Design for serendipity: a Research through Design approach

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A note to the reader

If you are reading this text in a digital format I recommend choosing a two-page layout. This is because two images (fig. 32 and fig. 37) are presented in spreads.
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Abstract

In this thesis I explore the concept of serendipity by looking at if and how it is possible to foster surprising discoveries of books during online searching, similar to such discovery while browsing bookshelves in a bookshop or a library.

Serendipity is a word originating in the Persian fairy tale The three princes of Serendip. In 1754 Horace Walpole uses the word for the first time, explaining that in the story the princes are “always making discoveries, by accidents and sagacity, of things which they were not in quest of”. In other words, serendipity is about finding interesting and valuable things not looked for.

Looking at “finding” in the context of computer systems and Human-Computer Interaction (HCI), Carr (2015) describes retrieval in three different modes: linear, non-linear and serendipitous. Both linear and non-linear searches have a well-defined goal and the result of a search is in clear correlation with the search intention. Serendipity, on the other hand, has “misalignment of intention and outcome”. This is to say that if we look at the result of finding something as a process of searching for a pre-defined outcome only, serendipity fails as a retrieval process. However, inherent in the word serendipity is the fact that if something of interest is found during the search, it has some sort of value.

The approach chosen to study serendipitous search is Research through Design (RtD). The core of this approach is that knowledge can be produced through making. The knowledge emerges while reflecting on making of concrete artefact, as well as how these artefacts support finding answers to the research questions.

My aim was to create visual representations, or visual speculations as I call them, which demonstrate how serendipity can be a valuable approach in certain design situations. By doing so, I hope to open up a space for discourse about serendipity in design. I exemplify my approach by showing how I used sketching and visualisation to make visual speculations. Furthermore, I have used reflection, debate sessions and annotated portfolios to capture new insights. Finally I have evaluated the effectiveness of my artefacts in relation to the research questions.
1 Introduction

Dörk, Carpendale and Williamson, in their paper *The Information Flaneur: A Fresh Look at Information Seeking*, introduces the “information flaneur” (Dörk et al., 2011). “Flâneur” comes from French and describes both an activity and a state, originally in a city setting. The flâneur engages in a form of exploration, it is not merely about going for a walk or a stroll. There is a curious intelligence, a level of aware idling: the flâneur is a “passionate spectator”, but not gawking. The poet Charles Baudelaire described the flâneur as both part of city life and incognito, simultaneously present and aloof. It is a state of mind open to serendipity, a willingness to be “lost”. Rebecca Solnit says “(…) you get lost, in which case the world has become larger than your knowledge of it” (Solnit, 2006 p. 23). She means this in a good sense: by stepping into unfamiliar territory we can discover and explore, giving room for serendipity, and finding things not looked for. Exemplifying the flâneur, imagine yourself in a second-hand bookshop. You might have gone there on a whim, with a hope of finding something relevant to your interest, or in search of a specific item. Either way, second-hand bookshops often have stacks, piles, and shelves of books in various states of disarray. People remove a book and place it back in a different place, there might be shelves and boxes of unsorted books, and often there are discount bins. You wander around for a bit, glancing. A book catches your attention, you examine it, place it back, or decide to buy it. This environment has a great potential for serendipity. The flâneur mindset is often described as a “prepared mind” and the environment in this example can be said to be a “prepared system”.

To a large extent, retrieval in digital spaces revolves around finding specific artefacts and to device algorithms and interfaces that allows for drilling down with increasing precision: search engines being case in point. They are “recommender” systems whose aim is to extract/surface relevant items from an overwhelming mass (André et al., 2009 p. 311). This assume that there is a knowledge gap to be filled, and that artefacts that can fill this gap exists. As suggested by Gary Marchionini, searching in that sense is about “fact retrieval” or “questioning answering” (Marchionini, 2006 pp. 42-43). On the other hand, serendipitous and investigative “searching” – or rather, looking – can potentially expose gaps in knowledge (ibid.). Back in 1997 professor of journalism Ted Gup reflected on the development of the World Wide Web, and expressed concern that its structures and architectures lacks ways of retrieving, storing and organising information that are “wondrously whimsical and exquisitely inefficient” (Gup, 1997).

In this thesis, I attempt to create “flâneur-friendly” visualisations, that can perhaps in some sense be seen as whimsical and inefficient. I do this by the methodology of Research through Design (RtD).

1.1 Motivation

Buchanan suggest that in design research the creators’ placement is more important than categories...
(Buchanan, 1992). Nigel Cross, similarly says that design knowledge exists in \textit{people, processes,} and \textit{products} in that order (Cross, 1999 pp. 5-6). I therefore find it pertinent to describe some of my personal background that I think relevant.

I have an apprenticeship in restoration bookbinding, a year in art school, and a diploma as a ceramic production thrower. I have also worked for six years within an engineering field, building and testing marine research instruments. Subsequently, I have worked individually as a web and graphic designer alone and in design teams, with responsibilities for conceptual, system, graphic, and interaction design. Further, I have participated in creating systems and cross-disciplinary solutions for specialist researchers in life/earth sciences, and worked with complex cross-disciplinary scientific data and information. In my spare time I draw, paint, write articles about art, design, architecture and science, take photographs, and code applications and websites. All this, I argue, creates what Buchanan calls my \textit{placement} outside categories such as “graphic designer”, “artist”, “web developer”, “IT-specialist”, “engineer”, or “artisan”. The sum of this is that I consider myself, as suggested by Nigel Cross, a designer-researcher, as I come from these diverse design practices into research (Cross, 1999 p. 9).

This project and approach started out of an interest in how visualisations can be used to explore. Having worked with scientists in earth and life sciences and created cross-disciplinary systems and visualisations, I grew interested in the problems of identifying not only ways of presenting the known, but exploration. As I discovered in this work, the value in being able to explore and \textit{speculate} was incredibly important for these scientists, and from this grew the interest in serendipity – not in the sense of random chance, but the idea that it might be possible to create speculative, explorative artefacts – what André et al. calls “serendipity-inducing” (André et al., 2009 pp. 310-311).

The choice of books as the case was a natural one: I am educated as a bookbinder, I read, and book-like and book-related technology has come on in leaps and bounds the last decade. As a subject in which the concept of serendipity is easily imagined, as per the second-hand bookshop example, this seemed a clear, concrete case.

\section*{1.2 Questions}

Two main question are posed to guide exploration of the problem space:

RQ1: How can the concept of serendipity be explored through RtD?

RQ2: How can speculative visualisations enable serendipitous book finding?

To study serendipity, say André, Schraefel, Teevan, & Dumais, is very difficult: it is not something easily “captured or induced” in experiments, and can be hard to identify (André et al., 2009 p. 306).
At the core of Research through Design is the thought that knowledge can be created through making. The rationale here is that since serendipity is a very difficult thing to study within a traditional, scientific mindset; that perhaps Research through Design can offer a fruitful approach on how to unpack the problem, value, and experience of serendipity. There are undoubtedly many ways in which Research through Design could aid in this, but my approach focus on four main tasks: sketching, visualisations, debate, and the creation of an annotated portfolio.

- **Sketches**: exploring the problem space of “what can be”.
  
The aim of the sketches was to tease out some ideas and speculate around the problem.

- **Visualisations**: visually refine a selection of the sketches and open for speculation around serendipity.
  
The aim of the visualisations was to create speculative, concrete artefacts around which discussion on serendipity could be done.

- **Debate sessions**
  
The aim of the debate sessions was to bring to light unseen aspects of serendipity through discussion, speculation, debate in general, and in relation to the visualisations that I made in particular.

- **Annotated portfolio**
  
The annotated portfolio is an analytical tool that aims to highlight some aspects and features of the visualisations, my design intentions and outcomes.

I address these question from a “designerly” point of view. This is to say that I am not analysing them from – say – a philosophical, psychological, historical, sociological, or engineering perspectives. Findeli argues that a design project should be “designerly targeted” in that it should not address the concerns of such other fields (Findeli, 2010 pp. 298-299). A design project, then, can build on aspects of other fields but has its own designerly focus. I have chosen an approach to Research through Design that is perhaps a little a-typical: I lean on the RtD typology created by Krogh et al., who suggest five kinds of knowledge production in Research through Design. They name them **accumulative, comparative, serial, expansive, and probing**. I will return to the definitions of all of them, but the one identified with my work is the one called **expansive** and is described as “mapping”, similar to the work of biologists or cartographers. The knowledge pursued is that of identifying areas not yet uncovered, and to “reveal its qualities” (Krogh et al., 2015 p. 9). Expansive work does not have any clear direction in the sense of one task building directly on a previous one in a predetermined manner. This approach, they say, can create new knowledge in exploration of an area as the exploration expands. The goal is not deep knowledge, but a broadening perspective through exploration of “new aspects, approaches, and techniques”. The keywords they use to characterise this is “broadening and extending” (Krogh et al., 2015 p.
9). In this sense, my work is about opening up for a broad perspective on serendipity, through attempting to view it via “new aspects, approaches, and techniques” (Krogh et al., 2015).

I believe that serendipity presents a rich and interesting opportunity in HCI design and research, and the result of my research is that the study of serendipity can indeed be a good fit for a Research through Design approach. Through the exploratory and speculative tasks, the richness of the potential of serendipity is presented. My contribution to Research through Design knowledge is through the experimental techniques, the approach to the design space, and what I believe to be a broadening of the understanding of visualisations for serendipity.

1.3 The structure of this thesis

This thesis is divided into six chapters.

1 Introduction establishes my goals and aims with this thesis.

2 Search, serendipity, and visualisations. This chapter addresses the underlying concepts of search and retrieval, serendipity and sagacity, and offer some examples of visualisations that can be characterised as “serendipity-inducing”. Following that, I offer a description of visualisations and the difference between visualisations for certainty and visualisations for speculation. Finally, in this chapter, I describe a core concept in my work: visualisations for speculation.

3 Background: design research. This chapter starts out with broad strokes, and discuss the relation of science and design with a little historical background on how design is (often) treated and viewed in HCI. I describe what is called “wicked problems”, and how design research sits with other research traditions.

4 Methodology: Research through Design. This chapter outlines Research through Design as a methodology, its relation to theory, research rigour, and design practice. I also briefly discuss intermediate knowledge, and the concept of the annotated portfolio.

5 Methods. This chapter describes the case and the process: the four tasks of sketching, visualisations, debate sessions, and the creation of an annotated portfolio.

6 Findings and discussion. I give a summary of the concepts of Research through Design, serendipity, and visualisations for speculation. I then I discuss the four tasks, their respective results, and the totality in relation to the research questions.

7 Conclusion. A short summary of my findings and suggestions for further design research.
2 Search, serendipity, and visualisations

This chapter discusses search and elaborates in particular on serendipity and sagacity. I address the questions: what is searching and retrieval? What is serendipity? What is the nature of visualisations in general, what are the differences between artefacts for evidence and artefacts for speculation? Finally, in this chapter, I outline the relationship between prototypes and visualisations for speculation. This last term is an important one in my work, as will be made clear.

2.1 Search and retrieval

As mentioned earlier, Carr characterises retrieval in three different modes: linear, non-linear and serendipitous. The first indicate a “known-item search”. In the second, several items might be relevant and an increasing refinement of search can hone in on particular items. In both these cases there is a predetermined goal, and the success or failure can be measured. In contrast, serendipitous finding has a “misalignment of intention and outcome”, and is – in the view of a finding process – a “failure” (Carr, 2015). Digital information retrieval systems are often made around the idea that there is a knowledge gap to be filled, and with increasing precision one can “zoom in” on items that will fill this gap: the linear and non-linear modes. As Marchionini described, this is “fact-retrieval”, “question-answering” or “query-response” (Marchionini, 2006 p. 42). André et al. suggest that essentially all systems for retrieval are “recommender systems” in some way (André et al., 2009 p. 309). For example, a typical search (engine) result is a list-out, and one can get the impression that there is a ranking of “best fit” or “best hit”. This may or may not be the case, as often the criteria for the ranking is opaque. Then there are visual investigative and exploratory systems that enable “looking” (Marchionini, 2006 p. 43), and allow for serendipity. This, according to André et al., alters the idea of ranking, but they also ask if such a system might just be a different kind of recommender system, and perhaps a bad one at that. The answer, they suggest, is both yes and no (André et al., 2009 pp. 310-311). The aim of both the query-response and the visual exploratory system is to help identifying interesting content from masses of options, but André et al. suggest that a “serendipity-inducing” system can be, in a positive sense, an “un-recommender system”, and that some level of randomness can be beneficial (ibid.).

2.2 Serendipity: the unsought finding

Sindbad the Sailor had no quarrel with the caliph’s project, though he’d never before set sail with any motive nobler than restless greed. As he knew from hard experience, however – and will presently declare to his dinner guests, at the end of their monthlong fast – you don’t reach Serendib by plotting a course for it. You have to set out in good faith for elsewhere and lose your bearings... serendipitously.

Barth, 1991
In this section I elaborate on serendipity and sagacity. The latter is not a focus of this work, but it is worth mentioning as the mechanism that gives shape to serendipity on an individual level.

In his paper *Anatomy of the unsought finding*, Van Andel defines serendipity as making an “unsought finding”. He suggests that the unsought finding means that: “two or more elements (observations, hypotheses, ideas, facts, relations, or insights) are combined originally […] to something new and true (science), new and useful (technology), or new and fascinating (arts)” (Andel, 1994 p. 643). McCay-Peet & Toms similarly defines serendipity as a valuable “unexpected experience” that occurs when a person interacts with “ideas, information, objects, or phenomena” (McCay-Peet et al., 2015 pp. 1473-1474). Danzico suggests that perhaps “chance encounter” is another way of describing the concept (Danzico, 2010 p. 16). Serendipity is on one level described as “happy accidents”, but not in the same sense that finding money on the street is a happy accident or luck. Lindsay strongly argues that serendipity is not luck, magic, or even accidental: it is a mechanism through which we discover “unknown unknowns” (Lindsay, 2014 pp. 4, 14). Serendipity has been used to describe both the stumbling upon of something interesting (for example while reading the newspaper) and world-changing discoveries (such as penicillin) (Andel, 1994 p. 639; Foster et al., 2003 p. 5; André et al., 2009 p. 306; Thudt et al., 2012 p. 2), but what each of these have in common, is the ability to recognise the “unsought finding”. A problem with serendipity, Lindsay say, is that it is often relegated to after-the-fact anecdotes when other descriptions or explanations don’t fit (Lindsay, 2014). Van Andel similarly argues that serendipity is underestimated in a number of fields including science, technology, and art. The reason for this, he says, is because of rationalisations after-the-fact. In this way descriptions of crucial serendipitous events are removed from research (Andel, 1994 p. 644).

**Sagacity**

In the literature, there is a distinction between two elements of discovery: serendipity and sagacity. While serendipity is about finding something unexpected (and valuable), sagacity is the ability to make use of it in some sort of intellectual leap, and is dependent on the individual (Andel, 1994 p. 643; André et al., 2009 p. 306; Kefalidou et al., 2016 p. 1). For serendipity to happen, Thudt et al. (2012) suggests two essential factors. The first factor pertains to personality traits: “observational skills, open-mindedness, knowledge, perseverance”. The second they call environment and includes “coincidence, and influence of people and systems” (Thudt et al., 2012 p. 2). This corresponds to what is also called the prepared mind and the prepared system.

**The prepared mind**

Several scholars argue that some cross-disciplinary knowledge is important to make use of serendipitous discoveries, and a prerequisite for this is often called the “prepared mind” (Andel, 1994 p. 646; Foster et al., 2003 pp. 4-5, 25; André et al., 2009 pp. 306, 309, 313; Dörk et al., 2011; Thudt et al., 2012 p. 2; Lindsay, 2014; Carr, 2015). In other words, the mindset of the flaneur
mentioned earlier: both present and aloof, engaged, but not too strongly focused on a particular task. Lindsay suggests that some of the properties needed for serendipity to happen is an ability to think in metaphors, refraining from drawing conclusions, and resisting working within defined domains and disciplines. He quotes Lawley, who say that it requires systematic thinking, but outside basic cause-and-effect (Lindsay, 2014 p. 10). The “prepared mind” is described by Joichi Ito as consisting of peripheral vision and creativity:

You don’t get lucky if you plan everything – and you don’t get serendipity unless you have peripheral vision and creativity.

(Ito in Lindsay, 2014 p.10).

Van Andel argues that serendipity is never an accident or a random event: it happens in a particular setting when some peculiar circumstances triggers a prepared mind (Andel, 1994 p. 645). To van Andel, the prepared mind is characterised by a number of things such as curiosity, intuition, artistry, and flexibility, but most of all, with what he calls “loose blinders” (Andel, 1994 pp. 645-646). His argument is that blinders are necessary to get things done, but a person with a prepared mind are able to recognise when something serendipitous happens, and remove them (Andel, 1994 pp. 645-646).

Personality traits and whether a mind is “prepared” or not, is not something a designer / creator can have much influence over, so the focus then becomes to create environments where coincidence is possible: what is called the prepared system.

The prepared system

Foster & Ford suggest that for serendipity to happen in information encountering, it is not only the (flaneur-like) prepared mind that is important, but also the “prepared retrieval system” (Foster et al., 2003 p. 9). Van Andel on the other hand, argues that it is impossible to create serendipity in a system or otherwise, as the very moment something is programmed, designed, or computed choices are made and it cannot be said to contain true serendipity (Andel, 1994 p. 646). Though André et al. to some extent agree that to design (digital) environments to “generate” serendipity is almost a contradiction in terms, they say it is possible to “optimise the opportunity” for discovery of something interesting and valuable (André et al., 2009 pp. 306, 310). Lindsay more directly dismisses the general argument of van Andel’s view as romantic and magic: he believes it is perfectly possible to design for serendipity (Lindsay, 2014). Rahman, in essence, agree with this: saying is possible to create environments that can lay out some serendipitous information, but that does not mean serendipity will occur (Rahman et al., 2015 p. 939).

D’Ignazio’s goes so far as to criticise the way most digital systems are engineered, and say they exhibit what she calls the “Tyranny of Extreme Utility”. She finds them oppressive in their call for efficiency, and see this as the opposite of serendipity. In her view, there is in this way of creating
systems a lack of understanding of the value of “wandering off”, looking at things that might well be useless, and discovering the unsought. She sees a great and worthwhile challenge for engineering and design to “make uselessness and triviality matter once again” (D’Ignazio, 2014). Lindsay concur with this, stating that a shift is needed, from efficiency, “doing the same thing over and over, only a little bit better”, towards serendipity: where novelty and discovery can offer great rewards (Lindsay, 2014).

