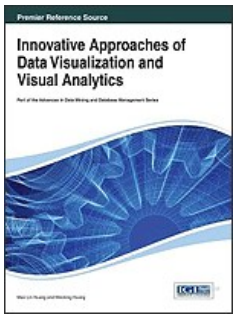

Innovative Approaches of Data Visualization and Visual Analytics

Chapter 15: Visualizing Information-Triage—A Speculative and Metaphoric Interface for Making Sense of Online Searching

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ABSTRACT

In many ways, the promise of the Internet has been overshadowed by a sense of information overload and anxiety for many users. The production and publication of online material has become increasingly accessible and affordable, creating a confusing glut of information users must sift through to locate exactly what they want or need. Even a fundamental Google search can often prove paralyzing. In this chapter, the author examines the points at which design plays a role in the online search process, reconciles those points with the nature of sensemaking and the limitations of working memory, and suggests ways to support users with an information-triage system. The author then describes a speculative online searching prototype that explores these issues and the possibilities for information-triage.

INTRODUCTION

The Complications of Complexity

Search engines like Google allow users access to unimaginable amounts and types of complex information, but the ways in which search results are visualized often makes comparing and contrasting these results difficult. In many ways, the promise of the Internet—easily sharing information via a network of globally connected hyperlinks—has been overshadowed for many users by a sense of information overload and anxiety. The production and publication of online material has become increasingly accessible and affordable, creating a confusing glut of information users must sift through to locate exactly what they want or need. Moreover, the visual display of this information has remained woefully un-designed, under-designed, and/or unconsidered.

Generations of people who have been trained to passively accept information from sources of vetted authority are now interacting with a dynamic system of globally linked information, raising slippery questions that are no longer easy to answer. Is an article in the Encyclopedia Britannica on augmented reality equal to an entry in Wikipedia? Can a blog posting about diabetes be more informative than an appointment with your doctor? In the shifting context of the Internet, credibility and authority should never be assumed, but often are.

Information overload is not a new problem. People have been inundated with increasing levels of information since the Industrial Revolution and the explosion of printed material and resulting mass-media that came along with it (Wright, 2007). What *has* changed in the last twenty years is the ease of access to an unchecked flood of information. According to Clay Shirky (2008), Internet technology writer and academic, what we are experiencing today is not really information overload—it is filter failure. Filters that developed over the last few hundred years to deal with large amounts of information have started to break down as the Internet has moved society from a process of top-down edited publication to one of bottom-up open-source dissemination. Design can (and should) engage with this issue to develop better tools and systems, helping users understand and filter the information they encounter online. One method, which has yet to be fully explored, is information-triage.

The concept of information-triage is derived from the medical process of sorting through and prioritizing patients for care. The word originates from the old French verb *trier*, and means to sift, separate, or select; traditionally, three discrete categories for sorting were used (Merriam-Webster, 2012). A medical triage practitioner must quickly recognize, sort, categorize, and prioritize the status of a given patient—usually in a hierarchically driven and methodical way. Each new case is moved through a system following scripted sets of criteria, allowing less critical cases to be dealt with as time allows, and the most critical cases to be dealt with immediately (O'Meara, 2007).

The concept of triage migrated to the computing and business world as tasks and jobs became increasingly complex, and the amounts of available and accessible data grew exponentially. Other HCI (Human Computer Interaction) and Information Science researchers have begun investigating a related concept known as *document triage*, the manual process of briefly reading through multiple source documents, and quickly making decisions regarding relevance and saliency. These quick decisions allow a user to sort through large quantities of initial documents, which are then explored in more detail depending on user goals and needs (Geng, Laramee, Loizides, & Buchanan, 2011).

However, researchers have found that the document triage process is imperfect, and many users miss relevant sources and connections when using current document search and display technology (Buchanan & Owen, 2008). Information-triage is the selecting, sorting and categorizing of different kinds of information, while document triage is the process of selecting, sorting and categorizing sets of whole documents. These concepts are certainly related, and many aspects of the search process in general are affected by a user's ability to successfully conduct triage.

Part of the anxiety Internet users feel has to do with the shifting nature of the human attention span and the limits of working memory. As users engage with data and information online, they are bombarded with multiple levels of layered material and alternate avenues of discovery. The user encounters countless screens, ads, and links, which are all competing for attention. These short bursts of disjointed data are distracting for even the most focused user, and over time users often forget what they were searching for in the first place. When attempting to gather information to aid an important decision—especially when a search yields conflicting opinions—this chaotic atmosphere can prove paralyzing.

However, users are not without some inherent tools—one human ability being investigated and incorporated into interfaces is *sensemaking*.

Studies related to this concept are currently being conducted in many different disciplines including medicine, geography, organizational communications, management and HCI (Pirolli & Russell, 2011). By integrating the findings from sensemaking research into the design of search engine interfaces, users can be given explicit tools to utilize in intuitive and flexible ways.

In this chapter, I will: examine current methods for search result visualization; explore and address the points at which design plays a role in the online search process; investigate those points in relation to the nature of sensemaking and the limitations of working memory; and suggest one way to visualize search results within a metaphorical and speculative interface design that would allow users to benefit from both the use of information-triage, and specifically designed data visualization.

BACKGROUND AND MOTIVATIONS

Content and Visual Analyses of Existing Search Engines

I have conducted an analysis of ten of the most commonly used search engines: Google, Bing, Yahoo, Ask.com, AOL, MyWebSearch, Blekko, Lycos, Dogpile and WebCrawler (eBiz/MBA, 2012). This analysis included an examination of the same six elements of interface design and functionality:

1. Initial search page
2. Search term assistance
3. Search results interface
4. System settings/preferences
5. Advanced search options
6. Basic image search

The analysis found that all ten of the search engines are quite similar in setup, function and overall experience. Most of the interfaces begin with a simple search box page, show results in pages of lists, and have some personal setting options. A few of the search engines include large photographs, article listings, and popular news stories on the initial search page. Of the ten search engines analyzed, most report on their results pages that they are in some way pulling results from, or powered by, Google. This fact helps to explain why so many of the search engine interfaces are strikingly similar.

All ten of the search engines display results in nearly identical ways. Generally, the interfaces default to showing ten results per display page, with navigation at the bottom that allow users to move on to subsequent pages. Each result listing consists of a title, a URL and some synopsis text pulled from the website listed. The typefaces and styling for this text are identical for all search engines analyzed. In part, this sameness is due to conventions traced back to the first iterations of HTML, and to cultural expectations that have built up over the last few decades.

Most of the search engines, especially the most popular two, Bing and Google, emphasize sponsored results, which are not clearly differentiated from the non-sponsored results. For the most part, these results are labeled as "Ads" in small type, and generally appear in three locations: at the top of the search result listings, in a column on the right-hand side of the interface, and often at the bottom of the page. Some of the interfaces place a lightly shaded box behind these ads, but in all cases the typefaces, style and kinds of language used are identical to the search results themselves. This raises questions and concerns about the credibility and motivations of all the sources listed, as well as the search engines themselves. Users cannot easily distinguish between these two types of inherently different information.

The analysis also found that overall, advanced searches are shallow and limited. None of the ten search engines allows a user to search-within-a-search to narrow her results. Some of the search engines do offer help pages to assist the user with search basics, but in general these pages are difficult to find and poorly organized. Bing and Google offer reasonably robust search help once the pages are found and accessed. The assumption seems to be that users will just type in search terms based on conversational phrases or questions, rather than Boolean phrases or other types of advanced search methods that Information Science professionals utilize.

Of the ten interfaces analyzed, only Google and Blekko truly allow for a faceted search. A faceted search is the assignment of multiple categories and tags to an object, enabling the categories and tags to be ordered in multiple ways. Google allows users to sort result listings by location and time ranges, as well as a somewhat confusing list of specific filter criteria: Sites with Images, Related Searches, Visited Pages, Not Yet Visited, Dictionary, Reading Level, Personal, Nearby, Translated Foreign Pages, and Verbatim. These options are not all self-explanatory, and feel like a list generated by multiple requests or ideas over time and cobbled together, rather than a cohesive and understandable system. Blekko allows users to sort result listings by location and a system of user assigned "slash tags"—labels that users choose and apply to specific results according to whatever criteria they choose. The other search engines allow users to sort by large context categories, but not more specific criteria. Since none of these systems allow for a true search-within-a-search, the facets and distinctions aren't robust enough to help a user narrow her search effectively and efficiently.

