Eat This Book:
Human-centered research and software design using the metaphor of food to support media consumption and design an ambient technology display for stashes of to-be-read ebooks

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Abstract

Eat This Book:
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Chair of the Supervisory Committee:
David Socha, PhD
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There are widespread concerns about how changes in media and technologies are affecting people's media habits. Clay Johnson (2012) proposes using the metaphor of an "information diet" to consider this as a health issue, to which insights from the realm of food and diet can be usefully applied. This thesis describes using the information diet metaphor in a user-centered design investigation of the domain of media consumption. Qualitative research interviews with 10 subjects provide evidence about both the validity and the limits of the information diet metaphor. The general utility of using metaphor in the research phase of design is also discussed. Insights from the domain of food diets are considered to help people gain more control of their media consumption. Numerous functional gaps, missing affordances, and unmet needs that face today's media consumers are identified. Change strategies from the realm of food that may be applied to media consumption are also identified. A model of media stashing is derived from the interviews. Qualities of paper books which are missing from ebooks are identified, and the impact of those missing qualities on stashing functionality is examined. An ambient display of a digital "to-be-read" shelf which delivers previously-unavailable stashing functionality for readers of ebooks is explored through design-based research with prototypes. Numerous design considerations for such slow technology solutions are identified. Prototype code is available as an open-source project on GitHub.

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I also thank my classmates: Yulana Shestak and Ren Wu collaborated with me in human-centered research on problems of readers. David Langer and I built on this research in creating the Windows Phone application "Phix the Bookfinder." This thesis is a continuation of exploring the problems in media consumption I began with them.

I am also grateful to several experts I consulted with for background and advice. Skip Walter co-taught with David the Human-Centered Design class where I first began exploring problems for readers, and also generously discussed this research with me, suggesting several valuable perspectives and avenues of exploration. Lark Griffin Preyapongpisan, MFA, provided me with insights from the history of books, the art of bookbinding, and our relationship with books as physical objects, which informed considerations of missing qualities of ebooks. Margaret Doherty Spain's expertise in interior design shared considerations for important physical design qualities of living spaces for both food and media. Alex Petrescu, architect of the online service CanIStreamIt.com, discussed real-world design considerations for a consumer-facing service to help cope with proliferating digital media sources.

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Contents

And he said to me: Son of man, eat all that thou shalt find: ***eat this book****, and go speak to the children of Israel. And I opened my mouth, and he caused me to eat that book. And he said to me: Son of man, thy belly shall eat, and thy bowels shall be filled with this book, which I give thee.* ***And I did eat it: and it was sweet as honey in my mouth.***

— Ezekiel 3:1-3 (Douay-Rheims Bible)

1 Introduction

As a consequence of information technology developments, we have more ways of accessing a greater volume of information than at any previous point in human history. More information is being created and shared than ever before; more media technologies exist; prices fall while markets expand; the widening reach of technologies such as cellular networks and the Internet is expanding information-based connectedness to a greater portion of the world's population. In short, we are in an age of unprecedented information abundance. Barring societal collapse, this trend seems poised to continue for some time.

Yet this abundance and its new ways of reaching us mixes benefits with drawbacks. More is not always better; and what is new is not always superior to what came before. There are widespread concerns about the changes to our media consumption and information habits which have accompanied the adoption of these technologies, with impacts ranging from the personal to the interpersonal and ultimately to society at large.

Clay Johnson (2012) uses the metaphor of food to conceptualize our media habits as an "Information Diet." He uses this metaphor to provide a powerful analysis and critique of public policy problems that he links to our information consumption. Johnson reflected on the situation and drew parallels between problems in the realm of food and those in the realm of media, and suggests guidelines rooted in another dietary tradition, veganism, as a prescription. But are the problems Johnson identifies the ones that really concern people? And is his prescription what they need?

This research focuses on how technology can be used to help people better manage their media consumption needs and address their concerns. Thomas Sander (2009) posits that "information technology is uniquely positioned for assisting individuals with their flourishing in a way that is effective, scalable, and ethically responsible. Following the tradition of successful, galvanizing notions such as Positive Psychology and Positive Health, I propose to call the study of information technology from the perspective of human flourishing Positive Computing." (p309). This research follows that approach.

This paper explores the thesis that applying this metaphor of food and diet to the realm of media consumption could help better understand and design solutions for people's media consumption.

Through an iterative research process, I explored the following key research questions:

1) Does the metaphor of food fit media consumption?

2) How useful is applying the metaphor of food to media consumption? How will applying the metaphor make sense of people's practices and problems? What solutions can be generated for those problems by applying the metaphor?

3) What is the role of stashes and stashing for managing one's information diet?

4) How would a stashing solution for ebooks — a virtual to-be-read pile — change how people manage their media consumption?

Section 2 reviews background literature. Sections 3-5 cover the primary research questions in separate sections, each of which contains additional background specific to each question. Section 3 investigates the metaphor's fit and design utility, which I investigated by conducting qualitative research interviews with 10 subjects. These interviews also provided insights into people's unmet needs and techniques for making changes to consumption. The interviews also asked how changes in technology have affected media consumption. Notably, all subjects described qualities of paper books which they greatly missed in ebooks. Section 4 discusses "stashing," a practice from the realm of food that was uncovered in the interviews and found to also exist in the realm of media — for example, books are often stashed in "to be read piles." I propose a model for stashing, and point out how the missing qualities of ebooks may interfere with the functionality stashes provide to paper books. Section 5 describes use of design-based research with prototypes that use persuasive, ambient technology to implement stashes intended to address media consumption problems related to reading and ebooks. Figure 1 provides a graphical overview for the visually oriented.

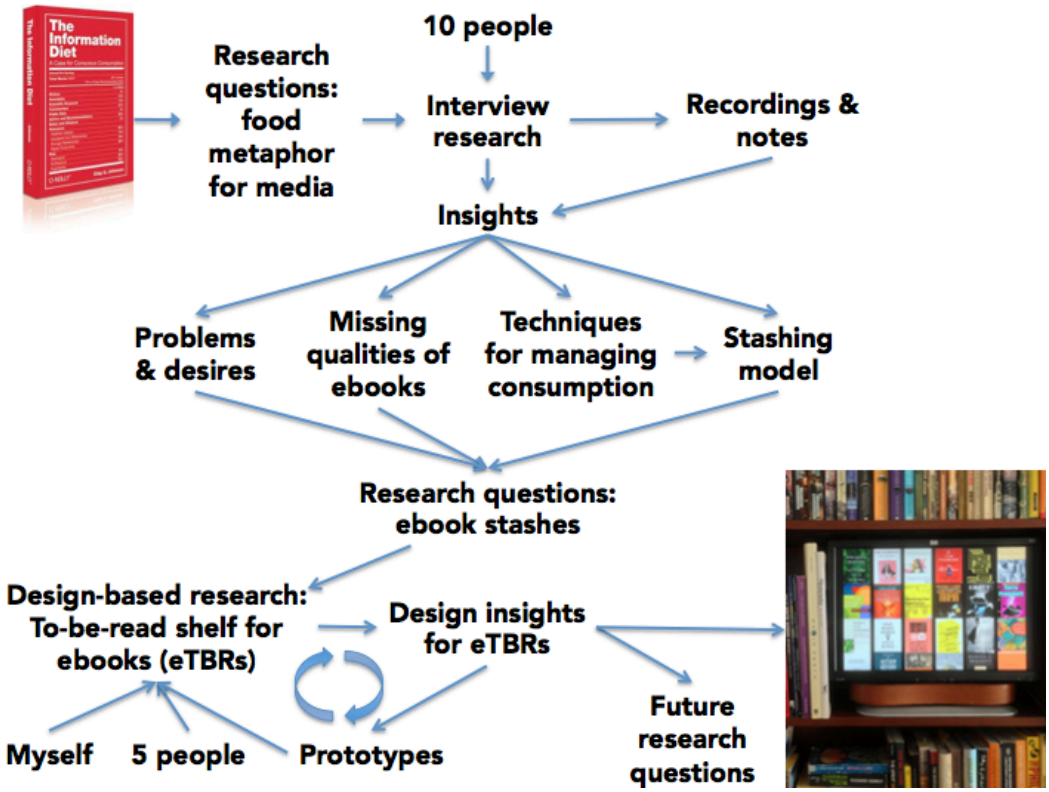

Figure 1. A graphic overview of the research program described in this thesis.

2 Background

The background review begins with the starting motivation for this research: the positive psychology movement's focus on supporting human flourishing, and this notion's adoption by technology researchers.

Next, I review background information about the general approach used in this research, covering human-centered design's orientation to be informed by people's sense of meaning and value, as well as the use of metaphor as a potential avenue for accessing people's understanding.

The review continues with discussion of Clay Johnson's Information Diet metaphor, reviewing his claims about the correspondence between food and media. Next, information on the health effects of media consumption demonstrates that controlling media consumption has impact beyond the information and entertainment.

Finally, changes in the media landscape that have accompanied technological developments are reviewed to provide context for new challenges facing media consumers.

2.1 In pursuit of happiness: Positive Psychology and technology

A key motivator for this thesis has been my desire to investigate how technology can be used to improve people's lives. As we shall see, the field of positive psychology has been studying what it means to have a good life, and these findings have been expanded by computer scientists and other researchers who seek to understand in what ways technology can support these goals.

At the start of his term as the head of the American Psychological Association in 1998, Martin Seligman faced the realization that psychology spent a great deal of time understanding mental disorders, but did not have as much to say about how to make normal life more fulfilling. Borrowing a term from Abraham Maslow, he encouraged research in pursuit of Positive Psychology. Mihaly Csikszentmihalyi , who pioneered studies of "flow" and optimal experience, joined Seligman in writing *Positive Psychology: An Introduction* (Seligman & Csikszentmihalyi, 2000) and encouraging other researchers to conduct empirical studies on the subject.

In considering Positive Psychology's aims, Scollon and King (2009) refer to the two types of happiness defined by Aristotle. *Hedonistic* happiness is based on maximizing pleasurable sensations, and minimizing painful ones. *Eudaimonic* happiness is based on satisfaction in a broader sense and comes from living in accord with one's authentic self. This perspective focuses on living with meaning and the outcomes achieved from actions, instead of just the sensations of experience. Seligman also identified the importance of interpersonal or social happiness as what he called a third pillar of happiness.

This positive approach inspired researchers outside of psychology. Tomas Sander (2009) coined the term *Positive Computing* to refer to "the study of information technology from the perspective of human flourishing." Sander explicitly draws on the goals and mechanisms identified by Positive Psychology research, and posits that "information technology is uniquely positioned for assisting individuals with their flourishing in a way that is effective, scalable, and ethically responsible." It is in response to Sander's call to action that this

research focuses on how we can use technology to help people with their media consumption needs to increase their overall happiness and flourishing.

Riva et al (Riva, Baños, Botella, Wiederhold, & Gaggioli, 2012) built on the different characteristics of personal experience related to personal well-being to develop a framework for positive technology (summarized in Table 1). There is opportunity to engage and support all three categories of positive experience in the realm of media consumption. Some of people's media consumption is driven by the positive experiences it yields; some is done to help support the positive aspects of self-image and self-actualization. And as modern life involves a great deal of media consumption, we find great opportunities for social connectedness by discussing media with our friends, and seeking out social discussions around particular media with like-minded fans.

Category of Positive Experience	**Application of Positive Technology**
Hedonistic	Using technology to foster positive emotions and experiences
Eudaimonic	Using technology to promote engagement and self-empowerment
Interpersonal / Social	Using technology to promote social integration and connectedness

Table 1. Riva et al. (2012) propose designing positive technologies to support the three categories of positive experience identified by Positive Psychology.

Zimmerman (2009) proposes a philosophical stance for experience design he calls *designing for the self:* "design of products that help people move closer to their idealized sense of self in a specific role through their interaction with the product (products that help people become the person they desire to be)." One pattern he identifies is "making long term goals more present in people's lives."

In section 5.1.1, I will return to the subject of positive computing and discuss in further detail research into the mechanisms by which persuasive technology can bring about those behavior changes that people desire.

But next, I turn to Human-Centered Design processes, which help to understand what people desire in the first place.

2.2 Human-centered design

Human-Centered Design (HCD, aka User-Centered Design or UCD) is rooted in the premises that:

1) people are experts on themselves, and
2) engaging potential users of solutions deeply and frequently during the design process results in better outcomes

The design firm IDEO defines Human-Centered Design as follows (IDEO, 2009):

> *Human-Centered Design (HCD) is a process and a set of techniques used to create new solutions for the world. Solutions include products, services, environments, organizations, and modes of interaction.*

> *The reason this process is called "human-centered" is because it starts with the people we are designing for. The HCD process begins by examining the needs, dreams, and behaviors of the people we want to affect with our solutions.*
>
> *We seek to listen to and understand what they want. We call this the Desirability lens. We view the world through this lens throughout the design process.*

Therefore, solutions can be made more effective and compelling by engaging people who would use the system in order to understand their values and needs, and involving them in the design process throughout to gain evidence and insight as early in the design process as possible. This minimizes effort wasted in building something that is off the mark, and also drives creations of solutions that provide superior user experiences (UX), which leads to increased solution adoption and effectiveness.

Similarly, Slywotzky (2011) suggests examining the hassles people face in "existing products, services, and systems that cause people to waste time, energy, and money" which cause "headaches, disappointments and frustrations." Finding and eliminating these hassles is a design strategy for creating disruptive solutions which people will seek out and adopt in favor of incumbent solutions which still suffer from those hassles.

Throughout this research I sought to learn from people using a variety of methods. Specific methods were individual interviews and using prototypes as tools to gather further feedback and more concrete understanding of people's needs and ways to meet them. Additional background on specific methods used in different phases of the research is provided in each research section.

2.3 Use of metaphor in design

Metaphor can be used to enhance understanding. In design, there are two directions where understanding is needed. Most often, people think of using metaphors in the design of software in order to help the users understand how to use the software. But metaphor can also play a useful role in helping designers understand the problem domain. My research explores this latter aspect.

2.3.1 Using metaphor to help users understand software

Designers and researchers have often discussed use of metaphors in solutions by having the solution embody a metaphor so that users can more easily understand what it does and how to operate it (Norman, 2002). The canonical example is the desktop metaphor used by personal computer graphical user interfaces. Many other examples exist: for example, the metaphor of a tabbed notebook binder to organize information was used in Tabworks (Moll-Carrillo, Salomon, Marsh, Fulton Suri, & Spreenberg, 1995) and was later adopted by other software such as Microsoft's OneNote.

A related use of metaphor in software design, which has been the subject of a great deal of discussion in User Experience (UX) and Human Computer Interaction (HCI) communities in recent years, is *skeuomorphism*. See for example (Hobbs, 2012) and (Greif, 2013). Skeuomorphism goes beyond use of a metaphor of a real world object that performs the same function in its design; it also includes graphic elements, even including non-functional ornamentation, to make its appearance a literal imitation of the metaphor's source. Figure 2 shows two different carpenter's level applications; the one on the left is highly skeuomorphic. The one on the right provides the same functionality, but does not have the same degree of resemblance to a real-world product.

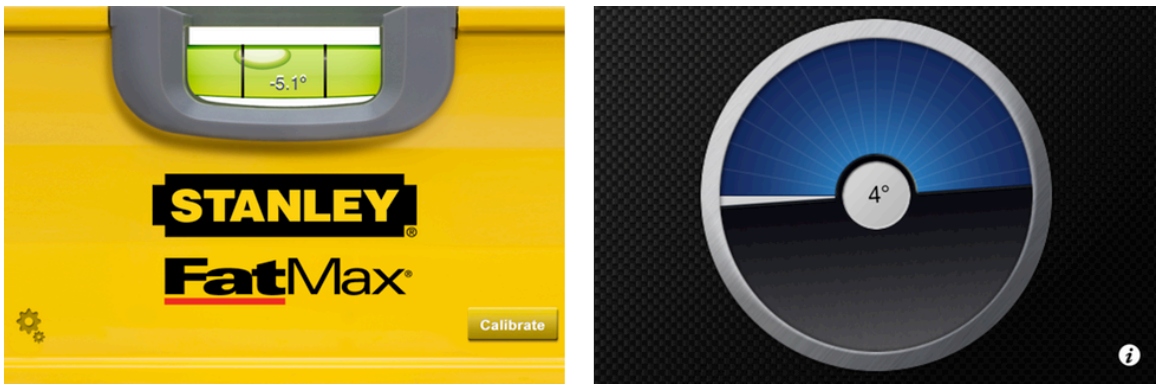

Figure 2. The two mobile applications shown here perform the same function with visual designs that contain higher (Stanley Level, left) and lower (Levelbot, right) use of skeuomorphism (resemblance to physical objects that perform the same function).

One concern about the use of metaphor in solutions is that it depends upon the user of the solution understanding the metaphor; if they do not know the metaphor's source, then they may not be able to recognize how they are supposed to use the solution. Shen et al. (Shen, Woolley, & Prior, 2006) point out that many metaphors are culturally specific and may not work well across all cultures, so designers should take care to consider diverse audience backgrounds when designing solutions based on a metaphor.

Kay (1990) cautions that "metaphor is a poor metaphor for what is needed" and warns that taking metaphors too far can be harmful if, in seeking to be faithful to the metaphor, they bring limitations into the solution which do not need to be present.

But in addition to applying metaphor in the *design* by embodying a metaphor in a solution so that the *users* can understand the solution, there is another use of metaphor available to HCD, and this is what I will focus on in this research.

2.3.2 Using metaphor to help designers understand problems

Metaphors can be applied in the *research* phase to help the *designers* gain insights into needs and gaps which the solution design can address.

Madsen (1994) describes several cases of using metaphors in the research phase by having users generate or respond to alternative metaphors and asking them to consider their domain in light of those metaphors. For example, in a library system project, "the staff was challenged by three different metaphorical views of what a library is or could be. The three metaphors were 'the warehouse,' 'the store,' and 'the meeting place'" (p58). In another case, stakeholders in a production planning system were asked to brainstorm possible metaphors for the process, and came up with many alternatives including a travel agency, a bakery, a soccer match, and raising cattle. Note that both of Madsen's examples assume many metaphors will be generated, whether brainstormed by the users or suggested by the researchers, before ultimately selecting one or more. Madsen ends by deriving several guidelines for using metaphor in research, which I have summarized in Table 2. I will apply several of these strategies, especially in identifying metaphors for use in research.

Generating metaphors for use in research	Evaluating metaphors for selection as the basis for design	Developing the selected metaphor for use in design
Listen to how users understand existing systems Build on already-existing metaphors Use predecessor artifacts as metaphors Look for real-world events exhibiting key aspects	Choose a metaphor with a rich structure Evaluate the applicability of the structure Choose a metaphor suited to the audience Choose metaphors with well-understood literal meanings Choose metaphors with a conceptual distance between the source and the metaphorical meaning Have at least one concept bridging the source domain and the target domain Do not necessarily explicitly incorporate the metaphor in the final design	Elaborate the triggering concept Look for new meanings for the concept Restructure the perception of reality Elaborate assumptions Tell the metaphor's story Identify the unused part of the metaphor Generate conflicting accounts based on different metaphors

Table 2. Madsen (1994) proposes guidelines for applying metaphor in different phases of research and design.

Lakoff and Johnson's *Metaphors We Live By* (1980) discussed how deeply embedded metaphors are in our language and culture. Their work points the way to using the *existing* metaphors that are already part of how people talk about certain topics, and suggests that identifying and exploring the metaphors people *already* use will provide far more power and insight than metaphors that are spontaneously or arbitrarily generated, precisely because the existing metaphor has already deeply affected how people who share the metaphor conceive of the domain it describes.

With awareness of this aspect of metaphor on shaping people's understanding, Carpenter (2008) explains how using metaphor can be both beneficial and inimical to gaining understanding in qualitative research. Fittingly, Carpenter uses a metaphor in his explanation: illumination for understanding. Table 3 summarizes the benefits and potential drawbacks of this use of metaphor.

With this understanding of the potential benefits, we can see how using metaphor for this investigation is appropriate for several reasons. First, we are all media consumers, so the process is extremely familiar to us; adopting a new viewpoint through use of metaphor may help us perceive things we normally pay no attention to. Second, evoking emotion can be very helpful for identifying what is important to people and where they may have unmet needs. And third, we may be able to identify solutions that work in food so we can apply them to media.

Shedding Light (benefits to understanding)	Casting Shadows (potential problems)
Assist understanding a familiar process in a new light Evoke emotion Suggest appropriate interventions Providing structure to the data	Mixing metaphors Not following through or abandoning the metaphor Metaphors that do not fit the data Oversimplifying or overshadowing the data Projecting polarizing ideologies Misinterpreting cultural metaphors

Table 3. Carpenter (2008) identifies ways that using metaphor can help and harm understanding in qualitative research.

Casakin (2007, 2011) and Hey et al. (Hey, Linsey, Agogino, & Wood, 2008) contend that not much research has been done on the efficacy of using metaphor in design. Casakin studied the use of metaphor in the architectural design process and found evidence that metaphors can be particularly helpful in the early stages of design, specifically for developing an understanding of the problems to be solved. Hey et al. describe how metaphor can be used in design: both in reframing and describing a problem, as well as in finding solutions to that problem.

So there is precedence for using metaphor in research and design, and it seems to be well-suited for the current topic of inquiry. Section 3.1 describes the methodological approach applied to investigate these topics through use of metaphor.

Let us now turn back to the metaphor that triggered this line of inquiry: Clay Johnson's "information diet."

2.4 The Information Diet: applying the metaphor of food to media

Clay Johnson (2012) coined the term *information diet (ID)* as a way to reframe our struggles with information as a health problem, rather than a problem of productivity and efficiency. He also advocates treating our information consumption as a food diet, making conscious choices that include consideration of the physiological outcomes and ethical results.

Johnson draws parallels between what has happened with modern industrialized food systems and information systems. He relays a familiar narrative about the modern food system (see also Hauter, 2012; Moss, 2013; and Schlosser, 2001). This narrative claims that with an industrial emphasis on profitability and efficiency, food becomes standardized, processed, and increasingly engineered to exploit human characteristics that evolved in a context of scarcity, such as a preference for salts and fats. People's diet habits have also changed, driven by both societal changes and advertising: things that were once occasional treats are now mainstays of some people's diets, and serving sizes have also shot upwards. The net result has been epidemic levels of diet-related health problems.

Johnson claims that the same strategies of optimizing content for maximum consumption and profitability have been adopted by many modern media producers, who are increasingly part of larger corporations which expect maximized profit and efficiency. This drives creation of media that will be consumed by the most for the lowest cost of production. A name often used for the most prolific of these modern media producers is *content farms*; the farming reference here is to the industrialized version of modern agriculture, not the romantic image of the small family farm.

So, the argument goes, we see the proliferation of media choices that are attractive and require little engagement to consume, though they provide little of lasting worth to the consumer. This content traffics in affirmation and reinforcement of beliefs — as Johnson puts it, "who wants to hear the truth when they can hear that they are right?" (p8) — sensationalism, prurience, and fear. Johnson draws a sharp contrast between that sort of content and information which has higher "nutritional value" but which takes more time and money to produce, such as investigative journalism. This information also takes more effort to consume, as it does not simply reinforce existing notions or provide immediate stimulation, and may raise awareness of problems that need to be addressed.

There is an obvious parallel here between highly processed food that is appealing on the surface, and it takes less energy to digest, and yields less nutrients than healthier foods; the same is true with modern 'junk food' media like celebrity gossip and reality shows.

Johnson brings another concept from the domain of food to media consumption by proposing a prescriptive information diet. This "info-veganism" diet adopts vegan principles and tactics:

- Avoid highly processed information – favor original sources and on-the ground reports over punditry.
- Take control of your consumption technology so you are not responding and reacting to information coming at you, but instead choosing what information to seek out and consume.
- Consider the impacts of your consumption choices on your health and on society as a whole – if we keep choosing unhealthy information, then that is what producers will provide.
- Consume locally — focus on information about what is happening geographically close to you and your local community, and what is happening to people who are socially close to you.

Johnson thinks that people's beliefs will be changed by changing the kind of information they consume, engaging their critical faculties more; and that society as a whole can make better decisions if we all improve our information habits. Pariser (2011) likewise warns that we are in danger of being trapped in "the filter bubble" by self-selecting into isolated groups who choose a biased media diet, rejecting sources which conflict with our views.

But it may not be the case that changing the information we consume will be sufficient to change our beliefs. A recent study of the mechanisms of polarization (Dandekar, Goel, & Lee, 2013) shows that the problem may go deeper than simply what information we are exposed to (or choose to expose ourselves to). Even when exposed to the same information, we have biased assimilation - what we take from it depends heavily on our existing beliefs and we tend to give more weight to that which supports.

Also, Johnson's focus on *information* does seem to miss out on some of the value that people get from media consumption. We do not eat purely for nutrients, and it is not only to gain information that we choose to consume media. But here, too, we can draw from the realm of food for an idea of what may be missing from this conception – I will explore this further in section 2.6.

Additionally, while Johnson proposes a prescriptive diet, he does not have much in the way of practical advice about how to adhere to that diet. It's one thing to know that you should

reduce your consumption in one category and increase another, and to form the intention to do so, but it is in actually carrying through on these good intentions that many people get stuck. Here too, I will examine what people do in the realm of food and see how it can be applied to problems of media consumption.

On the whole, I found Johnson's identification of this metaphor quite compelling. The metaphor of food for information is one such that is deeply embedded in Western culture. The Tree of Knowledge in the Garden of Eden, and the command to Ezekiel to "eat this book" (quoted above) are but two early instances. Lakoff and Johnson identified many other modern examples, such as "He *devoured* that book," "This is the *meaty* part of the paper," and "All this paper has in it are *raw* facts*, half-baked* ideas, and *warmed-over* theories."

