A Cognitive Model of the Use of Familiarity in the Acquisition of Interactive Search Skill

Juliet Richardson (RichardsonJ@Cardiff.ac.uk)

Andrew Howes (HowesA@Cardiff.ac.uk)

Stephen J. Payne (PayneS@Cardiff.ac.uk)

School of Psychology, Cardiff University, P.O.Box 901, Cardiff, CF1 9DG, U.K.

Abstract

Searching through menu structures is a common method of interacting with computers: browsing the world-wide web, using computer software and searching databases are just some of the tasks that require menu search, or *interactive search*. In this paper, we address the question of how initial search experiences are encoded and then used to guide subsequent searches.

One of the most obvious guides as to which options to select during initial search in an unfamiliar menu structure is the semantic *plausibility* of the labels. However, the label semantics are rarely a sufficient guide to the correct route to a goal. In the absence of perfect semantic guidance, people may rely on recognition to guide their search. In an experiment reported by Payne, Richardson and Howes (1998), we found that both the familiarity of menu labels and their semantic plausibility were used as a guide to which options to select by someone who had been shown how to traverse a menu structure to reach a particular goal, and was then asked to traverse part of the menu again to achieve the same goal.

In addition to using recognition knowledge, it is also possible that users could rehearse their choices during the initial search process. For example, at any one time, users could attempt to rehearse the sequence of choices leading to their current position in the menu structure. Upon reaching the goal, the most recently rehearsed sequence would be the correct sequence. In an experiment (reported in full in Howes, Richardson & Payne, 1998), we found that rehearsal of this type seemed to be dependent on the searcher being able to form a spatial representation of the menu space. No lexically-based rehearsal seemed to take place.

We are developing a cognitive model of these and other findings. One of the key issues that the model addresses is how to separate memories for the current trial from memories of previous trials in order to switch behaviour between processing driven by memory for events on previous trials and processing driven by an exhaustive search algorithm (in this case depth-first search).

The model increases the activation levels of nodes representing seen and tried menu options (activation levels increase by a greater amount for options that have actually been tried by the model than for options that have merely been seen). These activation levels are then used to classify menu options into four categories: untried; seen-and-possibly-tried; definitely-tried; and very-recently-tried. The model also has judgements of the relative plausibility of the different labels for a given goal pre-programmed into it. These plausibility judgements are then used by the model in conjunction with its assessments of the activation levels and knowledge of whether or not the goal has already been achieved in order to decide which action to take. The plausibility judgements are used in a straightforward way to limit the model's search to just the subset of labels that have been judged to be plausible for the current goal. The assessments of activation levels are used in a more complex way according to a control scheme that is an extension of that used by the AYN model of interactive search (Howes, 1993; 1994): Before the goal has been achieved, the model avoids labels that it assesses as definitely having already been tried. Once the goal has been achieved, the model prefers items that have been assessed as definitely-tried over "familiar" (assessed as seen-and-possibly-tried) ones. It occasionally makes errors by selecting, on the basis of their familiarity, items that have only been seen before and not actually tried. The model matches the observed behaviour of participants, who were also seen to select menu labels that had only been seen before. The model also avoids options assessed as very-recently-tried once the goal has been achieved. This enables it to switch back to an exhaustive search algorithm from an algorithm based on repeating previously tried choices, when it is searching for the goal for the second or third time.

Lastly, the model is consistent with some of the empirical data from Howes, Richardson and Payne (1998). It was able to learn the correct menu choices at roughly the same speed and in the same pattern as the experimental participants in a spatially inhibited condition. The model learns the correct route through the menu simply through the gradual increase in activation of the tried choices.

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