Overall, these search engines, especially Google, excel at cataloging the web and returning increasingly accurate results. But the functionality and visualization of both the interface and results is poorly developed, and in many cases, a hindrance to a user's cognitive abilities and needs. When faced with a solid and utterly homogeneous screen of text, most users have trouble discerning among the returned results, because visual, spatial, cognitive and sensemaking cues are not utilized in any meaningful way.

Working Memory: For Better and for Worse

Our brains are overflowing with information—tasks, memories, ideas, conversations—which comes at us in a steady stream from technology, media, other people and our environment. We have an undeniably impressive ability to manage immense amounts of this information on a

daily basis. But even as we cope, when the steady stream becomes heavier and faster, we are left feeling uneasy, anxious and overloaded.

Our ability to process complex information is related to how well we can focus our attention, which is directly linked to the capacity and limitations of our working memory. As our brains overflow and our tasks become more complex and taxing, we discover that working memory can be very limited indeed. Alan Baddeley, a professor of psychology at the University of York, defined the term working memory. Working memory is "a limited capacity temporary storage system that underpins complex human thought" (Baddeley, 2007). It allows the brain to actively hold, and temporarily capture information, and is part of what makes attentional control, focusing on one object or concept while ignoring others, possible.

Working memory is what allows us to temporarily remember a phone number or verbal directions to a friend's house. It allows us to solve a math problem or to think through the steps needed to complete a process. This is the workhorse of our cognition, allowing us to move through information and situations without having to commit everything we encounter to long-term memory.

Working memory operates in conjunction with short-term memory. Short-term memory is a storage system for information on a short-term basis, while working memory is the active manipulation and use of that information. Long-term memories are created through the short-term memory system. These memories generally occur when a sensory stimulus proves particularly powerful or engaging, or through active and conscious rehearsal or memorization techniques. Long-term memories are considered lasting and enduring. They are part of a complex retrieval system, allowing users to call them forward as desired—although this process is imperfect, as anyone who has claimed an answer was "on the tip of my tongue" can attest.

Baddeley has constructed a model to explain working memory, which is based on clinical findings centered on dual-task experiments. When a user was asked to complete tasks involving two of the three ‘perceptual domains’ in the model—verbal information and language, visual information, and narrative and time based information— she was able to complete both tasks simultaneously nearly as well as when the tasks were attempted separately. However, when a user was asked to carry out more than one task within the *same* perceptual domain she found it significantly harder. Therefore, Baddeley posited, there must be some kind of interference when a user attempts to process too much information in one perceptual domain at a time. This explains why most people are able to draw while listening to music or someone speaking, but unable to comprehend someone speaking to them while simultaneously watching the news on TV.

Working memory also has an overall limited capacity. At some point, it becomes full and cannot hold any more information. New pieces of information can be taken in but only through the loss of another piece of information. An example of this concept at work is the everyday shopping list. Your mother asks you to go to the store to pick up just a few things. She verbally lists off the items for you: a loaf of bread, a carton of eggs, a quart of milk, and a stick of butter. This list is fairly short. You repeat back the items and might rehearse the list once or twice on the way to the store but have no problems remembering without a written list.

Now imagine she asks you to remember thirteen items instead of four. Even if you try to rehearse this list several times, chances are you will forget something. This is because you have filled your working memory. Typically, people can easily store four to seven items in their working memory. But at some point, the storage is full, and you need to employ another strategy to help you retain and recall the information.

The limitations of working memory have many implications for the task of searching online. Attempting to make sense of multiple search results at the same time can fill the capacity of working memory, creating a sense of unease or confusion for a user. This is specifically difficult because of the way most of the search engine interfaces are designed. The structure of the pages, the use of barely styled lists of text, and the repetitive sameness of page after page of blue and black type on a white background don't allow users to effectively discriminate relevant results. Within the distracting and overwhelming world of the connected laptop or mobile phone, these limitations are pushed even further. Most of the search interfaces found online have not been designed to help users with this cognitive limitation.

Sensemaking: Processing and Understanding Information

Sensemaking is a cognitive process that has been studied in several different knowledge domains including medicine, policy making, understanding geographical influences on patterns of data, and the intelligence community. Simply stated, sensemaking allows humans to make sense of complex information and data encountered in the world around them. Pirolli and Russell discuss the implications for sensemaking in terms of HCI in their introduction to an issue of the *Human-Computer Interaction Journal* dedicated to the topic:

> Sensemaking involves not only finding information but also requires learning about new domains, solving ill-structured problems, acquiring situation awareness, and participating in social exchanges of knowledge. In particular, the term encompasses the entire gamut of behavior surrounding collecting and organizing information for deeper understanding (Pirolli & Russell, 2011).

Pirolli and Russell go on to discuss three perspectives currently being posited in the literature regarding sensemaking:

- **Representation Construction Model of Sensemaking:** This model organizes the sensemaking process along an axis of structure and effort, and focuses on smaller sub-tasks within the larger search goal; specifically these sub-tasks are organized into those related to "foraging" and "sensemaking"; the model follows a recursive process of a user's interactions with information which include searching, making connections, supporting those connections with evidence, and reevaluation.
- **Data/Frame Perspective of Sensemaking:** This model uses the idea of "frame" construction, and explores how users encounter data, try to place that data within a frame, and then reconstruct those frames as needed to make sense of the information; this perspective comes from outside the world of HCI, but closely relates to the idea of "context" used within HCI and design research.
- **Collaborative Sensemaking:** This perspective investigates how teams of researchers and other types of workers make sense of information as they work together; this research also explores the difficulties faced by teams and how the members find focus as both individuals and team-members.

All three perspectives have ramifications for the research in this chapter. The first describes a methodical process users employ or could employ; the second explores the importance of framing and reframing information into different contexts and understandings; and the third examines the social and collaborative aspects of sensemaking, which have been present on the Internet since its beginning, but are just starting to be exploited in truly intentional ways. Ntuen, Park, and Gwang-Myung (2010) further characterize sensemaking in the following ways: as an aspect of foraging, or seeking and collecting information that seems pertinent to the task at hand; as a way humans attempt to fuse information together, making connections and finding ways to explain strange juxtapositions or information that is surprising in some way; and as the comprehension of context.

Several examples of interface prototypes that incorporate concepts from sensemaking research have been recently designed. Examples include interfaces: to help military experts make decisions (Ntuen, Park, & Gwang-Myung, 2010); to support geographic analysts (Tomaszewski, Blanford, Ross, Pezanowski, and MacEachren, 2011); and to engage self-directed student learners in the process of completing tasks related to education (Butcher & Sumner, 2011). In all three cases, the interfaces designed focus on giving a user the power of spatially organizing information she has already located and decided was important. The interfaces utilize many spatial cues, cordoning sections off into different boxes for different task-purposes. The designs also integrate drag-and-drop techniques to help users intuitively understand the movement and sorting of information. Two of the interfaces integrate maps and charts, enabling users to plot information points using these types of schematics.

Overall, these three interface examples do not address the need for triage to occur at the site of the search engine itself, where raw data is being initially chosen and collected. While the systems do acknowledge the creation of spatial understandings of visual data, the designs do not go much further beyond organizing the space into multiple divisions and boxes. Other types of visualization and organization could be employed to further address the cognitive needs of users.

Information-Triage: Defining the Term

As the role of multi-tasking is being applied to more professions and activities, methods for ‘cutting through the clutter’ become integral to even basic tasks. Finding ways to sift through all the text, images and multi-layered links of the Internet in order to drill down to exactly what you need, exactly when you need it, has become a necessity. While the ways in which we're interacting with information are quickly changing, our need and desire to sort through it all remains the same. This is where the idea of triage is useful.

