Sii: the lightweight analytical search interface inspector

Max L. Wilson
Future Interaction Technologies Lab
Department of Computer Science
Swansea University, UK
m.l.wilson@swansea.ac.uk

m.c. schraefel
Intelligence, Agents, and Multimedia Research Group
School of Electronics and Computer Science
University of Southampton, UK
mc+jcdl@ecs.soton.ac.uk

ABSTRACT

In this paper we report on a recent analytical inspection framework, called Sii, which has been designed to evaluate the ways in which a search interface supports different information seeking behaviours. Using established theories from information seeking research, this inspection method can be used by the designers of search interfaces to quickly assess design ideas. Whether the evaluator is a digital librarian, a usability specialist, or an information retrieval engineer, the method provides early search-focused insights into designs. We present an overview of the framework, some key related research, and some example results. We conclude by discussing our efforts for making sure the method is as lightweight to apply as possible, while still producing insightful results.

1. INTRODUCTION

Inspection methods such as Cognitive Walkthroughs [13] and Heuristic Evaluations [10] have become established as low cost, time-efficient usability assessments. As inspection methods do not require a complete or even partially implemented interface, they can be used early in the design process and resolve usability issues early. These approaches, however, are concerned with broad and generic usability issues, rather than the needs of searchers. Our approach has been to design a lightweight search-oriented inspection method [14, 15], called Sii[1], which provides insight into the support for different information seeking behaviors, and types of searchers, provided by search interfaces.

In the following sections, we first review related work on: information seeking and inspection methods. We then provide an overview of Sii and some quick examples of the insights it can produce for information seeking interfaces. We conclude by discussing our efforts for making sure the procedure is as lightweight as possible, while still producing insightful results.

2. RELATED WORK

Related work covers two areas: inspection based usability evaluation methods and then key information seeking theory that is used within the Sii framework.

2.1 Inspection Methods

Inspection methods are designed to provide early analytical insights into designs in order to catch usability problems early. Inspection methods became popular in the early 1990s as the benefits of finding usability issues early were identified in software development. Bossert, for example, showed that the development cycle could be reduced by 50% if usability issues were identified early [5]. Further, Lederer and Prasad showed that the top four reasons for project overrun were all related to unexpected usability issues [9].

The Cognitive Walkthrough [13] is a method where experts step through a prototype design using a scenario of use or task description, asking set questions about whether novice users will be able to work out what to do or comprehend how the interface responds to their actions. Evaluators are asked to simply rate any usability problems in terms of severity, noting potential resolutions.

Heuristic Evaluations [10] take a different approach, where evaluators simply consider how designs match up to simple guidelines, such as avoiding expert terminology, recovering from errors, and even maintaining a consistent balance of content and white space. Using heuristic evaluations, interface designs can be checked to avoid known general usability issues.

No good way of directly comparing the strengths of these sorts of methods against other usability methods has yet been identified [8, 11]. Vredenburg and colleagues showed with a survey that usability practitioners find these inspections to be much cheaper and faster than user studies, while providing similar validity [12].

2.2 Information Seeking Theory used by Sii

Sii is built upon three main pieces of information seeking theory. In 1979, Bates identified 32 search and idea tactics that apply generally to the way people find information [1, 2]. Developed mainly in library conditions, these tactics include: narrowing a search, broadening a search, monitoring task completion, looking up authors, varying terms used, and processing results. These are listed simply in Table 1, but not described fully in this short position paper.

Table 1: Bates' Search and Idea Tactics.

Tactic Category	List of Tactics
Monitoring Tactics	CHECK, WEIGH, PATTERN, CORRECT, RECORD
File Structure Tactics	BIBBLE, SELECT, SURVEY, CUT, STRETCH, SCAFFOLD, CLEAVE
Search Formulation Tactics	SPECIFY, EXHAUST, REDUCE, PARALLEL, PINPOINT, BLOCK
Term Tactics	SUPER, SUB, RELATE, NEIGHBOR, TRACE, VARY, FIX, REARRANGE, CONTRARY, RESPELL, RESPACE
Idea Tactics	RESCUE, BREACH, FOCUS

Later, in 1990, Bates identified four levels of search strategies: Strategies, Stratagems, Tactics, and Moves [4]. Moves include both mental and physical actions. Physical actions might be entering a search term and clicking the search button. Mental moves might include scanning results and choosing search terms. Tactics are those shown in Table 1, which are made up of one or more Moves. Stratagems are made up of a combination of Tactics and Moves, and may include activities such as: searching through journal issues, checking an author's publication list, and looking up citations. Finally, Strategies are made up of a combination of

[1] http://mspace.fm/sii/ - The Search interface inspector

Stratagems, Tactics, and Moves, and are similar to higher-level work tasks, like researching for a paper.