On the background of this, it is perhaps fair to say that serendipity is a subjective experience, but it is possible to create environments that place and juxtapose items (be it ideas, facts, relations, objects) to at least have the potential to be “serendipity-inducing”: to create prepared systems and flaneur-friendly environments.

2.3 “Flaneur-friendly” visualisations

Engineering serendipity is hard, counterintuitive, and worthwhile (D’Ignazio, 2014).

According to André et al., studies looking at how to support serendipity seems to all point to visual components. They suggest that the field of interaction design can play an important role in creating designs that can aid serendipity (André et al., 2009 pp. 309, 312). I will here give two examples of prototypes that can be “serendipity-inducing”.

The bohemian bookshelf

The prototype interface made by Thudt, Hinrichs & Carpendale, called The bohemian bookshelf (2012), is a visual library interface. It consists of five interlinked interactive visualisations, meaning that if one is explored, the other four adjust accordingly, and allows for viewing both a collection and individual works in five different “modes”. The creators argue that the interface aids serendipity and exploration in six ways: (1) by visually representing different perspectives simultaneously; (2) through abstraction creating curiosity; (3) by indicating relational placement (adjacencies) of books in a collection; (4) by opening for several paths for discovery; (5) by providing previews (of covers); and finally, (6) that it is a digital environment that allow for playful information finding (Thudt et al., 2012 p. 1). The interactive system links five “views” of a collections, as illustrated in fig. 1, and exploring one will alter the other four accordingly. In this way, there are five different visual ways of browsing and exploring (clockwise from top left): 1. by following keywords, 2. dominant colours of covers, 3. alphabetical author “scroll”, 4. the “book pile” indicating thickness of book by sizes of the squares, and 5. the timeline, indicating when a book was published and what time/era the content is concerned with. It is a visually pleasing interface that can give five different “contexts” to the same book.
In 2014, Catherine D’Ignazio of MIT created a browser plugin to allow for serendipity in news stories. When a user opens a new browser tab, a map is loaded with a sidebar listing some news stories from a particular, but random location (fig. 2). The map is deliberately close-up of the geographical area with roads and local topography visible; so as to avoid the perceived distance that can come with global maps. No more than five stories are listed at the same time. It is an experiment in opening for something unexpected, and her explanation is that when a new browser tab is opened, there is a short window of opportunity. There is a switch in task in that action, and this can be used to aid in discoveries, and potentially open for serendipity (D’Ignazio, 2014). In short; Terra Incognita can be seen as flaneur-friendly and serendipity-inducing.
These two systems can exemplify ways of (visual) thinking about serendipity. They both can be seen to be “prepared systems”: they cannot prescribe or predict serendipity, but they can in some ways create an environment in which serendipity can occur. One could imagine that they both can pave the way to further meanderings. A news article from Karaj, Iran might open a new path to other subjects, trigger some curiosity, combine with the users current knowledge of perhaps unrelated issues. Both systems, as I interpret them, aims at broadening a view, rather than funneling a path to a concrete end goal. Another aspect of them both, is the deeply considered visual choices made. In the case of Terra Incognita, D’Ignazio say she deliberately chose a close zoom as the default. Instead of displaying – say – a traditional world map with one or more dots, her rationale was that a sense of local geography, buildings, and topography would create a sense of closeness to the ground rather than a detached birds-eye view. Though I can see that this might also be felt as “context-less”, it also adds both a level of intimacy and a level of almost abstract visualisations. In the case of The bohemian bookshelf, the visualisations are carefully constructed as abstract models. Both prototypes are what I view as digitally native: the abstractions and their encoded data and information would be hard to imagine as anything else but digitally driven.

2.4 Certainty and speculation through visual artefacts

The purpose of visualisation is insight, not pictures.
Card et al., 1999 p. 6

In this section, I elaborate on what can be called different types of visual artefacts: those whose aim is to clarify and prove, and those whose aim is to create new questions.

2.4.1 Visible certainty: artefacts for evidence

In 1610, Galileo published Sidereus Nuncius (The starry messenger). In it, he described and drew what he saw in the night sky. In the text, Galileo links textual description and drawings with the phrase oculata certitudine: visible certainty (Tufte, 2006 pp. 97-103). Around this time, visual representations became evidence in themselves and became powerful tools for arranging information (Rosenberg et al., 2012 p. 10). The exclamation “I see!” is an expression that means “I understand”, and Alberto Cairo suggests: “we understand because we see” (Cairo, 2012 p. xv). Visualisations can be powerful tools for information processing (Buchanan, 1992 pp. 12-14; Bertin, 2011 p. 2; Cairo, 2012 pp. 61, 78;). An example often used, is Mendeleev’s periodic table of chemical elements. Mendeleev visually placed the known chemical elements according to groups and valences. By doing so, it became apparent that there were elements yet to be discovered, and this way of manipulating the known made the unknown visible. Mendeleev’s model was of great aid to science, and still is (Kemp, 2001 p. 68; Bryson, 2004 pp. 140-145; Yau, 2013 p. 243; Börner et al., 2014 p. 3). According to Manuel Lima, the purposes of data visualisations are to document,
clarify, reveal, expand, and / or abstract (Lima, 2013 pp. 80-81). The periodic table can be said to embody all five of these. According to Jacques Bertin, visualisation in this sense holds a special place as having two functions: they are storing mechanisms and research instruments (Bertin, 2011 p. 2). It is, however, argued that visual evidence is not the same as visual proof. Visual evidence can well be a conceptualisation of thought, a visual representation of processes, and they can be abstract and metaphorical (Costa in Cairo, 2012 p. 18; Lima, 2013 pp. 80-81). In other words, artefacts for evidence does not have to be quantitative, they can be evidence of thought.

2.4.2 Visible uncertainty: artefacts for speculation

Visual artefact can be productively ambiguous.

Grocott, 2012 p. 3

Of course, the previously mentioned visualisations may have aspects of speculation about them. However, in the context of my work, I make a distinction here. While the visible certainty aims for a sort of specificity, artefacts for speculation suggests multiple interpretations and ambiguities.

During a design process many artefacts are usually produced. Some might be incomprehensible doodles, photographs, cardboard, clay, or paper objects. In general, Fallman suggests two types: tools for thinking are (usually) sketches, that help a designer to think about, speculate, and interrogate a problem space. Tools for presentation, are artefacts (drawings, sketches, models, prototypes etc.) that aid in communicating ideas to others and help in establishing a common language (Fallman, 2003 p. 229). This is not to say that the one always happen before the other, or that the latter is more important than the former. A functioning object might have been made that might spark new sketches: new ideas, as tools for visual thinking. Artefacts for speculation, Hibberd suggests, can be both fictional and practical, and aid in reflection on future possibilities (Hibberd, 2015).

In my experience, the tools for thinking are immensely important. They often tend to get discarded, but in my view they have value: not only as documentation of a process, but as visualisations for speculation in their own right: I believe the incompleteness of often unexplained of sketches can allow for greater amount of useful ambiguity. “Misunderstanding” a sketch can be instrument in new interrogations. In this I believe that sketches have great generative potential. I here present two types of artefacts for speculation: prototypes and visualisations for speculation. My work is focused on the latter, but I include a little about prototypes, so as to make clear how they differ.

2.4.3 Prototypes

According to Wolf, Rode, Sussman & Kellogg, different uses of the word prototyping have created confusion in the CHI (HCI) community. They argue that the aim of prototyping in creative de-
sign is not about punctuating a process with a product for evaluation, but the artefact is “about presenting the designer with opportunities to analyse her work” (Wolf et al., 2006 p. 4). Analysis in this context is not about evaluation or criticism, but about reflections. The artefact is “a vehicle to inspire an informed decision” (Wolf et al., 2006 pp. 4-5). It is then possible in this view to see that a “prototype” can be either a tool for thinking, or a tool for presentation. In my work I deliberately avoid using the term prototype to avoid this confusion. My sketches and visualisations can perhaps be seen as low-fidelity prototypes, but I find this unsatisfactory: they are made to help contemplate and speculate about some phenomena, not trying to clear a path towards a concrete, functional artefact. This is why I call them visualisations for speculation.

2.4.4 Visualisations for speculation

In my work, visualisations for speculation includes both tools for thinking and tools for presentation. In practice this means that I consider all sketches and visualisations that I have made as speculations. Two of them are clearly more articulate, hence the differentiation of “sketch” and “visualisation”. But this, to me, does not define them as “tools for presentation”, and the others as “tools for thinking” exclusively.

So what is the purpose of speculative visualisations? In my experience, there are two main types: one, visualising some data can reveal patterns and connections or lack thereof, and these can be speculated about (as per the example of the periodic table of chemical elements). The other type is to create visualisations not based on “knowns”, but rather speculate about issues through visual means. This approach can crystallise some unasked and unanticipated questions. In other words: the first type starts with a premise along the line of “what can we do with the data / information we have?” This might throw up visualisations that enable speculation, by arranging data and information in novel ways. The latter operates around questions of “what might we want to see?” In either type, the visualisations for speculation is not primarily about analysis in a traditional sense that it is not necessarily about visible certainty. Neither is essentially about revealing fixed patterns nor to create new, indisputable “knowns”.

My work focuses on visual speculation. Through sketches and visualisations, my exploration eventually crystallised into more concrete questions and a need for data to visualise the speculations. But importantly, speculative sketching came first. The visualisations for speculation are artefacts created to explore a conceptual design space: they are concrete in that they are visual artefacts, they are conceptual in the sense that they are visualising ideas so as to forming a base for discourse. Through this visual exploration, I hope to address the core question of serendipity.
3 Background: design research

For hundreds of years, we have believed that if something is logical in hindsight, then logic should have been enough to get the idea in the first place. This is complete and total rubbish.

Edward de Bono in Fletcher, 2001 p. 140

In this chapter, I describe perspectives on design research. I start out with broad strokes and include a little HCI history and how design has traditionally been viewed in the HCI community. I elaborate on the concept of “wicked problems” and how this relate to design research. The next chapter focus on Research through Design as my chosen methodology.

Faste & Faste look at the traditional strategies of scientific inquiry having focused on inductive reasoning: “what is so” (from observation), and deductive reasoning: “what must be so” (from prior knowledge). To be able to address “what might be”, they say, requires a third way of logic: abductive reasoning (Faste et al., 2012 pp. 2-3). This is a reasoning based on experience and ability to synthesise (Kolko, 2010; Koskinen et al., 2011 p. 76; Faste et al., 2012 p. 2; Culén, 2015 p. 5). In short, the act of synthesis is a process of filtering, choosing, and combining ideas (Kolko, 2010; Höök et al., 2012 p. 3), from which to create a “what could be”. Synthesising invites into the process knowledge of many kinds, some that might be tacit, seemingly unrelated, personal experiences, and preferences. Koskinen et al. describe it as a “creative mash of common sense and research” (Koskinen et al., 2011 p. 76).

3.1 Science and design: citizens and tourists

Historically, according to Buchanan, the relationship between science and design has been:

Each of the sciences that have come into contact with design has tended to regard design as an “applied” version of its own knowledge, methods, and principles. They see in design an instance of their own subject matter and treat design as a practical demonstration of the scientific principles of that subject matter. Thus, we have the odd, recurring situation in which design is alternately regarded as “applied” natural science, “applied” social science, or “applied” fine art.

Buchanan, 1992 p. 19

Science is a term that means different things in different fields to different people. Professor Martin Kemp goes so far as to say that the term – as it is used today – is a “crude and undifferentiated descriptor” (Kemp, 2001 p. 5). A simple view is to see “the scientific project” as striving towards knowledge creation by way of observation, hypotheses, experiments, and theory; creating universal knowledge that is independent of situated, specific situations and artefacts (Turnbull, 2000 p. 75; Stolterman, 2008 p. 58; Wilson, 2012 p. 7; Lima, 2013 p. 12; Gaver, 2014 p. 149). This view of science, Stolterman says, is generally about reducing complexity and the discovery of “what is”
Background: design research

(Stolterman, 2008 p. 58), to enable objective knowledge free from personal bias (Wilson, 2012 p. 7).

There is a misconception that design is a middle ground between science and art (Fallman, 2003 p. 231; Wolf et al., 2006 p. 4). Design is not a hybrid discipline, says Fallman, it is a tradition that is part of many disciplines, and HCI is just one of those (Fallman, 2003 p. 230). To Gaver, for something to be considered either science or design is dependant on “its similarity to canonical examples of each” (Gaver, 2014 p. 146). Neri Oxman outlines what she calls the “four modalities of human creativity”: science, engineering, art, and design. She describes these as often being considered their own separate “substances”, their own discrete domains: “if you’re a citizen in one (domain), you’re a tourist in another”. But, she say, if what is created has some meaning or relevance, it is likely that the effort operates in more than one domain. She argue that knowledge creation is entangled across these disciplinary boundaries, and it is no longer possible to produce or pin-point knowledge within one domain (Oxman, 2016). An example of this could be the work of Eduardo Kac and Joe Davies in the 1980’s where they artistically explored how to modify the DNA of bacteria to carry messages. The work was thought “outrageous” both artistically and scientifically, but this is now a respected scientific field (Wilson, 2012 p. 21). Krippendorff describes the difference between the result of scientific and designerly concerns: the first is focused on the truth of a proposition, whereas design is concerned with what is plausible and compelling (Krippendorff, 2007 p. 72).

3.2 Design and HCI

What Human-Computer Interaction strives for, is to take into account both the technical side of computers and what it takes for humans to interact with computers and other technological artefacts. HCI aims at understanding human and machine capabilities and limitations and how these can be beneficially utilized to achieve something in a better way or something previously not achievable (Baecker et al., 1995 p. 1; Quaggiotto, 2010). Fallman says that the aim of design in HCI is to “unfold a coherent whole” in creating something new (Fallman, 2003 p. 231). In HCI the tools and techniques for this has traditionally been systematic collection of information, data, and use of theory. In this view, design itself tends to, he says, vanish under the covers of these more conservative structures. Simply putting theory, data and field information together cannot create the whole: “to do this, there is only design” (Fallman, 2003 pp. 230-231). Rogers and Wolf et al. concur with this, respectively saying that theories cannot “do design” (Rogers, 2004 p. 129), and that interpreting collected information and data cannot “in themselves be the basis for design” (Wolf et al., 2006 p. 5).

3.2.1 Conservative, romantic, and pragmatic views

Fallman suggests that there are three competing views in HCI as to what design is: the conserva-
tive, the romantic and the pragmatic view (Fallman, 2003 pp. 225-227). The conservative approach sees design as a scientific or engineering approach: with its base in rational philosophy, this view uses “methodology and terminology from natural science, mathematics, and system theory” (Fallman, 2003 p. 226). The romantic view sees design as something “magic” that emerges from designers having particular talents. This view emphasise individuals and their creativity over transparent process and logical reasoning, and suggests that design is closely related to art. The pragmatic view is that of “situatedness”, that sees the designer in a particular space and time, and design is then about reflection over this situatedness, the materiality, and the conversation between the designer, the artefacts, and the wider setting (Fallman, 2003 pp. 226-227), in what Ihde call a “dance of agency” (Ihde, 2009 p. 54). Traditionally in HCI research, Zimmerman et al. says, “design” has been equal to “usability engineering” and is then placed in the conservative view described above. For people in the design community, they say, the term “design” means something rather different: a designer is a person with formal training or substantial experience in design directions such as graphic design, product design, architecture, or interaction design (Zimmerman et al., 2007 pp. 494-495). Researchers, Fallman says, are often uncomfortable about the fact that design elements cannot demonstrate the predictability and control they can demonstrate in other parts of their work. But, he say, it is not helpful to see design as either a purely scientific task (conservative view), as black-box magic (romantic view), nor concealing it as something that are merely means to a end (Fallman, 2003 p. 230). He humorously exemplifies this: “Then we designed the prototype. Ugh...it took forever! Anyway, here are the results of our meticulous evaluation!” (Fallman, 2003 p. 230). But by ignoring the role of design, design might “forgetfully” be thought of and constructed on the premises of natural or social sciences. These branches of science generally do not offer insight into what design mean in the context of research (Fallman, 2003 p. 225).

### 3.2.2 Design method movement and influence on HCI

Gedenryd describes design methods as a direction in design research that started around early to mid 1960. The fundamental notion was that the increasing complexity facing designers required new and improved ways of designing. To achieve this, new procedures were developed, and this direction was called design methodology or the design method movement (Gedenryd, 1998 p. 19; Koskinen et al., 2011 p. 15). The fundamental idea was that one could create a scheme that detailed procedures and activities and specify in what order and how these should be done. Gedenryd describes four principles that he argues all variants of design method-thinking follows: separation, logical order, planning, and product-process symmetry. If the task is two-fold; one: understanding the problem, and two; providing a solution, then through design-method-thinking they could be separated into different phases and sub-phases (Gedenryd, 1998 pp. 19-21). It is not in the scope of this thesis to analyse these or describe them at length, but suffice to say that the over-arching idea was that design could and should be logical, ordered, scientific (in a natural-sciences way),
Background: design research

and compartmentalised. In other words, seeing design as something that can be executed by following predefined steps. The problem with this, say Gedenryd, is that though the goal of rationality is noble, the methods simply does not work (Gedenryd, 1998 p. 59). The reason for this is that “the structure of the product and the process behind it are held to be the same” (Gedenryd, 1998 p. 63). Fallman notes that design method-thinking has been highly influential in HCI, and that its failure is well documented: he says that in practice, design practitioners do not work in that manner, and in fact, it might even be impossible for them to do so (Fallman, 2003 p. 228). Design processes are messy, contain many dead ends, twists and turns that are not presented as the final proof (Gedenryd, 1998 pp. 61-62), and this, I believe, is why the design method movement could not get the terrain to correspond to the map.

There is, according to Zimmerman et al. currently little consensus in the HCI field as to how design researchers can contribute to knowledge other than by developing methods (Zimmerman et al., 2007 p. 493). Wiberg & Stolterman say that HCI has focused on developing idea-generating techniques and concept-to-implementation methods, and in doing so “providing less support for identifying and tracing ideas in design” (Wiberg et al., 2014 p. 533). In my view, this is part of the issues Research through Design attempts to address.