We also talk about people's subjective media preferences as a matter of *taste*. We *consume* both food and information, and we are products of what we consume. Eating food provides us with calories and nutrients, while consuming media provides us with information.

I wondered if this food metaphor could be leveraged to help better understand people's problems with media consumption and thus inform the design of solutions that will meet their needs and support their values. In Section 3, I explore the metaphor further with interview subjects.

2.5 What do we know about food that informs media?

In order to expand the investigation of food as a metaphor for media, I review some of what we know about food consumption that may inform and inspire designs of solutions to help manage information consumption.

2.5.1 Producers exploit taste to increase profitability

Many critics (Hauter, 2012; Petrini, 2003; Portinari, 1989; Schlosser, 2001) have described that the food we consume is increasingly processed and produced with lack of concern for the health effects on its consumers. Johnson argues that this pattern is being followed in media, to much the same effect. Moss (2013) reports on the subject with unprecedented cooperation and detail from sources inside the industry, relating how and why producers of processed foods have gone about explicitly engineering their products to be maximally efficient in prompting people to consume more of them, particularly by manipulating the amounts of sugar, salt and fat they contain. These three food categories were not present in abundance through much of human evolution, yet they are needed in some amount for survival, so we have evolved to find them extremely appetizing so they would be consumed when available. But now that we have an abundance of food available to much of the world's population, and in fact these ingredients can be produced much more inexpensively than more nutritious options, our food itself is becoming unhealthy for us in order to make us eat more of it. Worse, as we consume more processed food, we find that alternatives which have not been 'pumped up' taste less appealing.

Johnson claims this same vicious cycle is affecting modern media consumers and producers as well. It can be cheap to produce content that is appealing to prurient interests. And the media producers do know exactly what appeals. As more of our media consumption behavior is digitally mediated, more of it can be tracked than before. Once, publishers knew which books sold, but not necessarily who purchased them. Now they can see information about our consumption at a much more granular level than before – not just knowing what TV show is getting better ratings, but knowing which 30-second segments are fast-forwarded through by which viewers, and which viewers change channels at that point. So

the media equivalents of salt, fat and sugar are being identified on a personal level, and we are increasingly being fed a media diet that is just what we find most appealing – though not necessarily what we want to be consuming in the long term, or in the relative amounts that we would like.

2.5.2 Appetite and satiety responds to variety

Taste-specific satiety (Havermans, Janssen, Giesen, Roefs, & Jansen, 2009) is another concept from the realm of food that we will see applying to media consumption. Havermans et al. reference a distinction between food liking and food wanting. *Food liking* is the degree to which people find certain foods pleasurable to eat in general, and it tends to change rarely. *Food wanting* (people's appetite to consume a food) which varies considerably over short periods, such as while eating a meal. People can be full of one kind of food and not want to eat any more of it, but able and willing to eat more if a different kind of food or flavor is available. Their liking or taste for that food does not change as they eat it, but their appetite for it does. In Sections 3.5 and 4.2 I discuss how food-liking as long-term, relatively stable *tastes* and food-wanting as short-term, frequently changing *appetites,* both apply to our media habits.

2.5.3 Consuming without thinking

Brian Wansink's research at the Cornell University Food and Brand Lab, summarized in his book *Mindless Eating* (2006), shows that much of our food consumption behavior is unconscious. Diets that rely on conscious intent to change behavior are less effective, especially in the long term. A more effective approach is to change circumstances to make the preferred choices and quantities easier to select, even when on "autopilot." The following are examples of factors that were found to affect consumption:

- **The "See-Food diet."** Named because you eat what you see. Making something more or less visible to moderate its consumption – candies in a clear jar vs. an opaque one, or plates of food covered in clear plastic wrap vs. aluminum foil
- **Variety**. Having multiple flavors to choose from increases consumption; when we are tired of one flavor, we can switch to another to address taste-specific satiety
- **Availability.** Seeing foods presented in large volume increases consumption. We take more peanut butter from a five-pound jar than from a 1-pound jar; we take a bigger serving of snacks from a gallon bowl than from a half-gallon bowl.
- **Stock.** If we have a large volume of an item in our cupboards (for example, we just made a bulk purchase at a warehouse club) we will increase our consumption of it until our personal inventory of it is down to what we consider to be normal levels.
- **Accessibility.** We eat more candies from a container a few steps away vs. across the room.
- **Attention.** Eating while watching TV distracts you from paying attention to what you are eating and your internal satiety signals which leads you to eat more than you would otherwise.

I draw on some of these in developing prototypes (see Section 5).

2.6 Information vs. media: experience, form, and content

While Johnson's information diet metaphor emphasizes the information content of our media consumption, I must also acknowledge the importance of the medium by which the information is conveyed, and the importance of the experiences of consumption. The people I interviewed suggested that perhaps a better analogy to the information component of our media diet is the nutritional component of our food diet; they told me there is more to their food and media consumption than just the information and nutrients it yields. This section explores some background research to expand on those distinctions.

Küng, Picard and Towse (Küng, Picard, & Towse, 2008) define media as "technologies (print, radio, television, sound recording and such like) through which content created for groups of consumers is moved and organized." Media includes mechanisms such as emails, text messages, and social networks that carry exchanges of content intended for small groups or even individuals. As McLuhan's "the media is the message" (1964) points out, the media can be as important as the content it conveys (Federman, 2004). Therefore, the term media here refers to the combination of the technologies and the content they convey.

We place a great deal of importance on the *aesthetic and emotional experiences* of consumption of both food and media, beyond the value of the nutrition or information we receive. As the Slow Food manifesto (Portinari, 1989) points out, we value the "suitable doses of guaranteed sensual pleasure and slow, long-lasting enjoyment" we get from the sensory, social, and emotional experiences of consuming food; this goes well beyond merely meeting our survival requirements in the most efficient manner (Petrini, 2003).

Similarly, we value the activities and experiences around media, even when it does not provide needed information. These include collecting, preparing, sharing, and discussing, in addition to the experience of consumption itself.

The value we get from media consumption includes the experience of media's form and its content, as well as extracting information and meaning from it. Therefore, having been informed by Johnson's Information Diet concept to use the lens of food to apply to our media habits, I expanded the consideration to include the entirety of our media experience.

2.7 Health effects of media consumption

What we eat is a key factor affecting many aspects of health, including life expectancy, growth, disease, complexion, mood, onset of puberty, weight, metabolism, and energy levels (as reviewed in Dauncey, 2009; Marcus & Kalarchian, 2003). Similarly, our IDs have effects beyond the experience of the content. So our media consumption has impact on our lives far beyond the moment of consumption, and giving people better control over their media consumption can yield real-world benefits to their health and wellness. Some examples include:

- Media habits can affect sleep, which impacts health (Bauer et al., 2012; Garrison & Christakis, 2012)
- Media habits can affect physical fitness; time spent on the couch watching TV or playing videogames decreases physical activity and exercise. (Todd et al., 2008)
- Consumption of violence-filled media has been linked to increased aggression and decreased pro-social behavior (Anderson, Bushman, & Anderson, 2001; Huesmann,

2007) though other meta-analyses challenge these conclusions (Ferguson & Kilburn, 2009).

- Media messages that convey societal pressures around body image are a significant factor in causing and sustaining eating disorders; increased exposure to such messages is causally correlated with increased disorders (Thompson & Heinberg, 1999). The same research shows that different media messages can be effectively used as interventions to counteract those influences.

The American Academy of Pediatrics (2011) cites dozens of such studies on the varied effects of media consumption on a wide range of physical, mental, and emotional health issues to support recommendations that the Academy now makes about media consumption for children, as they have long done for nutrition and exercise.

Overall, there is ample evidence that media consumption habits can have real-world health impacts.

2.8 The changing media landscape

Information technology has developed rapidly in recent decades, and these developments have been accompanied by many changes in the media landscape and our consumption habits. In this section I will survey some of the changes which pose serious challenges for people who are not satisfied with their current media habits.

Some critics (N. Carr, 2010; Rosen, Cheever, & Carrier, 2012) warn of the distracting effects of new media which provide frequent quick rewards for rapidly flitting between different media activities. They argue that the impact of engaging in this behavior causes severe detriments to our ability to think deeply and concentrate on a subject for an extended period, and our capacity to pay attention to social interactions and "off-line" experiences.

This concern about the impact of new media technology on the human experience is not new to the Internet age. It seems every introduction of new media technologies brings similar concerns. Such warnings accompanied the mass adoptions of first radio and then television in the twentieth century (Gladstone & Neufeld, 2011). They also accompanied the spread of the printing press centuries earlier (Birkerts, 1994). In fact, the earliest known expression of this same concern about technology ruining the human intellect came many millennia ago: Plato's *Phaedrus* recounts Socrates expounding on the deleterious effects on understanding and thinking from written language, finding it severely deficient in comparison to speech and memory (Wolf, 2008). (Ironically, we would almost certainly not know about this if it was not for Plato having written down Socrates' words.)

One of the notable changes in the modern media landscape is increased access to and use of more information from more sources by more people. But it has been a long time since humanity first passed the point where the amount of knowledge available was far greater than any one individual could consume in a lifetime. Wurman (2001) argues our novel modern problem is less one of *information overload* (too much information being available) than what he termed *information anxiety*: the concern that we are missing out on information we should have. One piece of evidence supporting Wurman's contention is the fact that the word FOMO (an acronym for "Fear Of Missing Out") was chosen as the word of the day for April 14, 2011 by UrbanDictionary.com, which tracks and defines popular slang terms ("Urban Dictionary: FOMO," 2011).

Consumer behavior is increasing moving towards digital versions across all formats of media (Nielsen Company, 2012a). The most recent format to begin the digital transition in

earnest is books. Figure 3 depicts the rise of ebooks in sales and consumer adoption. Ebooks accounted for less than 1% of US book publishers' revenues as recently as 2006, but are now over 20% (Association of American Publishers, 2013). Over 26% of Americans have read an ebook in the past year (Rainie, 2012). Since 2011, Amazon's customers have been buying more Kindle books than print books (Amazon.com, 2011).

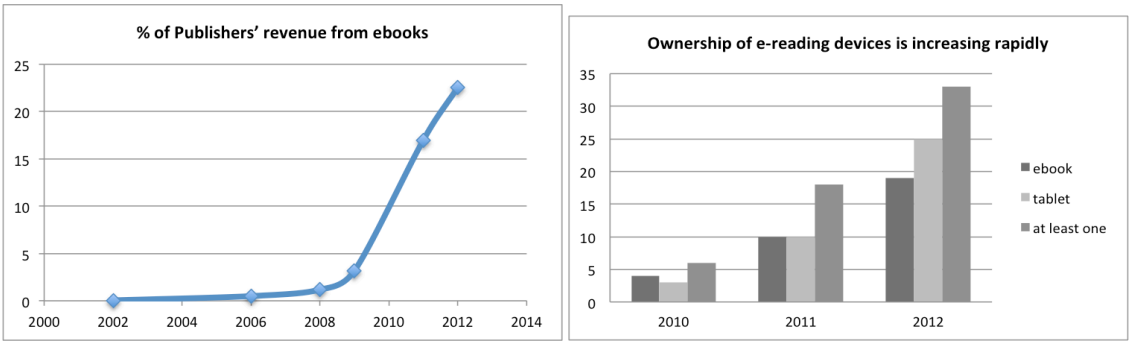

Figure 3. Consumers have rapidly increased purchases of ebooks in recent years (left, Association of American Publishers, 2013) as ownership of tablet computers and dedicated e-readers for reading ebooks increases (right, Raine, 2012)

Other changes in technology in the media ecosystem from this digital transition contribute to a central problem of modern consumption: being aware of a greater volume of media that we would like to consume than we could, even if we did nothing else.

- **Social recommendations.** People have long made personalized media recommendations to other individuals, based on the recommender's reflection upon the other person's tastes and interests. The current media ecosystem also encourages broadcasting reflexive recommendations by prompting consumers upon completion of an item to provide a rating – often as simple as 1 to 5 stars – and sharing it over social networks. In this mode, it is the receivers of these ratings who must decide whether or not the item is something they would enjoy.
- **Aggregated ratings & reviews.** In addition to reviews by professional critics, it is now common for people to consult reviews from other consumers. Sites such as Metacritic and Rotten Tomatoes summarize critic and audience ratings into simple metrics; Amazon.com displays a ratings histogram to show the distribution of ratings.
- **Recommender systems.** These systems use sophisticated analysis techniques to try to predict what specific items a given individual will prefer based on ratings assigned by other viewers who are similar to them (Konstan & Riedl, 2012; Sill, 2010).
- **Monitored media consumption.** Media producers now have much more detailed information available about how their media is consumed than before. Digital video providers like Netflix and TiVo can determine which specific segments of a show were skipped and which were viewed repeatedly. Ebook platforms such as Amazon's Kindle and Barnes and Noble's Nook can report similarly detailed data about book reading (Alter, 2012). Media producers are using this information to create content that will be even more appealing to consumers (D. Carr, 2013).

In addition to the factors above that contribute to people finding more appealing media they want to consume, there are also changes happening with the digital nature of media which affect long-standing media-related activities:

- **Stashes.** As squirrels save acorns to eat in the future, media consumers set aside or stash found media for future consumption. Petroski's research on the history of the bookshelf (1999) shows that this technique dates back centuries with physical writings. Most digital media sources have their own built-in mechanism to support this, such as Amazon's wishlists and Netflix' queue. It is common for researchers to find papers of interest via online searching, then to save or print a copy, but never ultimately read it (Rowlands et al., 2008). This evidence suggests there is some reward from searching, finding and stashing which is independent of whether consumption ultimately occurs. But do these digital media stashes work differently than stashes of physical media?
- **Displays of media.** People display media to communicate aspects of how they want to be seen by others and themselves (MacAdams, 1997; Swann, 1983). We collect this evidence — for example, by perusing someone's bookshelves — and use it to help us understand people (Gosling, 2008). We used to have to visit someone in person to browse their bookshelves, but social networks and ecommerce companies encourage us to share our media consumption with a much wider audience. Yet these online sharing methods are not as present when people do visit us.
- **Difficulty adapting to the loss of physicality of digital media.** As books, music, photographs and other media are increasingly experienced as digital information rather than physical objects, people's relationship to them has changed, and people are still wrestling with how to adapt to changes in available affordances (Golsteijn, Van den Hoven, Frohlich, & Sellen, 2012; Magaudda, 2011; Odom, Sellen, Harper, & Thereska, 2012).

In the next section I share people's reports of how these trends contribute to problems in modern media consumption: there is more awareness than ever of appealing things to consume, but the time available to consume them has not increased. At the same time, some forms of media are becoming more compelling and harder to resist while others have not.

3 Interview Research: Food, Media, and Metaphor

While Johnson's arguments (that our information diet, like our food diet, has been affected by changes that benefit the producers while harming consumers; and that techniques to respond to these changes may be adapted from food to media) seemed intuitively on-target, I wanted to investigate further. The key research questions (RQs) I wanted to address here were about 4 topics:

- **RQs1**: **Does the metaphor of food fit the domain of media?** How do people use food and diet metaphors to understand the domain of media? Do people use other metaphors for media consumption?
- **RQs2**: **How have recent changes in media technologies affected media consumption?**
- **RQs3**: **What unmet needs do people have regarding their media consumption?** What problems exist? What changes do people want to make, and why do they want to make them?
- **RQs4**: **How do people make changes in their consumption?** Could techniques for making changes in the realm of food inform the design of new tools or systems to improve people's media experiences and improve their ability to achieve the outcomes they desire?

3.1 Method

To investigate these questions, I used qualitative interviews (Turner, 2010) because they are well-suited to exploring the subjects' understanding and experiences (King & Horrocks, 2010). I was interested in gaining insights that would help me understand what was important to people, where they found difficulties, and how it might be possible to address their needs. As Rohrer (2008) says:

> *"Due to the nature of their differences, qualitative methods are much better suited for answering question about **why** or **how** to fix a problem, whereas quantitative methods do a much better job answering how many and how much type of questions."*

Ten interview subjects were informally recruited through personal contact during daily activities among adults in the Seattle area. No specific recruitment criteria were used. Subjects ranged from approximately 35 to 65 years old. Seven have children of elementary or middle school age; one more has grandchildren of that age. All subjects were female, middle-class, and college-educated. All subjects said they were comfortable using technologies such as computers and smartphones.

Interviews were conducted in person, one-on-one, during October and November 2012. Subjects were told the interviews would be 30-60 minutes long; if the hour mark was reached subjects were told and asked if they wanted to stop or continue. Interviews were audio-recorded and supplemented with handwritten notes. The recordings were reviewed later to transcribe specific quotes and review other information.

Each interview began by introducing the metaphor of information diet to examine media consumption. The interview was a blend of a guided interview, to ensure that certain topics were covered, and open-ended ethnographic interviewing (Blomberg & Burrell, 2012).

Table 10 in Appendix A contains the topic prompts and questions, which I referred to in order to make sure all subjects were covered. Following the practice of guided interviews, not every question was asked of every subject; if a topic had already been thoroughly discussed earlier in the interview, I did not ask people to repeat themselves.

I specifically probed the validity of the information diet metaphor with the interview subjects. I wanted to learn whether they felt it made sense to consider their media habits as a form of diet, and to see how they would react to that framing, especially if it would help unlock additional insights about their own media habits. To guard against the subjects accepting the metaphor out of social obligation, questions were phrased to encourage either acceptance or rejection, and subjects were asked to explore both accepting and rejecting the metaphor; for example, by discussing how the metaphor did not fit, in addition to how it did.

I asked about the contents of peoples' current media consumption in order to learn whether there were common media equivalents to "food groups" or "nutrients" that people had in common and which could be used in solutions.

To identify common changes and approaches that might help people accomplish those changes, I asked people how satisfied they were with their current media consumption, and to share changes (if any) that they wanted to make. I asked about changes in media consumption, whether changes that happened in the past, or were current or desired future changes. I asked what prompted the change, what they hoped to gain from it, and whether it did do what they had hoped it would do.

To identify promising approaches to supporting desired changes, I asked what techniques (if any) were used to implement the change, whether or not the change was successful, and success factors. I also asked about approaches people used to make changes outside of media, such as in the realm of food, or any other areas they identified, where they had approaches for making changes that worked for them.

There are several validity issues to discuss. External validity concerns are caused by the small sample size and the homogeneity of the population. Both provide significant concerns about how much of the range of experiences and understandings of the global population are reflected in the findings from these interviews. Referring to Carpenter's (2008) warnings about the non-universal nature of metaphors, we must particularly consider the all-female subject population, given that there has been much discussion of the different messages and attitudes about food for males and females in our society (see for example Wardle, Haase, & Steptoe, 2004).

It is also important to note that the qualitative research methods used here have significant implications for generalizability of the findings. The purpose of this research was not to measure the frequency or prevalence of various aspects of media consumption that could be extended to draw statistically significant conclusions about a larger population; other research methods would be needed for that purpose. Instead, the goal was to gain understanding of people's needs in a way that provided insights which could be used to design solutions that would fit into and support people's desires. As we will see in the next section, this research approach did yield several useful findings.

Detailed data from the interviews is in Appendix A: Detailed Interview Data. Below I discuss the findings relevant to the research questions, as well as a few other findings that emerged from the inquiry. All quotes from interview subjects are labeled and numbered; i.e. a quote from subject 3's interview is labeled S3.

3.2 RQs1: Metaphor fit

This section addresses the research questions on metaphor:

- Does the metaphor fit? How do people use food and diet metaphors to understand the domain of media? Do people use other metaphors for media consumption?

I found that the information diet metaphor resonated with subjects and helped them make sense of their media consumption. All but one of the interviews went beyond the 60 minute mark (even though the researcher pointed out the time and told the subject that the interview could be stopped) because the subjects had not exhausted their desire to explore their media habits in the light of the food metaphor.

Subjects were readily able to provide many parallels between media and food using the information diet metaphor; they also articulated many food metaphors in describing their media habits. Overall, twenty different food/media metaphors were used. Of those, over half were mentioned by more than one subject. Table 4 shows the different food and non-food metaphors used, along with how many subjects used each metaphor. Table 11 and Table 12 in Appendix A provide additional description of the metaphors.

Food Metaphor	Count
dieting	4
nutrition	4
breakfast	3
junk food	3
candy / dessert	3
potato chips	3
satiation	2
balanced diet	2
spinach / salad	2
bad tasting food	2
appetite	1
bingeing	1
choosing restaurant	1
digestion	1
meaty	1
sour taste	1
tastes/flavors	1
eating smart	1
grazing	1
flitting	1

Non-food	Count
addiction	2
cigarettes	1
sleep	1
financial budget	1
friends	1
poison	1
garbage	1
tools	1

Table 4. Subjects used more food metaphors (left) than non-food metaphors (right). The count indicates how many unique subjects used each metaphor.

The interviews uncovered many aspects of food and concepts from the domain of food that people bring to their media activities and understanding of their media experiences.

Examples include the need for balanced and varied diets, junk food that is tasty but has little nutritional value, and taste-specific satiety.

Subjects considered overall media consumption as similar to a food diet that needs balance:

> *"It's like balancing out your diet. Everybody needs a salad now and again, and you need to balance. I feel like if I just did junk media it'd make me sick. So I have to feed the various parts of me. [Pause.] Wow, this diet thing is really coming together for me as a metaphor here!" — S5*

Appetite, hunger, and thirst were all invoked to describe the desire for certain information and as the motivation for consumption choices:

> *"I decide [what media to consume] almost how you decide what to eat. What am I hungry for? Sometimes it's one thing, sometimes it's another." — S5*

> *"It's not just casual cruising for curiosity about what's going on - it's having a sense of urgency, I really need to know what is happening to my family and friends." — S1, describing what she called her "thirst" for breaking news about events that might affect people she cares about, like natural disasters.*

As Johnson suggested, unhealthy food like potato chips, candy, and desserts often referred to media that was appealing in the short term but didn't provide lasting value:

> *"Invariably with smut novels, those are so fast, it's more of a 'Oh, I'll have a candy bar' and then I'm done with it."—S9*

> *"I'll get sidetracked from news that is important by stories that are kind of, for me, in my information diet, like candy" — S6*

> *"If I felt like I was going to PerezHilton.com [a celebrity gossip website] too many times, I'd be saying to myself, 'No, you cannot have a candy bar again!'" —S5*

Aspects of our food appetite were used to explain media habits, such as taste-specific satiety:

> *"I stop with my morning news routine because there's only so much rich, meaty new news about the world I can consume before I start feeling ill. There's only so much information I can absorb - so much fat I can eat - before my brain says 'ok, you're done'. If it's on a weekend, I might be full of news and switch to entertainment" —S3*

Some subjects did identify areas of media consumption where the ID metaphor did not fit well for them:

> *"You get different things from a book depending on what you're reading it for, but the nutritional value of spinach doesn't change if you are paying close attention while eating it or not." — S1*

> *"[The metaphor] makes sense intellectually when you mention it, but feels kind of abstract though – it does not immediately resonate." — S7*

In some cases, they proposed alternative metaphors. Some of those non-food metaphors could be interpreted as possibly applying to food (e.g., addiction). But the subjects who proposed them were explicitly rejecting food and saying that these alternate metaphors were better fits for at least some aspects of media. Without exception, even these subjects did not reject the metaphor overall; instead, they were identifying exceptions, specific aspects of media where the metaphor did not fit well for them.

> *"Most of the TV programming available on cable is not worth consuming. It's not food at all, it's just garbage." — S8*
>
> *"I'd love to sleep all the time, but I need to moderate it. You do have to sleep some, though. Info is similar: I need some, would like to consume even more, and I need to moderate it." — S10*

Finally, use of the word "information" in the phrase "information diet" was somewhat problematic for subjects, even though they did approve of the food/media metaphor. The specific problem was that they generally did not regard their media consumption as purely informational. "Information" was taken by subjects to mean objective facts, as opposed to the information theory view of information as any data, irrespective of meaning. But the experience of consuming media was often valued for its own sake, independent of whether any factual information was conveyed:

> *"When you say information, I think news….I like my entertainment light and fluffy. I choose entertainment that doesn't provide information. Sometimes entertainment does provide some information, but it's not what I tend to seek out." – S6*

In summary, the people I interviewed suggested that perhaps a better analogy to the information component of our media diet is the nutritional component of our food diet; they told me there is more to their food and media consumption than just the information and nutrients it yields. While information is one important aspect of people's media consumption, it is like nutrition in food: an important factor in choosing what to consume, but hardly the only one.

The interview data provides evidence that the people interviewed do use the language and ideas of food to think about their consumption of media and information. While Johnson's focus on information is narrower than most people's concerns, his underlying insight that applying food thinking to media can provide insights appears to be on-target.

In coming sections, we will see how strategies from the realm of food can be applied to address problems in media consumption. But first, I discuss what the interview subjects told us about how technology changes have been affecting their media habits.

3.3 RQs2: Recent changes in technology and consumption

This section addresses the research question:

- How have recent changes in media technologies affected media consumption?

As I asked people about how their media consumption habits have changed, it was clear that digitization of human activities has significant implications. People reported that adopting new media technologies changes the experience of media consumption in ways that they did not expect, in addition to the more obvious benefits (and drawbacks) the technology delivered.

One example which prompted strong feelings was the constant connectedness brought by mobile computing. People appreciate the capabilities it provides, but it disturbs them how dependent on it they have become, and how it is tempting to pull out the phone even when in the middle of other activities.