In 1993, Belkin and colleagues designed a system called Braque based on 16 user types that were created by the combinations of four binary dimensions, as shown in Table 2. Users would either be searching for a specific item or scanning for a potential item (Method dimension). Users would be trying to learn from or retrieve an item (Goal). Users would be able to specify what they were looking for, or hope to recognize something useful when they see it (Mode). Finally users would be looking for information in an item, or metadata about an item (Resource). Google, for example is best suited for users who are searching, to select, by specifying (ISS15 and ISS16). Users who are scanning to learn by recognizing (ISS1 and ISS2), however, may benefit from browsing interfaces.

Table 2: The 16 user profiles identified by Belkin et al.

ISS	Method	Goal	Mode	Resource
1	Scan	Learn	Recognize	Information
2	Scan	Learn	Recognize	Meta-Information
3	Scan	Learn	Specify	Information
4	Scan	Learn	Specify	Meta-Information
5	Scan	Select	Recognize	Information
6	Scan	Select	Recognize	Meta-Information
7	Scan	Select	Specify	Information
8	Scan	Select	Specify	Meta-Information
9	Search	Learn	Recognize	Information
10	Search	Learn	Recognize	Meta-Information
11	Search	Learn	Specify	Information
12	Search	Learn	Specify	Meta-Information
13	Search	Select	Recognize	Information
14	Search	Select	Recognize	Meta-Information
15	Search	Select	Specify	Information
16	Search	Select	Specify	Meta-Information

3. Sii: SEARCH INTERFACE INSPECTOR

Put simply, Sii operationalises the three models discussed in Section 2. Bates' Moves are used to quantify her earlier defined tactics, and tactics are prioritized for different types of users. The complexity of this operationalisation, especially prioritizing tactics for different types of users, are described [15] and validated/modified [14] in previous work.

3.1 The process of applying of the framework

The process of applying the framework, which can be performed online[1], is shown in Figure 1. Sii can be applied to multiple interface designs or existing systems. The elements of each interface are listed, such as: the search box, the results list, the 'similar results' button, and suggested search terms. Then for each feature of each interface, the user is asked to count the number of moves (mental and physical) required to achieve each of the 32 tactics.

```
L1. For each interface
    L2. For each feature in the interface
        L3. For each tactic defined by Bates
            Count how many moves the user must
            make to achieve the current tactic with the
            current feature.
        L3. Next tactic
    L2. Next feature
L1. Next interface
```

Figure 1: The process of applying the Sii framework

3.2 Interpreting the results of the framework

In her Berrypicking model of information seeking [3], Bates suggests that 'the searcher with the widest range of search strategies available is the searcher with the greatest retrieval power'. The Sii framework values support in terms of the breadth of search tactics provided to the user.

The Sii framework produces three types of graphs for analysis: 1) comparing the support for the 32 search tactics, 2) comparing the contributions of different interface feature designs, and 3) comparing the support for different user profiles. The figures discussed below show example results from a comparison of three digital library interfaces by Capra and colleagues [6]. The interfaces were the Relation Browser (Red), an uncustomised version of the Endeca interface (Blue), and the U.S. Bureau of Labor Statistics website (Yellow). All three were the versions available at the time of study and included the BLS data. The graphs produced by Sii were later [14] able to explain some of Capra's unexpected results. Here we simply show the graphs to explain the types of insights Sii can provide.

Figure 2 shows the support provided for each tactic by the three interfaces. The graph can quickly show the tactics that are not supported, by one or all of the interfaces, and which design better supports each tactic. Figure 3 provides the alternative view, showing how each interface feature contributes to the support provided. This graph, therefore, shows which features are in each