Triage is generally, and almost exclusively, associated with the medical practice of sorting and prioritizing patients based on the urgency of their need for care. Several triage systems are available for medical practitioners. These typically consist of colorful and meticulously codified tags and a course to teach triagers how to use the system efficiently and quickly. This extremely structured process is built around routine. Each time a triager encounters a patient, she moves through the same series of steps. She carefully records pertinent data and has been trained to be both methodical and unemotional as she moves through a disaster area, emergency room, or doctor's office. Patients are typically ranked along a four- or five-point scale to determine severity of injury and the urgency of immediate care (FitzGerald, Jelinek, Scott, & Gerdtz, 2010).

A visual analysis of several of these triage systems revealed that they use similar techniques and visual conventions, which include the use of color-coding (using primary colors); icons; simple geometric shapes; roman numerals; fill-ins and check-boxes; strong visual hierarchy; charts; arrows; and perforated sections containing bar-codes. Furthermore, all of the tags analyzed read from top to bottom, used little text, and were double-sided. These tags are designed to move the triager through her routine step-by-step, alternately asking her to examine the patient and catalog specific injuries, check and document vital signs, and to then use this information to prioritize care.

Triaging Information: Data as Patient

Information-triage is the process of sorting, grouping, categorizing, prioritizing, storing, and retrieving information in order to make sense and use of it. Peter Lunenfeld, media theorist and professor of media design, discusses this notion of information-triage: "Info-triage is more art than science, a practice that involves the weighing of options and the measuring of time. We tend to think of time in relation to efficiency, but info-triage is about more than job performance, it is a practice devoted to mindfulness…[it] is not so much about efficiency as the culling of the distraction in the search for meaning" (Lunenfeld, 2011). In this context, information-triage is not merely a sorting technique, but also, a type of curation.

Several methods of information curation currently exist online. Search engines offer a fundamental form: they seek out sites based on key words and phrases, and display the results back to the user in a hierarchical fashion. Sites like Google allow users to look through an abbreviated version of the Internet, making it possible to find particular pieces of information relatively quickly and easily. In fact, since their inception over ten years ago, today's users of search engines would likely define them as indispensable. It is difficult to remember what the Internet was like before their implementation.

Google created another useful interface for curation with iGoogle, a customizable ‘personalized’ homepage. Users can place widgets on their page containing information as diverse as the weather report, today's news headlines, games, and interesting images from other sites like Flickr. iGoogle offers a holding place for information and content that a user would normally have to visit multiple separate websites to view. It acts as a catchall, a single drawer the user can access to keep the content she deems most important to her close at hand. And, when this content exists within one portal, there are fewer chances for the user to become distracted by non-relevant material. iGoogle is both a display of choice and a buffer from distraction. Lunenfeld posits, "Info-triage accepts the psychological insight that those confronted with a vast array of options are often less satisfied than those who select between a smaller set of alternatives" (Lunenfeld, 2011). Ultimately, what this notion of info-triage offers is a sense of abbreviation—a threshing out of the chaff—allowing a user to focus on what is actually wanted or needed at any given time.

The concept and underlying process of information-triage are directly borrowed from the medical context, but the metaphor can only carry so far. If medical triage is about maximizing the number of survivors, treating those most likely to recover or eventually be healthy, then what is

info-triage ultimately attempting to do? ‘Save’ only the most useful or pertinent information? What happens to the information deemed unworthy or beyond help? Information given up for ‘dead’ could later prove crucial to a user's purpose. Should an information-triage system give the option to ‘resurrect’ information? If a user's search task is less urgent, can info-triage still be useful?

A significant distinction between medical triage and information-triage is the motivation behind the act. Medical triagers are motivated by a sense of emergency, duty and the greater good. They are confronted with an overwhelming and grave situation and have been trained to move through survivors or patients quickly, assessing which category each patient falls into. They must act with a sense of urgency because lives are on the line. The motivations behind information-triage are quite different, as this concept functions on a much less visceral level. Generally, no one's life is at stake, and even when information is messy, it is much less so than human bodies. Info-triage allows for mistakes and uncertainty, and is greatly enhanced through the power and efficiency of computers and databases.

Information-triage can also be described in these two ways: triage as *noun* (a result, or a display of information that has been triaged) and as *verb* (the system or process of triaging information). This is an important distinction because the concept of triage can be helpful in both aspects. Providing triage as a result allows a user to understand information more easily. It offers a focus, a filtering, a distillation. Providing triage as a process allows a user to think through a search. It supports her with tools and criteria with which to evaluate the information she encounters. These two aspects are useful for different kinds of situations, users, tasks, and timeframes.

What Does Information-Triage Look Like?

Info-triage can take many different forms, some subtle, some overt. The emotional qualities of these triage experiences can also be quite different. Below are three examples of current digital information-triage. Each offers up a slightly different flavor of this term.

Ommwriter

Attempting to write a text on a personal computer can be deceptively difficult. Because writing software like Word exists as a window, functioning among many other windows and the Internet, the temptation to procrastinate is great. The functional yet chaotic nature of the desktop makes it difficult for a user to focus. Herraitz Soto & Co. has created a soothing environment for writing, which addresses these difficulties, called Ommwriter. The website for this product defines the software as, "a simple text processor that firmly believes in making writing a pleasure once again, vindicating the close relationship between writer and paper. The more intimate the relation, the smoother the flow of inspiration" (Ommwriter, 2010).

The software operates as a bare bones, full-screen text editor with a decidedly Zen look and feel. The designers of the interface have stripped away any superfluous frills or functions, leaving a writing environment that is relaxing and quiet. A text box is automatically generated in the center of the screen, a handful of options float off to one side, and an optional background image keeps the environment from feeling too stark. The overall effect soothes and provides focus, especially because the user has to save her text and close the program before she can use another piece of software or her web browser. This basic limitation forces the user to think twice before trying to multi-task or procrastinate.

Of course, the usefulness of Ommwriter is limited and much of the appeal is in its novel aesthetic presentation. The tools to manipulate the text are basic, and the software does not include a spellchecker. Most writers require and desire far more robust support and tools. However, just the mere act of simplifying the interface and displaying it full-screen creates a sense of focus.

Viewzi

Co-founded in 2006 by Brandon Cotter and Chris Mancini in Dallas, Texas, Viewzi (please note, this site is now defunct) offered Internet searchers a legitimate alternative to Google. The co-founders described this search engine as, "a new and highly visual way to search that brings all your favorite stuff together in one place." Viewzi operated as a mass search engine aggregator, culling results from Ask, Google, MSN, and Yahoo. However, the real charm (and usefulness) of Viewzi lay in its multiple ways to view results. The website offered nineteen different view modes, some open-ended and some specific.

Many of the view modes were so specific that the usefulness was limited, for instance Celebrity Photos, Songs, or Recipes. These modes allowed the user to sort through these particular types of media in novel and visual ways, but did not facilitate overall research or making meaningful connections. However, these modes provided info-triage at a highly specific level. If a user clicked on the Recipes view mode, her search results were culled from four popular cooking sites, not just the Internet at large. The effect of this specificity meant that the user may have missed out on several hundreds of thousands of recipes from the overall Internet, but the search results she did receive were likely to be more useful.

Three of the more general types of searches on Viewzi were particularly interesting examples of info-triage: the Power Grid, the Web Screenshot, and the 4 Sources. These three view modes reconfigured results, normally seen in a static list, in a dynamic and visual way. The overall effect was a display that had been filtered and prioritized.

The *Power Grid* pulled search results from Yahoo and Google and placed them on a six-by-three grid. This view mode also allowed users to move, hide, open (launch) and star (highlight) pages through mouse clicks and key-strokes. Users were also given the option to view results as either text or home-page screen shots. This mode created a visual snapshot of the total search results, allowing the user to view them just eighteen at a time, and also provided a mechanism with which to sort and eliminate results in an intuitive way.