> *"My iPhone is always in my hand or in my pocket. If I forget it at home on my way to work, I'll turn around and get it, because I don't want to be without it. I never would have done that with my previous phone." — S9*

> *"I'd like to be able to go without my phone - leave it at home. It feels unhealthy that I need to have it all the time…. Having the iPhone has completely changed how I work. … I can work all the time. You think about this stuff saving you time, but it gives you the capability to work more. It doesn't give you free time." — S10*

Another examples is a change in news sources, which has largely moved from print newspapers and magazines to online reading:

> *"I used to read the local newspaper, now I hardly ever do. There's greater access to different kinds of information online. The local paper's quality dropped, it wasn't worth reading anymore." — S7*

> *"[Print magazines] could totally go away and I wouldn't even notice. Most of the information they used to give me is now on the Internet somewhere. If It was a cooking magazine, or Entertainment Weekly - you can easily find the same crap online. And all the magazines that would be worth reading are now online themselves." —S9*

Even people who read the print edition supplement it with online:

> *"If I'm interested in something I read in the Sunday paper, I will then go online to read the comments, which are fascinating, because now that its online, you can genuinely see a conversation with people and often the author responds, which is something, in the old days, you didn't have. You might have a letter to the editor or two, but you wouldn't have 40 different comments. So if you think someone makes a really nice comment, you get to vote and promote that comment - I really like that. Subjects that I'm passionate about, it's really nice to see people push back and the authors respond." —S1*

Both of these media transitions have been covered extensively by others (see for example N. Carr, 2010; Gladstone & Neufeld, 2011; Menzies & Newson, 2007; Powers, 2010; Rosen et al., 2012).

Two other areas where media changes are causing changes, which were mentioned by many interview subjects, are those of reading books and watching movies and television shows. First, the emergence of ebooks prompts people to complain that the experience of reading ebooks is lacking several valued affordances compared to those provided by paper books. This may provide clues how to support the subjects' oft-stated desire to read more. Second, as people are choosing to get more of their television and movies streamed over the Internet instead of by broadcast, they are finding this method of viewing affects their consumption in ways that they did not expect. The next two subsections cover these two topics.

3.3.1 Consuming eBooks vs. paper books

Even though I did not specifically ask about this topic, all but one of the interview subjects volunteered that they preferred reading books on paper to reading ebooks. Despite this, most subjects — even those with strong preferences for some aspects of paper books — have begun to adopt ebooks for at least some of their reading. As I related in Section 2.8, ebook adoption has been increasing rapidly in recent years.

Half of the subjects attributed their preference for paper books to their own nature. One self-identified as a "Luddite" when discussing this, and another prefaced their preference by saying, "I'm not technical." But as we discussed further, it became clear that the issue was neither ineptitude nor a rejection of technology in general or in the realm of media consumption — these same people used computers, smartphones, tablets, media centers, and consoles for many other aspects of their media consumption. The problem for them is that ebooks are lacking some affordances of physical books (Table 5 summarizes these). These same affordances were also mentioned as missed even by those who read ebooks frequently, such as this subject:

> *"I think with books it's more of a comfort thing half the time. You're surrounding yourself with books, the smell of them, the feel of them, the mustiness." — S9*

Only one of the people interviewed said they had an outright preference for ebooks over paper books. For that person, the benefits of ebooks (such as being able to purchase a book and begin reading it in seconds, having all their books available wherever they were, digital highlighting, and searching) outweighed the missing affordances of paper books.

For all the rest, paper books still have advantages that they are not yet willing to entirely give up. Understanding these missing affordances may provide insights into ways that ebooks and ereaders can be improved to increase their adoption and acceptance.

Some of these affordances affect the experience of reading. The changing thickness of the stack of pages behind and ahead of the current page as one progresses provides a tactile sense of "location" in the book. The tactile sensation of different books' covers and bindings can become such a part of the experience of a book that a reader can distinguish a volume by feel alone. And ink on paper provides excellent legibility, with clarity and contrast not yet met by other display technologies:

> *"I have the [Kindle] app on my phone, and 80% of what I read is on my phone, but it's probably really bad for my eyes. It's just so much easier to find things to read and access them quickly." — S9*

Intriguingly, many of the missing affordances are not missed while reading the book, but before and afterwards. These complaints indicate that important aspects of reading books occur when we are not actually reading.

Several of these aspects are related to the visibility of books. A reader who is deciding what to read will often pick up a book and look at the information on the cover and flaps, or flip through the pages to get a quick sampling of what is inside.

Subjects explained that while rich information about ebooks is readily available on ecommerce sites while people are considering whether to purchase them, once the books have been acquired, it is harder to access that information. This is especially challenging when deciding what ebook to read next. Unlike a physical book, you can't get a sense of what type of book it is from the appearance of the cover, and you can't easily read the information on the cover and flaps to get a summary of the book, an author bio, and endorsement blurbs; all that is available is the title and the author. Even once opened, the most readily available information is the first page of the text. The front cover image may be available, but most ereaders don't display the cover when you first open an ebook, and the other types of content that people often consult when choosing what to read may not be included in the ebook at all.

One subject who pirates ebooks in bulk, and then reads them later, says:

"I have this habit of getting 10 ebooks, and then reading 5 of them, and getting another 10, and reading 5. So I have all these ebooks I don't know what they are." — S9

We also use books' visibility to look at other people's reading: peering at the book in someone's hands to see what they are reading, or looking at their bookshelves to see what they have read. This serves two functions: it helps us discover books we may be interested in reading ourselves, and it also helps us learn something about the other person. Similarly, we can display books to tell other people about ourselves (more on this in Section 4.2.3). The physical nature of books allows us to organize them, often picking them up and reading parts of them, or recalling associated ideas and events; some readers highly value this way of interacting with their books:

"I love to rearrange my library. It helps me think about the books differently and appreciate them more." — S7

Table 5 contains a complete summary of qualities that paper books possess which ebooks lack, as identified by interview subjects.

Paper book affordance	**What the affordance makes possible for people to do**
Front cover	Shows other people what you are reading Graphic design can convey the genre or style to expect When you have started a book but are not actively reading it, the sight of the cover reminds you this is an available book you are still in the process of reading and prompts you to read more of it
Physical bookmarks	When you have started the book but are not actively reading it, the bookmark poking out is visible and reminds you this is a book you are still in progress reading, and shows you exactly how far through the book you are.
Back cover / dust jacket	Provides author bios, book summaries, and endorsements. These are used in two distinct stages of the reading process: 1) Acquisition: to determine if the book is one they want to read in the future. This need is addressed for ebooks with information on the vendor's store such as descriptions, reviews, and customer ratings – this is richer information than is possible to provide in the limited capacity of the cover. 2) Selecting a book to read: When deciding what to read next among available books, evaluating whether a particular ebook is a good fit for current context & desires, this information is not readily available at all.
Thickness	Shows overall length of book While reading, the thickness of the pages on either side of the page you are reading provides tactile feedback on location in book and progress.

Paper book affordance	What the affordance makes possible for people to do
Can be identified by cover or spine while shelved or piled in a visible spot	Reminds that the book is available to be read Serves as a reminder to self / display to others of your interests Can be kept in the physical location where it will be used
Visibility	Physical books on shelves are visible to anyone who enters the space. Books on shelves are regarded as visually attractive. One subject, an interior designer, told of a client who purchased dozens of books simply for display purposes because they liked their appearance, with no intent to read them – without even any knowledge of what the books were about. Examining someone's book collection to learn more about them and their interests is a common activity. While some online services enable sharing of books, these are not widely adopted, nor are they automatically visible to anyone who visits.
Organizable	Physical books can be organized physically by any number of schemes. Organizing one's books is a valued activity, another way of engaging with them. People use idiosyncratic organization schemes which reflect their own understanding and categories.
To-Be-Read piles and shelves	Readers often keep books which have been acquired but not yet read in specific locations.
Tactile feel of binding, cover, and pages – texture, friction	Provides tactile differentiation between books. Readers reported that they can often distinguish between several books they are actively reading by touch alone.
Can be loaned or given to friends	Sharing books with friends is an important social activity for many people which ebooks do not support as well as paper books. As implemented by Amazon and Barnes & Noble, the two most popular commercial ebook ecosystems, ebooks can be loaned if publishers give permission for each title. Such ebook loans are limited, both in the number of times a book can be loaned and the duration of each loan. Finally, loaning ebooks requires that both people use the same ebook ecosystem.
Legibility / eyestrain	Reading on LCD displays (such as smartphones) were reported as causing more eyestrain than reading paper books, while e-ink displays were considered roughly equivalent to paper in that regard.
Smell	The smell of books was mentioned as something important missing from ebooks. Perhaps the involvement of smell in memory is involved, and future generations who grow up without having the smell of paper books enmeshed in their memories won't miss it.

Table 5. Subjects identified several affordances of paper books that are missing or inadequately provided by ebooks.

The fact that people complain about these missing affordances indicates that we should look at what role these affordances play and the activities they support in order to find areas where we may be able to improve the reading experience even as ebooks become more popular. I delve into this further in the other phases of this research, particularly in Section 4.2.4.

For those interested in exploring new possibilities for ebooks, which are not necessarily possible with paper books, I suggest Peter Meyers' *Breaking the Page* (Meyers, 2011) and the Text 2.0 project (http://text20.net).

3.3.2 Consuming video

The increasing ability of people to stream or download an increasing range of television programs and movies over the Internet for viewing on devices ranging from traditional television sets to computers, tablets and smartphones is driving changes in consumption habits. Another area where on-demand is cutting into broadcasting's share of media consumption is in radio: podcasts are an increasingly popular way of listening to content that used to be only available as a live broadcast. I focus the discussion on movies and television because more interview subjects have those forms of media as major components of their media diets than radio and podcasts, and because the subjects spent much more time discussing the impact of these changes to their TV and movie viewing habits.

This increasing ability to get video content over the Internet has driven a practice called *cable-cutting*: dropping broadcast cable television subscriptions and shifting to on-demand viewing. According to ongoing studies by organizations such as the Pew Research Center and the Nielsen corporation (Fox & Duggan, 2012; Nielsen Company, 2012b, 2013) cable-cutting is a growing trend among American TV viewers. This was reflected in the interview population: all of the subjects who had cable mentioned that they have at least considered it, and 4 of them have done so.

Every subject who had or was considering cable-cutting checked beforehand to find out what shows would and wouldn't be available to them from other sources. They typically found that some of what they currently watched would not be available (e.g., sports) or they would have to wait to be able to watch it (TV shows whose episodes are not available for purchase until a year or more after the original air date). They considered these changes carefully and didn't make the change if they found they'd have to give up favorite items:

> *"Dislike for the cable company was our initial motivation. We didn't like paying so much money for relatively little value. We weren't really trying to change our information consumption, we were trying to avoid patronizing Comcast." — S7*

This consideration of the change in content availability is an example of anticipated effects of a change in technology. Yet the cable-cutters reported being surprised by the extent to which other aspects of their viewing habits were impacted by changing from a broadcast model to an on-demand model.

One key difference was the need to intentionally choose what to watch once turning on the TV and "seeing what's on" was no longer available to them. The lack of ability to just see "what's on TV" or channel surf forced people to make more intentional decisions about

what to consume, and this was reported as a positive change by every subject who had cut cable:

> *"I was surprised to find how much aimless channel surfing went away." — S3*
>
> *[After cutting cable] "When I sat down to watch TV, the only thing I'd watch would be* Mad Men*. Then when I finished it, I was like 'what am I going to watch?' I sit down at the computer and ask myself 'what's good?' [Before cutting cable] if I turned on the TV I didn't ask myself what's good, I'd just happen to see something and I will sit there and watch it." —S5*

Being able to view television at any time can also affect consumption of other media types:

> *"Now that I have increased ability to find good TV to watch by streaming, I don't listen to music as much anymore." —S4.*

On-demand viewing has also changed how people consume television series; several people reported that they now watch entire seasons or even complete series over a short period of time. In another use of the food metaphor by subjects, this was sometimes called "bingeing." People also are more reluctant to start watching a TV series while it is being broadcast, saying things like "I'll wait until I can stream the whole season at once."

Media producers are responding to this in different ways: on the one hand, releasing entire seasons at once (as with Netflix's in-house production House of Cards) and on the other hand, shifting towards content where timeliness and interactive and social participation is an inherent part of the experience, such as reality shows like American Idol.

As this technology change has been adopted, people appreciate the increased control of their viewing consumption it provides, and the reduction in mindless consumption. In upcoming sections, I discuss how we can support people in consuming those things they really want to consume.

In the next section, I turn to the problems, unmet needs, and unsatisfied desires people experience with media consumption.

3.4 RQs3: What do people want?

One of the primary goals of conducting this research was to gain insights which could help when designing solutions that would be valuable for people. I wanted to find out what problems people really faced, instead of assuming I already knew what problem needed solving.

This section addresses the following research questions:

- What unmet needs do people have regarding their media consumption? What problems exist? What changes do people want to make, and why do they want to make them?

By conducting the interviews and listening to the subjects describe how they cope with their media consumption, I collected data to help understand these issues. Section 3.4.1 describes their most commonly mentioned desire (to read more books). Section 3.4.2 discusses problems dealing with the selection of content available. Section 3.4.3 discusses problems of "bad tastes" and Section 3.4.4 covers unmet needs of parents who want to better manage their children's media diets.

3.4.1 Read more books

Reading more books was the desired change people talked about most. Books were also the only category of media that every subject mentioned as part of their media diets.

One reason given for not being able to read as much as desired is the amount of time reading takes.

One subject recalled that during pregnancy she was required to rest more, so had time to read novels. But now it "feels like an indulgence" to spend the time it takes to read a book given the "busy-ness of life." Another said:

> *"Books are my choice of entertainment - when I have the capacity to fill my brain with something besides everything else that's going on during the day. I imagine that's what will happen when [my younger child] starts preschool - I'll eat books again….I wish I had time to read a book every day" — S10*

Another echoed Nicholas Carr's (2010) concern that Internet media consumption is affecting the ability to concentrate and thus read:

> *"I'd like to bring back my ability to sit down and read a paper book – a longer attention span. Right now [that's] just aspirational. I don't love that I feel like I have trouble with my attention span, but it's not bothering me enough that I want to do something about it." — S6*

Other people embrace the fragmented attention Carr warns about, and use it in order to, for example, read more while also consuming other forms of media:

> *"I want to see a movie with [my partner] but I also want to read this book, so I do both at the same time." — S9*

As we will see in section 4, people's explanations of their behavior may not be accurate; one reason is that some of their decision making process is inaccessible to their conscious thought processes. So while we can accept that people do in fact desire to read more books, we should be more cautious about accepting that their explanations for why they don't read more books are accurate. It may be possible to help people achieve their desires to read more without adding additional hours to the day.

This unmet desire to read more books is itself involved in one of the problems people have with books – namely, what happens when desirable books are acquired but subsequently not read.

In section 2.8 I reviewed many new ways that people now have for finding out about books they would like to consume. Interview subjects told us that this imbalance in rates between discovery and acquisition vs. reading ends up causing problems when people are not able to keep up with their reading desires: the unread books pile up and cause clutter that both is physically in the way and also causes a feeling of being overwhelmed:

> *"We need a bookshelf. They're taking over every work surface in the house and we have to do something about that." — S10*

> *"I'm feeling overwhelmed by stuff —not just books, all the kids' toys, etc. That drives use of the library, because the books [we borrow] don't stay in the house." —S6*

"I have this habit of getting 10 books, and then reading 5 of them, and getting another 10, and reading 5. So I have all these books I don't know what they are." Interviewer: So those leftover ones - do they just stay leftover? "Yeah. It's sort of like hoarding. I had a pile of physical books - and it got to the point of 'Ok, this is ridiculous, I've got to get rid of some stuff.' I'll get rid of things if I already read them or if I'm not going to read them. And I got rid of a whole bunch of stuff where it was just sort of like, ok: look at the back of the book - are you really going to read it? And I got rid of the ones I decided I wasn't going to read after all. And even then I still had a full bookshelf of books, most of them I still haven't read. It's terrible." — S9

While accumulating unread ebooks doesn't cause physical living spaces to become cluttered, at least the physical books property of taking up space provides a prompt that signals people to take action to deal with the surplus. In section 5, I investigate ways to provide ebooks with some of the beneficial properties of a physical collection of books.

3.4.2 Satisfy current hunger

Next, we turn to another problem people face: choosing what to consume at any given moment.

"I don't go in [when choosing what to read next] looking for [a particular genre such as] fiction vs. biography. I'll look for something that appeals to me…" —S10

"Usually it's not 'Do I want to read a book or watch TV? Do I want to play a game or see a movie?' It's 'What game do I want to play?' or 'I want to read a book, what book do I want to read?' Maybe that's a function of having a lot of content around at different states of completion, and I can choose what I want to pick up and experience." —S9

People find this surplus of desirable options to be a problem.

"I feel like it's too much. At our fingertips is too much. We have infinite entertainment, we have infinite information, and I don't think it makes us better people, or happier. " — S3

"Before Netflix, it was possible for there to be nothing on; that doesn't happen anymore." — S4

"The problem is more sorting through [the list I keep of books I want to read] and figuring out what I want to read [now] than accessing them." – S8

"I get so many recommendations from colleagues, I wish I could skim quickly to keep up with it all. But I feel like I need to read each one in depth, so I end up not investigating most of them." — S5

"There may be 30 headlines, I may go and research one more deeply. I'm not just eating everything because it's there; I have to pick what I want to learn more about." — S2

"I used to have a list of movies I want to see. And I never got to any of them." — S6

Section 4.1 reviews literature on decision-making that helps to explain why having to invest effort in choosing between many positive options can actually reduce satisfaction.

3.4.3 Avoid bad tastes

A related problem of undesired content was mentioned with special vehemence: content whose intrusion into consciousness causes strongly negative emotional responses. Consuming undesirable content sometimes caused strong reactions. These reactions were visceral, like an unexpected mouthful of a disgusting taste:

> *"What stops me is when I get stories as I'm reading, what stops me and makes me turn off is when there's a story that's devastating. Like as I'm trying to look up what Mitt Romney said at a campaign rally, I see '3 children beg for their lives as mother kills them' and then I'm like, 'Aagh! I can't look at this stuff, it's too much!' So then my information diet gets tainted by horror. I wish there was a way to filter that. That's the sour. That's the orange juice in my milk - it totally sours it." —S5*

> *"I wish it didn't occupy a portion of my brain. I hate that I know* anything *about the Kardashians." — S5*

> *"[After having kids] I couldn't read anything dark, depressing, intense, where bad things happened. I didn't want to read bad news - nothing that made me feel bad. Things hit you harder when you have little kids. It isn't the kind of story I wanted to have in my head." — S8*

To avoid this problem, people have to accomplish several steps. They have to identify the link between the content and the emotional reaction. They have to determine where they were getting the problematic content from. Finally, they have to change their behavior to avoid the source:

> *My browser home page was set to MSNBC, but I used to get exposed to the wrong type of information, like those stupid 'test your relationship' quizzes they have. And then I'd get all upset about my relationship; it made me question things that weren't a problem. I changed my home page and now there's no problem." — S6*

> *A year ago I cut down drastically on how many politics sites I went to because it was too stressful. It was creating free-floating existential angst - everything is going to be bad forever, everyone's terrible. So I cut down the number, and went to the ones that are less opinion and more newsy. I used to go to Daily Kos a lot but they made me too angry, and I don't need that in my life. So I took the time I used to do that and found other things - I read local news blogs about things that are happening in our neighborhood. I substituted angst for happy local things. That was an excellent decision to cut down on that craziness. — S3*

In both of these examples, the people describe using strategies to change their behavior. Strategies for making changes to diets will be investigated further in Section 3.5.2.

3.4.4 Feed children well

Three parents specifically mentioned concern for being able to monitor and manage their children's media consumption. Parents want to restrict their kids consumption to material appropriate for their intellectual and emotional developmental levels – especially when accessing the Internet, where nearly any content imaginable is just a click away:

> *"Needing to know what kids are up to on the Internet takes effort, and lots of parents don't have the time — or the ability." —S3*

Parents are concerned with insulating their children from negative messages and values, keeping them from over-consuming types of media that do not provide much value. They want their children to be provided with a healthy diet, and to develop healthy consumption habits:

> *"One of my children was obsessed with videogames and television, and it was interfering with the rest of his life. So we took it out of his diet completely for several months. Then we allowed him to start earning back a moderate amount with good behavior, but he had to earn it." —S2*

> *"I try to reserve the book budget for my daughter because she wants to hold that book in her hand and keep it and have it be hers and read it over and over. I know that's going to last longer than me buying a book and reading it once and donating it." — S10*

Another aspect of family consumption is exposing children to parents' media habits and interests:

> *"The whole family shares one account for ebooks across all devices – which means everyone sees all of everyone else's books, regardless of whether they're interesting to them." — S2*

> *"In the house I grew up in, we're all readers, so you would sit down and there's a book nearby that you'd be like 'well, that's interesting! where'd that come from?' And you'd read that because somebody would leave it lying around." — S9*

Parents also have challenges in finding content appropriate to consume based on the context of consumption, such as the audience or who is present and exposed to the content, even if they are not the primary audience. Parents mentioned the need to find media for the entire family to consume together, such as read-aloud books and family movies. And parents had challenges with not wanting to expose their children to the "adult" portions of their own media consumption.

In the next section, I look at several other ways that context moderates our appetite for different types of media.

3.5 RQs4: Our changing diets

I asked these research questions about making changes in our diets:

- How do people make changes in their consumption? Could techniques for making changes in the realm of food inform the design of new tools or systems to improve people's media experiences and improve their ability to achieve the outcomes they desire?

In the interviews, I was struck by the differences between short-term and long-term changes people described. In Section 3.5.1, I discuss the ways context and appetite shapes our diet and changes in the short term. In Section 3.5.2 I discuss how our preferences or tastes change over the long term.

3.5.1 Short-term changes in appetite

Because our appetite at any moment is contextual, even when all of the content choices we are choosing between are ones that are desirable to us in general — for example, if we

selected them ourselves — we may see many items that we do not want to consume *right now*. And we may have a hard time judging what exactly it is that we are "hungry" for. Subjects provided many examples of the contextual nature of media appetites.

> *"When I want to entertain myself by playing a game, picking between all the games, choosing what I want from a gameplay perspective - that's going to be, 'Oh, do I want to have a story experience, or do I just want to get in there and shoot some stuff to vent some anger, or feed the part of me that just wants to kill things to get their gold and go shopping?' They all feed different parts of the soul." — S9*

Context can intensify negative reactions as well:

> *"Our free time, our energy, is precious. We're pretty hesitant to go out. When our first child was an infant, we went to see* Punch Drunk Love*. And I* hated *it. And one of the reasons I hated it so much was that I couldn't believe I had one of these precious nights out and I was spending it on a movie I didn't like. That took it from "meh, I don't like this movie" to "I HATE this movie!" – S6*

Depending on what you just consumed, taste-specific satiation (discussed in Section 2.5.2) applies to media as well as food. My kids say "my dinner stomach is full, but there's plenty of room in my dessert stomach."

> *"I stop with my morning news routine because there's only so much rich, meaty new news about the world I can consume before I start feeling ill. There's only so much information I can absorb - so much fat I can eat - before my brain says 'ok, you're done'. If it's on a weekend, I might be full of news and switch to entertainment" —S3*

When we are sick, we have different desires for media consumption.

> *When you're sick, it's really nice to be able to watch something mindless on TV or poke around on the Internet because your brain is just not functioning." —S4*
>
> *"Last year when I had pneumonia, I had to sit on the couch and wasn't allowed to get up. I watched that movie with the blue people [Interviewer: Avatar?] Yes! It was so surreal and colorful. I saw it through this lens of fever and a kitten purring in my lungs. It was cool, but it's not a good idea to get pneumonia just to experience a movie better." —S10*

Emotional state is an important aspect of context. One person spoke of the desire to watch familiar movies and reruns of television shows when sad as the equivalent of "comfort food." Another used media as a safe outlet for aggressive feelings:

> *"If I'm really angry at the world, I'll read my vampire stories where people get killed in violent and horrible ways, and then I don't have to kill people. It keeps me out of prison!" — S2*

So our appetites can change frequently based on context. Being able to factor our current appetite into our choices to make selections more relevant might go a long way to easing our media selection challenges.

But these are not the only changes to our consumption. Other changes in our consumption habits take place over longer times and in response to changes in our lives.

3.5.2 Making long-term changes: intentional vs. exogenous

I was struck that there are two types of changes to the subjects' information diets, with contrasting characteristics:

1) **Intentional media changes.** People wanted to make changes, but relying on willpower alone to implement an intention to change was usually not sufficient. Changes were more successful when people employed additional tactics to support the desired behavior or suppress the undesired behavior.

2) **Exogenous media changes.** Other events in people's lives often do cause large changes in people's media consumption without requiring much additional effort – in some ways, the media diet change is a coincidental side-effect of the other change.

I distinguish these causes by calling the first category *intentional* media changes, and the second *coincidental* or *exogenous* (having a cause from outside) rather than unintentional. This is not because the changes in the latter category were not intentional – people often do intentionally make the sorts of life changes discussed here. The motivation behind those changes was something other than, or outside of, effecting a change in media consumption.

The following subsections contain discussion of circumstances that lead to exogenous changes in media habits for the subjects, as well as several techniques subjects described for making intentional changes in both food and media consumption.

3.5.2.1 Exogenous changes affect media consumption tastes and habits

Subjects reported that their consumption habits changed, often in unexpected ways, as a result of other changes in their life. These changes were not difficult to accomplish or sustain, regardless of whether or not they were seen as desirable.

Since 7 out of 10 of the subjects have young children, parenting was mentioned often:

> *"Having young kids - when they were little, I read less; now they are older, I'm back to reading more." — S8*

> *"As kids get older and are more independent I have more control over my time. When the kids are in school, I have more control over how I spend my time." — S6*

Other examples of life events that drive changes in media consumption were changes in education (entering and leaving college and graduate school), changes in employment, and changes in commuting methods and lengths.