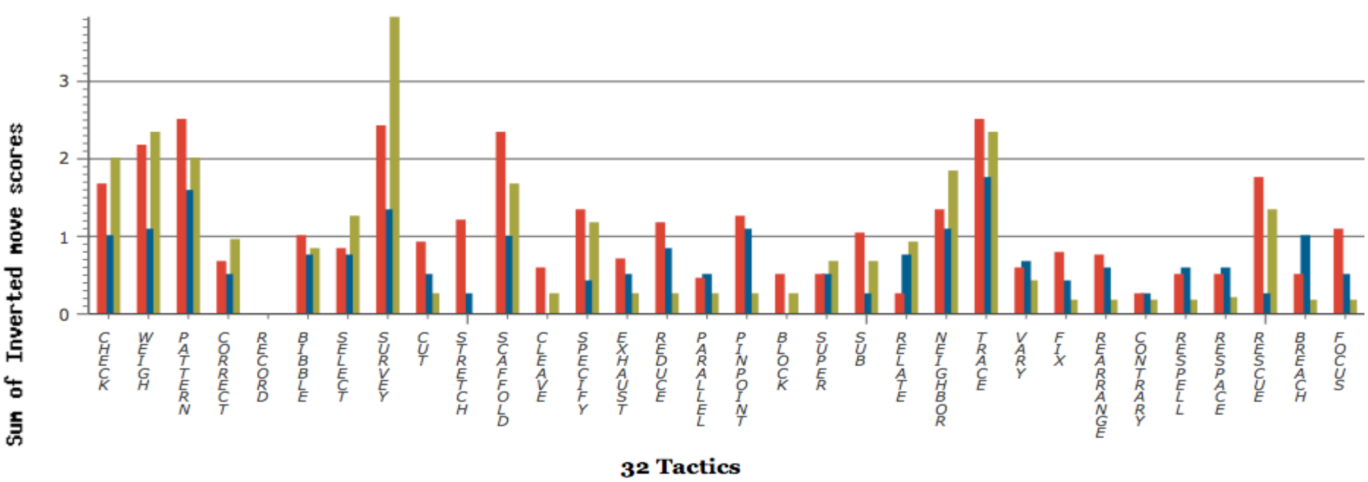

Figure 2: Graph comparing the support for each search tactic provided by each interface. Tall bars represent greater support.

design, and, if in multiple designs, which version contributes the greatest support for a wide range of tactics. Finally, Figure 4 provides a comparison of how each of the user profiles are supported. The types here map to the 'ISS' users identified in Table 2. Patterns like one side of the graph being higher than the other related to the Method dimension, for example. Here we can see all three interfaces, which were designed for browsers, do better for users who are scanning (Method) and recognizing (Mode), rather than searching and specifying, respectively. We can see here the unexpected result that the BLS website (in yellow) actually supported browsing more than the other two.

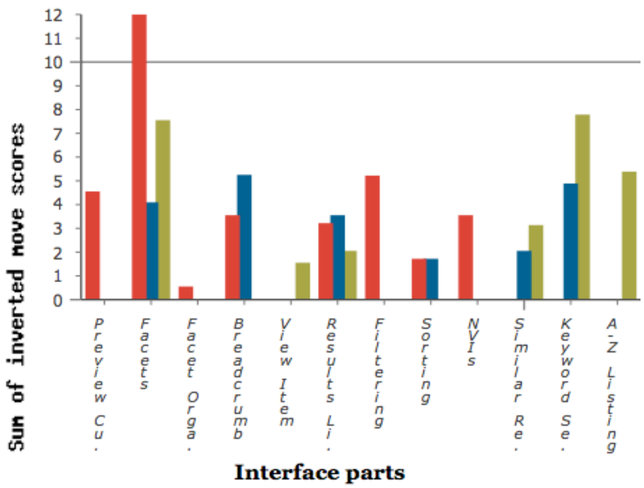

Figure 3: Graph comparing the support provided by each feature of each interface. Tall bars represent greater support.

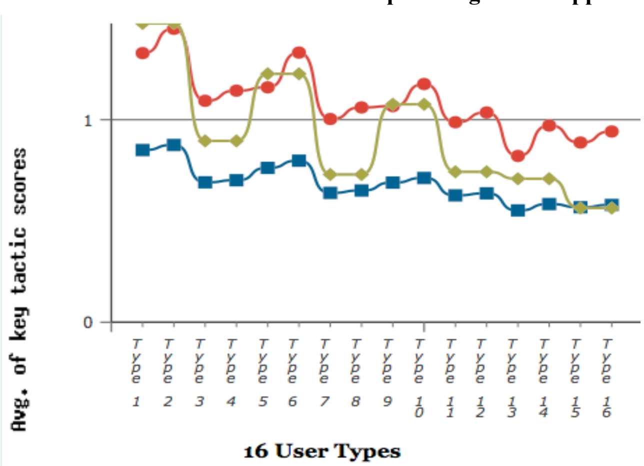

Figure 4: Graph comparing the support for the 16 user types by each interface. Higher points represent greater support.

4. DISCUSSION

One current concern for usability methods is in their 'down-stream utility' [8], in that their insights can lead to design changes, which can quickly be tested to show that they improve results. As Sii, unlike many other inspection methods, quantifies support, designers can quickly modify an interface design, and compare the outcomes to the original version in one graph. Every interaction of a design can be compared together to see how the support improved with each version.

The example evaluation in the section above showed that the depth of analysis produced by the framework can provide richer insights into usability study results than user studies. Such an analysis may also explain the unexpected results produced by Jones and colleagues [7] in their longitudinal (not so light-weight) field study of a location-aware mobile search interface. The interface provided search terms used by others in the same location to users, but users who used new interface enjoyed it less than those using the standard search box. [2]In performing an analysis with Sii, for example, we might discover that the two features contribute very different levels of overall support to the interface (as in Figure 3). Upon examining a graph like Figure 2, we might see that fewer of the tactics are supported. As the novel interface involved clicking on other users' search terms, we might see less or no support for tactics like VARY and BLOCK, for example, which involve manipulating queries. The participants in their study were able to resolve any information needs as required. An analysis with Sii might simply reveal that the novel interface is less useful for those who know what they are looking for (user types to the right of Figure 4), but better for the occasions when users were serendipitously finding information (towards the left of Figure 4). The usage scenarios at the beginning of their paper were more oriented users who find themselves in the profiles towards the left of Figure 4.