3.3 Wicked problems: the nature of design

To create requires that something can be envisioned before it can be caused. This is called Hellenic Imagination after Prometheus, the Greek god, credited with the discovery of the magical power of being able to imagine the future by projecting a horizon of possibilities.

Fletcher, 2001 p. 159

The word “design” is both a noun and a verb: it is the “name” of something, and something being done. MIT Design Lab director Joichi Ito calls it a “suitcase word”: it can be so many different things it that it almost have no meaning. However, he says, it contains important thoughts, ideas and practices worthy of exploration (Ito, 2016).

So what is the nature of design? Buchanan suggests that what sets design apart are two inherent peculiarities: one, it has “no subject matter of its own” and is therefore potentially universal; and two: it is fundamentally situated in that the designer must create a particular. He further say that design is an amazingly flexible discipline: it can contain a multitude of philosophical interpretations, as well as interpretations in practice (Buchanan, 1992 pp. 16-17, 19). According to Buchanan, all design problems are by their nature “wicked” (Buchanan, 1992 p. 15). This term comes from Rittel & Webber who first described wicked problems, which, in contrast to “tame” problems: have the property that “formulating the problem is the problem!” They argue that the process of attempting to solve a wicked problem is exactly the same as the process of trying to understand the nature of the problem (Rittel et al., 1973 pp. 161-162). There is no true-false or

1 “Wicked” used not as in “evil”, but as in “resistance to solution”.

Fletcher, 2001 p. 159

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1 “Wicked” used not as in “evil”, but as in “resistance to solution”.
correct-incorrect measure of wicked problems, the judgment of its success is subjective, dependent on the view of the analyst, and cannot be measured by formal logic. Assessment of a solution to a wicked problem can only be “good”, “bad”; or perhaps “better or worse”, “satisfying”, or “good enough” (for complete list of definitions of wicked problems see §A.3) (Rittel et al., 1973 pp. 162-163, 165). Though Rittel & Webber’s primary concern was with social planning and policy design, the term wicked problems have been widely adopted to design problems in a wider sense (see for example Buchanan, 1992; Cross, 2001 p. 2; Cross, 2006 p. 7; Wolf et al., 2006; Zimmerman et al., 2007; Stolterman, 2008 pp. 55, 57, 59; Koskinen et al., 2011; Gaver, 2012 p. 940; Zimmerman et al., 2014). To Buchanan, the wickedness in design problems speak of “impossibility”: the impossibility of strict boundaries between fields, and the impossibility of solving a design problem within any one domain, as described by Oxman above.

3.4 Design research

In this section I place design research in relation to other traditions of research, and Research through Design among them. The next chapter goes into Research through Design in depth.

Combinations of the terms “design” and “research” have in many respects an uneasy relationship (Zimmerman et al., 2007 p. 495; Zimmerman et al., 2014 p. 167). This stems from the debate about what research is: how it is done and what the end result could or should be (Frayling, 1993 p. 1). The word research has, according to Frayling, traditionally two definitions: one with a lowercase and one with an uppercase R. The lowercase “research” have been used as a descriptor of investigative and art practice (“I researched what car to buy”, “I researched period clothing for my painting”). Research with an uppercase R indicates “professional practice”, industry, innovation, and educational institutions (Frayling, 1993 pp. 1-2). However, Bruce Archer argues that research is “systematic enquiry whose goal is knowledge” (Archer, 1981 p. 30). Design, says Archer, “like science, is a way of looking at the world and imposing structure upon it”: his argument is that we can pay “designerly attention” in the same way that we can pay scientific attention to a phenomena (Archer, 1981 p. 35). In this view, research can be enormously varied. In their article Demystifying design research, Faste & Faste (2012) presents a model of kinds of research (fig. 3), along two axes: scientific versus practice-based, and theoretical versus empirical. They locate design research straddling both axes, but with the major part placed towards empirical / practice-based / craft. Further, they divide the unit (the circle) of design research itself into for quadrants (fig. 4) as follows:

![fig. 3. Kinds of research, Faste & Faste (2012)](image)
Background: design research

- Design of research: a linear process of designing theoretical research.
- Research on design: theory-focused study of the design processes themselves.
- Design through research: studies technological and natural phenomena.
- Research through Design: a hands-on, iterative process of creating knowledge through the creation of artefacts (Faste et al., 2012 p. 5-6).

Though methods, tools and techniques in design research may look “suspiciously” like design practice, Zimmerman et al. clarifies that the aim of design research is knowledge creation, and not to necessarily to aid in creating “workable” or viable products (Zimmerman et al., 2007 p. 494).

Gaver outlines Kuhns’ theory of paradigms; that when a field reaches a mass of influential research, a field-specific paradigm is created, this usually by way of theory that ties various research together (Gaver, 2012 p. 942). In design research, however, he doubts that such a consensus can be reached – or indeed should be attempted. He says it is in a “pre-paradigmatic” state of disagreements, a proliferation of methods, ideas, thoughts, values, methodologies and “design manifestos”; a lack of formalism and standardisation akin to what is normal in art, product design and architecture. He points out, though, that it is normal for a field to focus on disagreements and controversy, and that perhaps the disagreements are not quite dramatic as they might seem (Gaver, 2012 p. 942). Several scholars suggest that this lack of overarching consensus can result in the field of design research to suffer from “disciplinary anxiety”, including a perceived need to apply “scientistic” criteria, and that this is not helpful (Cross, 1999 pp. 7-8; Fallman et al., 2010 p. 2; Bowers, 2012 p. 69; Gaver et al., 2012 p. 49; Gaver, 2012 p. 938).
4 Methodology: Research through Design

I have chosen Research through Design as the methodology through which I address the concept of serendipity. This chapter gives an overview of the basis behind this methodology.

Research through Design (RtD) aims at conducting research and creating new knowledge through the creation of artefacts. This is achieved through the “methods, practices and processes of design practice” (Zimmerman et al., 2014 p. 167). Frayling succinctly formulates what he means by Research through Design as a question:

“How can I tell what I think till I see what I make and do?”

Frayling, 1993 p. 5.

What Frayling is saying here is that in the process of making, there is thinking. The making and thinking are inextricably linked, and the “telling” could not have been predicted before the making and thinking, nor can the thinking be predicted before the making, or the making before then making-thinking. This, then, is saying that Research through Design is about artefacts, how they come about, and ways of creating knowledge from the artefacts in design practice. A glimpse into history could perhaps exemplify this. The Chartres Cathedral was built without architects, structural plans, maps, blueprints or charts, and it was built by master stonemasons (Bowker et al., 2000 p. 14; Turnbull, 2000 pp. 53-54). Turnbull says the masons probably had working plans: short-term scribbles on bits of slate, planks or paper, solving problems on the fly. These processes seem to be a good deal of trial and error; indeed, Turnbull calls the construction of Chartres a laboratory for experiments (Turnbull, 2000 pp. 53-54). In essence, the stonemasons conducted research by making: research by practice, founded in experience.

Design proposals and design questions are by their nature vague, Gaver says, as they are about things that do not yet exist. The process and product of design can draw on innumerable influences and inspirations that can – but does not have to – include theoretical frameworks or empirical observations. Design can utilise information both fictional and factual (Gaver, 2014 pp. 151-153). Gaver uses the term “productive indiscipline” about design: it can borrow theories and methodologies from any discipline – or none (Gaver, 2014 p. 153). This indiscipline makes for great liberty, but it also means that design “gives up” the safety of familiar paths (Gaver, 2014 p. 162). It might be tempting to try to minimise these (at times) overwhelming uncertainties by applying methodological frameworks. The problem with this, Gaver argues, is that by “avoiding the terrors” that comes with freedom, the advantages of the productive indiscipline is lost: the ability to draw on idiosyncratic, personal, and sometimes inexplicable connections and experiences are removed (Gaver, 2014 p. 163). This “freedom from certainty”, he says, allows designers to “speculate, experiment, dream, and improvise”. It is not however an utterly random endeavour; he is careful to highlight that design work can operate with great freedom, “as long as they do
so in ways that are accountable as design” (Gaver, 2014 pp. 162-163). By this he suggest that an artefact can be created “outside” or “without” particular theories, methodologies or methods, but that the artefact can point to new perspectives. In this view, the artefact – or a collection of artefacts – becomes the centre of Research through Design.

4.1 The RtD artefact

Can artefacts be knowledge? This can be debated in many different ways, but Löwgren quotes Cross and says yes, in the simple way that an artefact can be the answer to a research question: “how would you design an <X>??” (Cross in Löwgren, 2013). Design research artefacts can have a relation to a particular theory, be it before or after the process. However, it is also some kind of object, and are therefore also an embodiment of design practice. In this way, Koskinen et al. say, the “prototypes are also tests of design, not just theory” (Koskinen et al., 2011 p. 61). In complex artefacts it becomes difficult with any certainty to argue the success of a theory behind a design, if indeed there was one. Koskinen et al. recognise a catch-22 here: by taking design seriously, it becomes increasingly difficult to extract “unambiguous theoretical conclusion”, as the successful element might be design (Koskinen et al., 2011 p. 62). According to Lisa Grocott, the particular artefact is of course a limited object as a research result, but it can be important in being part of a larger, emergent process that moves towards an understanding, and that this understanding is perhaps one that only design processes and artefacts can address (Grocott, 2012 p. 18).

4.2 Lab, field, showroom

Koskinen et al. outlines three types of design research: lab, field, and showroom. These are representations of what they call “constructive design research”. There are many ways of doing design research, but they argue that these three have been successful for some time (Koskinen et al., 2011 p. xiv). They call them constructive because the construction of something takes centre stage in producing knowledge, and attempts to open up the discourse “beyond” the discussion of RtD’s need – or not – for overarching, theoretical, prescriptive grounding (Koskinen et al., 2011 pp. 5-6). My interpretation of this is that constructive design research is in essence Research through Design, but with a clearer focus on the artefact than what some examples of RtD might indicate.

A design exploration may not neatly fit into one or the other exclusively. A project might use some elements from each at different points, or an exploration might over time shift from one to another, or vary depending on task. This is the case with my research, as it in a minor way takes elements from the each approach. This shifting or selection is what Krogh et al. call “drift” (Krogh et al., 2015 pp. 6-7, 10). I will address drift in the next section, but first a brief outline of lab, field, and showroom.
Lab

The background of the methodology has its basis in natural sciences: the idea is that aspects of design can be studied in laboratories with carefully crafted experiments. The goal is to find relations between human cognition and behaviour in relation to particular designs, and therefore the approach is often through psychology. If the lab studies can uncover relations of success / failure in regard to a particular artefact, then it should be possible to translate this knowledge into formulas “that would provide a solid ground for design” (Koskinen et al., 2011 p. 51). Studying the effect of a design artefact in a lab environment can allow researchers to focus on particular aspect of an artefact, and can test a hypothesis. To study these things can be difficult (or impossible) and prohibitively expensive in a real-world setting, and a lab can be fitted with particular technology (Koskinen et al., 2011 p. 56) such as eye-tracking cameras, and the environment can be controlled. The world of the laboratory, though, is removed from the real world. This is not to say that lab studies cannot say anything about the world at all, or that lab studies must yield statistics and hypothesis only (Koskinen et al., 2011 pp. 62-63). Recently, lab work has moved towards action and body, and thinking and knowing are studied, rather than focus on the cognitive psychology, in seeing that meaning is also created in interaction, not in cognition alone (Koskinen et al., 2011 pp. 111-112).

In my research, it is perhaps fair to say that I use a small element from this methodology. In the four debate sessions one focus was indeed on particular aspects of the visualisations. However, my aim was not to test or create an hypothesis, nor was the environment controlled so as to make the four sessions as identical as possible. In lab research, this is usually done to ensure that variations in the environment don’t distract or influence the participants unnecessarily so the results can be quantified in some way. The debate sessions were also meant to be removed from the everyday world so as to enable discussions around concepts and conceptual visualisations.

Field

The basis of field design research, is to bring the artefact out into the “real world”, and observe how people and the environment interact with the artefact. As opposed to the lab approach, field work aims to take into account the context into which artefacts are placed, and how people deal with them. While Zimmerman et al. (2014) describe the field as being fundamentally grounded in participatory and user centred design, Koskinen et al. describe it as “design ethnography”, but highlight that it is different from anthropological studies as the focus is more on the artefact (Koskinen et al., 2011 pp. 69-70). This might include prototypes, mock-ups, and workshops, and they describe that the goal can be to gain insight through “an exercise of imagination rather than mere data gathering”(Koskinen et al., 2011 p. 76), and this based on dialogue, cooperation, and interpretations.

In the debate sessions I held, a goal was indeed to gain insights by tapping into other people’s
imaginations through dialogue. However, the sessions cannot be said to be set in the everyday world, nor were they a direct study in interaction of people and prototypes per se.

**Showroom**

Showroom takes its inspiration from art and critical design, and does this by framing some aspect of everyday life in a more or less provocative way (Koskinen et al., 2011 p. 95; Zimmerman et al., 2014 pp. 173-174). Rather than a basis in variation of data-collection, hypotheses testing (lab), or replication (field); showroom aims at disrupting, surprising, creating dialogue, and raising awareness. Its practitioners often formulate their findings not as data, but as “returns” (Koskinen et al., 2011 pp. 93-94). The focus of the showroom approach is the potential change of some situation or practice. The artefacts produced aim to “make people think” (Koskinen et al., 2011 pp. 94-95), often by placing or exhibiting them out in “the wild”. This might seem perhaps a little too close to art such as surrealism, Dada, or “happening” performance, and it might well draw on these inspirations, but Koskinen et al. say that showroom design research address an issue in a different way. Being “close” to real life, the artefacts are in some way usable, and – at least in theory – possible to manufacture (Koskinen et al., 2011 pp. 99-100). The underlying notion of affecting change comes from the ability of the artefact to provoke new thoughts and debates. Koskinen et al. argue, that such artefacts should be placed in mundane settings. Art galleries and academic environments are subject to their respective intellectual language, but if the aim is to make “the world a better place” through disruption, they say, design must go where people go (Koskinen et al., 2011 p. 101). While field work usually focuses on use, showroom often focuses on the form (Koskinen et al., 2011 p. 100). Showroom work can then perhaps be described as a vehicle for discourse, and Koskinen et al. suggest that the ambiguous artefacts may be the vehicle through which people can create their own questions and view their own personal concerns (Koskinen et al., 2011 p. 95).

The aim of my research is not to provoke in the sense of upsetting preconceptions. However, I would suggest that in my work, creating dialogue is an important aspect, and I encourage contradictions in the process and products, also embracing ambiguity as an opportunity for embedding the artefact with own meanings. I take from the showroom paradigm also the view that the result of the debate sessions are “returns”, that they are contributors to emergence of new knowledge.

### 4.3 Drifting

A design exploration, such as mine, might at different stages use elements from each of the lab, field, or showroom approaches as described. Krogh, Markussen & Bang (2015) address this, and call it “drifting”. They studied ten PhD theses that in sum operated in all three types of lab, field, and showroom research. In this context, drifting means that there is – during a process – a shift in focus, methodology, method, and / or techniques. This, they say, are often considered a failure in research, as the basis for evaluation then changes through drifting. However, they argue that
in design this can be a good thing, as it speaks of a flexible designer with an ability to adjust to changing information and returns. But there is a dilemma here for RtD: if drifting is tolerated, how “can we trust the results of RtD?” (Krogh et al., 2015 p. 2). The next section address this issue.

4.4 RtD knowledge typology

To address drift, Krogh, Markussen & Bang suggest five design “typologies of knowledge construction” that can aid in formulating what kind of knowledge is pursued: they call them accumulative, comparative, serial, expansive, and probing. They are careful, however, to point out that these are not exhaustive, merely indicative (Krogh et al., 2015 p. 11).

Accumulative: primarily lab-based experiment where sketches and models are examined for “cognitive qualities, rather than contextual appropriateness”. They assign the keyword “depth” to this approach (Krogh et al., 2015 p. 8).

Comparative: different designs are explored in different contexts, for example the same design in different situations, or different designs in similar situations. The keyword is “acknowledging complexity” (ibid.).

Serial designs experiments are created and tested in a chronological order, meaning that one experiment is based on the previous one. The keyword is “systematizing local knowledge” (Krogh et al., 2015 p. 9).

Expansive is described as “mapping”, similar to the work of biologists or cartographers. The knowledge pursued is that of identifying areas not yet uncovered, and to “reveal its qualities” (ibid). Expansive work does not have any clear direction in the sense of one task building directly on a previous one in a predetermined manner. This approach, they say, can create new knowledge in exploration of an area as the exploration expands. The goal is not deep knowledge, but a broadening perspective through exploration of “new aspects, approaches, and techniques”. The keywords they use to characterise this is “broadening and extending” (ibid).

Probing: the probing approach is often originated in a personal motivation. The area of experiments “can be characterized as “illogical”, “artistic” and “impact oriented” and “characterized by selecting in an almost eclectic manner wicked, ir-reductive and self-contradictive design settings derived from pursuing opportunities in the environment” (Krogh et al., 2015 p. 10).

Krogh et al. argues that the typology is useful in that one can consider with more clarity what form of exploration is the best fit for what kind of knowledge-production interest one has. By viewing design experiments through this typology, they suggest, makes it easier to evaluate design experiments in RtD. By seeing lab, field, and showroom through the glasses of this typology, then drifting not only becomes acceptable, but potentially a rational part of practice.

In regard to my research, as stated in the introduction, the expansive type is what best describes
my efforts and results: the goal of exploring the concept visualisations for serendipity through making and discussing. In this sense, I am “mapping” new ground in two ways: one, in the “mapping” of the concept of serendipity itself through the annotated portfolio, and two, the manner in which I achieve this.

4.5 Theory, rigour, relevance, and accountability

In design, even the most meticulous methodology will not redeem a bad design, and even the most hare-brained processes will not ruin a good one.

Gaver, 2014 p. 147

Role of theory

What is the role of theory in RtD, or what role can it play? Theory, Bowers say, sits uncomfortably with design practice (Bowers, 2012 p. 68). Gaver also discuss this, and recognise that to argue that for contribution to be made, theory-building and ways of framing learning might seem plausible. Designers, though, he say, do not “engage with major theoretical approaches in HCI” (Gaver, 2012 p. 943), rather, they rely on a mixture of different techniques and general, guiding concepts. Theory, he continues, “underspecifies design”, meaning that regardless of theory, there will be a multitude of aspects of designing that a theory cannot capture (Gaver, 2012 pp. 943-944). Rogers echoes this, asking if there are ways theory can aid in design, apart from creating “guidelines and analytical frameworks” that seems to be of limited use? Her suggestion is that a different view is necessary: design research must focus on process (Rogers, 2004 p. 134).