The *Web Screenshot* was one of the simplest, most focused ways to view search engine results. This mode displayed each result one at a time as a home-page screen shot, annotated with synopsis text, the site URL, as well as where the result came from (Yahoo, Google, MSN, etc.), and how many other results came from that same source. The user was able to move through the results fairly quickly using the arrow keys on her keyboard, and the overall effect of viewing results in isolation allowed a user to focus on one thing at a time. However, if a search returned a large number of results, or if the search query wasn't specific, the interface quickly became cumbersome. The Web Screenshot offered triage through isolation and annotation.

The *4 Sources* mode allowed a user to compare her search results by search engine source. Results were color coded, and the user was able to select which sources she wanted to include in her search. This simple interface allowed for quick comparison between search engines and enabled the user to see where results overlapped among sources. Furthermore, this kind of comparison and visual overlap allowed a user to begin evaluating the credibility of sources.

Viewzi engaged users with a dynamic, visual set of displays and interfaces. The end result offered information-triage through prioritizing, visualizing, isolating, annotating and comparing search results. However, these interfaces are only hinting at the usefulness and power of information-triage, and the site itself has unfortunately disbanded and hasn't yet been resurrected.

Flipboard

Created in 2010 for the iPad, and recently expanded to several other mobile tablet-style devices, Flipboard is an app that allows users to digitally thumb through multiple streams of content found on the Internet in a cohesive and striking interface. Data, news stories, blog posts, entries on social media sites, is gathered from the Internet and flows into a simple, magazine-style display.

When a user initially downloads Flipbook onto a device, they are asked to choose content topics to personalize their experience. These topics include: News, Business, Tech & Science, Audio, Video, Cool Curators, Photos & Design, Living, Entertainment, Sports, Style, Travel and Local. Within each of these content topics, a user can further curate the kinds of content she would like to see. For example, under Tech & Science, users can choose to view: Space, Apps, Apple News, and Tech; or users can choose to view content from specific blogs and sources like the *New York Times*. This process of selecting from large categories of information and curating a personal experience allows a user to triage the content found on the Internet, creating an abbreviated and specialized space.

However, the real charm of Flipboard lies in the gestural interface. The content is labeled according to the topics initially chosen by the user, and then poured into a templated design created to look like the pages of a magazine. The focus here is on presenting multiple stories per page, and including images and headlines to allow a user to quickly move through a large amount of content at once. The user peruses the interface by flipping through the pages with a flick of her finger. New content is continually added to the front pages, and a small navigation bar at the bottom shows the user where she is spatially within the stream of material.

Flipboard allows users to triage information in two ways: by choosing the kinds of content to be included in viewing sessions, and by showing the content in a specific and familiar way. However, the interface is set up to feel like a magazine-reading experience, encouraging browsing and casual reading behaviors, rather than enabling a user to power through a great deal of precise information to reach a specific search goal. Flipboard allows for curation, but encourages a more random and unintentional grazing-based environment.

Our User, Ourselves

We know that working memory is directly related to how well we can focus our attention. We know that it is limited and when full, a user feels overwhelmed and anxious. We know that this anxiety, and the complexity of the online atmosphere make it difficult for some users to make careful, rational decisions. We know that a user's understanding of information in a search relates to a concept called sensemaking, but that the tools available online do not take this into account.

- Our user is bombarded with information.
- She is often pressed for time.
- Her life is full of distraction and multi-tasking.
- She finds it hard to focus on the task at hand, and her thoughts wander.
- Finding conflicting information about an important topic can leave her feeling confused and paralyzed.
- The current options for online searching do not adequately address our user's limitations of time, focus, or working memory.

MISE EN PLACE: AN ONLINE SEARCH INTERFACE PROTOTYPE

This speculative interface prototype is based on the idea of *mise en place* (French for "everything in its place") that chefs and cooks use to organize—and triage—their process, kitchen, ingredients, time, and space while cooking. Essentially, *mise en place* is a methodical, focused way to arrange all the elements in place before the main event begins, enhancing competency and providing efficiency through established expectations.

Mise en Place is proposed as an online interface, housed within a web browser that aggregates search results from other search engines (Viewzi, 2010). The system allows the user to organize and state the purpose of her search, and then displays visually coded results of her search query. These results are labeled according to large categories generated by the system, and a gradient of credibility generated by other users of the system. The interface is meant to be friendly and comforting, creating an environment that will allow users to make sense of search results and find focus.

Methods

The development of the *Mise en Place* interface began with a content and visual analysis of current manifestations of Internet search engines and interfaces, and connected those interfaces to the idea of information-triage. The analysis was created as a visual document that allowed for comparisons among current search systems. This process also created conditions for the discernment of patterns regarding what is and is not functioning within the domain of online search. The main problems found were in these areas:

1. Helping users organize their overall search
2. Helping users formulate concise and reliable search terms
3. Helping users quickly and visually understand search results
4. Helping users find patterns and make connections within large search result pools

At the same time, a review of current related research was conducted. This review focused on issues within the fields of interface and interaction design, cognitive issues including working memory and search behavior, the use of mental and cognitive models through sensemaking, theory regarding the organization of information in an online context, and visualization techniques for this type of information and data.

Next, the content domain of nutrition was chosen, based on the complexity of available information online, and the emotional nature of making decisions regarding nutrition. Finding results that seem trustworthy and reliable are more difficult during a search of this nature, and that complexity was needed to help develop a more robust and realistic prototype. Once the context was specified, user analysis was conducted—Who might be searching for information about nutrition? What are the different needs and goals related to an online search in this context? What kinds of behavior might be exhibited? A matrix was then created, which listed out possible behaviors and needs of potential users, including: things people are looking for, attributes of users, kinds of decisions, consequences, motivations, problems of attention, and problems of working memory.

Content from the persona matrix helped to create a series of specific personas for the prototype that typified sets of behaviors and needs encapsulated in personalities and characters that felt like real people. The personas were written and refined, and given names, backstories and head-shots. Narrative scenarios of use were then developed to start to explore how the personas would use the prototype during a typical day. Finally, visual studies and various prototypes were developed, edited, compared and culled, and then refined using a typical iterative design process.

An animated walk-though of the *Mise en Place* interface prototype may be viewed here: http://vimeo.com/11885160.

Preliminary user testing is currently being conducted, using paper and digital Flash prototypes and both obtrusive and unobtrusive user observation. Findings from this testing have yet to be compiled and analyzed. The *Mise en Place* prototype continues to be shaped and refined, and other speculative prototype interfaces are under development.

Design Details of the Mise en Place Prototype

A Metaphorical Interface

This interface utilizes the metaphor of a chef's *mise en place,* enabling the design to take on certain characteristics to help users manage space and give them a greater sense of control. A chef using *mise en place* gathers all the ingredients needed for a recipe into one space, measures these items out into small containers, and then organizes them according to the steps of a given recipe. The items generally included in this organization are actual ingredients, spices, utensils, and other cooking apparatus like pots, pans and appliances. *Mise en place* helps the chef establish a sense of control and creates a specific abbreviated space for all involved elements as well as the activity of cooking.

Mise en place enables the chef to manage space, content and activity in a powerful and meaningful way. She can make sure all the needed ingredients are present and measured out correctly; she can execute sub-activities in the process ahead of time; and she can be methodical and organized. This example of triage permits the chef to confidently execute her recipe, while allowing for some freedom to experiment and play with a dish. She can rely on her system, on the structure of *mise en place*, and try out variations to the recipe or cooking methods as desired. Without the system, cooking is far more chaotic.

Overall Visualization and Organization

The visualization and organization of this prototype attempt to embody the idea of *mise en place* in several ways. The structure of the interface is uncluttered and employs a strong and obvious grid. Important elements are placed at the top of the screen so the user has no trouble locating them. Search results appear in a large panel, can be previewed in small rollover windows, and can be viewed within a large lightbox-style window that appears on top of the main interface screen and has its own navigation. All elements appear within the current space of the screen so the user never has to scroll, and the interface itself is completely flat in structure—users never leave the space of the main screen or get lost in a series of links and tabs.