People found that changes in the technology they used affects their consumption:

> *"I have more of a tendency to skim stuff when it's on the screen than I do when it's on a printed sheet of paper. It's a lot easier to get distracted online. I'm not sure why that is, why I get more focus when its printed. There's no hyperlinks, there's no stupid ad on the corner with dancing people. Even though I grew up with the old TRS-80s, computers have always been for fun, it's only recently that they've become workhorses and research tools. So I still tend to want something printed if I want information." —S4*

Adopting new technology changes media habits:

> *"Technology absolutely changes my information diet. When I got a computer at home; when I got a laptop; when I went from dialup to broadband; when I got an iPad – each time, it gets more and more connected, and easier and easier, and I use more and more sites." — S1*

All of these exogenously-driven changes in media consumption, whether from technology or life events, were accomplished without much conscious effort. People might have missed things they had to give up on, but they didn't have to struggle to give them up.

On the other hand, changes that people tried to make intentionally often were difficult to accomplish. In the next several sections, I review several approaches people use successfully to make changes in the realm of food, and see if we can apply them to the realm of media.

3.5.2.2 Intentional changes: using diaries and self-tracking

One subject reported using food diaries to record what she ate in order to identify whether health problems were being caused by food allergies. Diaries and other forms of consumption self-tracking are also used in many food diets, such as Weight Watchers.

But subjects said they didn't think they would be helpful for changing their media diets. One problem is that as soon as the desired behavior is not maintained, that's a motivation to stop tracking.

> *"There's a discipline switch - it can stay on for months at a time. Tracking can help. But as soon as I go off my goal, I stop tracking. I might record breakfast and lunch, and then record nothing for dinner- because dinner didn't follow the diet." — S1*

Another complaint with tracking consumption in order to make a change is that it requires paying attention to the negative behavior:

> *"When a habit feels destructive, negative, that's when I need to stop it or cut back on it. Doing a behavior diary is something that wouldn't work for me; that would feel like spending too much time on negative behavior." — S10*

Self-tracking is discussed further in Appendix D: Personal Informatics for Media Consumption.

3.5.2.3 Intentional changes: removal

Another successful tactic for making intentional consumption changes in the realm of food is to remove the temptation entirely, by not having it available for consumption at all:

> *"There's a saying that dieting starts in the grocery store: if you don't bring it home, then you don't eat it. " —S6*

This removal approach works for media, too:

> *"I'm really happy that I've broken a lot of habits, like needing to know what happens on a TV show. I lived without a TV for a while. My roommate moved out and took the TV with her, and I consciously chose not to replace it. I did it on purpose, and got a dog, to get up off my butt and stop eating potato chips. I wanted healthier habits. I knew I needed to be more physical and social. It's easier to sit at home and tell myself I didn't*

need to go anywhere. I've always gone cold turkey and gone to the opposite extreme - then I can let a little bit more back in." — S10

It should be noted that this example predated the ability to access television and movies over the Internet. One of the difficulties with the removal strategy is that in our connected world is that such a huge range of media is available to us anywhere, anytime, on any device. Employing the removal strategy either takes willpower ("I just won't go to that website") or giving up a wide range of capabilities – such as getting a feature phone instead of a smartphone.

Some people use dedicated ereader devices as a variation of the removal strategy: these devices are optimized for displaying text. Unlike tablet computers and smartphones, these ereaders cannot be used for video content, and they can only barely be used for web surfing and games.

3.5.2.4 Intentional changes: substitution

People sometimes use substitution to replace an undesired option with a designated substitute:

> *"I used to go to Daily Kos a lot but they made me too angry, and I don't need that in my life. So I took the time I used to do that and found other things: I read local news blogs about things that are happening in our neighborhood. I substituted happy local things for angst." —S3*

> *"My browser home page used to be MSNBC, and I used to get exposed to wrong type of information…So I changed my home page to NYTimes.com, and now there's not a problem." —S6*

Next, another common approach is described: manipulating visibility and accessibility.

3.5.2.5 Intentional changes: visibility and accessibility

In the realm of food, modifying visibility and ease of access is yet another tactic used to encourage consumption of desired choices:

> *"When the kids are playing in the yard, I just put out a big cooler full of water and I slice up a whole bunch of fruit and put it in there. And the kids just drink it all day long. Nobody comes and asks me for soda." — S5*

Yet another subject described reducing their soda consumption at work by keeping a container of water at their desk, making it more accessible than the soda available in the break room. Another subject encouraged their family to eat healthier by creating visible stashes of healthy food (e.g., a bowl of fruit on the kitchen table) while less healthy options were relegated to a closed cabinet. Figure 4 depicts a fruit bowl as a highly visible and accessible "stash" of food, compared to a refrigerator whose contents are hidden.

Figure 4. A fruit bowl placed on a kitchen table (left) has a high degree of visibility and accessibility. A refrigerator's contents are both invisible and inaccessible (center) until the door is opened (left). Pictures taken by the author recreating examples described by interview subjects.

One family removed the ability to receive broadcasts on their television; it can only be used to watch DVD's. The family can access Internet video, but only on the computer in the office, where the seating is not as comfortable as in the living room and the display is not as large.

People also reported using placement of media items in prominent locations to support their consumption. Nine out of the ten interview subjects mentioned keeping books they intended to read in specific locations such as on bookshelves in living rooms and offices. (Figure 5 shows two examples on bedside tables). These were referred to by names such as "to-be-read piles" and "to-be-read shelves." "Bathroom reading" is another example.

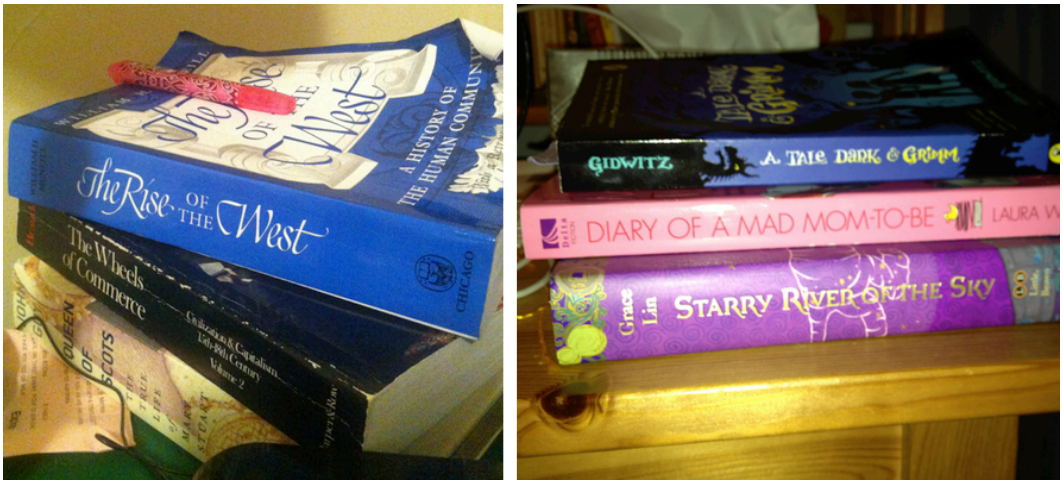

Figure 5. People frequently stash physical books they want to read in piles where they can be seen when not being read; at present, there's no way to do this with ebooks. Pictures provided to the author by research subjects.

Even a change in interior design can significantly change media consumption:

> *"I moved to a new home where the TV is visible from the kitchen; now I watch TV while cooking and eating, which I never did before." —S4*

Other stashes of physical items included DVD's from Netflix kept next to the TV, and magazines and catalogs stacked on a mail table.

In addition to the physical groupings, subjects also described having a wide variety of digital collections of items to be consumed later. These include ereaders, digital video recorders'

listing of shows, Netflix Instant Queues of streaming video, and Amazon.com wishlists. However, these digital stashes are not persistently visible, and this may be related to some of the problems people have with consumption of digital media.

I expand on these collections, or stashes, in Section 4.

3.6 Conclusion

Here are the key insights and findings from these interviews:

1. The most common desired change was more book reading. Reading is seen as a "healthier food" and people want to "eat better."

2. Ebooks are missing many qualities compared to their paper predecessors. This isn't a surprise… but it is interesting that so many subjects without prompting referred to the missing qualities. That's a clue that these things really matter to readers — at least *these* readers — and there's ample opportunity to keep addressing them.

3. People have less success changing their food diets with willpower alone than if they use any of a variety of strategies. Successful strategies include manipulating visibility, availability, substitution, and removal.

4. We found examples of some of these food diet change strategies already being used successfully to manage media consumption.

5. Stashing incorporates both visibility and availability strategies. Stashing is already used as part of people's book habits, but it could be improved.

While the generalizability of these findings is limited due to the research method and population, as discussed in Section 3.1, we can still build on them. I examine stashes in more detail in Section 4. Then in Section 5, I explore ways to help people achieve more reading by providing better stashes for ebooks.

4 Stashes & Stashing

After hearing how stashing plays a role in managing food consumption, and seeing that it already had some use in media, I suspected that stashing could be further leveraged to provide a way of helping people to better manage their media consumption.

People intentionally collect and store items for future consumption. I refer to this activity as *stashing* and the collections as *stashes*. Subjects provided several examples of using stashes to control food diets.

Subjects also described using numerous media stashes. Book stashes were most common, mentioned by nine out of ten. Some used different book stashes for different categories of books.

The conceptual boundary between digital sources and digital stashes in particular is ambiguous and difficult for users to navigate; some sources contain their own stashes (such as wishlists and libraries) and some of those have further organization available within them (multiple wishlists, shelves, playlists, etc.). Some stashes are separate from sources, or only loosely linked. For example, as pictured in Figure 6, some online stashes provide separate links a user can click on to search for an item at a variety of sources, but the stashes do not have deeper access to the source's data, for example to be able to look up prices from each source and display it directly. This is often a function of restrictions placed by the sources on the allowed uses of data from that source for business reasons.

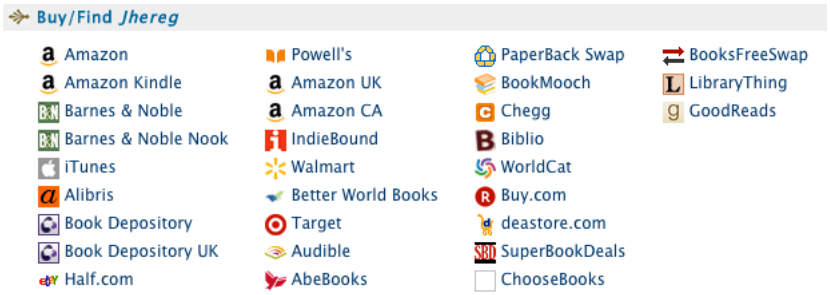

Figure 6. Some online book stashes, like FictFact.com (pictured here) provide links to several different possible sources, but the user has to follow each link to find whether the title is actually available.

Another example of deep access to other sources which is lacking in many stashes is showing the actual availability of a title in various libraries from a separate stash. Instead the user must follow each link and check each source independently. A comparison of the functionality of various book reading tools and stashes is provided in Appendix C: Features & Gaps of Existing Reading tools.

In order to understand stashing better so that I could gain insight into applying it effectively, in Section 4.1 I describe additional background research on decision-making to gain insights into how using stashes might influence decisions. In Section 4.2 I develop and describe a model to understand how stashing activities fit into the larger picture of media consumption activities in general.

4.1 Background

In Section 2.1 I first discussed the decade-old Positive Psychology movement and its focus on human flourishing and happiness. But that was not the first time that happiness and satisfaction have been studied. There is a rich history of studying happiness in the context of decision-making: how do we make choices that satisfy us? And why can't people explain the reasons for their choices?

4.1.1 Two system thinking: now me vs. future me

> *"I'll look for something that appeals to me before I look for something that I 'should' read... Books I should read are things that have real depth, that I'm glad that I read it when I'm done, because it makes me think for days. Although right after I finish reading it, it's not always so nice." — S10*

Several researchers examining our decision making habits have proposed variations on the idea that we seem to treat our future or past selves as if they are different individuals, whose experiences we value differently, not the same person at two different points in time. This section reviews two examples.

This discontinuity of identity between the choosing self and the evaluating self helps to explain why we make decisions that we may not be happy with in the long run. Imagine having a choice between watching an entertaining but shallow blockbuster movie starring a favorite actor, or reading a well-reviewed book on a subject you are interested in. Perhaps you will be happier in the long run if you read the book. But those benefits will go to a "future you." On the other hand, watching the movie will be more entertaining to "present you."

Of course, we don't literally think that our future and past selves are really different people. But this weighting towards the present and discounting of the future helps explain some of our decision making processes.

One example of research that exposes the difficulty of valuing one's future self are the "Oreo experiments" (Mischel & Ebbesen, 1970). In these studies, young children were presented with a choice: get a small treat immediately, or resist eating the treat for 15 minutes in order to get a larger, better treat. These experiments suggested that the children were making tradeoffs between what they would experience in the present, and in the future. The "now me" would have to put off something pleasant, but "future me" would receive a greater benefit. All the children understood on an intellectual level that the reward would be better in the future. The children who were better able to hold off and collect the bigger payoff later employed various strategies to guard against the desire of "now me" to receive the treat immediately. The most successful strategies were those which reduced the unpleasantness experienced by "now me," such as distracting themselves from the treat with another activity, or even going to sleep. "Brute force willpower" strategies which focused on explicitly resisting the temptation of the immediate treat were less effective. So even the children who successfully got the better benefit for their future selves had to do so by distracting their present selves.

Kahneman (2011) notes a related, but different, time-based difference in our conception of our self that affects our decision-making, with the arrow of time pointing into the past, from the *remembering self's* memory of an experience, back to the experience itself (Figure 7). The *experiencing self* who actually had that experience only exists in the present, but the

remembering self is who reflects on it and makes meaning of it, including deciding whether or not it was a good experience.

Kahneman presents evidence that people end up valuing their memory of an experience more than the experience itself. In one experiment, people were asked how much they would pay for a wonderful vacation, if at the end of the vacation they were given a magic potion that left them with no memories of it. Flipping the "no memory" scenario from a positive experience to a negative one, people were also asked how they would feel about undergoing an extremely painful dental procedure without anesthesia, if they would have no memory of it afterwards. In both cases, the subjects decided that the remembering self trumped the experiencing self: if they wouldn't remember it, then there was no benefit to having a positive experience, and no reason to avoid a negative experience.

In other experiments, Kahneman showed the same effect pertains even when moving from somewhat unrealistic thought experiments to real scenarios such as colonoscopies or keeping their hands in ice water for several minutes. By exploiting memory effects such as the peak-end rule (which says the quality of the peak and end of an experience determine the judgment of the entire experience's quality), he found that people who went through two versions of an unpleasant experience and are asked which they would prefer to repeat, will prefer experiences they *remembered* as better, even though they were objectively worse to *experience* and were reported as such in the moment.

Comparing these two disjoints in identity in time and the relation to decision-making and satisfaction (Figure 7), we can see the difficulty:

- The decision about what to do is made by "now me" on behalf of "future me," but "now me" has a hard time valuing "future me's" experience over its own experience.
- Our ultimate satisfaction depends on how well that future me reflects back on the experience once it is over and future me becomes the remembering self. It's largely irrelevant what now me – the experiencing self – thought of the experience at the time.

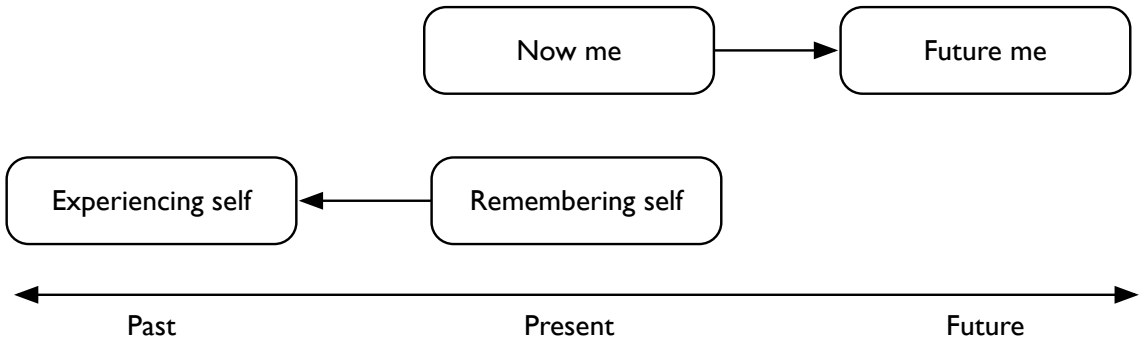

Figure 7. "Now me" has a hard time considering "future me" when *making* decisions (Mischel & Ebbesen, 1970). But it is the "remembering self's" opinion when looking back on experiences that counts most in *evaluating* decisions and answering questions like "overall, how happy are you with your life?" (Kahneman, 2011).

Now, Kahneman is not arguing that our experience in the moment is unimportant. In fact, he points out how odd it is that we spend only a small fraction of our time thinking back on memories, compared to the duration of the experiences that formed those memories, yet it is our memories which we turn to in order to assess our overall happiness.

Instead, he is pointing out that these two selves have very different ways of evaluating happiness, and while we spend most of our conscious time as the experiencing self, it is the remembering self we call upon when making decisions and reflecting. One conclusion is that we need to be careful to consider which self is talking when we are interpreting people's reports of happiness and satisfaction.

This helps to explain why many of our decisions are made in a way that we cannot articulate. Even better, researchers have found insights into the mechanisms that affect our decision-making. The next 3 subsections will examine several of them which may be applicable to media consumption.

4.1.2 Satisficing

The "expected utility theory" of classic economics posited people make decisions rationally, by considering all options and selecting the one that will give the optimal outcome. But Simon (1956) observed that we often use a strategy of *satisficing*[1] (quickly choosing something good enough), instead of *optimizing* (evaluating all possible choices to find the best one).

Klein (1998) studied how people make decisions about actions in a variety of circumstances, especially what he called "naturalistic decision making." This was in contrast to some of the highly artificial decision scenarios that many previous studies had conducted, which he criticized as forcing people into making rational comparisons based on a limited amount of data presented as a collection of explicit facts. He was concerned that the decision process used in these scenarios was qualitatively different from how we make decisions in situations where information is implicit, incomplete, and ambiguous, goals are unclear, and there is no obvious process that should be followed. Klein also found support for the satisficing strategy, where people quickly selected a possible answer, tested it briefly – for example, by imagining proceeding with it, and perhaps comparing against the imagined outcome of one other option — and then proceeded.

Schwartz (2004) found that people tend to be happier with the outcomes of satisficed decisions. This is because optimized decisions require more effort. So the results from decisions where an optimization strategy was used need to be better in order to justify the additional effort, compared to a satisficing strategy – and they usually are not, because our satisficing decision-making is usually quite accurate. So we can see one way that stashing can increase our satisfaction: by reducing decision-making effort.

4.1.3 Availability & priming

If people only consider a few options when making most decisions, why are some options considered before others? To answer this, I examine two related cognitive mechanisms: availability and priming.

Tversky and Kahneman (Kahneman, Slovic, & Tversky, 1982; Tversky & Kahneman, 1974) proposed the *availability heuristic* to explain how people make certain kinds of decisions. In short, information that is relatively easy to recall is more likely to be recalled. Encountering that information more frequently increases its availability. So when we can think of something more easily, we think its probability of occurring is higher. Similarly, if we are

[1] The word *satisfice* is a combination of the words "satisfy" and "suffice."

asked to choose an option, we are more likely to choose the one that comes to mind more easily; the ease of recall is interpreted as making the option more appealing.

This is closely related to the mechanism of *priming*: making certain options more available for consideration through visibility or other forms of awareness (Soon, Brass, Heinze, & Haynes, 2008). This suggests that stashes influence our consumption not just through ease of access, but also by making the options more available to us through priming.

4.1.4 The path of least resistance

Thaler & Sunstein (2008) suggest adopting a *choice architecture* — a strategy of framing decisions so that it is easier to select the outcome that will be better for us in the long run. They suggest this is an effective way to address the tendency we have to make choices based on present desires rather than future outcomes. One example is in leveraging the tendency we have to accept default options. Making desirable behavior (e.g., making contributions to a retirement plan through a paycheck deduction) the default choice, and requiring an explicit action to opt-out, is a successful strategy at improving outcomes. This approach was also demonstrated to be effective in supporting healthier meal choices. (Other examples of using choice architecture are provided by the persuasive technology strategies of tunneling and reducing, see Appendix B: Persuasive Technology Strategies.)

4.2 A model of stashing

Given the importance of stashing to our subjects, I derived a model of stashing behavior in order to better understand where tools could better support healthy media consumption (Figure 8). This model incorporates many insights about gaps in tool support related to media consumption.

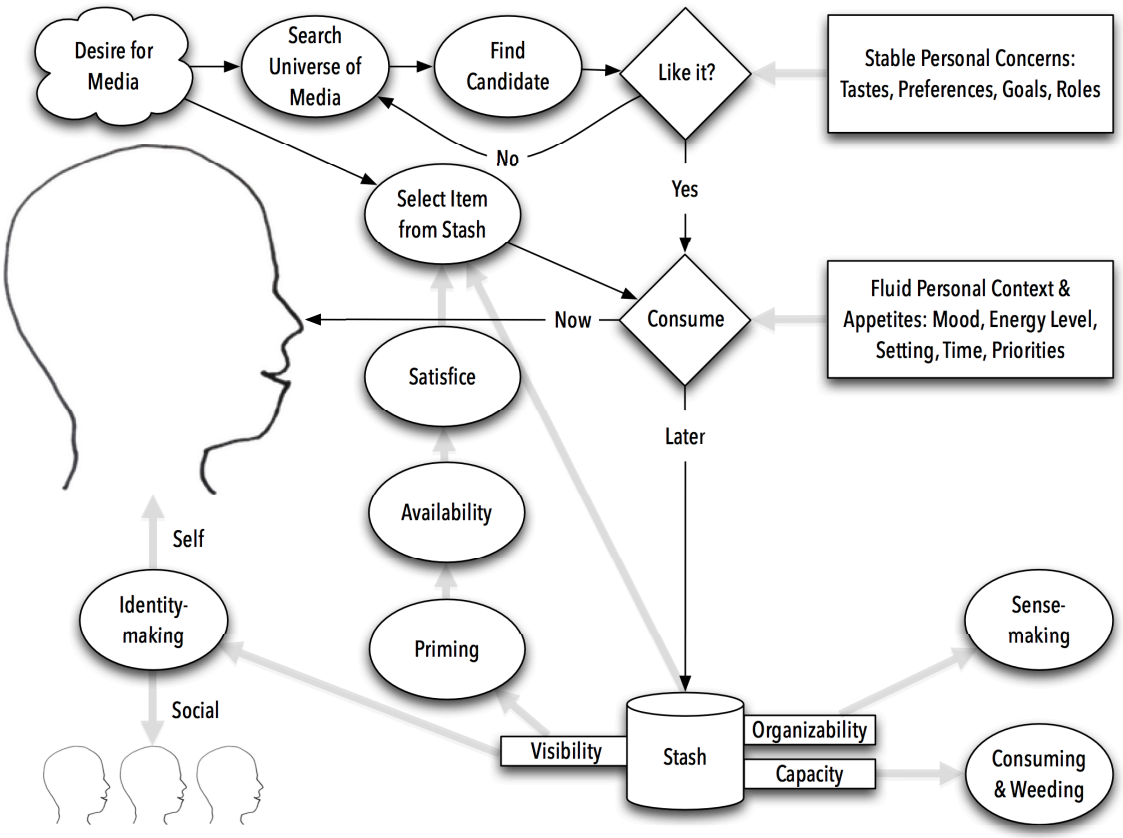

Figure 8. Along with changing contextual factors and stable personal concerns, the visibility of our stashes influences our media consumption. In this diagram, the thin black lines indicate activity flow; wide grey lines indicate influences. Various qualities are indicated by the labels hanging off the stash; each quality supports one or more additional function performed by stashes.

One entry point in our model is when people form an intention to consume media. At this point, they have a choice to either search for media in one of their stashes, or search the universe of media. While searching, they may find something and consume it, add more items to one of their stashes, or stop looking. This is a choice between finding something that the "now me" wants to consume versus stashing something for a "future me." In addition, a person may spend some time making sense of their stashes, organizing them and weeding items that no longer are wanted, and so on.

Another entry point is prompted by simply paying some amount of attention to the stash. This might lead to nothing more than low-level priming through awareness, but sometimes people pay deeper attention to their stashes and become engaged in activities such as organizing, sense-making, and weeding (removing books, for example because they no longer seem appealing, or are overdue library books).

In the following sections I examine how stashes are related to several topics discussed previously: context, priming, and identity claims. I also refer back to several media problems identified in Section 3, and show how stashing is relevant to them.

4.2.1 Context

The process of choosing what media to consume is highly influenced by context, as shown in Figure 8:

1. Fluid personal context, such as appetite, mood, setting, and time of day. These change frequently.
2. Stable personal concerns such as long-term goals, roles, personality, and tastes. These change infrequently.
3. Pre-existing stashes of media.

Note that the personal concerns and context are largely invisible to most stashing systems. What would it mean to a stashing system if it could know your mood, who is with you, and so on? Clearly, knowing more about these types of context would help provide more refined choices. Some different types of filtering which may be helpful to meet various appetites is expanded on in Table 6. This is an area for future research.

Missing capability	**Discussion**
Filtering for context	Several different kinds of context affect what choices are relevant: - time (of day, day of week, season) - social – who is present - mood
Filtering for experience	Sometimes people are looking for a type of experience, not a particular type of media. A desire to laugh might be met equally well by the right funny video game, standup comedy show, cartoon, or movie.
Filtering for category or genre	Sometimes people are looking for a specific category of item, such as a new science fiction book to read.

Table 6. There are different ways that stashes could be filtered to dynamically weed out choices not applicable to the media user's current context.

