }
]
Anyone can download each figure’s data by clicking on “Download Data” below the figure on Roguelike Universe: https://spaxe.github.io/roguelike-universe/