5. CONCLUSIONS

It is crucial for e-commerce and repository providers to get search right, or customers/users simply go elsewhere for their information needs. For IBM[2], careful redesign of search functionality reduced use of the help button by 84% and increased sales by 400%. The aim should be to make sure a) that searching, browsing, exploring, and other forms of information seeking are all supported, and b) that users find it intuitive to search to do so. Returning to the quotation of Bates above, 'the searcher with the widest range of search strategies available is the searcher with the greatest retrieval power'.

For IBM, the cost of redesign was estimated to be 'in the millions', involved more than 100 employees, and took ten weeks. The Sii framework can be applied in much less time, and with much smaller costs, than user studies. Compared to other inspection methods, like Cognitive Walkthroughs and Heuristic Evaluations, Sii produces search-oriented usability issues, rather than general issues. Our on-going work aims to reduce the learning curve required to apply the results. Early results, studying students using the framework, show that it may take 1-2 hours to become familiar with the procedure of using the Sii framework. Further, single-sentence concise descriptions of the tactics, combined with examples, are favoured over full academic definitions. Consequently, the work is focusing on the careful definition of these tactics in the online tool[1], and providing appropriate examples, in order to make sure that Sii's procedure is as lightweight as possible, while still producing insightful results.

REFERENCES

[1] Bates, M.J. Idea tactics. JASIS, 30, 5 (1979). 280-289.

[2] Bates, M.J. Information search tactics. JASIS, 30, 4 (1979). 205-214.

---

2 http://www.nytimes.com/library/tech/99/08/cyber/commerce/30commerce.html - Good website design can lead to healthy sales.

[3] Bates, M.J. The Design of Browsing and Berrypicking Techniques for the Online Search Interface. 13, 5 (1989). 407-424.

[4] Bates, M.J. Where should the person stop and the information search interface start? Inf. Process. Manage., 26, 5 (1990). 575-591.

[5] Bossert, J.L. Quality function deployment: a practitioner's approach. CRC Press, 1991.

[6] Capra, R., Marchionini, G., Oh, J.S., Stutzman, F. and Zhang, Y., Effects of structure and interaction style on distinct search tasks. in JCDL07: Proceedings of the 7th ACM/IEEE-CS joint conference on Digital libraries, (2007), 442-451.

[7] Jones, M., Buchanan, G., Harper, R. and Xech, P.-L., *Questions* not *answers*: a novel mobile search technique. in Proceedings of the SIGCHI conference on Human factors in computing systems, (San Jose, California, USA, 2007), ACM.

[8] Law, E.L.-C., Scapin, D., Cocktotn, G., Springett, M., Stary, C. and M., W., Maturation of Usability Evaluation Methods: Retrospect and Prospect. in Proceedings of the COST294-MAUSE Closing Conference, (2009), IRIT Press, Toulouse, France.

[9] Lederer, A.L. and Prasad, J. The validation of a political model of information systems development cost estimating *Proceedings of the 1991 conference on SIGCPR*, ACM, Athens, Georgia, United States, 1991, 164-173.

[10] Nielsen, J. Heuristic evaluation. in Nielsen, J. and Mack, R.L. eds. *Usability inspection methods*, John Wiley & Sons, Inc., 1994, 25-62.

[11] Olson, G.M. and Moran, T.P. Introduction to this special issue on experimental comparisons of usability evaluation methods. Hum.-Comput. Interact., 13, 3 (1998). 199-201.

[12] Vredenburg, K., Mao, J.-Y., Smith, P.W. and Carey, T. A survey of user-centered design practice *Proceedings of the SIGCHI conference on Human factors in computing systems: Changing our world, changing ourselves*, ACM, Minneapolis, Minnesota, USA, 2002.

[13] Wharton, C., Rieman, J., Lewis, C. and Polson, P. The cognitive walkthrough method: A practitioner’s guide. in Nielsen, J. and Mack, R.L. eds. *Usability inspection methods*, John Wiley & Sons, Inc., 1994, 105-140.

[14] Wilson, M.L. A Transfer Report on the Development of a Framework to Evaluate Search Interfaces for their Support of Different User Types and Search Tactics, School of Electronics and Computer Science, University of Southampton., 2008.

[15] Wilson, M.L., schraefel, m.c. and White, R.W. Evaluating Advanced Search Interfaces using Established Information-Seeking Models. JASIST (2009).