The Whats and Hows of Programmers’ Foraging Diets

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ABSTRACT
One of the least studied areas of Information Foraging Theory is diet: the information foragers choose to seek. For example, do foragers choose solely based on cost, or do they stubbornly pursue certain diets regardless of cost? Do their debugging strategies vary with their diets? To investigate “what” and “how” questions like these for the domain of software debugging, we qualitatively analyzed 9 professional developers’ foraging goals, goal patterns, and strategies. Participants spent 50% of their time foraging. Of their foraging, 58% fell into distinct dietary patterns—mostly in patterns not previously discussed in the literature. In general, programmers’ foraging strategies leaned more heavily toward enrichment than we expected, but different strategies aligned with different goal types. Overall, these and our other findings help fill the gap as to what programmers’ dietary goals are and how their strategies relate to those goals.

Author Keywords
Information foraging theory; information diet; debugging strategies

ACM Classification Keywords
D.2.5 [Software Engineering]: Testing and Debugging; H.1.2 [Information Systems]: User/Machine Systems—Human factors

INTRODUCTION
Pirolli et al.’s pioneering work on information foraging theory (IFT) [17] has greatly influenced our community’s understanding of how humans seek information within information-rich environments such as the Web. The theory is based on the idea that humans seek information in a manner analogous to the way animals seek food in the wild. In short, it states that a human information predator seeks information prey by following information scent through an environment. Through these constructs, IFT has facilitated predictive models of how people navigate as they forage within websites (e.g., [3, 17, 20]) and during software maintenance tasks (e.g., [12, 13]). Furthermore, the theory has spawned principles for the design of interfaces (e.g., [23]) and has been leveraged for the design of tools that help people forage (e.g., [16]).

One area of potential for IFT that so far has been mostly untapped is using the theory to understand the diets of predators in a particular problem domain—that is, to understand the types of information goals those predators desire. A notable exception is Evans and Card [4], who investigated the diets of web users who were “early adopters.” They discovered that these users’ diets were...
considerably different from the information commonly provided by mainstream news sites, and they identified the niche topics that made up the users’ diets. They also noted that the information sources chosen by these users reduced the cost of attention by lowering the cost of social foraging and social interpretation. Clearly, these findings have strong implications for the design of sites to support such users. The Evans and Card work demonstrates the potential benefits of applying information foraging ideas to understand the diets of people in particular contexts.

Inspired in part by the Evans/Card paper, our work aims to expand our understanding of IFT diets by investigating the diets of professional software developers engaged in debugging. Work in the software engineering (SE) literature has investigated related ideas, such as the questions that programmers ask (e.g., [5, 10, 11, 22]), but that work was not grounded in a theory, such as IFT. Thus, by investigating the information diets of professional programmers from an IFT perspective, our work aims to help bridge the gap between such results from the SE literature and the IFT foundations and results from the HCI literature.

For an understanding of the “whats” of diet to be truly useful, we also need to understand the “hows”. Toward this end, we also investigate, from an IFT perspective, the strategies that programmers use during foraging. The literature contains numerous works on program debugging strategies (see [21] for a summary), but these have not been tied to IFT. We believe that such strategies both influenced and are influenced by programmers’ diets, and this paper investigates these ties.

Thus, in this paper, we address the following research questions with a qualitative empirical study.

- **RQ1** (diet “whats”): What types of information goals do professional programmers forage for during debugging, and how do those goals relate to one another?
- **RQ2** (foraging “hows”): How do professional programmers forage for information in terms of strategies?
- **RQ3** (“whats” meet “hows”): What strategies do professional programmers favor when foraging for certain types of information?

**BACKGROUND**

**Information Foraging Theory**

Information foraging theory is a theory of how people seek information during information-intensive tasks [18]. IFT is already well-validated empirically [3,6,12,13,14,19] and therefore provides a reliable scientific foundation for us to build upon in our own work. IFT was inspired by biological theories of how animals seek food in the wild. In IFT, a predator (person seeking information) pursues prey (valuable sources of information) through a topology (collection of navigable paths through an information environment). What information constitutes valuable prey depends on the predator’s information goals. Predators find prey by following information scent that they infer from cues in the environment, such as the labels on buttons or clickable pictures that adorn navigation options. Thus, the scent of a cue is the predator’s assessment of the value and cost of information sources obtained by taking a navigation option associated with that cue.

The focus of this paper is predator diet, that is, the variety of information types that a predator consumes. A predator’s information goals define his/her “ideal” diet, but what predators actually consume depends also on what is available in the environment and how costly the information is to obtain. The relationship between cost and diet in IFT is explained well by Anderson’s notion of rational analysis, which is based on the idea that humans tend toward strategies that optimally adapt to the environment [1].

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