One opportunity that is largely missing from the current stashing systems for digital media is the ability to cross-link stashes in order to get a more coherent way to manage and search the aggregate set of stashes, instead of being forced to do this within each stash individually. This is another area for future research.

4.2.2 Priming

Stashes "prime" our consumption choices. A person stashes items that they believe will satisfy their desire to consume in the future. It appears that the more visible a stash is, the more that stash primes a person's choice of what to consume; interview subjects said that using visibility to moderate consumption is effective. As shown in Figure 8, the visibility leads to priming, which increases the availability of the primed items to being recalled. Following the availability heuristic, these more-easily recalled items are selected more often. And following what has been learned about satisficing, people's satisfaction with decisions that required less effort is higher, because the pleasure of the outcome needs to pay off less decision effort in order to turn a figurative profit.

4.2.3 Identity claims

We do more with our stashes than add items to them and seek items to consume from them. We also use them to make identity claims – telling the story of who we are and who we want to be, to ourselves as much as to others (MacAdams, 1997). And when we encounter others' media collections, we are drawn to "snoop" because of the rich insights such examination provides (Gosling, 2008). Once again, it appears that the ability of stashes to communicate identity to ourselves and to others depends on visibility.

4.2.4 Capacity and Weeding

People are able to identify many things they want to consume in the future, but they have trouble actually getting around to consuming them:

> *"I used to have a list of movies I want to see. And I never got to any of them." — S6*

> *"I might have a list going of books I want to read, but then getting to a bookstore or a library becomes a challenge and I end up not getting a book. But if I have an ongoing list in my head or written down, then I just pick up the phone and I have it! It's done! Boom! The problem is more sorting through [the list of books I want to read] and figuring out what I want to read [now], than accessing them." — S8*

Our stashes fill with things we aren't consuming. We might overestimate the appetite of "future me" for consuming those items. We might overestimate the frequency of a particular "future me" context. (We may love watching documentaries, so we stash many documentaries we'd like to watch, but if the only time we have available for watching them is late at night when we are tired, and documentaries make us fall asleep in that context, then we won't make much progress in viewing them.) This results in:

- Identity conflict between presented media and self-image: I say I like to consume these things, but I am not consuming them.
- Difficulty finding the items in a stash for a given context among all the items that don't fit.
- Discouragement. Several subjects said that when their book stashes are full of the wrong things, it discourages all reading. They think, "I shouldn't get any more books, I have too many waiting for me to read" even though the books filling the stash are not ones that fit their current contextual appetites. The result is that they decrease their reading, tending to consume other types of media instead of reading what they might want to read.

This problem of full stashes has generated a neologism. Tsundoku is a Japanese slang word defined as the accumulation of purchased books which haven't yet been (and might not ever be) read. According to the Wiktionary entry (2013) this word is a pun based on the words tsundeoku (to leave piled up) and doku (to read). In both Japan and the US, people report having negative feelings such as guilt, embarrassment or shame about these piles of unread books that grow little by little.

Subjects discussed the physical presence of books as an important trigger to weed their collections (see also Section 5.1.3):

> *"I had a pile of physical books - and it got to the point of 'Ok, this is ridiculous, I've got to get rid of some stuff.' I'll get rid of things if I already read them or if I'm not going to*

read them. And I got rid of a whole bunch of stuff where it was just sort of like, ok: look at the back of the book - are you really *going to read it?" — S9*

"We need a bookshelf. They're taking over every work surface in the house and we have to do something about that." — S10

"I'm feeling overwhelmed by stuff —not just books, all the kids toys, etc. That drives use of the library, because the books don't stay in the house." —S6

Given the virtually unlimited capacity of digital stashes and the plethora of disconnected stashes, some of these issues are more problematic for digital stashes than physical stashes, but they can affect all sorts of stashes.

Removing an item from a stash is usually not available from digital stashes primary interface views; typically, one must go down into a separate item record to remove it from the stash. Promoting the interface for removing items to put it closer to parity with consumption choices – for example, putting a "remove" command at the same level as "play" – might increase consumption from the stash overall by reducing the effort needed to de-clutter the stash.

By listening to the interview subjects' discussions of media habits and hassles, and considering how stashing could play a role in addressing them, I identified numerous gaps in existing media stashing capabilities. A stash which provided these capabilities could be an effective tool for managing media consumption in a way that people find valuable because it helps solve their unmet needs.

Missing capability	**Discussion**
Weeding is harder than consuming	Removing an item from a stash is usually not available from main stash views. Promoting the interface for removing items to put it closer to parity with consumption choices might increase consumption from the stash overall by de-cluttering the stash, as library research has shown.
Prompt to weed items	With food, there are various cues that items may be candidates for weeding, such as visual appearance, smell, physical position (pushed to the back of the cupboard or refrigerator) or expiration date printed on the package. These affordances are not available with digital media.
Limited capacity of stashes	When stashes are at capacity, even if filled with items that do not meet current appetites, it can discourage acquiring more books. "I can't buy any more books right now, I have too many unread books waiting for me."

Table 7. Stashes for digital items are lacking in several qualities that support weeding. Because a well-weeded collection gets more consumption than one with too many irrelevant choices, this could make digital stashes less effective in promoting consumption of stashed items.

4.3 Conclusion

I started by identifying the use of stashing in the source domain of food. I probed further into how stashes are used for food, including identifying strategies, needs, values, and affordances. Then, I looked for parallels relevant to stashes missing in the target domain of media. In the next section, I begin designing a stashing solution.

5 Design Research: Digital To-Be-Read Pile Prototyping

The previous sections have enumerated rich information about the target domain and identified several potential areas of investigation. In this section, I investigate one specific area: a stash for ebooks — a digital To-Be-Read pile (TBR) — to encourage reading.

The key research question I address here is:

- What if our unread ebooks had a more visible presence, like a bowl of fruit on a kitchen table, or a stack of books on our bedside table? How might such an ambient display of ebooks in a to-be-read stash change how we manage our information diets?

Subsidiary research questions include:

- How should an ebook TBR make its contents visible?
- How will people want to populate the TBR with books?
- How can we connect multiple existing ebook stashes into a single TBR?
- Could a TBR work to give books a place in media centers, alongside the other types of media already present there?

I selected ebooks based on information from the interviews. Among the interview subjects, books were the most popular form of media. Reading more books was also the desired change most frequently mentioned by subjects.

Media centers provide a portal to a vast world of many types of entertainment, from television and movies to music, videogames, and social networks – but there is no place for books on media centers.

Books are now faced with competition for our attention from new forms of media that are more compelling and attractive for the hedonistic pleasures of "now me" to select, yet do not provide the long term satisfaction ('nutritional value' or eudaimonic happiness) that reading books does, so the "remembering self" is not satisfied – and because it is that remembering self who reflects on our media consumption and determines our overall happiness, we are unhappy about it.

Stashing as a mechanism was interesting to pursue for several reasons. In the realm of food, visibility of stashes is successfully used by some interview subjects to encourage or reduce consumption. Book stashes were also mentioned by several subjects as a major part of their approach to media consumption. These book stashes — to-be-read piles and shelves — make choosing something to read easier by separating the wild world of infinite choice from the moment of choosing something to read.

Priming, availability, and satisficing are well-known mechanisms of our decision-making processes which may explain why stashing works; but they depend on visibility of stashed items. Yet the digital stashes for ebooks are only visible when you access them, like the food behind a refrigerator's closed door.

People aren't as successful at changes when they rely on willpower alone to make an intentional change. But changes do happen frequently without effort in response to changes in the environment. The choice architecture approach suggests making the desired behavior easier to select. In the next section I will review various technology approaches that may be able to function in this way for ebooks.

5.1 Background

Before designing a TBR stash, I investigated several areas of literature. In order to understand what strategies were available that could encourage reading in the context of a to-be-read stash, I investigated persuasive technologies.

Stashes influence consumption choices primarily by being present in the environment, rather than through interaction. I looked at similar uses of technology, under the various labels of slow, calm, ambient, and environmental technology.

To inform the design of the TBR display, I sought information on how libraries and bookstores encourage selection of certain books. And to build on what has already been created instead of starting from scratch, I examined existing software tools people use to support their book consumption.

5.1.1 Persuasive technology

Persuasive technologies are defined by Fogg (2002) in his book of the same name as "any interactive computing system designed to change people's attitudes or behavior" (p1).

I learned in the interviews that people were interested in reading more. People said they enjoyed reading books and found it rewarding, but they just didn't tend to pick up books when the time came to choose what to do. They also said that their primary problem with this was not identifying books they would like to read, but making the decision to actually pick up such a book. So I went looking for persuasive technology strategies that could influence those sorts of decisions, based on what I had already learned about people's decision making processes (see Section 4.1).

Researchers are identifying a wide variety of strategies that can be applied in creating persuasive technology solutions (Consolvo et al., 2008; Fogg, Cuellar, & Danielson, 2003; Klasnja, Consolvo, & Pratt, 2011; Sander, 2009).

I selected several strategies as being most applicable to the problems of encouraging reading of ebooks, based on what people said about their challenges. These strategies are compatible with an approach of using ambient technology (more on ambient and related technologies in Section 5.1.2). I intentionally selected strategies which echo the existing uses of to-be-read stashes for physical books described in interviews.

Table 8 explains the selected strategies and how they are applied in the design of the TBR prototypes. Because an iterative design process was used (see discussion of method in Section 5.2) the relevance of some of these strategies and some of the specific design applications were not uncovered until after receiving feedback from subjects who tried the prototypes. A full listing of these strategies is Appendix B: Persuasive Technology Strategies.

Strategy	Explanation	Application in TBR design
Priming (Klasnja et al., 2011)	Activating an item to make it more available for selection. This is done by bringing it into awareness, even if only subconsciously. (Priming's psychological mechanism is discussed in Section 4.1)	By giving previously invisible ebooks ongoing visibility to the user, those items are activated in the user's mind for later selection.
Tailoring (Fogg et al., 2003)	Personalizing the solution to make it specific and relevant to the individual, instead of generic.	The TBR is personalized for the user with their own already-acquired but not yet read ebooks.
Intrinsic motivation (Klasnja et al., 2011)	Reminding people about the aspects of the desired behavior that they themselves find appealing; also, make using the solution appealing in itself.	Users of this solution will be people who already want to read more. If this wasn't the case, simply priming book choices would only result in their consideration, not their selection.
Aesthetic (Consolvo, McDonald, & Landay, 2009)	If the solution is to be adopted for the long term, it needs to be appealing and congruent with the user's sense of style. For example, some studies of fitness devices found users rejected use of unattractive devices because they didn't like how wearing them reflected on their appearance and self-image.	Many readers (and even some non-readers) like to display books in their living spaces, partially because they find the appearance attractive.
Unobtrusive (Consolvo et al., 2009)	While collecting or presenting data, solutions should fit into the user's everyday life without interrupting or unduly calling attention.	The TBR display should fit into people's living spaces as well as their current stashes of paper books.
Controllable (Consolvo et al., 2009)	Let users control and edit the data so that it reflects what they think is appropriate. Control also includes restricting and allowing access to the data.	Weeding support will allow people to remove items. Filtering support could enable people to hide certain items except when they choose to show them. Any sharing via social networks would need to be under the control of the user in what was shared and with whom.

Table 8. Various persuasive technology strategies are incorporated in the design of the TBR prototypes to encourage desired reading while addressing people's needs and values.

These strategies informed the design as well as the feedback sessions. Specific features and qualities were included in the designs to attempt to implement these strategies. And because the underlying strategies were explicitly considered, I was able to ask users not just "what do you think of that" but whether it actually delivers on the intended strategy. This helped focus the feedback and make it more actionable in future design iterations.

5.1.2 Ambient computing

Stashes influence consumption choices primarily by being present in the environment, rather than through interaction. I looked at similar uses of technology, under the various labels of slow, calm, ambient, and environmental technology.

In contrast to the typical interactive technology used by most applications that run on PC's and smartphones, researchers are also investigating a different approach to technology that functions in the background, providing information as part of the surroundings. This approach will be adopted for the TBR.

This approach, which is called *calm technology* by Weiser and Brown of Xerox PARC (1996), is distinguished by how we engage with and pay attention to it. Weiser and Brown were inspired in this neologism in trying to make sense of an artist's creation, a "Dangling String," which moves in response to traffic flowing on a local area network. Interactive technology, such as a word processing application or a videogame, needs to be at the center of our attention to function. Calm technology works by moving between the periphery of our attention and the center of it. By providing value ("encalming and informing") even from the periphery, the authors claim that calm technology empowers users without overwhelming them.

Similarly, Sengers (2011) reflected upon a sabbatical to an isolated island community and realized the benefits of being informed through environmental cues and tacit social knowledge which permeate awareness at a low level, such as taking the first frost of the season as the cue to go picking partridgeberries. She found a striking contrast to the use of typical interactive productivity tools which actively demand their users to pay attention to their prompts, and which often leave their users feeling busy and unfulfilled (Leshed & Sengers, 2011). Leshed (2012) followed up this research by designing a prototype mobile application "that offers serendipitous moments of downtime, pause, and introspective reflection." In doing so she:

> *"…faced a paradoxical challenge: to offer ways to mitigate stress and slow down with the very technology that is accused of being a source of stress: the smartphone. We therefore followed the principle of minimal design, acknowledging that not every activity be formally represented and that slowness and reflection can happen outside of the system without leaving digital traces. This may restore the user's control of when and how they should cut back and slow down, without being coerced or feeling bad about not using the application."*

The idea that a calm technology does not have to encompass and represent every aspect of the entire activity is a key one here. It contrasts with, for example, the approach used in self-tracking (see Appendix D) and food diaries (Section 3.5.2.2), providing a possible answer to the problem those approaches face when the user's behavior diverges from what will achieve their goals. I use this minimalist-inspired approach in TBR prototyping.

Inspired by the slow food movement (discussed in Section 2.4) others subsequently used the label of *slow technology* (Hallnas & Redstrom, 2001) to describe this calm approach, making information available in subtle ways in the periphery of awareness. But slow technology's design, at least as characterized by Hallnas and Redstrom, includes intentionally making it somewhat cryptic, so that it takes time to understand the meaning and operation of the system.

Others have used the terms *ambient computing* (Hap & Midden, 2010; Jafarinaimi, 2005; Kim, Hong, & Magerko, 2010) and *ambient media* or *informative art* (Holmquist, Skog, Göteborg, & Art, 2003) to emphasize the computer-driven display of information outside of traditional personal computing environments (i.e. desktop and handheld), without necessarily including an obfuscated design that requires extended time to comprehend.

For example, Breakaway (Jafarinaimi, 2005) is an ambient computing device intended to remind a desk-bound worker to take a break to get up and stretch. Breakaway receives input data from a sensor in the worker's chair to detect how long they have been sitting without a break. To communicate with the user, its output mechanism is an animated abstract sculpture which represents a person. As Breakaway detects that the person has been sitting longer and longer without taking a break, it slumps over further and further. In a trial, Breakaway was compared to using a traditional calendar program to display reminders. Breakaway was more effective in triggering stretching, and caused less stress and disruption because its alert mechanism did not interfere with other work being done on the computer, unlike the calendar reminders.

Therefore, one TBR design goal is to create an ambient display that conveys the needed information in a way sufficient to affect behavior without being distracting.

5.1.3 Encouraging book selection in libraries and bookstores

Interview subjects mentioned reading books as an activity they especially wanted to increase. To find ways to support this desire, I examined how libraries and bookstores encourage people to read more books.

Creating a display of books with their front covers visible is a well-established technique in bookstores and libraries, as pictured in Figure 9. Doing so takes much more shelf space than shelving books spine-out. But the tradeoff is worthwhile; books which are displayed this way are borrowed and purchased at higher rates so circulation increases overall (Goldhor, 1981). Even among books all oriented the same way, those which are closer to eye level and in more visible locations are purchased at much higher levels (Underhill, 1999).

Figure 9. Librarians display books face out to encourage readers to check them out. Picture taken by the author at the Seattle Public Library's Greenwood branch.

This approach of making books visible, especially by giving a clear view of their faces, does encourage people to borrow them from a library or buy them from a store. I explore whether this approach can also be applied in readers' personal spaces in order to encourage them to actually read the books they acquire.

Another aspect of this sort of display is the reduced number of options to choose among. Senger (2011) mentioned the freeing effects of living in an isolated environment where there were very few choices available. This echoes a study (Iyengar & Lepper, 2000) which compared what happened when people were asked to choose among 6 varieties of jam, vs. what happened when they had 24 varieties to choose from. Their results showed that having too many options can actually lead to "choice overload" and lead people to not make a selection at all, or be less satisfied with their selection. This study has been widely cited as demonstrating "the paradox of choice." It should be noted that a meta-analysis covering fifty experiments on choice overload did not find overall empirical support for the phenomenon, though many of the individual studies included did replicate the findings (Scheibehenne, Greifeneder, & Todd, 2010).

Nonetheless, as Senger reported in her personal experience, having to choose from a huge range of options is certainly a hassle faced by modern consumers, and as the research literature on *satisficing* demonstrates (Section 4.1.2) reducing the options considered in reaching a decision can often lead to higher satisfaction.

Librarians address this problem in their collections through a practice they call *weeding*. Like its botanical analog, weeding removes books from the collection. Slote (1997) performed numerous studies of library patron behavior before and after collections were reduced through use of various techniques to identify books people are not using: "In all our research, weeding by the suggested methods resulted in an increase in circulation. Fewer, selected volumes seemed to encourage more use" (p19).

Even though fewer books were available overall, more books were borrowed. Slote suggests this is because it is easier for library patrons to find and choose books when the undesired

books are not getting in their way. A retired librarian who reviewed a draft of this thesis agreed, commenting: "When you have a collection with a lot of low-quality books, people looking at the books say 'no, no, no, no, no,' and once they get in that pattern it is harder to say 'yes' to something they might like. But after you get rid of the bad books, they will say 'yes, no, maybe, yes, yes.'" (Deborah Becker, personal communication, May 7, 2013.)

In this design research, I explore how these key concepts relate to using a TBR to encourage e-book reading. In what ways could a TBR help people find satisfactory books with less effort? What sort of weeding support will users need in a TBR?

5.1.4 Existing reading support solutions

Before beginning design of a new tool, it is useful to examine existing solutions. There are several reasons for this. A good solution may already exist for the exact problem you are trying to solve. Existing tools may provide partial solutions which can be leveraged and tested. Studying these tools can provide an understanding of existing design patterns for the space which users may be able to more readily adopt. Finally, looking at the features already available can help to clarify exactly what needs to be accomplished, and what is unique about the problem you are trying to solve that hasn't been solved already.

In the case of books, there are many existing reading support tools. These tools have many capabilities to assist with various problems. I selected a subset of tools using an informal methodology, choosing from among those mentioned in the interviews and those frequently mentioned in online reading communities and by book bloggers. A list of the tools and a comparison of their feature sets is in Appendix C: Features & Gaps of Existing Reading tools.

The survey of tools combined with the interview results showed that the following problems are not well supported by existing reading tools. If a TBR can address the following unmet needs, it could be compelling and useful for readers:

- People who want to read a specific book are often willing to make decisions about tradeoffs for convenience vs. cost to fit their current priorities and desires, but gathering the information about possible options from several sources takes too much time and effort.[2]

- People have several places where they collect to-be-read ebooks; checking them all takes too much effort so people may not realize a book is available that they would like to read. People also can have a hard time remembering which stash contains a specific book they want to read. People sometimes even forget about digital stashes entirely.

- Digital stashes become overrun with undesired options. Unlike physical stashes they have no inherent capacity limits which force people to weed them.

- People purchase ebooks, then forget about them and don't read them; or they start reading them and then don't finish them.

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[2] Phix the Bookfinder is a Windows Phone application I developed with Dave Sanger in Kelvin Sung's CSS590 Mobile App Development class to help address the problem of needing to perform multiple searches at multiple sources to find a desired book. Phix allows a user to search once for a given book; in response, it displays both availability at local libraries and the price of the book at multiple online booksellers. A demo video is available on YouTube at http://www.youtube.com/watch?v=tJ5j5MKUEwY or search for "phix bookfinder." Unfortunately, Phix could not be released for public use because API limits would have been quickly reached once more than a few hundred people started using the application.

- People's digital media is not visibly present and so cannot provide identity claims to visitors — or to themselves.

5.2 Method

I used a *design-based research* approach to explore the design space of the identified problems and answer the questions raised in the background research.

Obrenović (2011) describes how design-based research helps deepen understanding through the process of attempting to design solutions. He positions it in relationship to other research methods including theoretical analysis, controlled experiments, and ethnographic inquiry:

> *Design-based research, however, can produce knowledge that normally could not be generated by isolated analysis or traditional empirical approaches, and therefore complements existing empirical and theoretical research methods. Design-based research facilitates disciplined, systematic inquiry into a real-world context while simultaneously doing justice to its complexity. It is conducted in messy, but entirely realistic, situations and while it produces claims with less certainty and replicability than other research methods, it can extend our area of inquiry beyond the scope of these methods.*

Human-centered design practice prioritizes getting feedback from real users as rapidly as possible while limiting investment. I was particularly interested in exploring presentation of the digital TBR. Early personal work with prototypes had already demonstrated that there would be issues and benefits that were not apparent until I actually had a glowing digital display to place in front of users, so approaches that did not involve working technology, such as paper prototyping, were not appropriate.

The goal was to get a minimum set of functionality that could be shown to users in order to get their feedback. Accordingly, development focused on what was needed in order to support feedback sessions where the researcher could be present to help guide the user or set up the application for them. Other considerations which would be necessary for a production deployment, such as error-handling, support for a wide range of sources, and security, were not important for this use.

5.2.1 Interactive Design Research Sessions

I brought back 4 of the interview subjects, and also 2 new subjects (male spouses of interview participants) for half a dozen design research sessions. Some sessions included multiple subjects, and some were individual. All participants used to-be-read stashes for physical books. All participants have some experience with ebooks, though ebook adoption rates varied widely, from reading a majority of books as ebooks, to only having read a few ebooks in total.

These design research sessions were carried out in either the researcher's or the subjects' residences. Subjects were asked think about how they would expect a TBR for ebooks to work, what concerns they might have about them, things they would want to be able to do with them, and what sorts of physical characteristics they would expect it to have.

Each feedback session resulted in iterative design to incorporate insights and findings into prototypes which would be used in subsequent sessions.

Insights from these interactive sessions are covered in Section 5.4.

Using short, conversational prototyping sessions to explore a technology that is intended to work over time raises validity concerns. Also, the subjects are not be able to provide feedback on what actually living with the device is like. This limitation is at least partially addressed by the other research method, described in the next section.

5.2.2 Personal Long-Term Design Research

As Hallnas and Redstrom (2001) state, slow technologies function by being experienced and reflected upon over long periods of time. Obviously, short feedback sessions could not provide this. Following the example of Odom et al. (2012) I lived with the various prototype systems in my own environment over time, and reflected upon my own experiences. They found that this process was very important for identifying, understanding, and addressing many practical implementation and design problems in slow technology that only surface when the solution is used in place over time.

Insights from my personal experience are covered in Section 5.5. As with the interactive design research sessions, findings and insights were incorporated into the prototypes on an ongoing basis.

Validity challenges are caused by having the experimenter as the subject; this is obviously a potential source of bias in terms of the generalizability of the conclusions, especially regarding efficacy. I am certainly not a neutral observer evaluating the value and effectiveness of this solution. At least the more concrete design insights related to physical and perceptual attributes are less likely to be subject to my personal biases.

5.2.3 Tracking and iterating on feedback

A backlog of features and functionality was maintained on an online kanban board (shown in Figure 10). Both the prioritization and the features were adjusted continuously based on what was learned through both research methods.

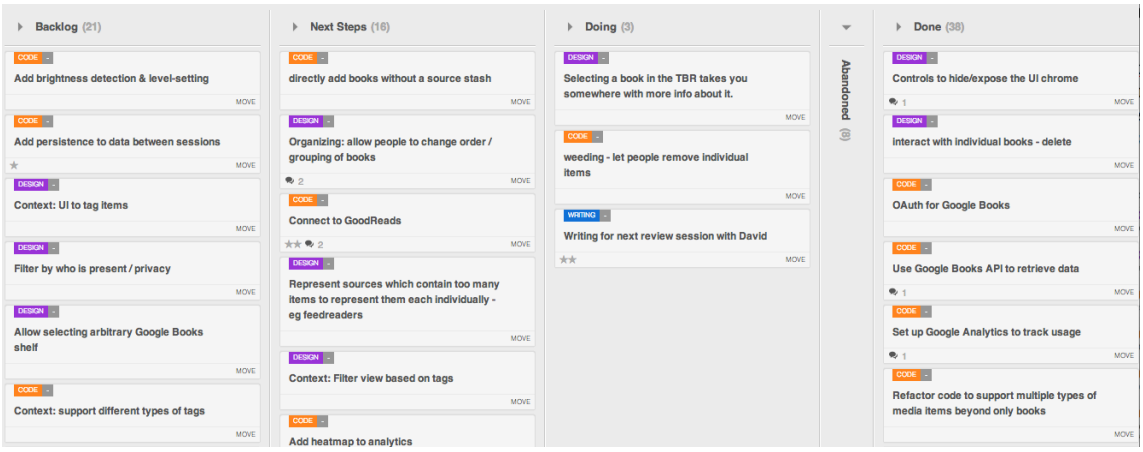


Figure 10. An online kanban board (http://kanbanery.com) was used to record and prioritize design and coding tasks, and updated continuously based on learning from users in feedback sessions. The board was also used by the author and his advisor to track and communicate other thesis activity including research, writing and administrative tasks.

5.2.4 Exploring TBR presentation

Various evolutions of functionality began with simply displaying a set of book cover images. There was a great deal of iteration on the presentation layer as more was learned about where and how people wanted to see their TBR collections.