According to Buchanan, a design practitioner uses his placement to create “working hypothesis” and shapes an idea about the generality surrounding an issue, where the designer draws on personal experience and knowledge from art and science. These generalities are “philosophies or proto-philosophies” that can contain many alternatives, contradictory views, and allow the practitioner to explore materials, methods, and principles (Buchanan, 1992 pp. 17-18). As (sometimes contradictory) views are articulated, they can, say Gaver, be seen as “theories”, but they must be recognised as “provisional, contingent and aspirational” (Gaver, 2012 pp. 937-938, 941, 944-945). Koskinen et al. simply say that “design is not a theoretical discipline”, and the considerations, reflections, theory, and frameworks that might be created, are usually post-design. This post-design effort can include arguments, process descriptions, and theories (Koskinen et al., 2011 pp. 118-119). They are thus, arguing that this – often post-hoc – construction is a way for designers to contribute to design theories and knowledge. The theory can help in making what is implicit in design explicit, but cannot “tell how to create good design” (Koskinen et al., 2011 p. 121).

Since design deals with particular artefacts, the resulting understanding is limited in the sense of generalisations. To Gaver, attempting to create generalisations dilutes the design knowledge, and by detaching it from the artefact it becomes untrustworthy (Gaver, 2014 pp. 160-162). The
role of theory in design, Gaver says, should be to “annotate groups of artefacts, not replace them” (Gaver, 2012 pp. 938, 944). In this sense, Gaver is saying that concrete artefacts can be sources of “theories”, while the process of creating the artefact may or may not have a guiding or prescriptive theory as a basis, or that these may well change during the process. In his view, it is possible to create rigorous and relevant work, providing the knowledge stays “close” to the artefact, and do not purport to generalisations.

Rigour and relevance

So how can Research through Design create knowledge that have some rigour in an academic sense, and at the same time be relevant to design practice? Design problems, says Storni, are multivariate and are generally too complex to believe in a single method or theory through which to extract knowledge (Storni, 2015). Both Fallman & Stolterman and Storni argues that rigour lies in the way knowledge is produced, rather than the process of how artefacts are made (Fallman et al., 2010; Storni, 2015). Fallman & Stolterman argues that to consider rigour means to look at “how well the approach does open up a design space and less how that is done” (Fallman et al., 2010 p. 5), and to look at not how the design solve a particular problem, but rather how it can “continue to ‘problem set.’” (Fallman et al., 2010 p. 5).

Storni argue that Research through Design is rigorous when modest, accountable, and generative. Modest, since RtD should not make claims to generalisations. Accountable, in documenting and discussing the background of design decisions. Generative, in its ability to open up for future designs, new angles, and enabling asking better questions (Storni, 2015).

Accountability and limited rationality

For accountability in science, Gaver says, he would expect the questions to focus on “how do you know what you say is true?” In design, the question is “does it work?” (Gaver, 2014 pp. 146-147). With this, he is not speaking of utilitarian, technical solutions, but how various concerns are addressed, and how the artefact “works” in suggesting possibilities (Gaver, 2014 pp. 148-149), and its potential for being inspirational and meaningful (Gaver, 2014 p. 163). Gaver argues that the fundamental accountability of design lies not in its adherence to theory or accountability of process (these are “at best, secondary”), but in what he calls aesthetic accountability (Gaver, 2014 p. 162). This is not about how “beautiful” an artefact is, but how it addresses multiple concerns, in a way how it is accountable to design. Bowers suggest that it should be recognised that Research through Design operates on a “limited rationality”, and the question should be how HCI can incorporate this limited rationality, rather than creating prescriptive frameworks for rigour and relevance (Bowers, 2012 p. 69).
4.6 Design practice, research process

Design knowledge is most trustworthy when it stays close to designed artefacts.

Gaver, 2014 p. 162

Design processes, says Brey, continuously reframe the problem, testing, creating new artefacts, abandoning them, returning to something discarded and so on. This means that the design process is open to serendipity, and in being so, can create unsought-for knowledge and insight (Brey, 2009 pp. 42-43). This makes for “messy” processes. This “mess”, according to Buchanan, is manifestations of arguments. He says that every item (sketch, blueprint, chart, graph, model or other) is part of this interplay, and each a concrete argument (Buchanan, 1992 p. 20). There is a particular reflection in the act of creating, a “conversation” with materials and process and that in this doing and reflecting, there is potential for creating new ways of seeing and creating meaning (Schön et al., 1992 p. 68; Fallman, 2003 pp. 227, 229). Faste & Faste describe practice as “a critical triad of discourse between the designer, the artefact, and the social environment that the artefact influences.” (Faste et al., 2012 p. 6). Don Ihde describes this interaction between the designer and material as a “dance of agency”, as the designer and the material have “accommodations” and “resistances” that exist in the space where the creator “interrogates” the artefacts by experiment. This dance, say Ihde, can yield desirable results and sometimes serendipity in this process results in something unintended and / or novel (Ihde, 2009 pp. 54, 57-58). This suggests that a process which has a goal of a planned-for artefact might end up producing an unplanned-for artefact that may be of greater interest. For design processes to produce value, does not per definition require a planned-for statement or use-plan. It is common, say Gaver, that novel artefacts can emerge from processes that are “(…) idiosyncratic, and even a bit mad” (Gaver, 2014 p. 147).

The design process, Grocott says, is a “speculative material act” in which the problem and the solution co-evolve (Grocott, 2012 p. 18). Seen this way, the RtD process can in a sense create, declare and solve a problem, and the artefact embody all three.

**Sketching as research?**

*Have we somehow conspired to arrange matters so that knowledge is always what we say about something rather than what we show about it? If so, it would account for the difficulty of using objects as constituting or communicating knowledge. Is the problem that the whole concept of knowledge and research arises out of words rather than actions, or do we simply have too narrow a range of examples, i.e. only lexical examples? Have we defined ourselves into a corner?*

Biggs, 2002 p. 2

Traditionally in HCI, the process artefacts are rarely presented (Fallman, 2003 p. 230; Wolf et al.,
Fallman say that often a prototype is created to study a phenomena; and the process of creating it is omitted (Fallman, 2003 p. 230). Gaver also describes this in relation to his own PhD, where he did not include the time-consuming testing, shopping, selecting materials, discarded tools, failed experiments, coaxing of participants etc. that he in hindsight argues would have been interesting and valuable (Gaver, 2014 p. 143). Wiberg & Stolterman succinctly describes this, saying that HCI has traditionally not provided much support for “identifying and tracing ideas in design” (Wiberg et al., 2014 p. 533). According to many scholars, to include sketches – in their nature they are visual half-thoughts or underdefined “proposals” – is valuable (Buchanan, 1992; Fallman, 2003; Wolf et al., 2006; Kolko, 2010; Gaver, 2014; Wiberg et al., 2014). Sketches, Grocott say, have a large capacity for speculation, in fact, she say that sketches are graphical, speculative ways of asking “what if?” (Grocott, 2012 pp. 3, 18).

A sketch can then be both a question and an argument that addresses one or more questions around a part or a whole. Krogh et al. describes them as “bold suggestions”; they are material representations of ideas, and they may change in incremental steps or in radical jumps. The experimental nature of sketches, they say, are that they are artefacts to reason around and evaluate. The evaluation is often based more on a “sanity check” rather than subject to any formal evaluative method, and there “is no second sketch without even the most rudimentary, theoretical, experimental, or aesthetically inclined evaluation of the first” (Krogh et al., 2015 pp. 6-7). According to Stolterman sketching is essential in design. It is disciplined exploration of ideas, details, relationships, function, form, and scales. Working on multiple designs simultaneously and switching between them, he says, is a “rational, disciplined, designerly way” of working (Stolterman, 2008 p. 61). Sketches may be more or less incomprehensible, they may be half-thoughts. The notion of making sketches precise tools for explaining concepts is at best only half the story. Sketching is about thinking, and many sketches are unformed thoughts that cannot easily be formulated, if at all. Cross explains that in the same way as with writing, sketching is an “intelligence amplifier”: writing is a way to reason, and so is sketching. Sketching “amplifies” thoughts, not only in being an externalisation of an idea or an aid to memory; but in that it is a way of thinking in design practice (Cross, 2006 p. 38). This way of visual thinking, say Cross, enables the designer to operate with any level of detail, overview and abstraction simultaneously, and see the design space from multiple viewpoints (Cross, 2006 p. 37).

Some of my own sketches I do not entirely “understand” myself. They are sometimes indeed half-thoughts, some are like puzzles. Working with them takes time, but allows me to interrogate the material that I am working with over and over again. Sketching, in my experience and practice, is a way of interrogating a design space, materials, and concepts. Kolko describes this well: “The artefacts developed by the designer are messy, usually drawn in the midst of deep and reflective thinking […]; crude diagrams lacking adequate captions or descriptions” (Kolko, 2010). Often, there is no clear connections between input and output, and the designer might even be “unable to articulate exactly why their design insights are valuable” (ibid.). The “mess” often consists of
Methodology: Research through Design

piles of sketches and half-written sentences “actually represents deep and meaningful sensemaking” (Kolko, 2010).

**Tools for thinking or tools for communication?**

I operate with two kinds of artefacts: sketches and visualisations. To explain the difference, Fallman describe them respectively as tools for thinking and tools for communication / presentation (Fallman, 2003 p. 229). In my work I see them both as artefacts for speculation. Though sketches are perhaps more “process” artefacts and often unfinished visual thinking, I believe they can have value in two respects: one: they can also be speculated about by others than myself; two: they indicate and document processes. The visualisations are more finished and are described and created deliberately to communicate concepts more clearly, but it is my belief that the one is not more “worthy” of discourse than the other. As argued by Wiberg and Stolterman, the creation of sketches and models are about the potential for “pointing to new design spaces” (Wiberg et al., 2014 pp. 536-537). Both sketches and visualisations are conceptual: they are not meant as a basis for creating functional systems, but to explore and open for speculation and appropriation, through the mindset of Research through Design. In doing so, I believe they have potential to suggest new design spaces.

### 4.7 Generative design, ambiguity, and appropriation

Gaver, Beaver & Benford suggest that openness to interpretation and ambiguity is something that can be an opportunity in HCI. This, they argue, can bring with it intrigue, mystery and delight (Gaver et al., 2003 pp. 233-235). Several scholars suggest that an important aspect of Research through Design artefacts lies in the potential to be open for appropriation. In short: creating artefact that are “generative” in the sense that they can be a basis for others to create new designs, and a tool with which to ask new and better questions (see for example Bowers, 2012 p. 75; Gaver et al., 2012; Gaver, 2012; Höök et al., 2012; Gaver, 2014; Storni, 2015).

### 4.8 Intermediate-level knowledge

Many scholars suggests that there is an intermediate level of knowledge in design research and practice: of knowledge residing in a space between theory and design artefact (*instance or ultimate particular*). This level do not aspire or claim universals or generalisations, but contribute value beyond the single artefact (see for example Höök et al., 2012; Löwgren, 2013; Dalsgaard et al., 2014; Wiberg et al., 2014; Ståhl et al., 2014; Höök et al., 2015). There are different approaches on how to expose and tease out intermediate-level knowledge. It is not in the scope of this work to go into details about these, but as will be clear in the next section, annotated portfolio *can* be considered a way to do this.
4.9 Annotated portfolios

In this section, I describe the approach of annotated portfolios, first introduced by Gaver and Bowers (Bowers, 2012; Gaver, 2012; Gaver et al., 2012). I briefly outline what the approach is, what it can be applied to, used for, and ways it can be created.

**What is an annotated portfolio?**

Löwgren describes the annotated portfolio as a methodology (Löwgren, 2013), Bowers describe it as a concept; as an “analytical tool” useful in HCI design research (Bowers, 2012 p. 76). The idea behind annotated portfolios is that a group of artefacts can be placed together and then “annotated”. The annotations are short texts, and it is these annotations that makes a collection into an annotated portfolio and allow for emergence of similarities and differences among artefacts. Coupled with design reflection, they create opportunity for new knowledge to emerge. However, Bowers says, it is not that the annotations reinforce particular points with more precision, but rather that relevance of the textual annotations are created in its “indexical connection” with particular artefacts (Bowers, 2012 p. 70). With this Bowers is suggesting that annotated portfolios, by pointing to particular features and properties, can open up for discourse and further designs. He is careful to highlight that it is the combination of annotations and artefact that is core: the one is not more important or more informative than the other (Bowers, 2012 p. 70). The annotations, Bowers say, is not about attaching classificatory texts to objects in a taxonomic sense: annotated portfolios are open to interpretations, and in Gaver and Bowers view this is exactly what we should do in design research: create designs and use approaches that allow for “interpretation and appropriation” (Bowers, 2012 p. 77; Gaver et al., 2012 p. 49). The annotations should have a strong connection to the concrete artefacts, but also allow for a general application in that specific portfolio: in this way, the whole can “configure a design space” (Gaver et al., 2012 p. 46). The annotated portfolio is both a collection and an argument. It should stay close to the artefacts in the collection, and the annotations relate to the goals and features of these.

**What can annotated portfolio be applied to?**

The concept of annotated portfolio can be applied to practically any artefacts in it widest sense. For example, annotations can be applied to performances, gallery installations, films, essays, computer code, prototypes, photographs. The artefacts can have clear similarities and be of the same “family”, or they can be “unrelated” artefacts placed in juxtaposition. This grouping, say Gaver, can “define a space of possibilities” (Gaver, 2014 p. 161). In my view, this opens up for phenomenally rich possibilities in how to view design and design research.

**Why annotated portfolio?**

The *aim* of the annotated portfolio is to contribute to HCI by using the *lingua franca* of design, and the annotated portfolio can do “some of the work of theory” (Bowers, 2012 p. 70). It is however...
important to understand these “theories” are conditional, flexible, changeable, and aspirational (Gaver, 2012 pp. 937-938, 941, 944-945). The annotated portfolio has a “self-conscious logic of limited rationality” (Bowers, 2012 p. 76). Annotated portfolios partly aim at addressing what the authors call “disciplinary anxiety” as mentioned previously in §3.4 (Fallman et al., 2010; Bowers, 2012 p. 69).

How is it done?

The annotations can be created in numerous, and multiple ways for a single portfolio, depending on the perceived audience, the designers’ purpose, intentions, preferences, and / or interests (Bowers, 2012 p. 72; Gaver, 2012 p. 944), and are therefore subjective and indeed conditional. They do not purport to generalisations outside itself. Hence, the annotated portfolio claims no generalities outside the boundaries of its own logic, Bowers suggests that this descriptive / generative approach is a far more designerly way, than attempts to utilise explanatory / predictive methods (Bowers, 2012 p. 76). Deductions cannot really be made based on annotated portfolios; but they open for discourse in considering similarities and differences between artefacts. Such discussions, Bowers say, can bring to the surface “successes and failings”, and in doing so, can be generative in pointing to potential future design research work, and be sources of inspirations (Bowers, 2012 p. 76). The annotations themselves are addressed by the designer depending on artefacts, context, aim, and audience.

The “limited rationality” of the annotated portfolio, I believe, is its strength: it should be acknowledged and appreciated exactly for its limited boundaries. The interpretation of a group of artefacts and their annotations can be ambiguous and subjective, and in this lies opportunities for “conversations” and “interrogations” between the designer and artefact, viewer and artefacts, designer and viewer (via artefact), and between artefacts. This, as I see it, is what can create a design space, and where artefacts can be vectors for speculation, appropriation, and have generative potential. In this sense, annotated portfolios can be seen as experimental and conceptual, though they are inextricably bound to their respective artefacts. Their artifactual, constituent parts – the designs themselves – can be subject to study of many fields (art, design, economy, engineering, history etc.), but the collage-like nature of the portfolio is its own entity, residing in its own research of bounded rationality.

To view their potential in light of how generative or open to appropriation they are, is of course very difficult: the result of this is in the future and is entangled in design processes themselves. By this I mean that as designers draw on inspirations, knowledge, and experience that are not always clear, this is true for the single design artefact, the annotated portfolio, and any future work. Therefore, though a design or annotated portfolio might not have directly influenced a new design, does not mean that it does not have generative potential.

Bowers argues that a portfolio should not try to reach outside its own boundaries, but Löwgren
suggests it can ($4.8). So then a pertinent question is; can an annotated portfolio be an entity that contains intermediate-level knowledge?

**Can annotated portfolios embody intermediate-level knowledge?**

Several scholars suggest that annotated portfolios embodies a form of intermediate-level knowledge (Löwgren, 2013; Dalsgaard et al., 2014 p. 1636; Höök et al., 2015 p. 34). Dalsgaard & Dindler view the annotated portfolio as an object that are both documentation and reflection, and in this sense can indicate an intermediate level (Dalsgaard et al., 2014 p. 1637). Though Bowers argues that the annotations of a portfolio are not abstractions (they are “indexical”, and stays “close” to the artefacts), Löwgren disagrees with this, and argues that the annotated portfolio can indeed have a level of abstraction and thus inhabit the “in-between space” of intermediate-level knowledge. His argument is that an annotated portfolio can indicate an wider applicability; and that it can be generative in the sense that other researchers and designers might appropriate some part of it and perhaps use it in designs far removed from the original portfolio (Löwgren, 2013). Bowers recognise this to some extent, and say that annotated portfolios can tentatively, speculatively, and modestly reach a little beyond the particular artefacts, but with care: they still needs to stay close to the particular (Bowers, 2012).

In my interpretation of this discussion, I subscribe to the suggestion that an annotated portfolio can be a vector for intermediate-level knowledge. In other words, I believe that the annotated portfolio itself should be concerned with the particular artefacts themselves only. The annotations of the portfolio itself, I believe, should not use the indexical properties to indicate generalisations. I think the portfolio itself should stay with the artefacts: the potential for intermediate-level knowledge then lies in the interpretation of the portfolio as a whole. This is not to say that the annotations should be “trivial”, concerned only with minor properties of a particular artefact. But in my view the process of annotating the portfolio should be entirely focused on those particular artefacts. In short, I believe the portfolio should be introverted, concerned with itself only, but that it can be a vehicle for generativity and therefore, it can embody intermediate-level knowledge.