The typefaces and color palette were chosen to feel friendly but reliable. The icons and other visual elements were designed to reinforce this sense of ease and trust. The images and symbols are simple, recognizable, and familiar—yet are not often seen in the context of other search engines. All these design choices help make the *Mise en Place* prototype distinct from other existing search engine options.

Taken together, all the elements are designed to provide the user with a sense of control and comfort, and to help her stay visually and spatially oriented in one space that she can easily understand and navigate.

Orienting and Preparing the User for Search

When the user first comes to the *Mise en Place* interface, she encounters a simple screen with a mottled blue background, the name of the interface at the top left, and three simple options at the top of the screen: *save*, *new search* and *saved search*. When the user chooses new search, she is then prompted by the system to determine what kind of search she is conducting. A small box near the top animates open, and

the system asks: *What is your _____?* When the user hovers her mouse pointer over the blank, a list appears offering the following options: *question*, *problem*, *idea*, *goal* and *issue*. (Figure 1) By offering up this targeted list, the system prompts the user to reflect on the current needs for this particular search—this kind of reflection helps give her focus.

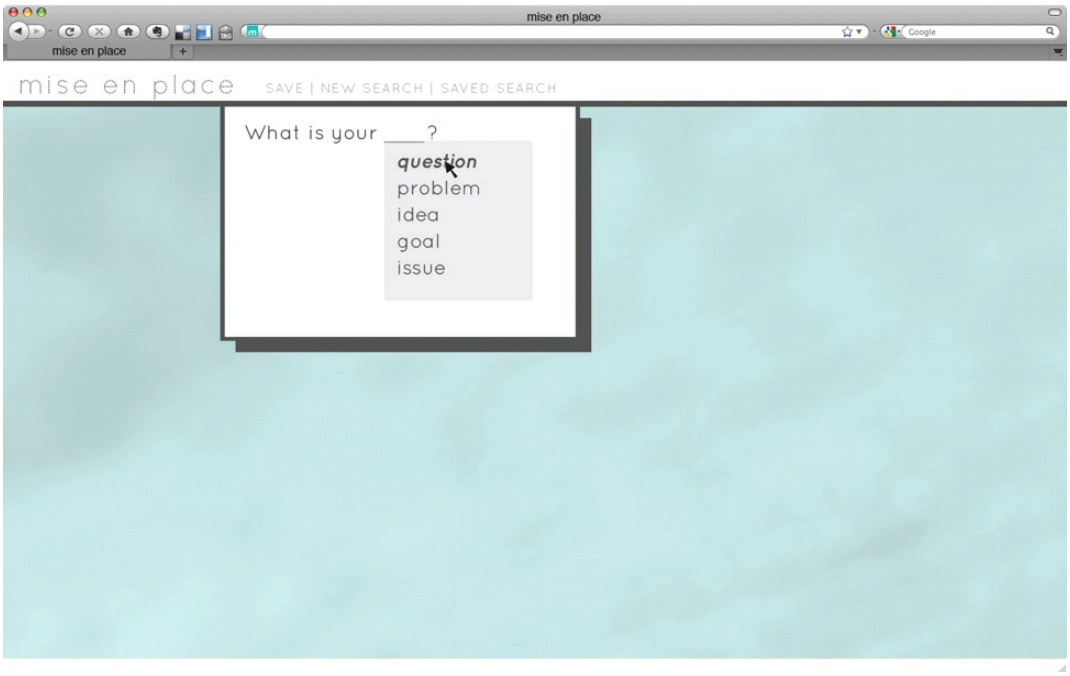

Figure 1: The interface asks the user to define her search as an information goal

Once the user chooses a word for the blank, the system restates this initial question using the response; for example: *What is your question?* A cursor begins to blink under the question, signaling to the user that she needs to provide a beginning question, for example: *How can I safely introduce a gluten-free diet to my daughter?* This question or statement now animates to a larger size, and becomes a part of the upper portion of the interface itself—enabling the user to view and review the question as she continues her search, helping her maintain focus. Finally, a search box appears in the upper left corner of the interface, with another blinking cursor. The user is able to view her focused question and then choose a specific term to search, for example: *gluten-free*. The search box is similar to those found across the Internet, making it familiar and understandable, yet the insertion of a focused search-goal as a prominent part of the interface introduces an unusual and useful element.

The Search Activity and Results

Now several new areas animate onto the screen: a *sort* tab, a color-coded *categories* list, a set of trustworthiness *symbols,* and an area for *search breadcrumbs* (a list of the searches undertaken during this search session, in the order the terms were entered). The sort tab is a personal area for the user to save and organize search results she deems important or wants to bookmark. A more detailed description of this area will be discussed further below.

The categories list helps to triage results into the following large system categories: *advocacy and opinion*; *explanatory and reference*; *practical and how-to*; *commerce and shopping*; and *latest and breaking*. These system categories are assigned using several criteria including meta-data, keyword relationships, and feedback from other system users.

The trustworthiness symbols are based on a gradient of reliability assigned by other system users. As users encounter sites within the search space, they are asked to assign ratings according to this gradient. The most trustworthy sites would be graded with a *smiley face*, while somewhat trustworthy sites would be graded with a *check mark*. Sites deemed somewhat untrustworthy would be graded with an *X*, and highly untrustworthy would be graded with a *skull and crossbones*. The final trustworthiness symbol is a *question mark*, which describes a site that has yet to be graded, or that users are unsure of.

Both the system categories and the trustworthiness gradient are initial attempts at creating a system of triage for the user, and are likely imperfect. A system with a social/participatory component such as this would demand a certain amount of flexibility, allowing users to give input regarding both types of filtering, helping to refine the system over time. This is an area of the interface that will be further addressed in subsequent iterations and prototypes.

Next, the *results* themselves would animate onto the screen, falling from the top into a large white box that dominates the interface. (Figure 2) The search results are rendered as small squares, each colored according to category and displaying a symbol according to the trustworthiness gradient. All the search results are organized into a tightly spaced grid, ten results high and twenty results wide. These numbers were chosen deliberately—by creating columns of ten, users are equipped to quickly estimate the number of sites shown. The initial state for the results is to show the highest ranked page (according to the page-rankings of the source search engine) in the top left corner, and the lower ranked pages in the bottom right corner.

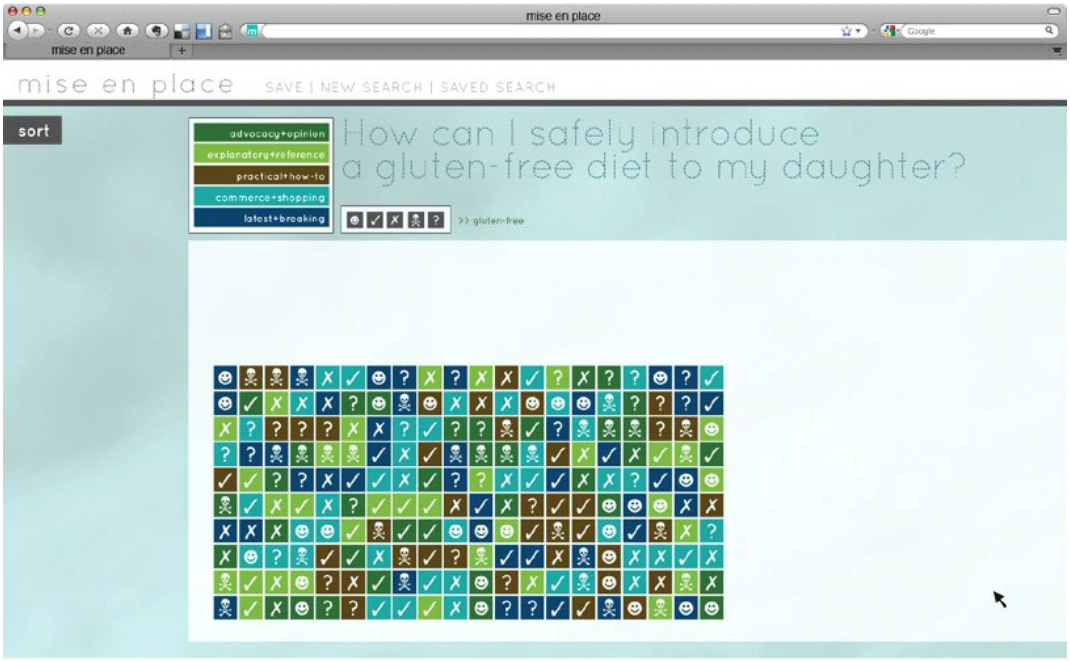

Figure 2: Search results are displayed as visually labeled squares organized in a grid, permitting the user to find patterns within the data

