

Abstract

While modern search engines are excellent resources for finding information on the web, in order to put together that information into a useful mental model and make a decision – such as for picking a new car for the family or choosing a JavaScript library to build websites – people often need to collect information about trade-offs from multiple sources, extract and synthesize snippets of information into meaningful structures, and share and justify their decisions and rationale with others. During this process of sensemaking, people’s mental models are constantly evolving as they gather more information about the decision space – the contexts relevant to their goals, the options available, and the criteria or constraints on which to evaluate the options.

This highly iterative and cyclical process puts a significant cognitive burden on users, and often requires them to externalize their evolving mental models rather than keeping everything in their working memory. However, the tools that people use for externalization – such as browser tabs, documents, spreadsheets, or note-taking apps – poorly support the constant shifts between collecting, extracting, organizing, and reorganizing that are needed. Furthermore, even if people do put in the work to organize and share an external representation of their decision (such as creating a list of suitable family SUVs or a comparison table of front-end libraries), it can be difficult for subsequent users to evaluate whether they can or should reuse that work.

In this thesis, I explore interactive systems which bridge the gap between the rapidly evolving mental models in peoples’ heads and the externalization of those models by exploring opportunities to **reduce the costs and increase the benefits of externalization**, thereby capturing more of the cognitive work that users engage in while making sense of information in order to help them as well as others who might benefit from their work. The research efforts described in this thesis can be divided into four major stages: *helping the initial user (1) capture and (2) structure information, and helping subsequent users (3) evaluate and (4) adapt and reuse the initial users’ sensemaking results.*

To lay the foundation, I designed the Unakite system, which enables people to collect, organize, and keep track of information about decision trade-offs and build a comparison table, which can be saved as design rationale for later use. To address the potential high interaction and interruption cost of manually collecting and organizing information, I explored automatic approaches by leveraging natural language processing (NLP) and passive behavioral signals such as mouse movement and dwell time (the Crystalline system). In the meantime, I also explored a family of lightweight gestures that can be used to fluidly collect and annotate information in-situ without much interruption to the primary activity of reading and comprehending web content (the Wigglyte system). To help subsequent users explore and evaluate previous users’ work, I developed both a framework and the Strata system that collects and visualizes key signals about the context, trustworthiness, and thoroughness of previous design decisions and rationale. In my proposed work, I would like to complete the cycle by exploring alternative knowledge organizational structures (e.g., lists, mind maps, affinity diagrams, etc.) that would both support the initial user’s sensemaking process and the adaption and reuse of that knowledge by subsequent users who share a similar goal or context. Similar to my previous work, I plan to evaluate the new systems through a series of lab and field studies with developers solving their real-world problems.

The series of work introduced in this thesis points to the importance of having tool support that helps users efficiently organize and manage information as they find it in a way that could also be beneficial to others, and therefore bootstrapping the virtuous cycle of people being able to build on each other’s sensemaking results, fostering efficient collaboration and knowledge reuse.