As I see it, the concept of the annotated portfolio is eminently suitable to openness, ambiguity, and generative potential. The portfolio consists of “real” artefacts, but its selection, juxtaposition, and annotations are made, so as to position some concepts open to interpretation, not punctuating a process with a “fact”. This openness to interpretation can create a fertile ground for speculation and serendipity, and this again can spark new designs, ideas, and direction of thought. According to Storni, the essence of RtD lies in its potential for other people to “ask better questions, propose new ideas, and produce better designs” (Storni, 2015). In this view, the annotated portfolio as an RtD artefact are internally concerned with what is, but open to interpretations of what can be.

In the context of my work, the openness to interpretation and allowing for ambiguity, I believe, are important aspects of creating flaneur-friendly serendipitous visualisations.
5 Methods

I did not think, I experimented.

Wilhelm Röntgen

In this chapter I focus on describing my case. Through this, I illustrate how I have used the methodology of Research through Design, and the methods of sketching, visualisations, debate sessions, and to create a portfolio and annotated it, hoping for knowledge around serendipity in search situations to emerge.

However, I start by a brief discussion on books, physical and digital ones. I have chosen a case involving books for my thesis work. This was a personal choice, and made for reasons explained earlier (§1.1). I am a bookbinder and love books, and in particular love serendipitous findings in all sorts of bookshelves. Technology are changing this relation to books, and I was curious to see if there was a way to extend and design for the beautiful experience of serendipity to e-books and online searches.

5.1 Case: serendipitous findings of books

As an example of something historically physical, books are increasingly becoming digital objects (Culén et al., 2011). Not only do we read e-books, but diverse digital tools are increasingly how we encounter, order, sort, buy, read, or request books regardless whether the item itself is physical or digital. This relationship and transfer from the physical world to the digital is a research field in itself. It is not in the scope of this work to go deeply into the particulars of this. It suffices to say that, in line with my own experiences, numerous authors have pointed out that transfer from physical collections to digital catalogues risks of loosing something in the process. They point towards the serendipity lost when the interaction with a collection is primarily through digital interfaces (see for example Gup, 1997; Foster et al., 2003; Koskinen et al., 2011; Thudt et al., 2012; Carr, 2015; Hibberd, 2015). Hibberd uses the example of the library of University of Technology in Sydney that implemented Automated Storage and Retrieval System (ASRS). The physical book storage is inaccessible to patrons: a book is requested through a digital interface and it is retrieved and delivered by a robot. In this system, she says, we loose the connection to the physicality, and our understanding of the collection it is altered. She argues that in these kinds of systems the digital catalogue and interface in a sense becomes the collection (Hibberd, 2015 pp. 1-2). However, she suggests that there is no reason to be nostalgic over this, but rather see it as an urgent and rich opportunity for bringing in visual design and research. Again, in line with my own intentions!
5.2 Data sources used in the visualisations

In this section I elaborate on the sources of data and information used in the visualisations. I did not, however, start with data collection: I started with sketching, and this will be described in the next section. Eventually the visualisations became based on “real” data and I give here an outline of the sources I ended up using.

5.2.1 Dewey Decimal System

Dewey Decimal System (DDC) is a widely used, numerical library classification system. It has ten top-level subject classes (General works, Philosophy & psychology, Religion, Social science, Language, Pure science, Technology, Arts and recreation, Literature, and History & geography), and each of those have numbered sub-classes. The information on what class a particular book belongs to, I have found in the Library of Congress’ online archives at https://loc.gov.

fig. 5. Dewey Decimal System classes, in the (arbitrary) colours I eventually assigned

5.2.2 LibraryThing.com

LibraryThing.com is the source of much information and data I use in my visualisations, so this section is a short outline of the service, its users, functionality, and structure. The reasons this is the basis for sketches and models, is its flexibility and the wealth of tags and metadata.

LibraryThing is one of the oldest online services, initially for managing physical book collections. It was from the start geared towards professional and semi-professional librarians running small to medium libraries. This is evident in for example the ability to generate and print bar-codes for lending (“circulation”), and allowing for having several items of the same work and in different editions. The user are given the choices of giving the items preset meta-information such as wishlist, currently reading, to read, read but unowned, and favourites (stars). It draws on numerous databases for finding old books, old editions, non-standard items and multilingual
support. LibraryThing has (currently) 1051 library catalogues, such as national and university libraries, and Amazon catalogues of (currently) 57 countries. It also has a flexible import/export functionality. It can contain “non-book” items such as articles and films. It has a community and user base of two million users and over 100 million works in their system, and they continuously acquire catalogues from libraries and commercial sources. LibraryThing has a comprehensive functionality for acquiring books in various formats.

5.2.3 Tags and folksonomies

Tags can be defined in different ways, but for my purposes, I follow Lohmann’s summary: a tag is an “arbitrary text label associated with a resource” (Lohmann, 2013 p. 12). In the context of LibraryThing this means that a user assigns a keyword to a book or author.

Tags can represent (perceived) properties across otherwise hierarchical and / or formal structures. Examples of tags we use every day could be pets, farm animals, wild, and weeds; and these are subject to change. What was once considered a weed may become an ornamental; something wild can be tamed. These tags do not change formal classifications such as mammal, nightshade family, or sheep, but can create meaningful groupings. The sum of a number of tags are often referred to as “folksonomy”; a “taxonomy” created by “folks”, meaning lay-people rather than “professionals” (for example, librarians, publishers, system engineers, chemists, biologists, architects etc.). Tags can be in a sense “personal opinions”, and relies on the language of its users, and is therefore a flexible method for sorting and grouping (Lima, 2013 p. 62; Lohmann, 2013 p. 16). In aggregate by multiple users, patterns and groupings of similarities and dissimilarities can emerge. According to Marliese et al., a folksonomy can create a certain level of consistency and stability with as few as a hundred tags (Marliese et al., 2010 p. 223). The point here is that tags traverse more formal structures (such as the Dewey Decimal System), can change over time, and are a result of the preferences of the users.

Since my focus here is tags in LibraryThing, the notion of the interactive tagging system that can be described as social tagging (Lu et al., 2010 p. 764; Lohmann, 2013 pp. 12-14), is important. Social tagging in this context means that individual and personal tags are available to the community. Tags can be ambiguous and personal. In their study, Marliese et al. revealed that from the ten books in LibraryThing they examined, nearly 40% of the tags were what they deemed personal (Marliese et al., 2010 p. 231). Presumably, a user chooses what makes sense to him – the tag might only be of use to the individual, but Bartley suggests that these might actually have value for other users (Bartley, 2009 pp. 4, 15). Much focus has been given to ways of consolidating tags: how to “semantifying” them and help users to use “correct” (or “less wrong”) tags in various ways (Bartley, 2009 p. 3; Lohmann, 2013 p. 19). To outline this debate is not in the scope of this thesis. In my work, I take the LibraryThing tags “on face value”. LibraryThing addresses the potential mess tags can cause by allowing users to connect tags onto catch-all tags (for example, the tags

2 Users can opt-out of sharing tags.
“shhrelock_hoomes” (misspelling) and “sherlockholmes” (lack of uppercase and space) can be hooked onto the catch-all tag “Sherlock Holmes”). This is of course dependent on the vigilance of the community, but as far as my enquiries go it seems to work well in relation to streamlining without overriding personal preferences or different spelling practices.

5.2.4 Amazon.com

I have used Amazon.com to find the physical measurements of books. This information is only intermittently available in LibraryThing. This information is of course dependent on a specific edition, and I have solved this by simply using the most common edition in LibraryThing.

I am now in a position to present the four main methods I have used to create my visualisations. I will present these methods in turn: sketching, visualisations, debate sessions, and the creation of an annotated portfolio.

5.3 Sketching

In this section I describe the sketching process, the tools and techniques, and present some of the sketches and the thoughts behind them.

Each research questions easily classifies as a wicked problem (§3.3). So how to even approach questions that have no clear definition, cannot be true or false, have any number of potential solutions, and no ultimate test for measuring success? In my experience, and based on my training, the best way to start is with pen and paper, and without too much fact-checking and information and data gathering beforehand. This is a good start for these kind of questions because it helps me to avoid the fixation on one particular source, or on one part of the problem. This keeps the problem space open. At the same time, exploring with pen and paper keeps me thinking, and thus, allows me to gain a deeper insight into the nature of the problem without judging what is “possible” and “impossible”. In general, I consider open prompts like “what do I want to see?” to be more valuable at the start than “what can I do with this particular data / information source?”

Tools and techniques

The primary tools were coloured pencils, pens, and paper; the techniques utilised was sketching. At various stages, chosen ideas were transferred to a digital platform using Adobe Illustrator to create digital versions of the sketches. I have also experimented some with visualisation software such as HighCharts, GoogleCharts, and Gephi. Different tools have different limitations and advantages. In my experience, it is easy to get stuck using specific software, and I have tried to avoid this. What I mean is that the limitations of a given software, or my lack of proficiency in it, might end up framing the thinking, and making it more rigid than it should be. On the other hand, paper sketches can get messy to the point of being indecipherable, and to edit them often
means starting over, while the endless editability in digital tools has the obvious advantage of copy-paste and moving objects around, working with layers, and hide-show.

**Messy processes**

*The only thing for certain is, like cats, ideas don’t come when called.*

Fletcher, 2001 p. 76

According to Wolf et al., it is widely accepted in CHI (HCI) research that messiness is core in creation, but it is rarely reported or described (Wolf et al., 2006 p. 4). Gedenryd describes this well: presenting a process to others usually means to go back into notes, scribbles, and sketches, extract the parts that became part of the solution, and present them in a, in hindsight, logical order. This suggests a sequential “timeline” of “proof”. However, he says, a design process never follows this path, and therefore it is a “mistake to see this as plan following, or to think of the proof as a plan” (Gedenryd, 1998 p. 62). Not until the end (of a design process) can a path be extracted, and this is work too: to reassemble bits and pieces into a systematic progression. In reality, he say, “there is just one process”: analysis and synthesis happens simultaneously (Gedenryd, 1998 pp. 61-62). This is very much the case in my research. The process – or rather processes – were not systematic, linear, or “orderly”. The “drawing phase” was continual. Many times during the process, I thought a visualisation finished or considered it a dead end, only to pick it up some time later and add a new adjustment or idea to it. For me, drawing is a way of thinking in the way that writing is a way of thinking. The “incubation” of thoughts and ideas does not necessarily involve any sketching – or writing – at all. I started one sketch, abandoned it, went back to a previous one that gave me a different idea for improvement, found some relevant literature and examples, went back to the first and so on.

I started very simply, and perhaps naively, by drawing a book, and associating freely around it, in text and imagery (example in fig. 6). A drawing was made to explore, there was no idea or concept to work around at this stage, and the sketches were perhaps more like doodles. After some seemingly idle doodling, a vague notion can emerge, or a sharp, clear idea.

The need for fact-checking, information and data gathering emerges from the sketching process naturally. I did not go into time-consuming data-gathering at this stage, but did some quick
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research to get a general idea, or work from experience of what would be plausible. From this I created some fictional, fairly reasonable data to test the sketch / visualisation in a few iterations. I might stick with this “fake” data and information across multiple sketches. Grocott describes this kind of process as a balance between the “impulse to stabilise” (gather “real” data) and a “desire to deviate” (speculative sketching) (Grocott, 2012 p. 21). “Real” data will be needed at some point, but I believe the urge to visually speculate should not be tempered too early. This enables speculation of the concepts and ideas, not framed by questions like “do I have these data?”, “is this practically doable?”, or “what can I do with this particular dataset or information?” but rather “what do I want to explore?”

Only when I explored an idea from multiple viewpoints, in several visualisations, did I decide whether to commit to the time it takes to gather “proper” data. This working with the fictional information does not mean a disregard for “real” data. Some of the visualisations demand sifting through and using several sources. As “real” data is gathered, the sketch / visualisation might change, both on fundamental and at the surface level. This might result in the realisation that the basic idea needs some adjustments or perhaps should be abandoned entirely. Then it is back to sketching again. This is not to say that this process can be described as a neat, circular thing. There are tangents, doodles, drawings, sketches, and data gathering going on simultaneously. Sometimes an idea, regardless of how well developed, is abandoned based on some gut-feeling. It might well be a viable idea, but personal experience and preference puts it aside. I doubt any amount of analysis could entirely explain exactly why it was abandoned, and this, I believe, is an example of where the designer’s experience in visual understanding kicks in. Of course, there are also practical considerations, such as limits on time and resources. Eventually, from these messy processes, two directions were distilled and further elaborated on. The result are two visualisations on which debate sessions and annotated portfolio then focused.

Naturally, I cannot include every little drawing I have made through this process, every napkin, notebook sketch; nor do I believe this would be useful. But I present here a collection because I think it is important to at least outline the effort, messiness, breadth, and rigour of these processes. Some directions turned out not to be fruitful or interesting, some are simply too convoluted or complex, and some I simply did not have the time to pursue. I believe there is potential for agency in each sketch. Each could probably be further developed and mulled over.

First sketches, exploring different types of visualisations

There are numerous types of well-known visualisations. Different types of data and information can be inserted into different types of charts, maps, and graphs. The first drawings are explorations of these, where I speculated about what kind of information and data could be inserted. Well-known visualisations could be for example time-series, scatter plots, bar charts, heat maps, geographical maps, networks, and trees. These drawings were made well before I decided on any particular data and information to use. In fig. 7, I explored different kinds of hierarchical
structures. As it eventually turned out, in one visualisation, I use the sunburst chart (bottom row, forth from left).

fig. 7. Sketches: hierarchical visualisations, variants on “trees”

fig. 8. Sketches: hierarchies, geography, chronology: loose explorations

fig. 9. Sketches: hierarchies, treemap, and a time-exploration of years-seasons

I loosely explored different visualisations, including variations and combinations on hierarchies, geographic, networks, timeseries, and maps in fig. 8 - fig. 9. In these two figures, there are the beginning of some visualisations that are not standard graphs and charts, that turn up again later in other sketches.

Hierarchy and relational

In fig. 10, I had the idea of trying to combine both hierarchical data and relational information. The exploration is still unclear to me: one thing is whether it is possible to do, another if it would
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actually yield interesting images of serendipitous discovery. I had a notion that the (orange) “blocks” on the inside of the circle could represent for example a book, the subsequent blocks (outwards) could represent various statistics, tags, or other data points. Then the (red and green) “bunting” crossing the circle would tie books together with some parameters such as tags, subject or other. This was rather vague, and though I interrogated this line of thinking quite a bit, I abandoned it as too convoluted. That is not to say that the idea is useless or impossible, merely that as I see it, it was leaning too much towards visual evidence, rather than visual speculation, as it is a kind of visualisation eminently suitable for data points.

![fig. 10. Sketch: hierarchies and relational explorations](image)

Colours

This was an early idea of using the colour of book covers as a kind of navigation. This is not an entirely novel idea, as the examples from the Bohemian Bookshelf in §2.3 demonstrates. The general idea here, though, was to extract the most dominant colour from covers of a collection, and display them as in fig. 11. The conceptual idea was that the colour blocks represent percentages. Meaning that fig. 11 would represent a collection of books. The largest block of colour (white) would be the dominant colour of most covers in this collection. In other words: the collection could be of 3000 books, and the white block might then represent 1200 books whose covers are predominantly white. I discarded this line of exploration for mainly one reason: I simply do
not find browsing books by colour all that interesting. It would yield a good deal of (perceived) randomness, and though that seems to be a part of serendipity, I found it a little weak on interesting information. This, of course, does not make the idea “useless” and it could be developed into something far more sophisticated and interesting. But as the initial sketch stands, I find it a little uninteresting as a tool for serendipity.

**Evolutionary river**

![Evolutionary river](image)

The idea here (fig. 12) is a rather abstract one, and is essentially about seeing information on an evolutionary continuum rather than discrete data points. The left-right direction could represent time, and then the colours in the “river” could indicate change. The colours could represent some subject matter, author life span, tagging practice, or any number of things. The basic idea was to somehow visualise a continuum of intermingling and overlapping. An example might be a visualisation of stories that somehow intermingle. Imagine that certain real or fictional people and places appear in different books: one could easily imagine that Sherlock Holmes are mentioned in stories not by Conan Doyle, that Paris or Atlantis appear in a range of literature. If this intermesh of connecting stories could be visualised, this evolutionary idea could be one way of exploring it. Sadly, I had to abandon this direction, as I believe it would be extremely difficult to create a meaningful visualisation in the time given. I do believe it has merit, though, and is an intriguing beginning for perhaps another project.

**Chronology by years, month, and seasons**

Sketching around the concept of time, here the idea was breaking time down into years and months (objective), in combination with seasons (fuzzy) (fig. 13). Loosely, the thought was that it would be possible to select – for example – a particular year, a particular month, but also summers spanning multiple years. The underlying experiment here was to view fixed points such as calendrical data in conjunction with more a more fuzzy notion of time. Running into the
problem of defining when summer ends and autumn starts, the concept would allow for fuzzy boundaries. Seasons are of course also dependent on hemisphere. Exactly what information this concept should be based on is not given: it could be the time a work was published, birth/death of author or other “real-life” event, or perhaps more interesting: the time described in a number of books. In other words: the idea was to allow for (fuzzy) selection of for example autumn-winter across X number of years. This could give a result of “stories set in (approximately) wintery-seasonal between 1938-1942”. I did not follow this idea further, but in hindsight, this might be one with great potential.

fig. 13. Sketch: exploring chronology in years, months, and seasons

**Exploring LibraryThing tags**

This is an early look at how LibraryThing tags can relate to each other, and if there are mutually exclusive tags (fig. 14). A work tagged with “nonfiction” is perhaps unlikely to also be tagged with “fantasy”. I took the top tags from LibraryThing and made a quick digital sketch of how they could potentially connect (fig. 14, left). The next iteration was the “hairball” digital sketch (fig. 14, right). The idea was to play with tags and see how intertwined they really are, or could be. Simply put, one could imagine that a work cannot be both “fiction” and “nonfiction”, though with some consideration, it could well be. Children’s books may not combine easily with “romance”, but then that depends on how to define “children”, or “romance”. “Short stories”, on the surface, might not overlap with “biography”, but it does not entirely exclude it either. In short; this exploration made it fairly clear that there are hardly any tag that exclude any other. In theory, there is nothing wrong with a book consisting of short stories for children, concerned with art and science through fiction and history, with an element of romance. So to move from theory to practice, I decided to run the real numbers on a selection of books. Both the sketches in fig. 14 are entirely made on “fictional” information: the exploration of the connectedness are entirely from my own perception.
fig. 14. Digital sketches: LibraryThing top tag relations

**Sunburst**

I kept returning to the graphic shape of the circle (as also seen in fig. 10 and fig. 14) and variations on the sunburst chart mentioned earlier. In fig. 15, I explored some variations, that, as it turns out, formed the basis for one of the two visualisations. In this image, I also speculate around the idea that if the circles overlap, it would eventually turn into a network.