The user may view a small thumbnail of the homepage for each search result by hovering over it. (Figure 3) The thumbnails are contained in boxes, colored according to the appropriate system category, which also display the title and URL for the search result. If the user clicks on one of these thumbnails, a large lightbox-style frame appears on top of the main interface. This frame contains: the website itself, which is completely navigable; the appropriate color- and symbol-coded search result from the main interface in the upper right-hand corner; and a simple navigation system. This allows the user to open up any of the individual search results to view a particular website, and then quickly flip through the others according to how the results are organized in the main interface itself. (Figure 4)

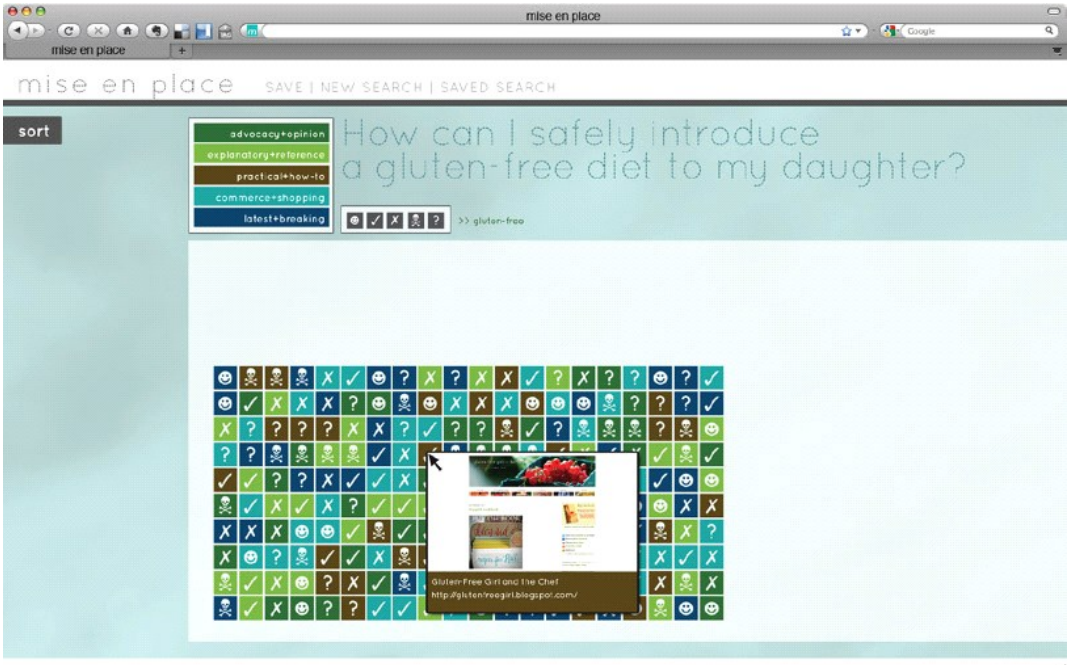

Figure 3: The user may view a thumbnail of each website with a hover behavior

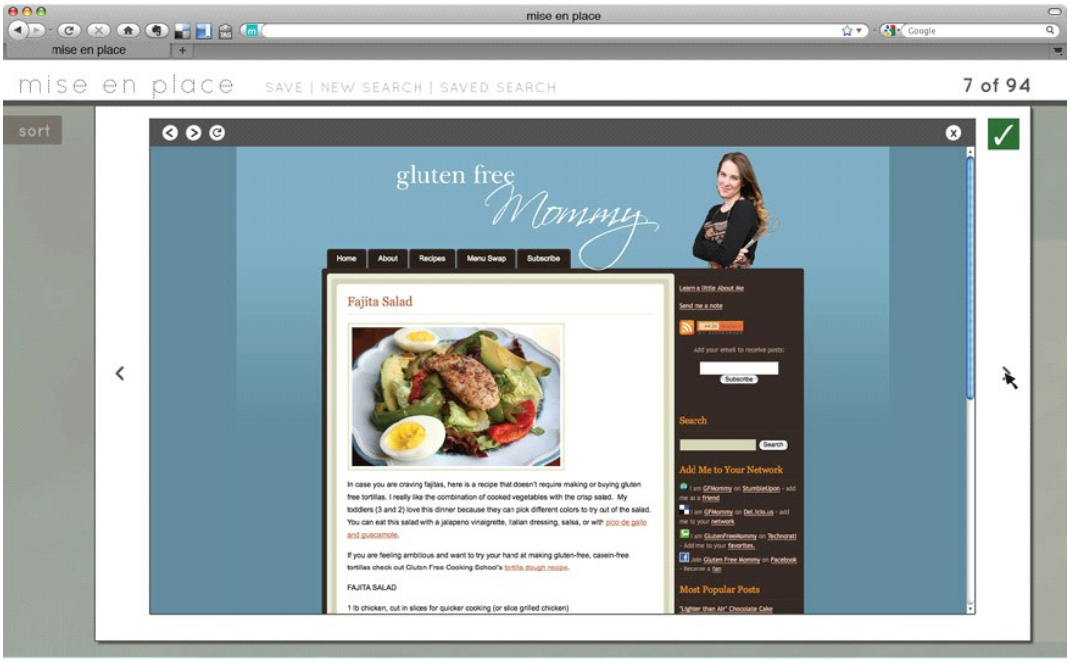

Figure 4: The user may view and navigate through the websites themselves in a lightbox-style frame

The Info-Triage Sorting Functions

The sorting functions of the *Mise en Place* interface allow users to triage search results in a powerful way. If a user clicks on the bounding box for the system categories list, the current search results will rearrange themselves according to those categories, displayed in separate columns in the same order as the list. If a user clicks on the bounding box for the trustworthiness symbols, the search results will rearrange themselves accordingly. If a user clicks on both boxes, the results will be sorted both by category and symbol: the categories sorted vertically into columns, and the symbols sorted horizontally into rows (Figure 5).

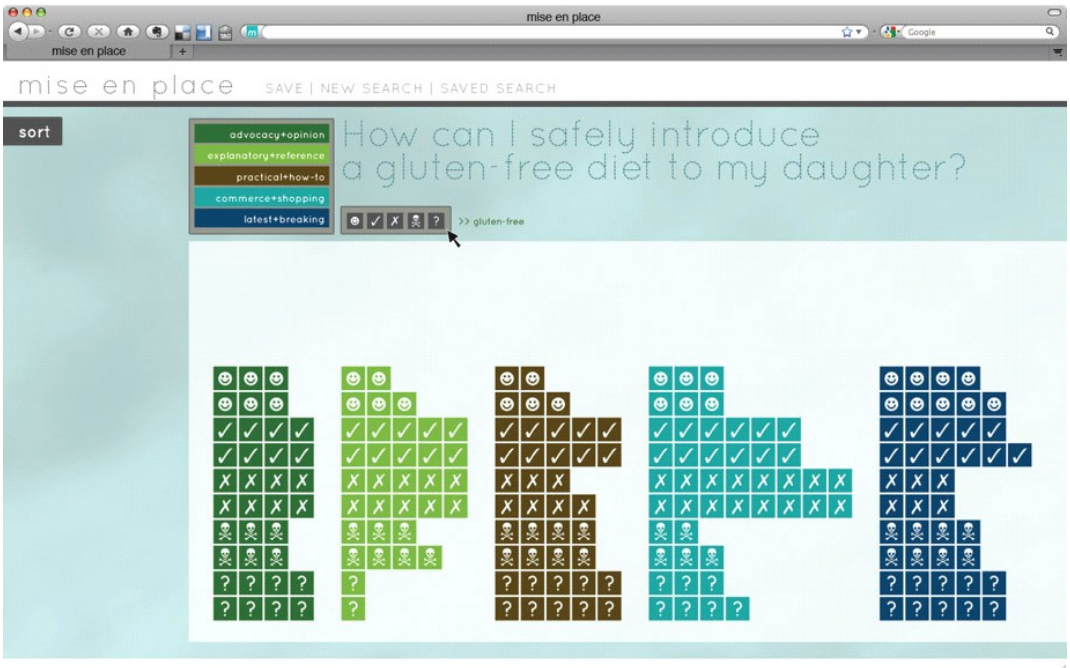

Figure 5: The search results are sorted into columns and rows according to both the large system categories and the trustworthiness symbols