5.2.4.1 Spines vs. covers & single vs. multiple

To investigate the effectiveness of different ways of displaying the books, I compared covers vs. spines in single and multiple (excluding a single spine). Figure 11 depicts the variations.

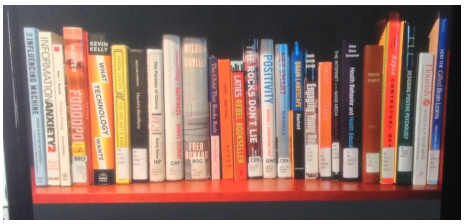
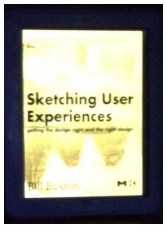
	Single	Multiple
Spines	(not tried)	
Covers		

Figure 11. Testing variations on covers vs. spines and single vs. multiple books to arrive at the final design.

5.2.4.2 Bookshelves, bedside tables, and media centers

I was interested in making a TBR for ebooks that could fit in with people's existing TBR piles for paper books. For this, I initially used an iPad, since it is approximately the same size as a hardcover book and could be placed in the locations people mentioned keeping TBR piles.

I was also interested in bringing books to media centers, which have developed into a central place for accessing nearly every popular type of media except for books.

On each platform, I explored the different affordances provided by a single image of multiple spines vs. sequential images of front covers presented as a slideshow. For the slideshows I used several different transition types (e.g., fade, wipe, mosaic tile) and 2-3 transition speeds (ranging from 2 seconds to a maximum of 20 seconds). Figure 12 shows the variations.

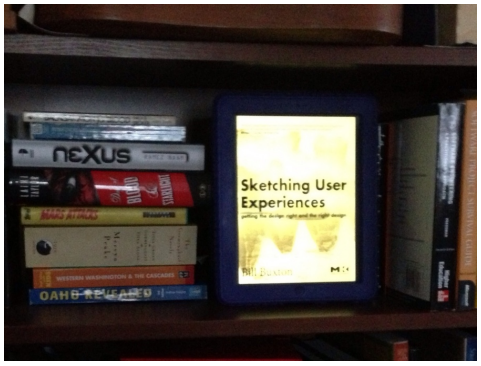
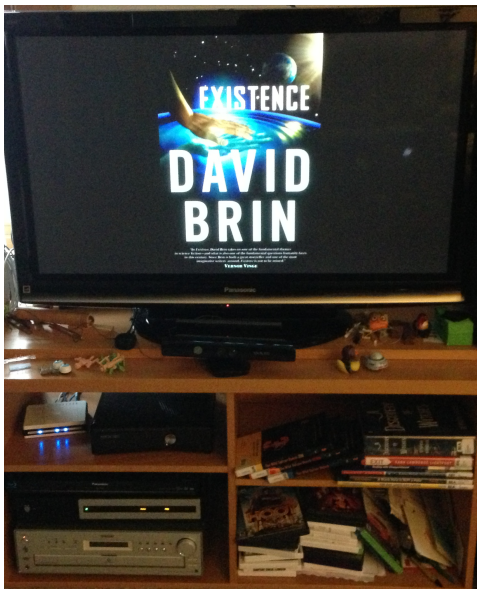
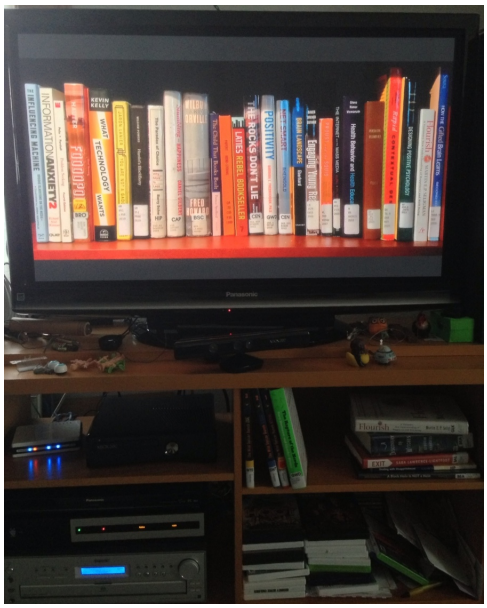
	Single Cover Slideshow	Multiple Spines Displayed Together
A small TBR prototype on a shelf at the edge of the room (iPad, 10-inch display)		
A large TBR prototype at the focus of the room (Television, 42-inch display)		

Figure 12. Prototype display mockups comparing different device sizes and display approaches provided useful design insights. Top left: Bookshelf display with cover images. Top right: bookshelf display with spines. Bottom left: television display with cover images. Bottom right: television display with spines.

5.2.4.3 Supporting endpoint diversity (device type and display size)

To explore a wider range of presentation approaches than the built-in slideshow software could provide, I decided to develop the prototype as a JavaScript web application which would work across many different web browsers.

I chose this approach because in early feedback sessions, I learned that different users were interested in using a wide variety of endpoints as the hardware for a TBR. The variety encompassed device type (e.g., smartphone, tablet, game console, Internet-connected TV, PC) and display size (from pocket-sized to big-screen TV).

To address the need to support a wide range of device sizes, I ultimately used a responsive web design (Marcotte, 2011). My implementation used JavaScript with CSS and jQuery to

implement a flexible grid which could accommodate a wide range of display resolutions and physical sizes while retaining legibility.

The prototype code is available as an open source project on GitHub[3] for people interested in examining it in more detail or extending this work in the future.

5.2.5 Exploring TBR interaction

The prototypes initially displayed manually-collected cover images of ebooks which the author had acquired but not yet read. The ability to customize which books were displayed was added and extended. I used several different approaches to populating the TBR shelf. First I used an XML manifest created by hand, which specified a set of cover image URLs and book titles. Second, I used unauthenticated API calls to read from a public Google Books bookshelf. Third, I used API calls in conjunction with OAuth to connect to a user's own Google Books collection.

5.3 Summary of Insights

This section summarizes what we discovered. Table 9 lists considerations for designing TBR solutions in particular and stashes in general. Each insight is labeled with the section containing further discussion of the relevant results. For clarity, each set of feedback and its subsequent design impact is discussed together, not necessarily in chronological or release order. In some cases, I was able to implement a design response and receive further feedback on it. In other cases, the feedback inspired future development ideas. The results are summed up into design considerations to inform designers of TBRs and other stashing solutions.

Section	Topic	Design Considerations
5.4.1	Privacy	Provide users with control of what data is shared and to whom. Request explicit permission before each act of sharing; make clear what information will be shared and to what audience.
5.4.2	Spinal affordances	Consider how digital stashes can provide all the information people are used to being able to see in their physical analogues.
5.4.3	Multiplicity	Show members of a collection together, rather than singly and sequentially. If more members exist than can be displayed together, try to minimize transitions.
5.4.4	Subsets / selection / inventory view	Consider the different ways people might want to divide and conquer their stashes in order to help find something that fits their current appetite without having to consider and reject items that don't appeal at the moment. How can a TBR present that information? Can the TBR anticipate or detect a user's current appetite?

[3] https://github.com/massivelyuseful/ToBeRead/

Section	Topic	Design Considerations
5.4.5	Television-specific issues	Since these displays are often used for other purposes, the ease of the experience of turning to the TBR display is important to optimize, since it will be performed more often than with a dedicated TBR.
5.4.6	Size & Scalability	TBR displays should be predominantly filled by representations of the content. Content should be presented with as much information density as is possible without sacrificing legibility, adapting to the size of the display used.
5.4.7	Populating	People are willing to manually populate books on their TBR; automatic importing and syncing from other source stashes is convenient but not a mandatory feature
5.4.8	Sense-making	Enable users to organize the items in their TBRs. Provide a way for users to get to more information about stashed items.
5.4.9	Weeding	Support weeding by providing cues that encourage weeding and a capability to easily remove items.
5.4.10	Energy efficiency	Mitigate people's concerns about energy consumption; try to avoid powering displays when no one is looking at them.
5.4.11	TBR as screensaver	Existing displays are good candidates for hosting TBRs when they are not being actively used for other purposes.
5.5.1	Priming	TBR's priming is effective in helping to increase consumption
5.5.2		Ambient displays need to be tested for attention-grabbing characteristics over time in environments that resemble the places they will be used. Brightness levels higher than the surroundings, motion, and frequent changes should be avoided.
5.5.3	Correspondence	The on-screen representation should match the item. Allowing the user to search for and select an alternate image is one solution.
5.5.4	Content Polymorphism	Design so that additional content types beyond books can be included.
5.5.5	Mobility	Be aware that the TBR's location may change. Consider how to handle items that are not available where the TBR is being viewed.

Section	Topic	Design Considerations
5.5.6	Ubiquitous access	Enable users to access the contents of their TBRs from any location or device.

Table 9. Design-based research identified many specific considerations that can inform the design of stashes.

The following two sections provide additional detail on each design insight. Section 5.4 contains those insights primarily derived from short interactive feedback sessions with subjects, and section 5.5 contains those insights primarily provided by the author's personal exposure to the prototypes over time.

5.4 Results & Discussion of Insights from Interactive Design Research Sessions

5.4.1 Privacy

One subject pointed out that displaying everything that they wanted to read would not always be appropriate:

> *"I wouldn't want everyone who comes into my house to know that I'm interested in [a particular subject]. My close friends, sure, but the babysitter or my parents? No!" — S2*

Because TBRs are displayed to other people who share living space or visit, it is important to let people choose what gets displayed. This is part of the persuasive technology strategy of being *controllable* (Section 5.1.1).

> *"Some books are displayed to impress people." — S7*

People also like sharing what they are reading with friends in order to have conversations about the books, and to make and receive recommendations. There are numerous social networks which people already participate in, both general purpose (e.g., Facebook, Twitter) and reading specific (e.g., Goodreads, Shelfari). Having the ability to share from the TBR to those existing networks was seen by subjects as much more useful than having yet another social network to join.

Design implication: controllability is key; people want to choose whether to share everything automatically or share only specific books, and they want to choose who to share with – whether publicly or only with specific individuals.

5.4.2 Spinal affordances

When people saw mockups which used a photograph of spines (as pictured in Figure 12), they appreciated several affordances spines provide that front cover images do not.

Some of the information provide cues about timing for reading the book. For example, the length of book is indicated by thickness, so if someone has a long period of time available for reading, they may be more inclined to pick up a thicker book than if they don't have much time available for reading. One reader said that she could see the location of her bookmarks sticking up out of the book, giving another set of cues about which books had already been started, and how much time it would take to finish reading each book.

A library sticker on the spine indicates that the book will need to be returned at some point, so there is a constraint on how long the book will be available to read, and a risk of fines if

not returned on time. People were also aware of a social obligation to other readers waiting for the book, especially when they themselves had to wait for their hold to be filled.

Despite the desirability of mimicking physical TBR displays directly, there were feasibility problems: existing images of book spines are not widely available, and generating spines that were both legible and matched the affordances of physical book spines would be a significant development challenge. Working with what was available, I used front cover images displayed in a grid layout.

Design implications: This leaves open several as-yet unanswered design questions. In the absence of spines, how could the TBR help users determine which books would be best to read given existing time constraints? And how could this information be provided without making the display overly cluttered and complex, detracting from its simplicity and aesthetic appeal?

5.4.3 Multiplicity

Subjects preferred a display of multiple books to a sequential display that showed books one at a time. The attention-grabbing nature of showing one book at a time, and waiting for the next to appear, was seen as a negative. Showing multiple books together, in context with each other, was seen as communicating something richer about the reader's interests than the sum of the individual books. Displaying the books so many could be seen in a single glance required less time than waiting to see the entire collection scroll past.

Design implication: showing many books together works better by providing more information in less time, requiring less time and attention to see more books, than showing them singly and sequentially can. When displaying collections with more members than can legibly fit onscreen at a given time, consider how to show them all over time while minimizing transitions.

5.4.4 Subsets / selection / inventory view

People were interested in being able to see subsets of their TBR books. People mentioned several different dimensions which they were interested in using for filtering:

- **Content-centric**: These are attributes of the book such as those found in a library card catalog. Examples include genre, subject, author. Another aspect of content mentioned by one subject is awareness of world events. If something is happening in the world that is related to a stashed item's content, subject matter, or author, that current event can be leveraged and linked explicitly to encourage consumption.
- **User-centric**: I learned from interviews that people often have their own idiosyncratic categories for making sense of their books, which do not necessarily line up with existing book metadata. People said that they would be interested in having the TBR show them just the books in a given personal category. But they were highly resistant to the concept of entering such metadata themselves; people do not want to spend time entering information into a catalog or database.
- **Context-centric**: Showing people options that are relevant to their current context, including: their mood, time of day, how much time they had available, and who was present with them. They also mentioned what other media they were currently consuming, and what they had just finished. For example, S5 said, "I read one novel at a

time, so if I just finished one, I'm probably looking for another." The same subject also said that if they were only partway through a novel, they did not want to see all the other novels they have waiting. Other subjects described numerous and varied additional ways their ongoing and immediately prior media consumption could affect their next media choice.

- **Source-centric:** Sometimes people did want to see only options available from particular sources, such as a particular retailer, or a specific library. One scenario was when they had a gift certificate; another was wanting to take books out of the library. Readers with significant investments in a particular proprietary commercial ebook ecosystem such as Amazon's Kindle or Barnes and Noble's Nook had a strong preference to stay within that ecosystem for simplicity and convenience sake.
- **Format-centric**: People mentioned times when they sought books in specific formats. Examples of this were going to the beach (where a paper book was preferred for resistance to damage from sunscreen and sand) and travel reading (where ebooks were generally preferred for their lack of weight and bulk, but where some paper reading material is needed because at present US air travel prohibits use of electronic devices during takeoff and landing). Paperbacks were the most desirable format for disposable reading; one family has a shared vacation home where it is typical to bring a few light reading paperbacks and leave them there, where they can be read by others who share the cabin. As a bonus, these paperbacks are also used as fireplace kindling!

Many of these contextual factors are readily available, such as time of day and day of week. Other contextual factors which once would have been unavailable to computer systems are now becoming more accessible. Camera-equipped devices can use facial recognition and other biometrics to recognize who is present. Moods and stress can be assessed from facial expressions and tone of voice. A great deal of information about people's personal contexts is available on social networks and online calendars. Over time, all of these factors could be leveraged to help identify what type of reading material a user may want to select at a given time. Of course, the privacy concerns mentioned in Section 5.4.1 become all the more important as the system detects more personal information.

Design implications: Consider the different ways people might want to divide and conquer their stashes in order to help find something that fits their current appetite without having to consider and reject items that don't appeal at the moment. How can a TBR present that information? Can the TBR anticipate or detect a user's current appetite?

5.4.5 Television-specific issues

There are special challenges in putting a TBR on a television or media center display. Because of their location and size, all of the attention-drawing issues discussed above were much more severe on a television.

- **Location.** Televisions are often placed at the focal point of the room, while bookshelves are usually on the periphery.

- **Size.** Television screens are usually much larger than the screens of other devices, and are intended to be seen from across the room, compared to other devices which are normally used within arm's length.

- **Non-dedicated devices.** Televisions are shared for other activities; even if a TBR is set up on one, it will be knocked off when someone wants to use the television to play a videogame or watch a movie.

- **Cumbersome, remote-based interface.** Television remote controls can be excellent for frequently-used functions with dedicated buttons, such as turning the power on and adjusting the volume. But accessing other functions usually requires navigating through a menu system using awkward interfaces. For example, it took considerably more effort to bring up the TBR display on the Panasonic Viera television than it did on the iPad: locate the television remote, bring up the Internet applications (waiting 5-10 seconds), select the photo display application (wait), select the appropriate album (wait), select slideshow mode (wait), and start the slideshow. This worked against the purpose and intent of a TBR display, which is supposed to just quietly remind without requiring much ongoing effort. Another subject's media center display (pictured in Figure 13) required using multiple remote-controls in a similarly complex procedure to bring up the web page of the TBR prototype.

  In contrast the peripheral display was much less complex to use; the iPad's picture frame mode could be activated without even unlocking the display – it is available with one click on a button available from the lock screen. And since it was not used for other purposes, the TBR did not to be restarted as often.

Design implications: Using televisions for TBR displays presents additional design challenges. Because the display is already frequently used for other purposes, the process of returning to the TBR should be examined. if it is too lengthy, that could be a significant factor in discouraging use. This is much less of a consideration for a dedicated TBR device, which may only need to be set up once.

5.4.6 Size & Scalability

Subjects were asked what they would imagine using to display their digital TBR. Responses covered a very wide range of display sizes and resolutions, from pocket-size to big-screen televisions.

When displaying book covers singly on a 42-inch TV, they looked like posters, not books. This made the connection with the actual book more tenuous, and broke the illusion that the book could actually be picked up. Displaying a full shelf of books at 150% of life-size compensated for the increased viewing distance of a TV vs. a bookshelf while avoiding the poster effect.

A responsive design (Marcotte, 2011) addressed the wide range of desired endpoints. Taking window size (in pixels) as the best-available proxy for display size, I created a flexible grid that expanded from displaying as few as 2 books side-by-side to as many as 8, depending on the window width. This worked well on displays ranging from a 65" widescreen television (Figure 13) to the narrow, tall browser window found on a smartphone (Figure 14).

The responsive design also helped maintain clarity of the cover images by not requiring them to scale too far beyond their original size, especially when only a relatively low-resolution thumbnail image was available. Most browsers and platforms scaled the graphics fairly well up to about 2-3 times original size, but beyond that, the image quality degraded sufficiently that people found the display both unattractive and unintelligible.

Figure 13. The web client prototype's responsive design scales up to take advantage of the information density possible on this 65" HDTV in one subject's living room.

Figure 14. The web client prototype's responsive design scales down to adapt to a smaller browser window, such as on a smartphone display, by reducing the number of columns so that book images are still legibly displayed

Tufte (2001) urges designers to maintain a high *data-ink ratio* – minimizing the amount of a graphic which is ornamentation rather than information. I encountered a related issue of a poor *data-whitespace ratio* in the initial responsive design. At first, the web application allowed the gutters (the blank space between images in the grid) to grow to handle intermediate sizes between the predefined grid breakpoints at which additional columns

were added . This resulted in a very poor whitespace to data ratio at some resolutions; at worst, the books occupied far less than half of the display (Figure 15). Modifying the design so the images proportionally grew while leaving the gutters relatively small allowed the covers to grow and provide maximum visibility, instead of leaving valuable display area unused.

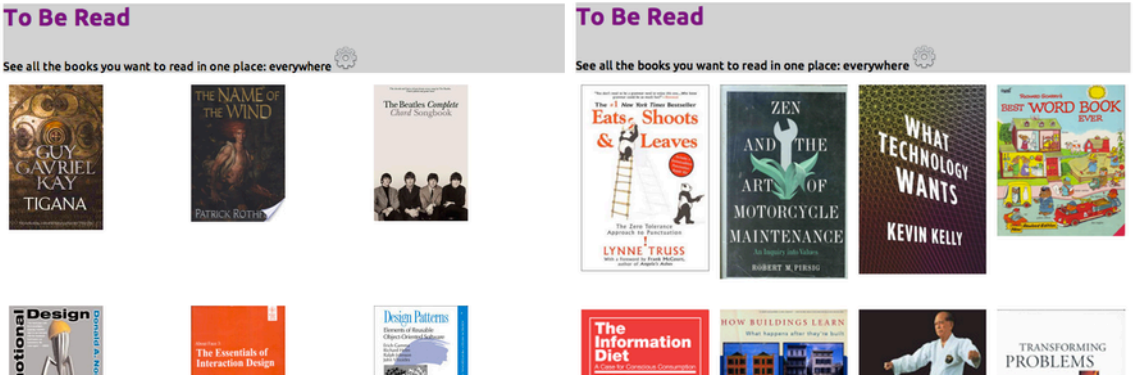


Figure 15. The initial responsive design of the web client handled scaling by inserting extra whitespace (left). Scaling the book images and leaving the gutters constant (right) yielded better book visibility.

Similarly, making it possible to hide and reveal the controls for populating and manipulating the contents of the TBR allowed more space for displaying content, often making an entire additional row of books sufficiently visible to be identifiable. Figure 16 shows the additional visibility yielded by hiding the controls.

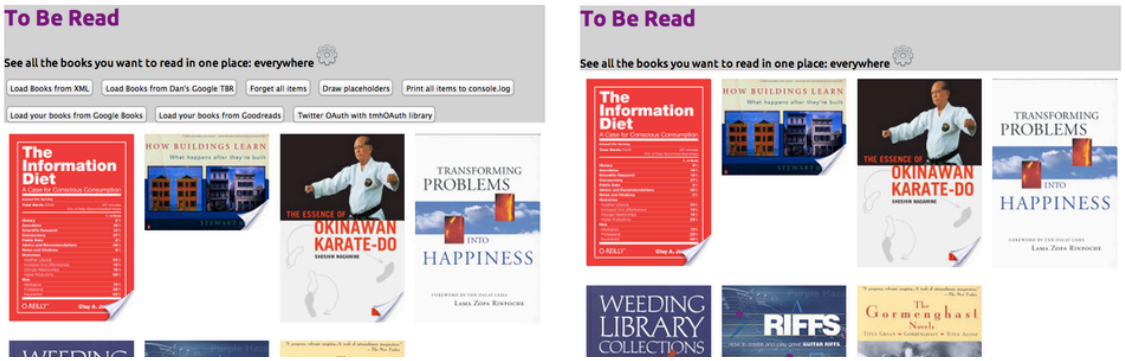


Figure 16. Hiding UI chrome provides more space for books. Even if the whole cover does not fit, books can often be identified from the top portion of the cover image.

Design implications: TBR displays should be predominantly filled by representations of the content. That content should be presented with as much information density as is possible without sacrificing legibility, adapting to the size of the display used.

5.4.7 Populating

While physical books can be combined in a single TBR without regard to source simply by placing the book in the stash, we are faced with a more complex situation for digital books. People have proliferating sources for digital media, each of which usually has its own disconnected stash.

As the research progressed, I wanted to be able to put the subjects' own to-be-read ebooks onto the prototypes. Using an XML manifest to set up prototype sessions with a selection of people's own books was too cumbersome to perform at the beginning of a feedback session. A more effective approach was to ask subjects to provide a list of their own to-be-read books in advance of a prototyping session.

The first independent stash that was connected to the TBR was Google Books. Using the OAuth protocol, users could authenticate using their Google credentials and authorize the TBR app to access their collection, as shown in Figure 17.

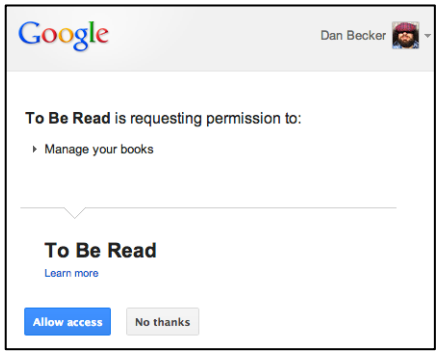


Figure 17. The prototype uses OAuth so users can authorize TBR to access their own Google Books collections.

From the interviews, I knew that subjects had problems caused by having the digital media they acquire be scattered in multiple, disconnected stashes specific to each source – providers such as Amazon, Netflix, libraries, and so on all have their own different digital stashes for the digital content people get from them. But quite soon, it became clear to me that most of the subjects do not use *any* source stashes that have accessible API's which could provide their books to the TBR. (For example, neither Amazon nor the Seattle Public Library — the two most popular sources for ebooks among my subjects — have such a capability.) While a screen-scraping approach could be attempted, such a solution would be fragile and would violate the terms of service of at least Amazon's website.

I was surprised to learn that these users were not bothered by the fact that the TBR shelf would not be able to automatically load their books — at least during the prototyping session. I speculate that they might feel differently about it, even being driven to abandon the application, if they had to continually keep it updated with a separate action. Speculation aside, during the feedback sessions, they had a simple request: "Just let me add books right here." They wanted to type in a search for a title or an author and be shown a list of results; they would select the right one and it would be added to the TBR. This came as a surprise to me; I had assumed that if books could not be automatically imported from other stashes it would be a major detriment to adoption.

Design implication: While automated access to some stashes is convenient, in some cases it is not feasible. People who are motivated to read are willing to put in some effort in manually populating and updating their stashes if they find that doing so pays off in achieving satisfaction and fulfilling intentions.

5.4.8 Sense-making and organization

People do things with their books in their stashes between when they add them and when they remove them.

One is sense-making: reviewing the items there. Sometimes this is done as part of deciding whether or not to read a particular book, testing to see if it has the right taste to satisfy the appetite of the moment.

> *"There are parts of the book I never read as part of reading the book, just to decide whether I want to read it at this moment. So I want to be able to pick up the book [off the TBR] and see those things." — S5*

The key items this user said they examined in their physical TBR books to make that further determination were the back cover text, the author biography, and the introduction.

People also spend time organizing their TBR piles.

> *"I love to rearrange and reorganize my library. Organizing my books helps me think about the books differently and appreciate them more." — S7*

Drawing from how people like to interact with their physical TBR stashes, we see that organizing books physically doesn't necessarily rely upon generating categories and then applying them. Instead, books can be grouped together by arranging them physically. Using drag and drop with a touch or mouse interface is quite natural for users. However, media center interfaces typically do not have such an easy and accurate method for interacting; traditional remote controls are not well suited for such manipulation, and gestural interfaces are still not widely adopted by users.

Design implications: Consider how to help users to interact with and organize the items in their TBRs. People like to examine the items in their stashes to learn more about them; provide a way for them to get to this information from the TBR. Additionally, if the physical layout of the books gains a semantic level, that may have implications for what methods of avoiding burning the image into certain types of displays, such as LCD and plasma, which can happen if the same image is displayed unchanging for an extended period of time. Shuffling a carefully-arranged bookshelf would not be appreciated!