5.4 Visualisations

In this section I present a number of visualisations I made, and the thoughts behind them. Some are built on ideas from paper-and-pencil sketches, some were created directly in digital tools. I then describe how, out of a number of visualisations, I selected two for further enquiry, through an annotated portfolio. I then describe the refinement and logic behind these two visualisations, that became the artefacts around which to hold debate sessions.

**Looking for 'discrepancies' and messiness in LibraryThing tags**

Considering the potential for discrepancies in user-generated tags, I wanted to explore if this was actually the case in LibraryThing. As mentioned, I wanted to take the LibraryThing tags on face value, and had idea that utilising discrepancies and ambiguities could perhaps be an interesting way of creating visualisations for serendipity. In other words, I was actually hoping for some illogical or deviant practices.
I selected 40 random books, and ran the numbers in comparison to the (all-time) top tags in LibraryThing (fig. 16, left). Gradually, I reduced the number of tags, to see if some glaring disagreements became visible, and finally decided on “fiction” vs “nonfiction”, as one can perhaps envision these to be mutually exclusive. From these explorations, I found the high consistency throughout a little surprising. As can be seen in fig. 16 (right) a few books have both tags, but considering the subject matter of the book, they are fairly reasonable. *Sophie’s world*, for example, is definitely a work of fiction but the subject matter is also history and philosophy. Tags, of course, do not need to be mutually exclusive, and the exploration here was motivated by an idea that inconsistencies in tags could create interesting gateways to serendipitous discoveries. From these explorations, however, there were not really any disagreements of note. One or perhaps two users our of thousands might have tagged a book with an “incompatible” tag, but this might well be down to automated imports, ignorance, or accidents, and these were – in my exploration of this – so rare as not to be useful for visualisations.

**LibraryThing tags on History of Western philosophy by Russell**

Instead of starting with top tags from LibraryThing, the next sketch (fig. 17) explores the con-
nection between (user-generated) tags and Dewey Decimal System (DDC) classes in relation to *History of Western Philosophy* by Bertrand Russell. To be clear, this is not computed, I am merely exploring the relationship. This means that it is by no means exhaustive, “correct” or “true” and is entirely based on my personal knowledge of the book, the tags and the classes. On the left side are the top levels of Dewey Decimal System, on the right, the top tags from LibraryThing for this particular book. Not surprisingly, the general weight of the tags relate well to DDC group of philosophy and psychology, but there clearly are other connections. Undoubtedly, the book could be read from a different perspective than the traditional view of linear presentation of Western philosophy.

As another approach to the problem area, I took as the starting a selection of 20 (physical) books from my personal bookshelf. The reason for this is that I have read them and can make some judgement on the content. This was useful in the initial exploration, as it allowed me to make some judgement on the trustworthiness of the information and data. Deliberately, the selection...
contains books that deal with a variety of subjects. This model started out with the idea to get a picture in my mind of 1. How the Dewey Decimal System works, 2. How my own bookshelf operates, 3. How LibraryThing tags work in relation to these. I reasoned that this could be useful for further exploration. The books are:

1. John McCarthy: *Some other rainbow*
2. Michel Foucault: *The order of things*
3. Janna Letts and Fiona Whytehead: *Captured voices*
4. Robert McLiam Wilson: *Manfred's pain*
5. J. R. R. Tolkien: *The lord of the rings*
6. Umberto Eco: *Baudolino*
7. Umberto Eco: *Foucault's pendulum*
8. Alan Fletcher: *The art of looking sideways*
9. Diana Hoare: *Advanced calligraphy*
10. Neil Shubin: *Your inner fish*
11. David Attenborough: *Amazing things*
12. Charles Darwin: *The voyage of The Beagle*
13. Richard Dawkins: *The ancestors tale*
14. Edward Tufte: *Beautiful evidence*
15. Bertrand Russell: *In praise of idleness*
16. Lawrence Lessig: *Free culture*
17. Noam Chomsky: *Media control*
18. Ruth Dudley Edwards: *The faithful tribe*
19. Bertrand Russell: *History of Western Philosophy*
20. Vermaas et. al.: *Philosophy and design*

I created an image that shows the book sizes (height and thickness) relative to each other and placed them as I would on my shelf (fig. 18). At this point the books to some extent follow a visual representation of the physical world. The colours are arbitrary, but correspond to the top level DDC groupings as introduced earlier.
20 books: Dewey Decimal System vs. me

I then made an illustration of how I would have grouped the books, had it been the only books I had in comparison with the DDC (fig. 19). My personal main dividing top categories are fiction and nonfiction. I am clearly not the only one thinking this way, as they are the two top tags on LibraryThing. I deviate from DDC on a few key points, such as not having a “social science” category, but rather dividing these into “politics”, “history” and “art”.
20 books: Dewey Decimal System vs. LibraryThing tags

The 12 most used tags on LibraryThing are: fiction, nonfiction, to-read, fantasy, history, science fiction, mystery, read, biography, poetry, novel, and romance. Clearly, to-read and read are individual, presumably time-dependent labels. Within tags on LibraryThing, there is nothing wrong with a book being both fiction, nonfiction, history, fantasy, poetry, and mystery all in one. In formal classification systems such as DDC, a top-level choice must be made. Hence, the “comparison” of DDC and LibraryThing is not a direct one. What fig. 20, shows, is essentially what tags can apply to what book. It is not exhaustive, merely indicative. What is interesting about this sketch, however, is the multiple access points of the tags. If you are looking for a book with some component of history, you will get access to an great variety within this small selection.

5.4.1 Selection through annotated portfolio

Based on these initial sketching and visualisations, I selected two ideas to develop further into more articulated visualisations. This selection was based on the making of a quick annotated portfolio, and annotating them with their main properties as I see them (fig. 21). The two on the left where subsequently chosen.
Visualisations for enabling serendipitous findings of books

- relational-hierarchical
- “river”
- formal-comparative
- sunburst

The potential of the first from left (relational-hierarchical), I considered to be rather towards visual evidence rather than speculations as suggested by the annotations. It also seems rather “closed” in that the hierarchical element seems visually to be a little too strict. The second (“river”), though visually appealing, I reasoned to be too obscure and abstract. Though this would be beneficial in other contexts, in the view of this work this seemed a less viable direction. It is a curious visual representations, rather art-like. Then the two from left seemed the ones with most potential for further work.

**Number three from left, formal-comparative:** the original thought here was to use a formal system (Dewey Decimal System classes), a visual representation of sizes and thickness of books, and in some way use tags from LibraryThing to make connections between them. Hence, the visualisation seems to speak of formal-physical-comparative.

**Number four from left, sunburst.** The sunburst idea seemed pleasing in its ability to be expansive and relational, but at the same time a contained visual object. It is a way of displaying hierarchical information, but at the same time, I believe, does not spell this out.

In the following sections I present the two final visualisations and the thinking behind them. They formed the basis for the debate sessions (§5.5) and the annotated portfolio (§5.6).

### 5.4.2 Visualisation I: the (ir)relevance map

Abstracting the previous ideas further, I considered making a “relevance map”, showing the DDC classification and the distance of relevance between the books through tags. This is where the models get increasingly complex and might need a closer study. Consider for example the two books *The history of Western philosophy* and *The order of things*. They will have a number of tags in common. For example, they both have the tags “sociology”, “history of science”, “history of ideas”, “philosophy”, and “history” in common. The tags are placed along the arch and the distance
between them are determined by a percentage (fig. 22).

Placing these tags (magenta dots) on the curved line can potentially show some relationships (fig. 22). By this I mean: the tag “history” have a high (user-assigned) count regarding Russell’s book and a lower regarding Foucault’s. Calculating the percentage, this would place the dot close to the first and away from the second. In this way, the magenta line becomes a kind of visualisation of “kinship” between the two works. As per the example; perhaps I have read *History of Western philosophy*, and what I want to learn more about is the history of science. Looking at the visualisation, I can see that Foucault’s book has a stronger focus on this in comparison, and I can also see what other tags they have in common. However, I can also see that they have a strong similarity in that the tag “history of ideas” are almost at the half-way point. I could then perhaps interpret the “relevance” between them to see that *The order of things* are much more focused on sociology and the history of science, but the two book have a strong connection to the history of ideas. And, as we follow the magenta line down, it seems that *The history of Western philosophy* is more strongly concerned with history and philosophy. If I have read neither, the magenta line can indicate what each book focus on, and learn how that correspond to my interest.
Each tag (magenta dot) could contain further information about other works in the same manner, as indicated in fig. 23. In this way the visualisation could become an interface with almost infinite connections.

The aim is to create serendipitous discovery of books by creating a “prepared system”. In this visualisation, the tags and their placement allows for comparisons. This comparisons, however, are in many ways low in information. By this I mean that the tags are presented as elements of comparisons without any contextual information. They are taken on face value, and the interpretation of the respective tags are open. As per fig. 23, the tag “ideas” is rather ambiguous, but the visualisations makes no attempt at clarifying. One could perhaps imagine the tag “party” turning up in some constellation, and to know whether this refers to a social get-together or a political entity would not be explained. This, in a more traditional system for finding might be seen as a weakness, but I think this is one element that can encourage a flaneur mindset. Not every detailed is fixed into a particular context, and the viewer are hopefully encouraged to keep an open mind.

In this visualisation, the Dewey Decimal System (can) represent formal information, the sizes of the books visually demonstrate number of pages, and can indicate content (tall books often have illustrations etc.). The comparative aspect of the visualisation is in contrast abstract.

This visualisation is a conceptual idea, and is basically a static “interface” of those 20 books only. To imagine this as a finished digital interface, the viewer could select particular works or authors,

**From concept to interface**

This visualisation is a conceptual idea, and is basically a static “interface” of those 20 books only. To imagine this as a finished digital interface, the viewer could select particular works or authors,
or have a random selection made. The viewer could select one book as the primary, and then slide the tags (magenta dots) up and down the arch, and the corresponding book would change accordingly. The viewer could perhaps also select some tags as the starting point, or be presented with a random selection. One could also imagine a number of filters that could narrow the “search” but I believe that the interface should not give too many opportunities for narrowing. After all, the aim here is to open up to meanderings and surprises. If too much granularity is allowed, it becomes more about retrieval, and less of a flaneur-friendly, serendipity-inducing visualisation.

How is this a ‘prepared system’?

It is a system in the sense that the data and information on which it is based on are replicable and it is technically possible to make. I would suggest that this is a prepared system in the sense that it encourages a flaneur mindset. This was to some extent confirmed and gave some interesting and unanticipated results in the debate sessions, and I address this in the next chapter.

5.4.3 Visualisation II: six degrees of separation

There is a theory that every person on the planet are only six people removed from any other person. The thought occurred to me that it might be true when it comes to books. The aim was not really to connect every book with every other one, but to explore unlikely paths. So with this thought experiment I thought it could be interesting to see what properties can be used, not to link a known entity to another known entity, but rather see how chains can emerge, and where one would end, after “six degrees”. The visualisations, it turns out, can show a path between for example the philosopher Michel Foucault, hobbits and Middle Earth.

The three variables I use, are author, title (of work) and (LibraryThing) tag. The visual representation is essentially a sunburst chart; displaying a hierarchical data set.

Wheel I

The starting point could be any tag, work or author, but for the first wheel, I chose the tag “foucault”. The reason for this is that I knew that there are two authors by that name and at least one book of fiction containing it in the title. I placed the tag in the centre of a circle and added the two authors and the book around it (fig. 24).

By using the information available at LibraryThing I then followed each “branch” with the other variables. In the case of following the book, the path becomes tag → book → author, and then the pattern is repeated. The next tag then is “historical fiction”. The top book under the tag “historical fiction” is The pillars of the earth, the author of which is Ken Follett, and the top tag for Ken Follett is “fiction” (fig. 25). Here the circle stop; at “six degrees” but could of course have been continued. The entire path then becomes:
- “foucault” → Foucault’s pendulum → Umberto Eco → “historical fiction” → The pillars of the earth → Ken Follett → “fiction”. (fig. 25)

fig. 25. Visualisation II: from the tag “foucault” to the tag “fiction”

Following the two other directions with the same pattern (fig. 26) then becomes:

- **Michel Foucault** → Discipline and punish → “philosophy” → Plato → The Republic → “classics”
- **Leon Foucault** → Recueil des travaux scientifiques → “physics” → Stephen Hawking → A brief history of time → “cosmology”.

fig. 26. Visualisation II: Wheel 1, three directions by starting with the tag “Foucault”
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The selection of variables are for the most part the top “rated”, but not always. Sometimes author → book → tag → author (etc.) would end up going in a circle. For example if starting with J. R. R. Tolkien, his top book might be *The Hobbit*, the top tag for *The Hobbit* might be “fiction”, and the top author for that tag might be Tolkien. To avoid this, I would then go “down” one notch and find the second most used variable.

**Wheel 2**

The second wheel, fig. 27, does exactly the same thing in the same manner, but this time the starting point in the centre is the tag “historical fiction”. This was chosen to explore intersection with the previous wheel.

*fig. 27. Visualisation II: Wheel 2, four directions from the tag “historical fiction”*

- *How to write and sell historical fiction* → **Persia Woolley** → “Arthurian (legend)” → *The mists*
of Avalon ➔ Marion Zimmer Bradley ➔ “darkover”

- The book thief ➔ Marcus Zusak ➔ “Holocaust” ➔ Night ➔ Elie Wiesel ➔ “Judaism”

- The pillars of the earth ➔ Ken Follett ➔ “fiction” ➔ Harry Potter and the sorcerers stone ➔ J. K. Rowling ➔ “fantasy”

- The other Boleyn girl ➔ Philippa Gregory ➔ “england” ➔ Pride and predjudice ➔ Jane Austen ➔ “19th century”

Wheel 3

Wheel number 3 (fig. 28), again, does the same but starts with Lewis Carroll. He is perhaps best known as an author of children’s stories, but he was a clergyman, mathematician, and photogra-
pher, and he published works on these subjects as well. The four directions then becomes:

- **Alice in Wonderland** → “classics” → Jane Austen → *Pride and prejudice* → “fiction” → J. K. Rowling

- **Symbolic logic and the game of logic** → “math” → Edwin A. Abbott → *Flatland* → “science fiction” → Orson Scott Card

- **The hunting of the snark** → “poetry” → Shel Silverstein → *Where the sidewalk ends* → “children” → Frances Hodgson Burnett

- **Games and puzzles** → “logic” → Douglas Hofstaeder → Gödel, Escher, Bach → “philosophy” → Plato

The three wheels can be placed so they intersect on identical variables, in this case on the tags “philosophy” and “historical fiction” (fig. 29). What is apparent even with these limited units is that some tags, authors, and works repeatedly returns. In this case, “philosophy”, Plato, J. K. Rowling, “classics”, “historical fiction” and Jane Austen keeps popping up. However, each of these three wheels and their respective “paths” are not really all *that* surprising. It is not a huge stretch of the imagination to get from the tag “foucault” to classics or Plato; nor from historical fiction to Jane Austen. Wheel number 3, with Lewis Carroll in the centre, makes for slightly more interesting oddities, but not much. I still liked the general idea, but wanted to try to make it more open to serendipity.

![fig. 29. Visualisation II: three wheels combined and overlaps exemplified](image-url)
Wheel 4: multiple paths

The previous wheels are fairly straightforward, and to my mind, the results are not really that surprising or serendipitous. I reasoned that to increase diversity and surprises, each node could have two connections. The result would then be – for example – the tag “historical fiction” would get one author and one work attached and so on. In other words, each node (going outwards from the centre) would be connected to two different variables. This might give some interesting results. A tag then has one top author and one top title attached (fig. 30). In this way, items double on each level and create new branches, as seen in fig. 31. The only “rule” is that no item is connected to the same variable. From centre to the rim, some eclectic connections are made, for example a between the tag “Foucault” and the novel *Dubliners* by James Joyce are created, with five intermediate steps. Following another path in the wheel, still starting with Foucault, but this time via the philosopher Michel Foucault, gives even more curious results: on the fifth level are “photography”, “Norway”, *The Hobbit*, Dan Brown and Barack Obama among others. On the sixth level we find for example “thriller”, “USA”, Niccolò Machiavelli, Shakespeare, Jo Nesbo and *Animal farm*.

At one point in the creation of this model, I made a choice to experiment with the path a little. Partly it was an experiment with a non-textual tag, but also because the origin of the path is a work on mathematics and science by Leon Foucault in French. I do not speak French, and with only one owner the branching becomes limited. I then made a choice to follow “*****” instead. This resulted in Jane Austen (i.e.: the top author for the tag ***** is Jane Austen). Going conventionally “down” from the stars, the top work was *Harry Potter and the sorcerer’s stone* and the top author (after Jane Austen) was J. K. Rowling.

The wheel has numerous oddities, such as (via philosopher Michel Foucault) ending up on the sixth level also containing “vampires”, *The little prince* and Cormac McCarthy. It is worth noting that in this project I “lost control” over where the paths would go: I have not read all those books, some of the authors I have never heard of, so I can make little judgment as to the quality or “relevance” or lack thereof. I make no judgement calls apart from the tweak previously mentioned. It is clear, however, that the wheel allows for some rather eccentric connections, and in this I believe lies opportunity for serendipity.
Methods

fig. 31. Visualisation II: Wheel 4, multiple paths

From concept to interface

This visualisation is a conceptual idea, and wheel 4 could be viewed as a (static) interface of the tag “foucault”. If we imagine it as a fully-fledged digital interface, each item would be selectable, and upon being selected, would then become the centre of the wheel. This “new” wheel would then be generated following the same logic, as described. If the interface was made to be dynamic, it would then display the current status of tags from LibraryThing. This means that the results of the visualisation would change as the content of LibraryThing changes. The interface would then be a “snapshot” in time. Additional functionality to control the variables could be implemented. For example, an option could be filtering based on time (“make a wheel with works written before 1937”), only in a particular language (“make a wheel in Korean”), or geography (“make a wheel with works that are related to Sub-Saharan Africa”). This would perhaps be an interesting and
perhaps a useful narrowing, but as argued earlier, too much filtering and narrowing might remove some serendipitous potential. Regardless of how the imagined interface might be envisioned and implemented, the underlying concept remains the same.