The user can also choose to discard whole categories and trustworthiness symbols by clicking on those individual elements within the bounding boxes. If, for example, the user decides she does not want to include results from the *commerce and shopping* category, she can click on that element within its bounding box and all the search results labeled as *commerce and shopping* will float down off the bottom edge of the interface—now they have been discarded. In the same way, the user can choose to discard all search results labeled with an *X* and a *skull and crossbones*. Once results have been discarded, the elements within the bounding boxes are grayed out, and the remaining search results re-organize into neat columns and rows (Figure 6).

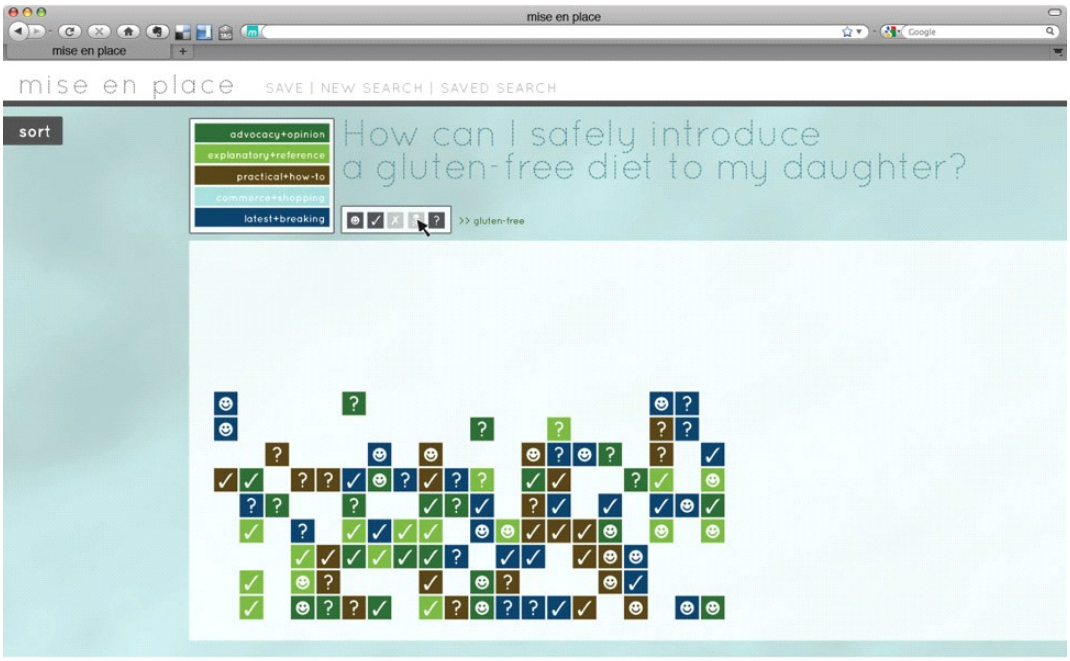

Figure 6: The user can discard categories as desired, and the results rearrange themselves accordingly

These simple sorting and filtering techniques allow the user to quickly see patterns within the search results, make large organizational decisions about which results to keep and discard, and continue to reconfigure the results during the search as needed or desired. The sorting functions also reveal connections among the categorization of the results and the information contained on the websites themselves—as the user explores the results, she can reorganize the data according to what she discovers at any given moment.

Currently, the bounding boxes for both the categories list and the trustworthiness symbols don't have compelling affordance. When a user hovers over these boxes, they will appear active, but otherwise, the interface doesn't intuitively signal to the user what those boxes and the elements within them will do. As always, a user willing to investigate will discover the functionality, but this is another area that will be revised in future interface iterations and prototypes.

The Personal Sort Area

The final element of the interface is the *personal sort area*. This area is accessed through a tab at the top left corner of the interface labeled *sort*. When the user clicks on the sort tab, it animates to the right, revealing a sort bar. This bar contains elements to control the sort area: an *add button*, a *delete button*, and two *navigational buttons* to move forward and back. These buttons allow the user to create and manage different sorting spaces within this area of the interface.

When a user adds a *sort space*, a box animates onto the screen that contains two different images of dishes. The user chooses whichever image she prefers, and that dish is enlarged in the top portion of her sort area. The user may name her sort space, for example: *Definitions*. She may also edit the name later or delete it. This name is displayed on the dish as a label (Figure 7). The user may create as many sort spaces as she desires, according to the changing needs of her search.

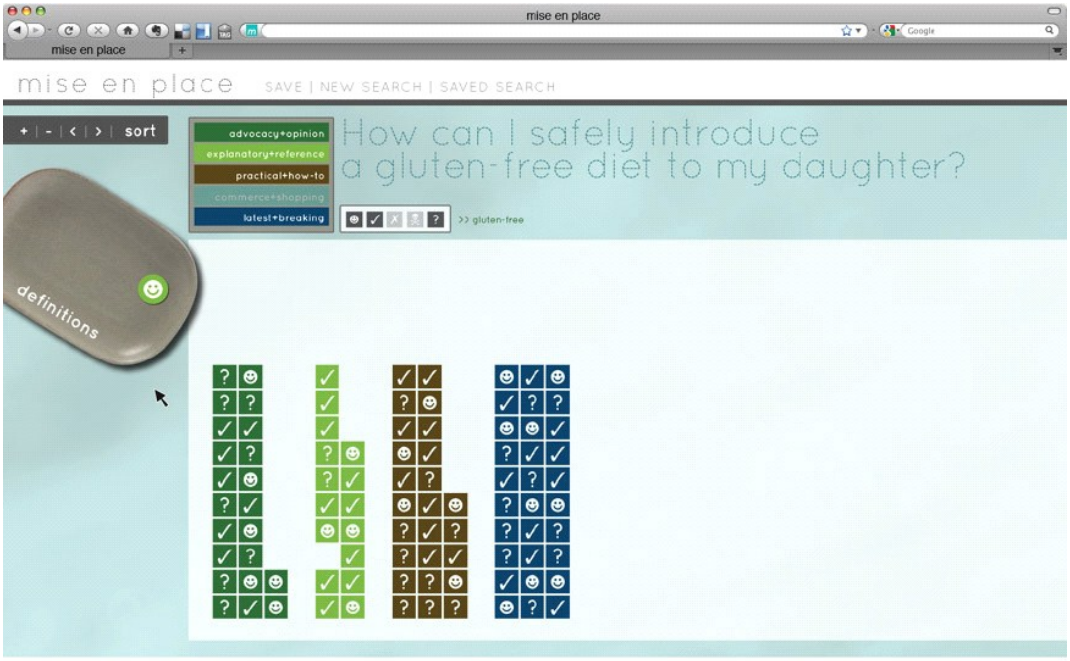

Figure 7: The personal sort area allows the user to set up specific sort spaces to help meaningfully organize saved results

Now the user may collect search results from the main interface and place them on the dish in her sort area. This is executed through a simple and intuitive click and drag. When the user drags a search result into her sort space, it changes from a square into a circle. This state change signals to the user that this particular result has been saved in her personal sort space. As she drags results into her space, the interface leaves holes where those results were. This ensures that the user doesn't attempt to drag the same result into her sort space more than once.