5.4.9 Weeding

When looking at the lists of books people had in their own various online stashes, there was a frequent response that there were "stale" and otherwise outdated items present in them. This seemed to be true for stashes that were consulted frequently and for stashes that had not been used recently – people rarely weeded their online stashes. Those stashes make it very easy to add items, but don't have a lot of support for removing items. Weeding could be better supported with a number of features, such as:

- Subjects use capacity as a prompt to weed in physical collections. Online stashes generally don't have a set capacity limit. So online stashes need some way to prompt / encourage weeding. For example, "you added this item a long time ago and haven't even taken a peek at it since then – are you still interested?"

- Subjects are often reluctant to irrevocably delete things. They want some record to remain, just not so obtrusive. An archival function would address that concern, where archived items would be moved out of main visibility but still retrievable.
- Weeding by topic – if there's an entire category you are not presently interested in pursuing — for example, material related to a project that has been completed — that entire topic could be dealt with at once. This would be a natural fit for tying into the categorization capabilities outlined in Section 5.4.4.

Design implications: Support weeding by providing cues that encourage weeding and a capability to easily remove items.

5.4.10 Energy efficiency

People were concerned that leaving the device on continually would be a waste of energy. Users suggested that an acceptable design response would be to sense when no people were present and then turn off the display. In lieu of a proximity sensor or motion detector capability, the TBR could be configured like a traditional programmable thermostat to indicate sleeping or work hours when the display should be off.

This is an area where alternative display technologies could be helpful; for example, e-Ink displays only use power when changing the displayed image.

Design implications: people may be concerned about the energy consumption of a display that is on all the time. Consider how this concern could be mitigated.

5.4.11 TBR as screensaver

People discussed two distinct "screensaver" scenarios where they said they would like to see a digital TBR on non-dedicated displays when those displays were not actively being used for other purposes.

One was for use on desktop computers whose monitors already show screensavers when not in use. These screensavers are used as part of the visual decoration of the room; if they were only trying to preserve the screen, they could set the display to turn off or display an all-black image. People felt showing TBR collections worked well in this mode because books are attractive, because they found social value in displaying their TBR books to communicate their interests to people who could see their screensavers — often their coworkers in office environments — and because they thought it was a good opportunity to expose their TBRs in an ambient manner using a display they already had available.

Another possible use of a TBR screensaver mentioned by subjects was on ereader devices themselves when not in use. They suggested they would prefer this over, for example, advertisements displayed on Amazon's Kindle. (Kindles are sold with a choice of paying less for a unit that displays ads, or paying a premium for a device that does not display ads. At present in the US, the difference is $20, but those who pay it just get shown artwork instead of ads.) Amazon's business model is to encourage people to buy more, and surely the ads help with that, but perhaps enabling the Kindle display as a TBR could also increase sales by increasing the number of ebooks read.

In Figure 18 a Kindle is pictured displaying an advertisement on the left, and a mockup of a TBR shelf on the right. Another approach would be to show only the cover of the book currently being read; either one might serve as a priming prompt to encourage reading.

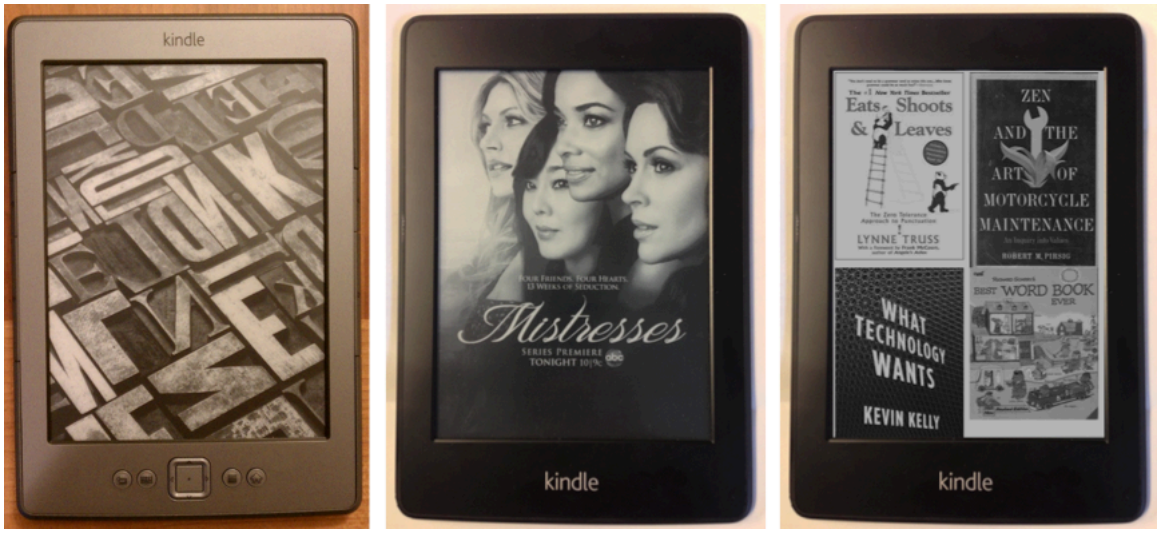


Figure 18. When not in use, Amazon's Kindle displays advertisements (center) for books and other items the reader does not already own, and may not be interested in. Even if users pay extra for a version that does not display ads, the Kindle only displays generic artwork as a screensaver (left). What if it instead displayed books that the reader had already purchased but hadn't yet read (depicted as a mockup, right) – or books that the reader had wished for but hadn't yet purchased?

Design implication: People value the idea of a TBR display and had several ideas for putting it on existing displays in those times when they were not being actively used for other purposes. Consider what displays people have available to them which could be used to host a TBR display.

5.5 Results & Discussion of Insights from Personal Long-Term Experience

As previously discussed, the following insights were primarily driven from my personal experience, though many of them were confirmed or expanded upon by subjects in the interactive sessions.

5.5.1 Priming

Before the TBR prototypes, it was common for me to forget newly-purchased ebooks and leave them out of consideration if they were not consumed immediately.

After adding unread ebooks collected since 2009 to the TBR prototypes, the old ebooks were much more in awareness, and I read 3 of them in the first 2 months of using the prototypes. This was a personally significant effect, especially considering that I was also doing a great deal of reading in research for this thesis at the same time!. Other ebooks which were subsequently acquired but not included in the prototypes did not get a boost in consumption. It seemed to me that because I was not forgetting about the books entirely, when it came time to choose a book to read, I already had a hunger for reading one of the ebooks "waiting for me" on the TBR.

This personal experience strengthened my belief that other people might also find the TBR's priming effective in helping them increase reading of books they'd selected.

5.5.2 Attention-drawing vs. Ambient

A number of the findings were related to drawing attention. An ambient display needs to allow the user to choose when to attend to it, rather than drawing the user's attention.

- **Light levels and color bleeding.** In Seattle, the light levels change frequently as the sun plays peek-a-boo with the clouds. The iPad display had to be turned up to be bright enough to be legible when the room was lit with sunlight. But when the clouds came and the room dimmed, the same brightness level caused the image to shine out into the room, so much that when the image changed to a different color, that entire part of the room glowed in the new hue, as pictured in Figure 19.

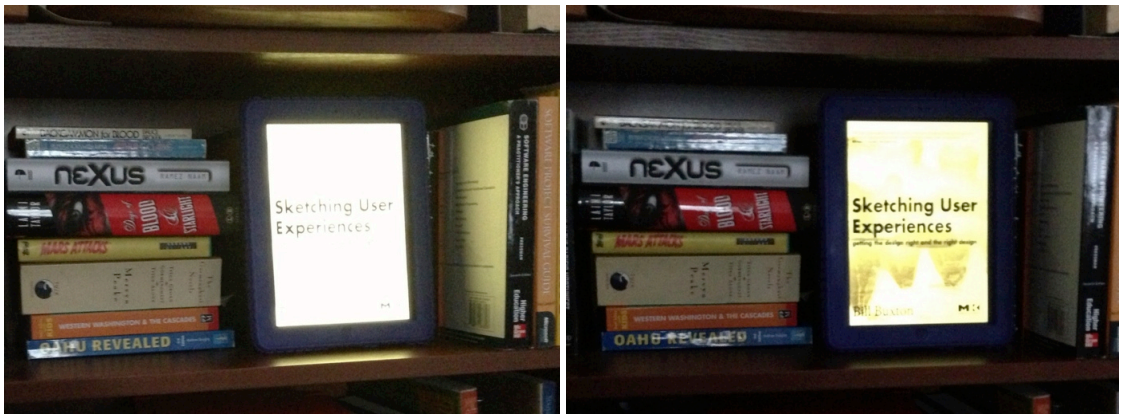


Figure 19. When the brightness is too high for ambient lighting conditions (left) the light bleeds onto surrounding surfaces, changing their color and drawing attention with every change. Adjusting the brightness to match the room (right) avoids this problem.

- **Perceived motion.** The prototypes which used existing slideshow functionality on iPad and a television set offered choices in how the transition between images was managed, from a simple cross-fade to a complicated "checkerboard" animation. The more complex and longer lasting the transition was, the more attention it drew. This distraction was obtrusive and unwelcome. The best transition was an instant cut from one image to the next – as long as this did not cause a change in overall room lighting brightness and hue as mentioned above.

- **Frequency of changes.** When the image changes, even with a minimal transition, it can still draw attention. Therefore it is best to change quite infrequently. Ideally no changes would be needed, but depending on the number of items in the TBR and the resolution of the display, they may not all fit onscreen at once.

Design implications: ambient displays must avoid drawing the user's attention unintentionally. Brightness levels higher than the surroundings, motion, and frequent changes should be avoided. Other attention-grabbing characteristics may only surface in the environments where it is used, and will not necessarily be detectable by people who are already actively paying attention to it. Ambient displays need to be tested for attention-grabbing characteristics over time in environments that resemble the places they will be used.

5.5.3 Correspondence

At one point I decided to try including a representation of physical books in a prototype TBR I was using (more on this in Section 5.5.4). In some cases the TBR ended up displaying a cover image from a different edition which did not match the physical book I had. I found this lack of correspondence confusing; I did not recognize the book from across the room, and this sense of confusion drew my attention in a negative way.

Design implication: it is important to have the on-screen representation match the item. An effective design response to this issue would be allowing the user to search for and select an alternate cover.

5.5.4 Content polymorphism

Polymorphism is a concept from computer science where different types of data can be used with the same interface. I soon realized that supporting different types of content in the TBR would be beneficial: for example, I could also add a representation of physical books into my TBR display alongside the ebooks. This was easy to accomplish, but then I found that once I started mixing content, I needed to provide some clues about where to find the book. This general problem also occurred for users who added ebooks from multiple sources.

If library books were to be added, giving an indication of due date would be helpful, or at least an indication that it is a library book in the first place, as we saw was helpful from the picture of the spines that showed library stickers (Figure 12).

Other types of media which may be particularly well suited to including in a TBR include other reading material such as magazines, journal articles, and RSS feeds from blogs.

Design implications: People may want to put more types of items into the stash than the design originally anticipated. Consider what additional content types people may want to include and how they could be included.

5.5.5 Mobility

While visiting family in Minnesota over winter break, I brought the iPad along so it could be used for other purposes. On a whim, I decided to set it up as a TBR display while it was charging each night. This ended up working very well.

- It provided a bit of a feeling of home while staying in someone else's house.
- While on vacation, I have more time than usual to read. So having visibility to a wide range of ebooks I wanted to read available is particularly useful: as I finished many books, I had to choose a new book to read many times.
- Because the ebooks displayed were all accessible to me, I felt like I had brought a nice stack of reading material and I had many choices to fit different possible appetites, instead of being constrained to a selections made while packing by a 'now me' who

Figure 20. Prior to having a digital TBR, the author brought this TBR stack of physical books on a vacation

might incorrectly predict what 'future me' would want to read on vacation. As it happened, I did end up reading a different proportion of books than I would have predicted – I did considerably more non-fiction reading than I anticipated.

In the past I have taken vacations with a big stack of physical books (one is shown in **Error! Reference source not found.**), which provided the TBR priming effect. When traveling with only ebooks before having a digital TBR, the invisible media problem affected me, and selecting a next book to read took additional effort. Being able to take my TBR with me proved quite beneficial.

Design implications: The TBR itself may have a changing physical location. Especially if physical media items are included, consider how to handle items that are not available where the TBR is being viewed.

5.5.6 Ubiquitous access

One of the prototypes used a collection of images on a web service. This provided an unexpected benefit: by checking the collection remotely while I was at a bookstore, I was able to verify that I already had a book, and so avoided buying a second copy of a book I already owned. (This has happened far more often in the past than I care to quantify!)

Design implication: Consider how to enable users to access the contents of their TBRs from any location or device.

5.6 Conclusion: Summary of TBR design considerations

The feedback provided by users exposed to very early prototypes inspired new features and also helped change feature prioritization. Knowing what sorts of features were highly desired and which were not highly valued provided clues to design architecture to provide flexibility where needed. This was a nice balance between taking a strict "YAGNI" (You Ain't Gonna Need It) approach, where hooks to support future functionality are not created until they are actually required, vs. the opposite problem of over-architecting flexibility that may never be needed.

In addition, I also received information about the value of a TBR for implementing desired media consumption changes. The preliminary prototypes of to-be-read piles successfully changed my media consumption. While using them, I read the displayed books more often than before, and when I was looking for a new book to read, I selected books from the available list. However, visibility alone did not incline me to read a book that I was not interested in reading otherwise.

The experience of exploring the potential of these prototypes myself and with others reinforced my belief that there is an opportunity to use TBRs to increase consumption of ebooks, and possibly other forms of digital media, by using ambient displays to increase the visibility and priming of media we have stashed because we want to consume it.

6 Conclusion

This research explored the thesis that applying the metaphor of food and diet to the realm of media consumption could provide a better understanding and inform the design of solutions for people's unaddressed problems.

I found that applying food thinking to our media consumption was very fruitful. Like food, media is a central part of most people's lives. We have woven it into our social interactions. We have emotional responses to food and media. Our identity is often tied to our media consumption, both in communicating our identity to self and others, and our eudaimonic desires to consume media in ways that accord with our best nature. Finally, there is also a degree of purely aesthetic, hedonistic appreciation of the food and media we consume.

But the people who participated in interviews told me that the Clay Johnson's "information diet" metaphor was not the best way to convey the parallels between food and media. The primary shortcoming was the emphasis on information, which they regarded as describing only objective facts and news, not including such things as art, entertainment, and social interactions. The interview subjects felt that focusing only on "information" was an overly narrow view of their media consumption, which did not adequately explain their motivations — just as looking at one's food consumption purely from the basis of the nutrients provided would not cover the breadth of activities and values people associate with food.

Applying the metaphor of food to media did prove valuable in understanding people's needs and problems in the domain of media. Using the food metaphor as the starting point for the conversation was successful in eliciting a rich and detailed understanding of people's motivations and desires for media. Subjects related many ways that context changes appetite rapidly over the short term: for example, being sick can make one hunger for comfort food and comfort media, and encountering a repulsive item of food or media can temporarily suppress one's appetite in the respective domain. Subjects also told of how their tastes and habits change in response to external, or exogenous, causes.

But there were several important problems in media consumption that were uncovered independent of the metaphor. For example, changes that have accompanied the digitization of media were the subject of a great deal of discussion from interview subjects, who were eager to discuss how these changes have changed their habits in positive and negative ways, and what they did and did not appreciate about the ways media and their consumption has changed. The open-ended interview approach was very successful at eliciting many of these, primarily by diverging from the metaphor-based inquiry. The food metaphor does not have good support for exploring the differences between physical media and digital media. This is understandable because food, unlike media, has not and cannot become digital and leave its physical nature behind — at least, as long as humans continue to exist as biological, embodied beings.

The metaphor was also helpful in identifying potential approaches to solving those problems, though I was surprised in how this worked. I had wondered if I would find a technique in the realm of food that was not being used at all with media, and that I would need to investigate how it could be applied to media. Instead, by examining the two domains in parallel, I saw how some techniques were applied in both domains. For example,

the use of stashing for both food and media. If I had not heard from people about the utility of those techniques for supporting changes in food, I would not have recognized the potential for better applying them in the domain of media.

The significance of stashing's use in people's media habits was uncovered from recognizing its presence in the domain of food. Background research provides experimental confirmation that stashing does in fact affect consumption of food. The model of stashing explains how the effectiveness of stashing in accomplishing certain functions relies upon certain qualities as visibility, capacity and organizability. Visibility encourages consumption and enables identity claims, capacity prompts weeding and shifting from acquisition to consumption, and organizability enables sense-making. These qualities aren't present, or are weaker, for stashes of digital items than they are for the physical stashes of food and media that interview subjects discussed. This means that the transition to digital media may be resulting in functionality gaps for media consumers. Perhaps if these gaps were addressed by providing digital stashes with these qualities, it would increase media consumers ability to better manage their habits.

Exploring the design space possibilities of applying stashes to some of the media problems identified was accomplished by carrying out design-based research with prototypes, both independently and with user feedback. The approach of using a slow technology ambient display to provide an electronic "to-be-read" display for ebooks appears to be promising. Numerous actionable design considerations have been identified, as well as additional use cases, functionality, and other possibilities, all without requiring large investments in development. Many of these insights have already been incorporated into the prototype code, which is available as an open-source project.

Finally, though a controlled experiment to measure the efficacy of the solution has not yet been conducted, my own experience was that when I had a TBR prototype in use, it did help to keep previously-acquired ebooks in consideration and increased their consumption, compared to when I was not using a TBR for my ebooks, and I have installed it in my home as an ongoing part of my reading toolkit (Figure 22).

Figure 21. A TBR prototype installed in the author's personal To-Be-Read bookshelf.

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8 Appendix A: Detailed Interview Data

8.1 Interview Questions & Topic Prompts

The following table contains topic prompts and questions, which I referred to in order to make sure all subjects were covered. Following the practice of guided interviews, not every question was asked of every subject; if a topic had already been thoroughly discussed earlier in the interview, I did not ask people to repeat themselves.

Category/topic	**Topic Prompts & Questions**
Metaphor fit	Does the metaphor of food and diet for media consumption resonate for you, or not? Are there parallels you have between food and media? Are there places where the metaphor does not work? Are there other metaphors that work better for you for any aspect of media consumption?
ID contents and categories	What categories or "food groups" make up your information diet? Are the categories it based on genre, media/delivery, specific subject area? What do you include in "information diet" and what is outside of it?
ID changes	If you could do whatever you wanted, how would your ID change - what is your ideal/fantasy ID? What keeps your ID from being that ideal? Are there any changes you would like to make in your ID? Are you trying to make that change now? How's it going? are there parts of your ID that you try to increase? other parts that you try to limit? Have you ever changed ID diet, or tried to? What has caused changes in your ID? Was it a decision you made then changed behavior? Or did your diet change without it being a conscious choice?

Category/topic	Topic Prompts & Questions
How do you cope with your ID now?	Do you organize your media into categories? What categories? Do you use that organization? How? Do you use any tools or processes? Do you track or look back on your previous consumption in any way? Are there problems you face with your ID? How do you address them? Do you ever have problems finding something to consume? Do you go category first and then pick an item from that category? (I want to read a book, let me look at the pile of books I have on the "to be read shelf") Or pick a specific item from among candidates in many categories?
ID variations over time	Is your ID constant, or does it vary depending on time? Why? Distinguish one-time shifts and cyclical (e.g., vacation reading, election season vs. I don't play videogames much anymore) Contextual factors? Time (of day, season); who is with you; where you are (home, on the bus, in coffeeshop, on a plane); what you are doing (Working? on vacation? Exercising?); how you feel; how much concentration and control of your attention you have
Changes outside of ID	Have you ever attempted / made a behavior change in your life? (E.g., take medicine/vitamins, start a hobby, diet, exercise, sleep habits...?) What change was it? What motivated it? How did you go about it? Did you use any supports for making the change? Did you successfully change the behavior you were trying to affect? Partially successful, completely successful? Did you get the expected outcome from making the change? (E.g., if your change was to exercise more, and the motivation was to lose weight, did you lose weight?) How did you know the outcome? Did you measure, track or evaluate the behavior or the outcome in any way? Did you get any unexpected effects from making the change? How satisfied were you overall? What do you attribute the outcome to - what mattered, and what was just coincidental / unimportant?

Table 10. The researcher used this list of questions and topic prompts to ensure that all interviews covered key areas of inquiry.

8.2 Food metaphors

The following table displays the different food metaphors used by interview subjects. In cases where the application of the concept from food to media may be ambiguous, so the discussion column provides clarification of the meaning, as explained by the subjects.

Metaphor	**Number of subjects who used metaphor**	**Discussion**
dieting	4	Changing consumption
nutrition	4	We need certain minimum amounts of some components of our diets, and should limit the amounts of others.
breakfast	3	Morning news/information routine, consumed along with morning coffee/breakfast; skipping either is disturbing
junk food	3	Very appealing sensually, but not nutritious
candy / dessert	3	Like junk food; also an additional implication of a treat that should normally be had only after a healthy meal
potato chips	3	Easy to consume large quantities mindlessly; low nutritional value, high in unhealthy fats and salt
satiation	2	Sense of fullness when consumption limit has been reached
balanced diet	2	Having appropriate relative proportions of different
spinach / salad	2	Healthy, good to consume; you feel you ought to consume more of it, but not as appealing as other, less healthy options
bad tasting food	2	Warns you to stop consuming
appetite	1	When choosing what to consume next, what fits your current appetite?
bingeing	1	Watching many episodes of a TV show on-demand in a row, back-to-back
choosing a restaurant	1	Accommodate multiple people's preferences - choosing a movie
digestion	1	Process after consuming (output/excretion was not included)
meaty	1	Information that is worthwhile to consume; has merit and significant content
sour taste	1	Content in media that causes a negative reaction and impells you to stop consuming that media item (e.g., turn off the news after a disturbing story)

tastes/flavors	1	Sensory differences among media - variety, like differences in flavors of different foods or types of cuisine
eating smart	1	Learning what you are consuming, staying aware of & evaluating your food consumption in terms of nutrition
grazing	1	Continual consumption, but at a low level of intensity
flitting	1	Like a hummingbird - moving rapidly between many different sources and taking a quick sip from each

Table 11. Interview subjects did find the food metaphor resonated with their media diets in many ways.

8.3 Non-food metaphors

The interviews did not assume that subjects would find the food metaphor to apply to media consumption, or that food was the only metaphor that might be used. This table records metaphors from outside the domain of food that were used by interview subjects. While some of these terms could be considered to have a relationship to food (for example, food addictions) the interview subjects said that these were not food-related uses.

Metaphor	Number of subjects who used metaphor	Discussion
addiction	2	Compulsion to consume media independent of conscious desire for that media; subjects compared to a drug addiction, not a food addiction
cigarettes	1	Anxiety caused by not having phone available because can't access the media/information on it
tools	1	Some consumption is trying out a new media just out of curiosity about what the medium itself is like, not out of interest in the content. "It's like ok, tomorrow, I might decide to look at what's going on at Pinterest - but not to effect some change in the information I'm consuming, it's more about trying the tool." [S8]
sleep	1	Would like to have much more of both sleep and enjoyable media, but consumption is time-constrained by competing priorities (have to go to work)
financial budget	1	Viewing media consumption like a budget; allocating amounts of time/attention for various categories and staying within limits
friends	1	Being surrounded by books is like having friends around - don't feel lonely or bored
poison	1	Some media causes adoption of ideas or values that lead to harm
garbage	1	Some media has no value at all, should not be consumed.

Table 12. Non-food metaphors used by interview subjects

8.4 Information Diet Categories

Within a common culture, people are very consistent on whether things are or are not food. But there was considerable divergence in opinions of what is included in the larger category of their information and media consumption. Subjects varied on whether or not they included in their conception of information diets such things as:

- Sporting events (disagreements on classification went down to the level of professional vs. recreational, and in-person vs. via other media)
- Live artistic performances (for example, one person felt that going to a concert was part of their information diet, but seeing a busker performing on the street was not; other people did not consider any live performances to be part of their information diet)
- Interpersonal communications (face to face, telephone calls, text messages, paper letters, emails, social network status updates, video chat)

Even after summarizing top-level categories (which necessarily obscures differences in category boundaries between individuals) there was a wide variety in the categories that people said were part of their information diets.

Category	**Subjects**
books	10
movies	9
news	7
tv	7
email	6
Internet	6
social networks	6
information on specific subject (work, hobby, interest)	5
music	5
face-to-face conversations	4
parenting information	4
podcasts	4
recipes	4
shopping	3
texting	3
videogames	3
live performances (e.g., plays, concerts)	3
magazines	2
mail	2
NPR game shows	2
personal / introspection	2

Category	Subjects
phone calls	2
advertising	1
photos	1
art	1

Table 13. Subjects generated a highly varied list of media categories. Even after summarizing, a great deal of variation remained.

The categories people discussed in terms of their own media consumption and choices were far more granular and idiosyncratic. To give a sense of the variations within categories, here are some of the different subcategories of books that people mentioned. Similar variations occurred within most categories. Every one of these distinctions was mentioned as something salient to media consumption decisions.

Fiction categories	Non-fiction categories	Other categories
vampire stories	Martial arts: Shinto	library books
scifi	Martial arts: Aikido	audiobooks
fantasy	Martial arts: Karate	books to loan to friends
steampunk	Medicine books	books to cherish for a long time
novels	Massage references	disposable books
short stories	Design resources	read-aloud books
Entertainment books	Biography	Hardcovers
Smut books	Books to learn something from	Paperbacks
Uplifiting emotional stories		ebooks

Table 14. People make many distinctions that are salient to them, even within a single category.