The aim is to create serendipitous discovery of books by creating a “prepared system”. The tags are the “vehicles” that allows for a “jump” from what might be a heterogeneous group of books or authors. For example, this is what allows the wheel to go from “physics” and Richard Feynman to Ann Frank. This happens via the tag “autobiography”. In a physical library or in an online library catalogue this would likely not happen: if you are looking (physically or digitally) at a book by Richard Feynman, the related / adjacent works would likely be concerned with physics. The visualisation do not contain assumptions in this sense: it is tempting and human to group things that have similarities or presume that there is an expected route to follow to some logical conclusion. To assume that someone who starts with Foucault and works her way outwards via science and cosmology would be dissatisfied at ending up with Jane Austen, vampires, or photography might well be a faulty assumption, as well as limiting serendipitous potential. It is perhaps tempting to see the elements of this visualisation as random, and to some extent they are. They are largely dependent on the statistics of LibraryThing and their users, the fickleness of crowds, and popularity of works and authors. However, as mentioned earlier, consistency in tags in LibraryThing is surprisingly high.

**How is this a ‘prepared system’?**

I would suggest that this is a prepared system in the sense that it is serendipity-friendly and encourages a flaneur-like meandering. This was to some extent confirmed in the debate sessions, and I will return to this in the next chapter.

## 5.5 Debate sessions

I wanted to find ways of gathering different views and understandings on serendipity in general, and in regards to my visualisations in particular. I find the approach of showroom (as described in §4.2) appealing, but somewhat lacking for my purposes. Placing artefacts in environments may or may not result in the kind of open, speculative dialogue and discussion I was looking for. It therefore seemed reasonable to hold some sessions where free flow of opinions and arguments could happen, and I call this debate sessions.

The Merriam-Webster dictionary define debate as: “a discussion between people in which they express different opinions about something”. In the word debate lies a suggestion of matched opponents, in that there is an equality between the participants. A debate is also a place for opposing views, and this I wanted to foster, in order to gain a wider understanding of the concept of serendipity. However, I did not want to pit unsuspecting participants against each other, so I reasoned that I would be the “opponent”. I reasoned that debate sessions in conjunction with
annotated portfolios could therefore be instrument in gaining knowledge and understanding, and allow me to conduct Research through Design on serendipity.

In this section I describe how the debate sessions were structured, and what was discussed. The result and findings are presented in the next chapter.

The debate sessions can perhaps be said to contain some small elements reminisces of lab, field, and showroom explorations, as elaborated on in §4.2 They were structured sessions with one or two participants. This aspect, in conjunction with the fact that the whole debate format was experimental for me, could be considered to be lab-like. The field aspect could be found in my openness to view my visualisations through the eyes of the other potential users, who may not have the same feelings towards serendipity and its desirability in search situations. At the same time, a debate was also an opportunity for displaying and showing. The intent, from the start was to create visualisations for speculation. So, I wanted to experience and explore the speculative nature of the showroom. Although aspects of all three Research through Design practices are in some way embodied in the debate format, I claim that it is actually a method that can be used in RtD more frequently. As suggested in the typology for Research through Design described by Krogh et al. (2015) (§4.4) the debate sessions can be said to be part of an expansive exploration.

However, I have not previously read, seen or been part of sessions with the same intent. In speculative and critical design, speculations typically unfold in a larger space, in some sort of public showroom. In my research, this was neither desirable nor possible. So, debate took a form of a familiar interview, or a very small workshop, but the intent behind it was very different. I wanted to propose something, but I also wanted opposition to this proposal, speculation and real dialogue around my proposition and serendipity to unfold. The knowledge sought was that of identifying areas not yet uncovered and understood, and qualities still unseen. Debates did not have any clear direction in the sense of task testing in a predetermined manner. As in the description of the expansive type of research in Krogh et al. (2015) (§4.4), the goal was not deep knowledge, but a broadening perspective on serendipitous search through exploration of new aspects that I did not yet see myself.

I enlisted the help of five people, with very different skills sets, to discuss and debate the visualisations. Two people could be describe as programmers, one as a graphic and interaction designer. One is a PhD candidate in interaction design, and one has a PhD in microbiology.

The aim of the debate sessions was to use the two visualisations as artefacts for speculation around the concept of serendipity. Deliberately, I tried the debate format with two people, and one with only one. As a result, I concluded that four sessions would be appropriate. Apart from the first one with two people, the remaining three where one-to-one conversations. In my experience, gathering two or more people often results in someone being dominant, and their views defining the direction of the conversation. I wanted to mainly listen and coax people into speculating around the subject, which is something, as it turned out, that people rarely think about. In addition,
splitting it into several sessions gave me more time with each person, and therefore it would be
more likely to get contrasting views. Considering these visualisations are in essence images, and
not interactive systems, the discussions where naturally focused on the concept. The discussions
were not about whether a particular visualisation should or could be made into a fully-fledged
digital interface: it was about how the concept of serendipity can be explored through RtD, and
how visualisations can enable serendipitous book finding.

The structure of the sessions were:

- How can we frame serendipity?

  This question entailed a discussion on what serendipity means, what it entails, how it works
  and how it is experienced. This was mainly to ensure that we either shared an understanding
  of the concept, or understood each other’s differing views.

- “Show and tell”: showing, explaining, and discussing the visualisations.

  I presented the visualisations on paper prints, gave a general explanation, and opened for
  a discussion about how well they embody a possibility for serendipitous search.

I tried to encourage the participants to write on the prints, to sketch, and doodle, but this rarely
happened. I did not push this, as I believe it more important that the discussions should flow
freely. The result was that some of them would write a little, and I would take notes on the print-
outs. In the next chapter, I will elaborate on the findings and returns of this method.

5.6 The annotated portfolio: intents, goals, features

In this section I present my views on the two selected visualisations (the (ir)relevance map and
six degrees of separation) through an annotated portfolio, created prior to the debate sessions.

An annotated portfolio, as explained in §4.9, can be seen as an analytical tool in Research through
Design. This portfolio (fig. 32) displays how I used my personal experience, insights, reflections,
and what I learned through the sketching, to consider the goals and key features of the two vis-
ualisations.
Methods

fig. 32. Annotations of intent, goals, and features
Reframing searching and finding

Willingness to be “lost”

Peak curiosity

“Breaking” the formal
6 Findings and discussion

This chapter gives a summary of the core concepts of my chosen approach of Research through Design and a recap of the core elements of serendipity and visualisations. Then I address the research questions, and discuss them in relation to my methods and findings.

6.1 Research through Design recap

Research through Design as an approach within HCI do not have overarching, proscribed frameworks in the traditional sense of scientific research (§3.1). In this, RtD can be said to share some common ground with other fields such as architecture, product design, fashion, graphic design, illustration, and fine and applied art. But, in agreement with Gaver and Bowers, I believe these fields have not collapsed from a lack of paradigms, systematics or consensus to methods, methodologies, theories, tools or techniques. On the contrary, these fields operate and thrive with contradictions and disagreements: their practitioners create multiple, parallel, contradictory worlds, and works fairly comfortably with uncertainty, ambiguity and contradiction. I believe that both creating and viewing ambiguity holds great potential for serendipitous happenstance. In my view, Research through Design thus has a lot to offer to my research on serendipity in particular, as well as HCI research more generally.

There is a number of suggested ways of approaching wicked design problems, how to gain insight and knowledge from artefacts, and the process of creating them. Though the disagreements of the field might be many, my research suggests that there is consensus on a few points:

- There are discoveries and knowledge to be made through making
- Messy processes should be acknowledged and documented
- The value of particular designs lies in their generativity, not just in its particular instance

Storni argues that Research through Design should be modest, accountable and generative (Storni, 2015). I have attempted to adhere to these principles: modesty, by consciously not making sweeping generalisations removed from the concrete artefacts, accountability by making the process transparent, and generativity in allowing the artefacts (sketches, visualisations, and the annotated portfolio) to be open for interpretation and appropriation.

I found that approaching knowledge-creation through making can be a more of a challenge than I had first anticipated. In the introduction I described some of my background to make it explicit that I consider myself what Nigel Cross calls a “designer-researcher”: someone who comes from a design background into research (Cross, 1999 p. 9). The essence of most of my educations and experiences has been about making things work, solving concrete problems, relating to customers, clients, users and their demands, limitations on time, resources, and money. Approaching a
problem space, then, where few of these apply has been more challenging than I thought it would be. There are nagging questions like “how will it work?”, “who will use it?”, “how can this be made into an interactive system?”, “is this even possible?” To subvert these questions, and focusing on the conceptual, open for appropriation, being indicative, aspirational, generative has been very challenging. There is a constant feeling that I should argue for and against all choices, that every sketch should be thoroughly analysed, explained and to some extent scientifically justified. In line with Gaver, I have come to believe that too many attempts at this means that it is no longer Research through Design. It is also tempting to try to extract some generalisations from the work, to expand the concept into a wide area, and perhaps make some sweeping statements as to its potential use or relevance. But, Gaver say, design knowledge should “stay close” to the artefact, and the further away from the artefact, the less trustworthy it is (Gaver, 2014 p. 162). It is tempting to hone in on solutions, to create “systems”. This would perhaps be easier to “sell”, and the resulting artefact would be more directly critique-able and therefore subject to evaluative guidelines from for example software development, user-centred and / or graphic design. But the sketches, visualisations, and the annotated portfolio are “visible thoughts”. They are interlinked, entangled visual responses to the problem space: “serendipitous visualisations for finding”.

6.2 Serendipity recap

Serendipity, I have established, consists of two elements: a prepared mind, and, in the sense of design, a prepared system (§2.2). The prepared mind (or lack thereof) is hard for a designer to influence or predict, so my focus has been on the prepared system. In practice, it is extremely difficult to study serendipity, and particularly in the “real world”. How to position oneself as a researcher in places where people experience serendipity? How to observe serendipity in action? How to measure serendipity? How to find objective definitions and units of measure? How to phrase questions for interviews? This, says André et al., is close to impossible (André et al., 2009 p. 306). In this sense I believe that Research through Design can offer a unique approach. RtD is flexible, designerly, and can incorporate the subjective without losing a scholarly mooring. It allows for speculation in process and products. Considering that serendipity is difficult to capture, which became clear both through the literature and in the debate sessions, I believe exploring it through making is a fruitful approach. There is no guarantee when designing something that serendipity will occur, as participant E said: “you can never build a system {for serendipity}, you can build it and hope it cultivates it”. It then might seem a hopeless or pointless task, but I agree with D’Ignazio, who says that though it is counterintuitive and exceedingly difficult, it is worthwhile (D’Ignazio, 2014).

So in this “impossible” task, I believe strongly that what Research through Design can offer, are artefacts for speculation: to create ambiguous objects that are open to interpretation. In this view, the problem of serendipity is well matched to the approach of Research through Design.
6.3 Visualisation for speculation recap

Fallman differentiate design artefacts into two main groups, *tools for thinking* and *tools for presentation*. The former are “process” artefacts for the designer to speculate around; the latter communicate an idea to other people (Fallman, 2003 p. 229). As I use the term *visualisations for speculation*, this includes both types: they are not contingent on something being “finished”. Artefacts made to allow for speculation will in their nature be ambiguous. If they were not, there would be little to speculate about. The challenge then is to create visualisations that are abstract and ambiguous enough to trigger curiosity and questions, but not so abstract as to be incomprehensible. A design can be read, interpreted and appreciated in multiple, contradictory ways (Gaver, 2014 p. 159; Wiberg et al., 2014 p 535), and each interpretation can all be equally “true”. I believe these different interpretations are valuable. To exemplify this through my work, the annotated portfolio aims at exemplifying this to some extent.

6.4 RQ1: Exploring serendipity through RtD

RQ1: How can the concept of serendipity be explored through RtD?

Serendipity can undoubtedly be explored through the methodology of RtD in numerous ways. In my work, I chose four main tasks, each as a way of interrogating the problem space in the process of exploring the concept: sketching, visualisations, debate sessions, and the creation of an annotated portfolio. In this section I present a summary of these four tasks and the findings of each.

6.4.1 Sketching

The first step in exploring serendipity was to create numerous sketches. The aim of the sketches was to widely speculate around the problem space and tease out some ideas on which to build an understanding, and create visualisations.

In practice, the sketching process was about visual thinking, in the sense that sketches are “thoughts made visible”. Though my tools for thinking are sketches, I do think they can have potential as artefacts for speculations in their own right. In this, I believe it is not for me to judge (too much) on which sketches are “worthy”. They are not “proofs” as in proof of concept, nor in always presenting clear intent. There is of course a possibility that sketches, in their disarticulated nature, are unfit as artefacts for speculation for people other than the designer. This I view in two ways: one, they represent a process and body of work regardless of interpretation and appropriation. In this, they ensure a designerly rigour. Two, I do believe that if interrogated further, the sketches can have potential for appropriation.

The result of this task was numerous sketches that each explored the design space of visualising serendipitous finding in different ways.
Findings and discussion

6.4.2 Visualisations

The second step in exploring serendipity was to create two articulated visualisations. The aim was to create concrete artefacts that would resemble tools for presentation, more than the sketches generally do. This was for two reasons: to refine two ideas visually, and to create concrete artefacts around which discussion on serendipity could be done.

The visualisations, as opposed to the sketches, are presented in a logical fashion in that the focus is on explaining the conceptual ideas. They might seem simplistic, but I hope I have demonstrated two basic ideas: a comparative system (the (ir)relevance map) and a linear, hierarchical system (six degrees of separation). Core to each are use of a social tagging system for books (LibraryThing).

André et al. ask whether “(...) a system that supports chance encounters is not simply another type of recommender system”, and maybe a bad one at that. The answer to this, they say, is both yes and no (André et al., 2009 pp. 310-311). Considering the two visualisations, they can be seen as kinds of “recommender systems” that indeed allows for “chance encounters”. The resulting visualisations, I argue, allows for some degrees of being “lost”. Whether they allow for being lost in an interesting way is a subjective thing. But I do believe that both directions of inquiry can open up for amazing surprises. I cannot through either of the visualisations “prove” that I have reached a goal in any scientific sense (§3.1). However, as argued by Gaver, artefacts are “proofs” in the sense that they exist, and can create a space for design by establishing a position (Gaver, 2014 p. 161). In their speculative nature, I believe that the visualisations can be generative in their own right (the debate sessions also suggest this).

The result of this task was two articulated visualisations that visually represent two different ideas.

6.4.3 Debate sessions

The third step in exploring serendipity was to discuss the concepts and visualisations with other people. Trying to find out how to do this in practice, given that I did not want just an interview or a workshop, I have come up with a form of inquiry that I have come to call here debate sessions. The aim of the debate sessions was to bring to light unseen aspects of serendipity through discussion, speculation, debate in general, and in relation to the visualisations that I made in particular. On a method level, I find that they worked much better in conjunction with RtD as my main methodology than interviews and workshops would.

As previously mentioned, the structure of the debate sessions where split in two sections. The first posed the question “how can we frame serendipity?” so as to open up the debate to the concept of serendipity. The second section was “show and tell”, where the two visualisations were presented, so as to open for debate on how well they embody a possibility for serendipitous search.
Findings from “how can we frame serendipity?”

It seems the concept of serendipity is something rarely thought about, and are difficult to pin down, but that we “know it when it happens”. That it is something more than happy accident seems clear, but what that “missing” bit could be required a bit of discussion, examples, and musing. Each participant seemed to clearly understand it on a level of a “valuable unsought finding”. Serendipity, they agreed, is a “happy accident”, but is valuable and enjoyable in a different way that finding money on the street would be. One definition that was suggested by A & B was simply:

“Surprising finding of value.”

E suggested that:

“Serendipity has to be a little more than just finding money on the street… the incident itself has to be much richer and more beautiful … the moment is quite intense.”

Serendipity is clearly different from the luck of finding money on the street, and E also clarified a difference between an aha-moment and a serendipitous experience. To her, the precursor to the aha-moment can be a deliberate process of searching for a solution, and the aha-moment brings it all together. Serendipity, on the other hand, she said:

“… has to catch me off-guard.”

Suggesting that it is indeed about finding something not looked for. E succinctly sums up her view of serendipity as:

“…something I did not even know I valued before I stumbled upon it.”

There was also an understanding that a not-too-focused mind was necessary: though you could be looking for something particular, a peripheral vision is useful. The example here being that while looking for a particular book in a physical library, a different one might catch your attention quite literally, peripheral vision. D said that:

“serendipity happens in the brain”

…suggesting that serendipity is an experience that is an unforeseeable event with a personal factor. So it seems that there is a fair consensus about serendipity being about an unsought finding of value. I introduced the idea that the two elements of serendipity is the prepared mind and the prepared system (§2.2). This suggests the question of whether design for serendipity is a contradiction in terms: whether it is possible at all. Participant C thinks that “visualisations for serendipity is an interesting paradox”, and participant A were adamant that “visualisation can support serendipity”. E was more explicit, and suggested:

“You can never build a system {for serendipity}, you can build it and hope it cultivates it.”
Findings and discussion

It was clear though, that the participants found the notion of design for serendipity intriguing, and some of them suggested systems that to some extent do this: Participant A mentioned the browser-plugin StumbleUpon, C talked about that he uses Wikipedia as his browser start page and this displays a random featured article, and E talked about how for example Facebook seems to create some of its suggestions on showing what is not searched for, much in the manner of my visualisations six degrees of separation.

Findings from “Show and tell”

I presented the two visualisations, the Six degrees of separation and the (ir)relevance map as paper prints. The reason for this is two-fold: in my experience, as soon as something is presented on a screen, the discussion often focus on interaction, such as “this link should be blue”, “I want to zoom here”, “why can’t I click here”, and similar. Since my aim was to use the visualisations as tools for speculation, I believe prints was the best option. Second, paper prints are easier to write and draw on, they are less “intimidating” exactly because they are accessible in a different way than had it been presented on a screen. They can be shuffled, folded, and masked. This ensured that the discussion and comments focused on the core idea of serendipity, not on system functionality or lack thereof.