When finished, the user clicks on the sort tab again, which closes the personal sort area. Any search results that have been saved into the sort area now appear as circles within the main interface. The user can easily see which results she has decided to save, can compare these to the rest of the results, and can continue reorganizing everything with the sorting functions of the system (Figure 8).

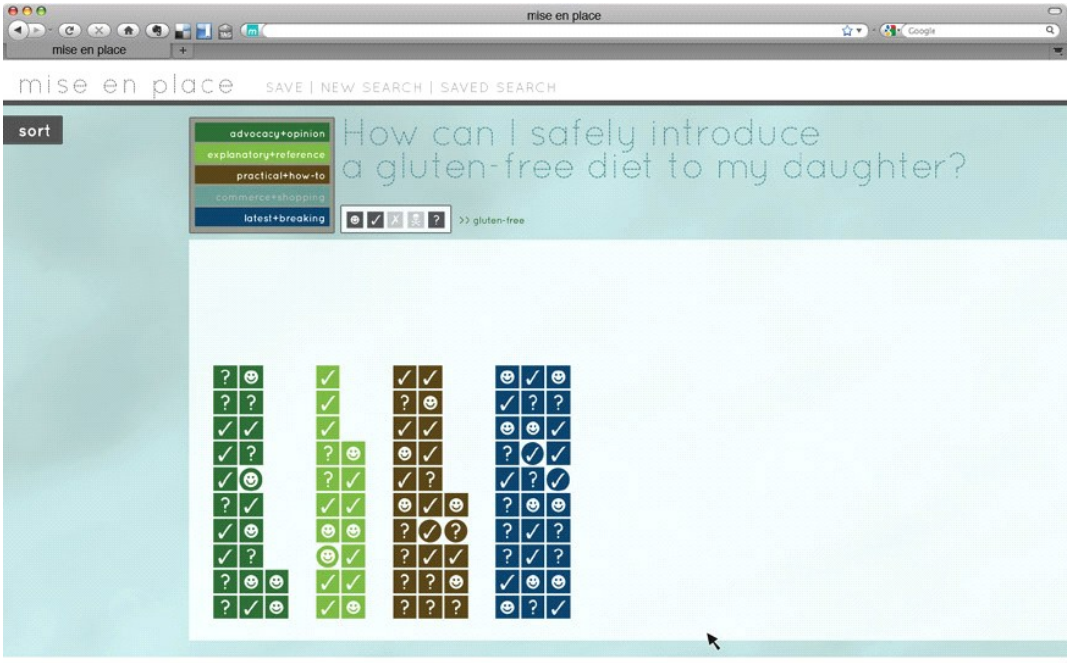

Figure 8: Results that have been saved to the user's personal sort area change into circles in the main interface

Saving Entire Searches and Sessions

The *Mise en Place* interface also allows users to *save* their searches and search sessions. As the user interacts with the interface during a search session, the system will keep track of the main focus statement (*How can I safely introduce a gluten-free diet to my daughter?*) as well as all the search terms investigated. Moreover, the system will also keep track of the search results sorted into the personal sort area for a given search. When the user is ready to take on a different search, or set a new search-goal, she can simply start a new search. In this way, the

interface system can scale and maintain flexibility for the different search needs of a given user, and for multiple types of users.

Addressing Needs Through Info-Triage

The *Mise en Place* interface encourages the user to sort through her search results. She can easily conduct mass sorts using the basic category and symbol menus, and she can discard types of results that aren't relevant to her search. The user can also choose to utilize her personal *sort* area, creating categories and affinities that fit particular and unique criteria.

Typically, search engines return results that look identical, are purely language-based, and attempt to be objectively neutral. The *Mise en Place* interface endeavors to color these same search results using sets of meaningful criteria, allowing a user to understand specific aspects of her results before she chooses to explore them. This also permits users to see and understand many more results at once, eliminating the tendency of only viewing the first few pages of results found on search engines like Google.

The *Mise en Place* interface addresses information-triage in these ways:

- The system gives the user the agency to make decisions and choices throughout the search process and offers visual and strategy support along the way.
- The system keeps the user focused on one step at a time and provides reassurance that ideas and information are not being lost in the shuffle; everything is saved and stored for the user to find again.
- The system addresses working memory by visually displaying information in digestible bits and allowing the user to sort through and make sense of her results as needed.

CONCLUSION

One challenge encountered in the creation of this interface was exploring how intuitive it should be. Where is the balance between robust and practical functionality, and minimal and intuitive interaction? By providing a simple set of tools and sorting functions, the *Mise en Place* interface attempts to create the possibility for many different kinds of interactions and experiences for users.

The concept of triage cannot simply be lifted whole from the medical discipline and pasted directly onto the discipline of information science or interaction design. The metaphor simply won't hold. Instead, my conception of information-triage echoes that of Peter Lunenfeld, "[it] is not so much about efficiency as the culling of the distraction in the search for meaning" (2011). Information-triage should enable users to intuitively comprehend and curate the material they encounter online.

As I have argued, the concept of information-triage has two facets. It can be thought of as a verb (process), and as a noun (display of results). By articulating this difference, I was able to design variations of both facets and explore what might happen to user experience when the balance of power between system and user shifts. However, these two facets should be explored further—I plan to continue investigating these issues in future interfaces and user testing.

Further research should also be done to answer questions within the following unresolved issues:

Balance

- How can we balance the needs of each individual user within the process of searching on a vast and chaotic Internet?
- What kinds of interfaces should we construct to balance a user's needs for efficiency, speed, relevance and ease of comprehension?
- How can we account for the great differences among users— even among one user's different types of searches?

Credibility

- How can we triage source credibility to allow a user to understand commonalities and differences, yet help eliminate or minimize what is superfluous?
- Who decides which sources are superfluous and what criteria should be used?
- What is the mechanism and structure for tagging these sources?
- How can we quickly signal to a user the differences between types of sources?

Relevance

- How much information-triage does the average user require? How much is too much?
- Do we need uncompromising diligence and vigilance, or can information-triage happen ambiently through interfaces and computerized tools?
- How can we continue to build interfaces that enable users to find information that is contextually relevant to them, without leaving out information that is surprising or creates innovative juxtapositions?

FUTURE RESEARCH DIRECTIONS

The Complexity Continues

As citizens, organizations and companies continue adding to the large masses of content online, users will continue to feel overwhelmed unless interfaces are created to specifically address user needs and limitations. The visualization of information in an online-search context can take many different shapes and forms, and is just starting to be investigated in ways that strive to help support users within the limits of cognition and understanding. Currently, these forms are exploring spatial and gestural ways to aid users, but more work should be done to create interfaces that are metaphorical and uniquely visual in nature as well.

HCI, human cognition, information science and computer science professionals need to work with designers and other experts to start merging the disparate bodies of research being produced that currently swirl around the main idea of helping users triage and understand information. Future research directions should employ collaborative groups of the above-mentioned professionals in the act of creating multiple speculative interfaces around this and other pertinent concepts. The visualization of search results online has remained stultified and static for nearly a decade, hopefully this is just the beginning of new user-centered forms and cognitively aesthetic designs taking shape.

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KEY TERMS AND DEFINITIONS

Data: Any piece of information in its raw form; information that has not been made sense of.

Information: Any data or piece of information that has been made sense of; data that has been given context.

Information-Triage: The process of retrieving, sorting, evaluating and prioritizing information in order to make sense and use of it.

Mise en Place: The act of organizing materials and activities prior to preparing a meal, done by a chef or cook in a systematic way.

Search Engine: An interface housed within an Internet browser that retrieves websites and other kinds of data from the Internet based on specific terms or phrases.

Sensemaking: The cognitive process of taking in information from various sources and trying to make sense of it.

Working Memory: The limited cognitive ability of humans to retain small amounts of information over a short period of time without committing that information to long-term memory.