I had been interested to see if there were common "food groups" to people's media consumption, perhaps so that a media version of the classic FDA "food pyramid" could be developed, and used as a starting point for people's media consumption. My takeaway was that people's media habits are quite varied, and for most people starting at one of the categories that is broad enough to be shared by many people (such as "music" or "fiction") is insufficiently granular to provide meaningful control in monitoring and shaping their media consumption to achieve their goals.

8.5 Media Sources

One of the research questions considered in the interviews was what composed people's current media diets. I was curious if there were common categories, analogous to the "food groups" used by prescriptive diets such as the US Food and Drug Administration's classic "Food Pyramid," which could be used as the basis of prescriptive media diets. I found instead that subjects' media categories are highly idiosyncratic. People agreed on common high-level distinctions such as fiction and non-fiction, but the categories and boundaries where people distinguished different types of media that they had different goals and preferences for were much more specific than that. Subjects typically expressed their unmet media desires as being much more specific than the categories that were broadly shared like fiction, or even genres like science-fiction. For instance, one science fiction fan made distinctions between several sub-genres of science-fiction, some of which they enjoyed and some of which they did not. This lack of commonality may indicate that it would not be helpful to try to establish people's media goals in terms of predefined categories; such an approach should allow users to define their own categories if the basic ones are insufficient for their needs.

Media type	**Sources**
Physical Books	Borrowed (from libraries, from friends) Purchased (new, used) Gifts
eBooks	Commercial ebook ecosystems (Amazon Kindle, Apple iBooks, Barnes & Noble Nook) Publisher-direct ebook stores (O'Reilly, TED Books) Open ebooks (e.g., Gutenberg library) Library ebook borrowing Ebook pirating Ebook lending
Television	Live - whatever is "on right now" Broadcasts recorded on digital video recorder (DVR) for later viewing On-demand television (Netflix, Amazon Instant Video, Hulu, iTunes)
Movies	Theaters (3D, IMAX, 'regular') On-demand subscriptions (Netflix, Amazon Prime Video) On-demand rental (iTunes, Amazon Instant Video) On-demand purchase (iTunes, Amazon Instant Video) Physical media (DVD, Bluray) rental (Netflix, Redbox, local video store) Physical media purchase (online stores, physical stores) Physical media borrowing (library, friends) Pirated downloads (torrents)
Newspapers & Magazines	Delivery subscription Purchase single copies Public copies (coffeeshops, libraries) Website (free vs. paid) Dedicated software app
Websites / Blogs	Visit website directly (URL memorized, search, bookmark) Dedicated software app Syndication (RSS reader or aggregation portal) Feeds on social networks (Twitter, Facebook, Pinterest, LiveJournal) Email digests

Media type	Sources
Conversations	In person On the telephone Text messages and instant messaging Email Letters
Social networks	Facebook Twitter LiveJournal Google+ MySpace
Videogames	Console game rentals (Gamefly, Blockbuster) Online purchases (iOS apps, Xbox Live Arcade, Steam) Physical media purchases Pirated
Parenting information	Information & forms sent home from school with children Children's homework assignments and completed/graded work Websites to check (children's homework assignments, class news) School email listservs Direct email from teachers "Googlestalking" - checking information about babysitters and kids' friends' parents before entrusting children to them
Work-related information	Collaborative & informative emails Professional email lists Instant messaging
Music	Streaming subscription collections (Spotify, Rhapsody) Streaming radio (Pandora, Last.fm, Rdio) Purchased songs (downloaded or stored in cloud services: iTunes, Amazon, Google) Pirated songs (ripped from friends or library CDs, downloaded via Bittorrent) Listen to songs on web (YouTube, MySpace)

Table 15. Subjects identified a wide range of media / information sources. This table is organized by media type for clarity, though it is important to note that this categorization scheme was not provided by the subjects.

9 Appendix B: Persuasive Technology Strategies

As the field of positive technology develops, researchers are identifying a wide variety of strategies that can be applied in creating persuasive technology solutions. This section provides an overview of strategies identified by several widely-cited papers in the field. Table 16 identifies the source of each strategy.

Fogg, Cuellar, & Danielson, 2003 [1]	**Sander, 2009 [2]**	**Consolvo, McDonald, & Landay, 2009 [3]**	**Klasnja, Consolvo, & Pratt, 2011 [4]**
Reduction	Praise	Abstract & reflective	Social learning
Tunneling	Social comparison	Unobtrusive	Social influence
Tailoring	Reciprocity	Public	Priming
Suggesting at the right time	Use of virtual humans (to exploit mimicry, empathy, emotional responses, rapport)	Aesthetic	Goal negotiation and coaching
Self-monitoring		Positive	Intrinsic motivation
Surveillance		Controllable	
Operant conditioning		Trending / historical	
		Comprehensive	

Table 16. Positive Technology researchers have identified a wide range of strategies that can be used to support positive change; this table identifies the source of each strategy discussed below.

In order to make sense of these varied strategies, I have clustered them into categories and included definitions. Strategies proposed by different researchers may partially overlap each other. Each strategy in the following table is labeled with the number of the original source as shown in the table above.

Category		Strategy	Definition
Goal setting		Goal negotiation & coaching [4]	Providing guidance to set goals that are significant but achievable
		Priming [4]	Activating an item to make it more available for selection. This is done by bringing it into awareness, even if only subconsciously. (Priming as a psychological mechanism is discussed in the background on decision-making; see section 4.1)
		Tailoring [1]	Personalizing the solution to make it specific and relevant to the individual, instead of generic.
Experience of Doing		Aesthetic [3]	If the solution is to be adopted for the long term, it needs to be appealing and congruent with the user's sense of style. For example, some studies of fitness devices found users rejected use of unattractive wearable devices because they didn't like how wearing them reflected on their appearance and self-image.
		Intrinsic motivation [4]	Reminding people about the aspects of the desired behavior that they themselves find appealing; also, make using the solution appealing in itself.
		Reduction [1]	Making complex tasks simpler to accomplish, e.g., by reducing the number of steps involved.
		Tunneling [1]	Reducing the number of decision points involved in accomplishing a task, e.g., by leading the user through a series of pre-determined steps.
Data collection		Comprehensive [3]	Provide for the collection and display of all behaviors that are relevant, not just those that are easy to handle with available technology.
		Controllable [3]	it is important to let people control and edit the data so that it reflects what they think is appropriate. Control also includes restricting and allowing access to the data.
		Self-monitoring [1]	Eliminate the tedium and increase the reliability and completeness of collecting data on activity, progress, or status by automating data collection. Enables reflection on current state and trends.
		Unobtrusive [3]	Solutions should fit into the user's everyday life without unduly calling attention to the solution or the user.
Feedback & Reflection	Individual	Abstract & reflective [3]	Instead of presenting raw data, find a way to abstract its presentation in a way that encourages reflection on activity and its relation to goals
		Operant conditioning [1]	From behaviorism, using reinforcement (either reward or punishment) to encourage or discourage specific behaviors. Note that there are significant moral considerations in use of this technique because of its potential for direct harm (from punishments) and abuse (even when positive reinforcement is used, it is a powerful technique that can

			encourage behaviors that are themselves negative).
		Positive [3]	Suggests only using positive reinforcement when desired behaviors are performed; when they are not, sustain the user's interest, but do not either punish or reward.
		Praise [2]	Cheering desired behaviors is a simple form of positive reinforcement.
		Trending/historical [3]	Allow the user to see past behavior and how it relates to their goals. Consider that goals may change over time. Devices used for collecting data may change over time as well, so data portability is important for being able being able to see trends over time.
	Social	Public [3]	Because the data being collected may be exposed to other people while the user is working with it, represent it in a way that will not cause embarrassment or discomfort in that event.
		Social learning [4]	Other people can teach how to do activities
		Social comparison [2]	Enabling people to see how other people are behaving can motivate and provide information about what is achievable.
		Social influence [4]	Both teamwork (wanting to support teammates and not let them down) and competition (wanting to beat others) can provide motivation.
		Surveillance [1]	Awareness that one's behavior is being monitored motivates people.
		Reciprocity [2]	Having an agreement with one or more other people to mutually support each other's goals
		Use of virtual humans [2]	People respond powerfully to images of human expressions and body language; virtual humans can be used to exploit mimicry, rapport, and other emotional responses to motivate desired behaviors and strengthen commitment to goals.

Table 17. Persuasive technology has a wide variety of strategies available to support different aspects of behavior change.

10 Appendix C: Features & Gaps of Existing Reading tools

Many tools for readers exist. These tools have many capabilities to assist with various problems. I wanted to examine these tools to identify existing design patterns and idioms used in reading tools, as well as to clarify what gaps existed that need to be filled.

I selected a subset of tools using an informal methodology, choosing from among those mentioned in the interviews and those frequently mentioned in online reading communities and by book bloggers.

The table below compares the available functionality of several tools. Some of these capabilities are from the survey of new media technology (Section 2.8), and others are capabilities imagined to address problems described by interview subjects.

The tools were selected through an informal process. Several of the tools were mentioned by interview subjects, including physical TBR shelves, emailing notes to oneself, paper lists, and electronic documents. Goodreads.com and Amazon.com were both mentioned by multiple interview subjects as well. Amazon has several overlapping tools with different capabilities; for clarity I distinguished between their overall website, wishlists, Listmania, and the capabilities available using Amazon's Kindle ereader devices.

I also examined a variety of other existing software tools. I identified these tools through web searches for reviews of tools for readers, and selected the most frequently-mentioned ones. These included Google Books, LibraryThing, Delicious Library, and Shelfari. (Goodreads also featured prominently in these results, and it would have been included for that reason even if it had not already been identified by multiple interview subjects.)

I found that while many of these tools provide ample support for identifying books of interest and storing a reference to them for later, they did not provide encouragement to actually read those books. They also had limitations in spanning multiple stashes, leaving users in a position of needing to perform multiple checks and searches to find a book they had stashed previously. This presents an opportunity for future solutions to fill these unmet needs.

Key: • = has capability o = partial capability blank cell = no capability

Problem	Capability	Physical TBR shelf	Email to self	Paper list	Unstructured file	Goodreads	Shelfari	LibraryThing	Delicious Library	Google Books	Bibliocommons	Amazon.com website	Amazon Kindle	Amazon wishlists	Amazon Listmania
Discover books you will want to read	Recommendation engine					•	o	•	•			•	•	•	
	Receive suggestions from friends					•	•	o				•			•
	Curated lists from others					o	•	•		o	•				•
Decide whether you want to read a specific book	reviews					•	•	•	•	•	•	•			
	publisher's description					•	•	•	•			•			
	author bio					•	•	•	•			•			
	cover image					•	•	•	•	•	•	•	o		
	endorsement blurbs					•						•			
Organize books	Existing book metadata					•	•	•	•						
	User-provided categories				•	•	•	•	•	•			o	•	•
	Arbitrary, direct arrangement	•		o	•				•	•			o	o	o
Add books	Barcode scan					•	o	•	•	•		o			
	From partial / incomplete author or title	o	o	o	o	•	•	•	•	•	•	•		•	•
	Cover image recognition									o		o			
Remember a book you want to read later	in a specific format	•	•	•	•	•	•	•	•	•	•	•		•	•
	regardless of format		•	•	•										
	before it has been published		•	•	•	o				o	o	o			
Recall & review previously-stashed books	independent of source/vendor								o						
	connect to and aggregate multiple source stashes														
Choose what to read next from books you already have	Provide a stash for books you want to read	•				•	•	o	o	•			o	o	
	Prime awareness of stashed books through ambient visibility	•													

Problem	Capability	Physical TBR shelf	Email to self	Paper list	Unstructured file	Goodreads	Shelfari	LibraryThing	Delicious Library	Google Books	Bibliocommons	Amazon.com website	Amazon Kindle	Amazon wishlists	Amazon Listmania
Share and display your reading	Tell others about a specific book		•			•	•	•	•	•		•	•		o
	Display what books you read to people online														
	Display what books you read to people who visit you	•													
Finish reading 'in progress' books	Indicate current position in book	•											o		
	Provide a visible reminder of in-progress books	•											o		

11 Appendix D: Personal Informatics for Media Consumption

One specific subset of persuasive technology that has gained in popularity recently is the field of personal informatics: collecting and reflecting on objective data about one's own behavior in order to better achieve desired outcomes. In recent years, technology capable of supporting this practice has become more affordable, easy to use, and widely available, with commercial offerings from companies such as Nike, Phillips, and Fitbit crossing into mainstream use.

11.1 Background

The Quantified Self (QS) movement is based on the practice of personal informatics. In personal conversations with attendees at Seattle Quantified Self Meetups, they told me they often find that simply measuring something causes the measured behavior to change. This is reminiscent of the "Hawthorne effect" discovered in productivity studies at the Hawthorne power plant in the early twentieth century. The meaning and mechanisms of the effect are debated, but in general it claims that performing an intervention where the subjects knew their productivity was being measured increased productivity, regardless of the actual intervention (Olson, Verley, Santos, & Salas, 1994).

Another powerful mechanism which seems to be at work in QS is related to the "Seinfeld Chart," named after the work habits of the comedian Jerry Seinfeld: he simply marks a large X on a wall calendar each day that he writes and tries to "not break the chain" (Isaac, 2007). In addition to the intrinsic motivations of performing the desired action, the QS'ers told me that the desire to maintain the unbroken streak and see the ongoing record of success serves as extrinsic motivation. This seems connected to Macadams' identity claims (MacAdams, 1997) and Swann's self-verification (Swann, 1983); we want to see and show others evidence that supports our self-image, so by creating visual evidence about our behavior where we will see it, we are more motivated to behave as desired in order to keep the evidence and our self-image in accord.)

QS'ers also reflect upon the collected data and sometimes gain insights which help them achieve their goals by finding patterns.

The Personal Informatics approach of tracking data has a problem, which is that people stop recording data when it is not favorable.

> *"There's a discipline switch - it can stay on for months at a time. Tracking can help. But as soon as I go off my goal, I stop tracking. I might record breakfast and lunch, and then record nothing for dinner- because dinner didn't follow the diet." —S1*

Ian Li (Li, Dey, & Forlizzi, 2010) developed a model of personal informatics, where he identifies different phases of activity around personal informatics and challenges that people encounter in each phase. There is a great deal of similarity with other persuasive technology, but the focus is heavily weighted towards data, and there is less attention paid to the experience being measured.

Personal Informatics Activity Phase	Hassles
Preparation – decide what to record & how	**Tool/data lock-in** - choosing the wrong tool can result in abandoning data **wrong / insufficient data collected** - so initial efforts may not be able to provide desired insights
Collection – observe and record data (manually or automated)	**Tool** may not be available when / where needed **Remembering** to collect data **Time-consuming** to collect & record data **Accuracy** may be estimated or measured poorly **Motivation** needed to maintain collection effort
Integration – prepare and transform the data so the user can later make sense of it	**Transcribing** data from collection to analysis tools **Organizing** data so it can be processed **Scattered visualizations** requires users to observe analysis in different places **Multiple inputs** makes combining data effortful
Reflection – short term to review recent performance; long term to reflect on goals, progress, trends and identify patterns	**Lack of time** – analysis **Visualization tools** often don't provide the views of data people are seeking **Self-criticism** can be hard to resist when reviewing personal data, this can prompt avoiding reflection **Interpretation** of the data can be difficult **Searching** for the desired information can be difficult or slow **No context** provided - if data collection is sparse, the reasons for a change may be unclear **Sparse data** – if not much data is collected, analysis may provide insufficient meaning, leading to giving up on personal informatics
Action – take the new understanding provided by data and apply it to change behavior to meet goals	**Lack of suggestions** – people may not know what to do to change a pattern they have identified **Sharing with others** – may be difficult to present data and insights to others who can advise on actions (doctors, social networks, forums)

Figure 22. People who use personal informatics face a number of challenges in each phase, which should inform the design of tools (Li et al., 2010).

In the next section, I examine existing tools that address media consumption and evaluate them against these challenges. I will also show how many of these challenges can be

addressed in a design concept for a personal informatics solution for media consumption in section.

11.2 Survey of existing personal informatics tools for media consumption

Personal informatics is effective for some people in helping make sense of their behavior and achieve desired changes. I wanted to determine if there were existing personal informatics tools for media consumption that would help address the needs people face.

The Quantified Self community maintains a directory of over 500 personal informatics tools[4] submitted and categorized by the community members. The categories represent different areas of life where people want support in making changes. While some of the categories are tangentially related to media consumption (e.g., lifestyle, productivity, learning) none of the categories are specific to media consumption.

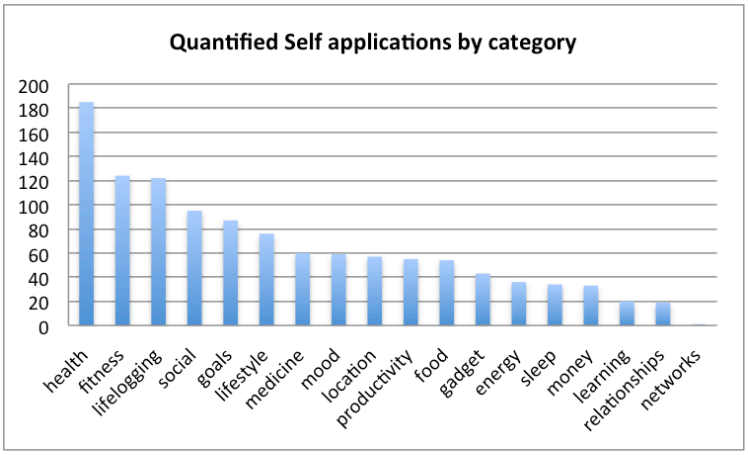

Figure 23. While the Quantified Self community has curated a guide to over 500 personal informatics tools available to help people make changes in many areas of life, media consumption is not represented.

Because none of the categories was a direct fit, I reviewed the descriptions of all the tools. From that list, I identified 13 tools relevant to media consumption – if it were a distinct category, it would be smaller than all but one of the existing categories in the guide. I evaluated which categories of media they addressed and which stages of personal informatics activities they supported. Table 18 summarizes my findings.

[4] http://quantifiedself.com/guide/

Tool	Media category support								Personal Informatics stage support				
	Books	Television	Movies	Music	Websites	Magazines	Newspapers	Social networks	Perparation	Collection	Integration	Reflection	Action
GoodReads	•									•		•	•
LibraryThing	•									•		•	•
ReadMore	•									•		•	•
Readmill	•									•			•
Readernaut	•									•			•
Amazon.com	•	•	•							•			•
Recall	•	•	•							•			•
RescueTime					•					•			
LastGraph				•						•		•	
LastHistory				•						•		•	
Balancer					•					•		•	•
Miso		•	•							•			
Voyurl					•					•		•	

Table 18. Personal Informatics tools for media consumption are incomplete in both media category support and in supporting all stages of personal informatics activities.

The results make clear that there are no solutions that support all stages of personal informatics for any media category. And media consumption is at present even more poorly supported than it appears from the table above.

- Several of these products are now apparently defunct (Voyurl, Readernaut) or are research tools not being further developed (Balancer, LastGraph, LastHistory).
- Many of them only cover part of a user's consumption in a given category. For example, RescueTime can track websites you visit on your computer, but not your mobile phone. Balancer and Voyurl only track websites visited through Google's Chrome browser – and Balancer only tracks politics and news websites. Amazon's tools only provide data about media purchased from them.
- Preparation support – goal setting – is missing entirely.
- Collection support is the common feature present in all solutions, but solutions either require manual data entry or only support a small fraction of sources with automated data collection.
- Integration support is practically non-existent. Some tools provide basic export, but that is all.
- The support for reflection is quite basic in most cases, usually just providing a raw list of past consumption.

- The support for action is limited to providing a list of items that could be consumed, sometimes with links to one or more sources where the item could be purchased.

One of the most interesting tools provided is also the most narrowly focused, yet it has a broad range of support within its limited domain. Balancer, a browser extension, was created as part of a research project investigating diversity in opinion and news consumption (Munson & Resnick, 2010).

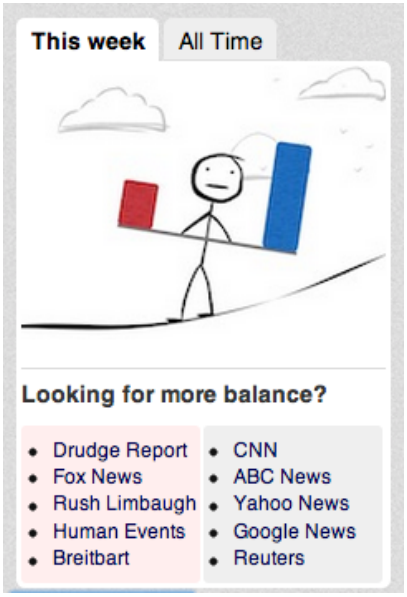

Figure 24. Balancer (Munson & Resnick, 2010) provides strong support for collection, reflection, and action in its narrow domain of reading politically balanced news on the web.

Within the constraints mentioned above, Balancer has excellent support for collection, automatically monitoring websites visited with no effort required on the part of the user. Reflection is supported with a simple graphic indication of the political viewpoint of news consumption (pictured in Figure 24). And action support is provided in the form of links to alternative sites from either side of the political spectrum. Still, it has no support for preparation – the goal it supports is predetermined. And it lacks support for integration; it is only capable of using data gathered within a single desktop web browser environment. There is no way to bring in data from other sources of political news and opinion, or even to combine the results of one individual on two different computers.

11.3 Design considerations of personal informatics for media consumption

Advertisers and publishers currently have better data on our media consumption habits than we do. It should be possible to provide interested people with tools and information to help them.

Such a solution should address the limitations we found when surveying existing applications. Emerging technologies could be leveraged and existing technologies could be extended to address current gaps.

Based on the research findings about people's challenges, I have provided design considerations relevant to supporting media consumption behavior change for each of the five phases of personal informatics activity defined by Li et al. (2010): preparation, collection, integration, reflection, and action.

11.3.1 Preparation

The solution should help people decide what changes they are trying to accomplish. Perhaps using an approach such as that used by the general purpose app Lift, where people are free to suggest any goals they want, and then these goals are available to be joined by other people. This enables formation of a community of people oriented towards the same activity, who can provide a variety of social supports to each other (see the relevant social strategies in Table 17).

11.3.2 Collection

Existing solutions have major weakness in data collection. Requiring manual entry of all items is too effortful for most users. There are some media platforms that provide excellent automatic data collection for consumption within that platform (e.g., Amazon Kindle, TiVo digital video recorder, Netflix streaming video, Last.fm music), but they have no visibility to media consumed outside that silo. And the platform providers often restrict access to the data – in many cases it is more available to publishers and advertisers than to the users whose purchasing and consumption behavior generated it. They also restrict access to the media itself using Digital Rights Management.

Yet fully automated data collection across all media types can be imagined quite easily; it appears we are on the verge of being able to achieve automated data collection of all of one's media consumption. After all, if a person is to be able to experience media, they must be able to see and hear it. (This is referred to as the "analog hole" in digital rights management.) So it is at that point where consumer-empowering technology can be inserted, identifying the media through sight and sound, just as media consumers experience it. And such technologies are increasingly prevalent and feasible.

- Wearable computing devices such as Google Glass will be able to **record samples of all media a person consumes or examines**. It must be noted that at present, there is a great deal of controversy about the ethics and etiquette of ubiquitous recording, which must be addressed before widespread adoption.
- In the interim, people are already using their smartphones to take capture pictures and audio snippets of specific media items in order to identify and save them.
- Many existing tools are capable of **identifying specific works of media** from small recorded samples:
    - Books can be identified from a cover photograph: example Amazon's mobile app and Google image search
    - Texts can be identified from small excerpts, such as with plagiarism detection systems
    - Songs can be identified from short recordings, such as with apps like Shazam and SoundHound. This technology is also being used to identify television shows and commercials; it would be conceptually simple to extend this to movies as well.
    - To identify live performances, location could be combined with event calendars.

11.3.3 Integration

If all of a person's media consumption is collected in one place, the integration hassles of bringing data together from multiple sources can be avoided.

Another challenge in spanning multiple forms of media is that of units. To use the food metaphor, it is the apples and oranges problem: how do you make sense of consumption of books vs. consumption of television shows?

Existing tools track consumption primarily based on media items: here are the books I read; here are the movies I watched. But a recording/sampling system would be able to tell how much time was spent on with each media item, and use time as a common measurement basis.

11.3.4 Reflection

It is important to tie reflection back to goals. We have already seen that people's categories and goals are idiosyncratic. A solution will need to enable presenting the data in a way that aligns with the goals they established during preparation. This could involve a tagging/training approach, where the system learns the user's categorization patterns over time.

Still, it is useful to provide people with a starting point, so breaking things down into media category (books, television, movies, music, social networks, etc.) would probably be a good starting place.

11.3.5 Action

Personal informatics solutions for media consumption could help with action in several ways.

First, context-sensitive prompting could prompt action. One aspect of context that would be readily available to such a tool would be a person's previous media consumption as well as their goals. If someone had just consumed something from one category they had set as part of their desired consumption, prompting them to select something from another category that they hadn't 'eaten' recently would be helpful.

If a PI solution could detect other aspects of a user's context, that could also be used to encourage action by filtering their recommendations based upon that context, as discussed in Section 3.5.

Another way that a solution could encourage action would be through use of priming, as described with the TBR design research.

11.4 Conclusion

Existing PI solutions for media consumption have numerous gaps in the various stages of PI activities. I have reviewed these and identified potential opportunities to fill these gaps in developing a more effective PI solution to support media consumption. Yet PI is not necessarily a solution for everyone. I heard (in Section 3.5.2.2) that some people find this sort of data collection and review approach ineffective, especially in returning to desired behavior after a stumble, while others feel this sort of activity is "obsessing" over negative aspects of their behavior, which they find nearly as odious as the behavior itself. Still, at

least those people who do find personal informatics a rewarding and useful activity may be well-served by a personal informatics system for media consumption which is designed in accordance with these design considerations.