The prints used shows the (ir)relevance map in two different “states”, mainly as a tool to introduce the concept in stages (fig. 33 and fig. 34). None of the participants had any problems understanding the idea behind the visualisation, and only needed a short explanation.

One of the intriguing comments on this visualisations, came from participant A: he called it an “anti-echo-chamber”, meaning that it would not funnel the process of finding into increasingly narrower subject matter. He recognised immediately that the aim of the visualisation was to open up to explorations without an agenda or with assumptions built in. Participant C sees the (ir)relevance map visualisation as being comparative, and speculated how the concept could be transferred to other fields and subjects, such as music, film, dating, food, and
travel. He found the thought interesting that a tag would have different connotation depending on the subject. This participant basically took the visualisations and “ran with it”: his speculations went far beyond the subject of finding books or indeed finding per se. Participant A and B also speculated around how the comparative system could be applied to other fields and subjects.

Participant C and B commented that the (ir)relevance map maintains a link to the physical world by the stack of books and their sizes, and that this contains some information. This information is can be related to the physical world, as opposed to the abstract comparative arches. Participant B and C explicitly described the aesthetics of the visualisation as very pleasing.

Six degrees of separation

The prints used were fig. 35 and fig. 36. This visualisation resulted in some different and contradictory views. In the first three wheels (fig. 35), the paths (spokes) is perceived as more predictable and therefore generally less interesting. The fourth wheel (fig. 36), however, resulted in a lot more close study. Participants A and C wanted more randomness, for example by using more individual and emotional tags such as “boring”, “yawn”, “super”, “upstairs”, “paperback” or similar. Participant D, however, thinks that more random elements would make it far less interesting. To her, it is partly the fact that a fairly strict pattern is pursued she finds fascinating. In this, she thinks the aim of an “unsought finding of value” might be more likely. She reckons that the logic makes each node more interesting, and if the connecting tags was more individual or emotional (such as “yawn”), this would make it too random.

Participant E describes this visualisations as kind of a visual version of the game Chinese whispers, or a kind of “family tree”. She describes it as an open-ended system that has “no certain agenda”. She pointed to the centre and the rim, and suggested that:

![fig. 35. Print-out 3, three circles of six degrees of separation](image1)

![fig. 36. Print-out 4, wheel 4, six degrees of separation](image2)
Findings and discussion

“Serendipity will be experienced when you do not even realise what is between”.

In her opinion, serendipity can mainly happen when there are several “degrees” between two elements, meaning that for example the one step from a book to a tag is too obvious for serendipity: one has to go further, for example from the centre to the rim. The other four participants found the meandering itself interesting, and C, B and D thought the potential for idle wandering serendipity-inducing. Participant C commented that the wheels of six degrees of separation are hierarchical and entirely abstract from the physicality of books.

During three of the four debate sessions, there were periods of silence as the participants studied the visualisation. I had not really anticipated this to the degree that it happened. Not all participants are avid readers, and some stick to very particular genres. Regardless of this, they would find a “door” into the visualisation. For example; if a reader mainly reads fantasy, there is Tolkien, J. K. Rowling, Harry Potter and The Hobbit. Should the interest be physics, there is Richard Feynman. Having located this, the visualisation can be “read” from centre out or from centre in. In this way it is then possible to have a very specific interest, but still be “pulled” into the visualisation by finding some item of interest. In this way, someone with absolutely no interest in the tag “foucault” can end up there, and find interesting works on the way.

Participants A, B, C and D agrees that for serendipity to happen there needs to be some element of randomness. The consensus here was that the visualisations should not be too “logical” or “obvious”, as in the example of the three first wheels of six degrees of separation (fig. 35). In short, if the visualisations had shown paths that one could reasonably guess beforehand, they would loose the potential for serendipity, and look very much like a formal system. It is worth noting, though, that in both visualisations the randomness is perceived: they both follow a fairly strict logic, but can give the impression of random elements. This might indicate that random in this context might more precisely mean “unanticipated”. This anchors the visualisations in the sense that it is possible to engineer a system, and demonstrably, it keeps an important element of surprise.

Inevitably, participants bring their own experiences and preferences to the table, that is essentially why I held the debate sessions. These personal aspects, in every session, resulted in each of them mentioning books, authors, music, artwork, films, or TV-series they somehow connected to the visualisations. One particularly interesting and unanticipated thing that happened in one debate session was that participant B sometimes went off and retrieved some books from her bookshelf. None of these were ones represented in the visualisations, but had some relation to them (the same author or similar subject). This was the session that included two participants, and the discussion sometimes shifted from the visualisations to the books she retrieved. I found this interesting, as this exemplified how the visualisations triggered further associations, recommendations of books, and potential for serendipity that in a way spilled over from the conceptual discussion to the physical world.

All participants found the visualisations interesting, and had no problems understanding the-
underlying ideas. However, something being interesting is not equal to having the potential for serendipity, though it certainly helps. What they agreed on, is that serendipitous finding is delightful and valuable. Creating visualisations for serendipity is perhaps close to a contradiction in terms, but it is a worthy endeavour, as they all value the experience. B’s comment,

“First it just looks pretty, but then it draws you in.”

…suggests that the visualisations are aesthetically appealing from a distance, but on close inspection they also have some substance to sustain an examination. If the visualisations encourages people to “interrogate” them, and people are happy to be “lost” in them, I believe demonstrates a potential for serendipity.

The findings I walked out with from the debate sessions were essentially that the participants generally share the same understanding of what serendipity is: a valuable, unsought finding. In addition, they also agree that creating systems for serendipity is a paradox, but one that is worth exploring. There were some different views as to how a “prepared system” could aid in serendipitous finding, and what this would mean in practice. For example, some suggested more randomness, another disagreed with this: she found the strict system itself more compelling. One suggested that serendipity happens when some intermediate steps between variables are invisible, other participants thoroughly enjoyed the exploration and speculation resulting from seeing these steps.

### 6.4.4 Annotated portfolio: after the debate sessions

The fourth step in exploring serendipity was to create an annotated portfolio based on the results of the debate sessions. The aim of the annotated portfolio was to indicate the two visualisations’ features and main properties in relation to the concept of serendipity as seen after the debates.

The information, views, ramblings, and thoughts that emerged in the debate sessions formed a basis for new annotations, as new perspectives emerged. As I had hoped, the sessions allowed me to explore the concept of serendipity in ways not possible through designing or reading alone. This is to say that the sessions brought to light some elements I had not thought about, made some tacit knowledge concrete, and allowed for more contradictory views. They therefore helped to focus the concept, its relation to the visualisations, and to see contradictions and juxtapositions. Bringing the different insights from the debate sessions together, I studied the visualisations through these new insights. This resulted in another set of paper prints, annotated with participants’ views, in addition to my own. The result of this repeated reflective interrogation is represented in the following image (fig. 37). I have not tried to find consensus or a lowest common denominator. The annotations highlight both similarities and differences between the visualisations, concepts, features and ideas. There is juxtaposition, but also annotations that note the family resemblance between them. They are concerned around the basic idea of “serendipitous finding”, but the two
Findings and discussion

main visualisations approach this differently. I believe the annotated portfolio highlight some concerns addressed, and simultaneously suggest some future concern: concrete annotations to these particular artefacts, but also visualisations for speculation on potential future and generativeness. The debate sessions were not merely as a tool for input, but they functioned as a new set of glasses through which to see serendipitous search and the visualisations I made to enable it. Thus, debate sessions can be viewed as a method that I propose, a partial answer to the research
question “How can the concept of serendipity be explored through RtD?” In the next chapter I will discuss this in depth.
Findings and discussion

6.4.5 Summary RQ1

RQ1: How can the concept of serendipity be explored through RtD?

In my research, I have explored the concept of serendipity through a literature review and four practical tasks. In isolation, each task have different, tangible results in relation to the exploration of serendipity. Seen together as a body of work, I believe that they in sum suggest one way the concept of serendipity can be explored through Research through Design. Seen in the light of the RtD typology suggested by Krogh et al (2015), each task helped in expanding and broadening the approach, aspects and techniques. In this respect, my findings are that exploration of the concept of serendipity benefit from a range of tasks: to broaden a perspective, to explore techniques, and to uncover new aspects.

In my research, what perhaps stands out as a particular difference from other RtD projects, is the choice of debate sessions. Many RtD projects focus on variations on lab, field, and showroom approaches, and all of these have an aspect of usability. In my research, however, since the goal was speculations and exploration, debate sessions seemed a better option. I therefore suggest that this can be a viable way for Research through Design work. This approach, I believe, can be a good match when concepts are to be explored, and when the knowledge sought are a broadening of perspectives and uncovering of new aspects. In sum, I believe the methods I applied worked well for exploring serendipity, and through this work I have gained an understanding of how this could potentially be applied to practical solutions.

6.5 RQ2: Serendipitous finding

RQ2: How can speculative visualisations enable serendipitous book finding?

This question addresses the two visualisations directly, whether it is possible at all to create prepared systems, and if so, to what extent my research achieves this. First, I give a brief summary of the properties of the two visualisations, and then offer a summary of how speculative visualisations can enable serendipitous book finding.

6.5.1 Visualisation I: (ir)relevance map

The (ir)relevance map is a comparative visualisation. There are three comparative elements present in the visualisation: one, the relative sizes of the books are illustrated, two, the use of social tags from LibraryThing, and three, the display of the Dewey Decimal System classes (fig. 33). To visualise a connection between two books, I created an arch between them (magenta line), and placed tags onto them (magenta dots). Then the visualisation becomes as follow: two books will have a tag in common. One of them will have a higher percentage of users applying that particular tag than the other. If this is visualised on the arch, one can perhaps find relations that
might aid in discovering unknown books. The result of this is that a set of relations can emerge, in a comparative visualisation.

### 6.5.2 Visualisation II: six degrees of separation

The six degrees of separation is a linear, hierarchical visualisation, essentially based on the principle of a sunburst chart (fig. 31). In this project I created four “wheels”: a group of three interconnected ones, and one separate. The idea behind them are essentially the same: it starts with a variable (author, tag, or works) in the centre, and expands out to “six degrees” (levels). The fourth wheel, as opposed to the three first ones, double variables for each level. The resulting tags, authors, and works takes on some intriguing directions, and creates some surprising connections.

The aim of both visualisations is to visualise serendipitous discovery of books, and primarily use LibraryThing tags as a vector for this. The LibraryThing tags themselves are not the goal: discovering books are. The tags become then “vehicles” that allows for a “jump” away from what might be(come) a heterogeneous group of books or authors.

For both visualisations, if we imagine them as interfaces, it is of course possible to create ways that gives more control over the variables. However, I have argued that this should be approached with great caution. In relation to serendipity, the visualisation / interface then might become more of a retrieval system that functions on the principle of zooming in to ever-increasing specificity. This can of course be useful, but I believe, it steps away from serendipitous finding. From my work, it seems clear that to design for serendipity should strive to strike a balance here.

### 6.5.3 Summary RQ2

RQ2: How can speculative visualisations enable serendipitous book finding?

Visualisations can be powerful tools for thinking, understanding, presentation, as well as being storing mechanisms and research instruments. In my work I have utilised folksonomies from LibraryThing.com as a vehicle for creating visualisations. I believe that to create the “unexpected”, it is necessary to look outside the logic of formal book classification systems. Visualisations, I believe, can be great instruments for surprising, delightful serendipitous findings. By embracing the “messiness” of folksonomies, using contradictory information, and the (potentially) ephemeral nature of these, visualisations can be created that aid in serendipitous discovery. I found that for visualisations to potentially be “serendipity-inducing”, they need to have a level of complexity to sustain interest. The participants in the debate sessions had different views on the two visualisations, and this indicate that there are several ways this can be addressed. However, I found that as conceptual visualisations, they can open up a speculative space for design. I suggest therefore, that speculative visualisations can enable serendipitous book finding by utilising data and information that are idiosyncratic, and by creating a level of visual complexity that peaks curiosity.
7 Conclusion

Serendipity is a new scenario around which to challenge our development and design efforts.

André et al., 2009 p. 313

We have lived with books for hundreds of years, and all of a sudden we have these digital mediums through which to relate to them. Some argue that the serendipity experienced in a physical environment such as a book shop are lost as the digital interface in a sense becomes the collection. However, I believe that visualisations can open up for new and different kinds of serendipitous discoveries. Designing for serendipity is perhaps in one sense a contradiction in terms. The prepared mind, the flaneur mindset are required for any serendipity to happen: a “curious intelligence” with peripheral vision, open to find the unsought-for. I have argued that though it is hard to imbue a viewers’ mind with a particular mindset, it is possible to create prepared systems ($2.2$). There is no guarantee, however, that people will view these efforts as a tool for serendipity, as participant E said; “you can {only} build it and hope it cultivates it”.

The aim of this thesis was to address two questions:

RQ1: How can the concept of serendipity be explored through RtD?

RQ2: How can speculative visualisations enable serendipitous book finding?

So how can serendipity be explored in general, and through Research through Design in particular? I have used the methodology of Research through Design and the methods of sketching, visualising, debate sessions, and the creation of an annotated portfolio. I believe my work can be seen as a contribution to the discourse around serendipity and design. First, in the way serendipity was examined through making and debating, second, in the principles of the visualisations themselves, and third, as embodied in the annotated portfolio.

My contribution to the methodology of Research through Design is that I suggest debate as a viable and fruitful method for certain design explorations. I believe is a good fit for examining the conceptual in an inquisitive and open manner that is distinctly different from methods such as data gathering through workshops or interviews. Research through Design can contain ambiguous information, ideas, and concepts, and might do this in a productive manner that contribute to understanding. Debate session can be a good way of bringing ambiguities and speculations to light.

My contributions to the design space of “design for serendipity” are conceptual visualisations for speculation and the annotated portfolio. The annotated portfolio, as presented in the first image (fig. 32), shows distinct features of each visualisation as my own interpretation, research and reflections. The second image (fig. 37), I believe, clearly demonstrates how the debate sessions
enriched this understanding. This richer understanding, then, I see as an extending and mapping of the design space.

### 7.1 Limitations

Within HCI there is a way of viewing specific design-focused projects as limited to their own particular objects and the designers’ subjective views, and therefore highly limited or even dubious. This, I believe, is not really the whole truth, as argued by my views on annotated portfolios as intermediate-level knowledge, the generativity of design artefacts, and my speculative approach and visualisations in general. However, I recognise that my project specifically has some clear limitations. I have tried to operate in what is regarded as a new field, and this will always be a challenge. I have not had any direct experience of, or knowledge of, Research though Design as an articulated methodology until about a year ago. My exposure therefore, to its nuances, different practices, and examples produced under its umbrella, was limited to what I could uncover simultaneously with creating my own artefacts. With these considerations, I have done my best within those limits.

### 7.2 Further work, new design spaces

I believe that serendipity is an important concept that the HCI community are beginning to examine. Though my research seems to suggest that the efforts so far are scattered, serendipity is a word that pops up with increasing frequency in recent literature. I think it is important for HCI to take a closer look at this concept, as this can enrich efforts in creating retrieval systems, and indeed our understanding of finding.

As my starting point is as a designer, and this work is done in the context of the design group at the Institute of Informatics at the University of Oslo, it is perhaps tempting to suggest further work in the direction of interaction design, system design, or similar. This, I believe, is perfectly sensible, but I would like to suggest some other directions and opportunities for further work. It could lean in any directions of art, science, engineering, or design: a functional digital system or application could be made, an art-like installation or images could be created and explored, or the concept could be explored in numerous ways using other media, visualisations, and design principles. I believe the potential is considerable, and whatever general direction, I believe can contribute to the discourse around the concept of serendipity in design. Considering it is important to me to stress that the work is wide open to appropriation, it is perhaps not a leap to also suggest that the ideas presented can be transferred to other artefacts and other cross-disciplinary spaces.

As for more concrete, practical suggestions, I believe that further work would benefit from drawing on a wider cross-disciplinary history, and a closer attention to other traditions in creating visualisations could be very valuable (I think about for example architecture, art, graphic design, software engineering, data visualisations). Of course, creating an actual, digital interactive sys-
tem might also be an possibility, though I believe there would be great value in exploring the concepts of the visualisations themselves. Further, I also believe that working more intensely on the spatio-temporal aspects could have enormous potential and add different meaning to the idea of being “lost” in a positive way. User involvement and teams could also be a path to explore further. I believe that a group of people could take this to interesting places. I am then imagining cross-disciplinary teams, consisting of for example (but not limited to); system developers, artists, librarians, engineers, programmers, philosophers, cartographers, biologists, graphic designers, and readers of all ages.

I believe that exploring serendipity for finding is a worthwhile endeavour. In the context of informatics and HCI, I believe these are early days. I hope to see some bold and creative work in the future: embracing the idea that being lost can be a good thing.

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*I will produce a computer virus and introduce it into my own desktop, so that when my sons put in their key word – say, “salamander” – the screen will erupt in a brilliant but random array of maps and illustrations and text that will divert them from their task. This I will do so that they may know the sheer joy of finding what they have not sought. I might even wish for this virus to spread from computer to computer. And I would name this virus for that which ought not to be lost – serendipity.*

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Section A: Appendices
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Other sources and inspirations

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Podcasts: The Observatory | No Such Thing As a Fish | BBC Inside Science | BBC The Forum | BBC The Documentary | Naked Scientist | The Infinite Monkey Cage | Nature Podcast | BBC The Digital Human | 99% Invisible |
A.3 The nature of wicked problems

This is the list of properties Rittel and Webber use to describe a wicked problem:

- *There is no definitive formulation of a wicked problem.*
- Wicked problems have no stopping rules.
- Solutions to wicked problems are not true or false, only good or bad.
- There is no immediate and no ultimate test of a solution to a wicked problem.
- Every solution to a wicked problem is a “one-shot operation”; because there is no opportunity to learn by trial-and-error, every attempt counts significantly.
- Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan.
- Every wicked problem is essentially unique.
- Every wicked problem can be considered to be a symptom of another problem.
- The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem’s resolution.
- The planner has no right to be wrong.

(Rittel et al., 1973 p. 161-167)
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