The Eyes Have It: Individual Differences and Eye Gaze Behaviour in Biomedical Search

Ying-Hsang Liu[1,3], Paul Thomas[2,3], Tom Gedeon[3], Jan-Felix Schmakeit[4], Marijana Bacic[1,5], Xindi Li[3]

1 School of Information Studies, Charles Sturt University   2 Microsoft, Australia
3 Research School of Computer Science, Australian National University
4 Google, Australia   5 Monash Health, Australia

ALIA National 2016 Conference, Adelaide – 30 August 2016

Introduction

- Current IR systems primarily designed for specified search (Belkin, 2008)
- Queries as user's articulation of information needs
- A gaze-tracking study to assess whether users pay attention to controlled vocabularies, such as MeSH (Medical Subject Headings) terms
- Design of natural search user interface to support query reformulation tasks

Research Questions

- What elements of search interfaces do searchers look at when searching for documents to answer complex questions?
- What is the relationship between user perceptions of an interface and the interface elements they look at?
- What is the relationship between individual differences and the interface elements which are looked at?

Methods

- User experiment to assess the effect of displayed MeSH terms on search behaviours and performance
- 4 × 4 factorial design (4 search interfaces and 4 search topic pairs); 4 × 4 Graeco-Latin square design
- Search system built on Solr, using OHSUMED test collection
- Search task: Find documents related to the topic
- Sample search topic:
  Imagine that you are 88-year-old with subdural. You would like to find information about reviews on subdurals in elderly.
- Gaze tracking uses FaceLab; Eyeworks for data recording and analysis
- Entry and exit questionnaires collecting user background information and cognitive styles
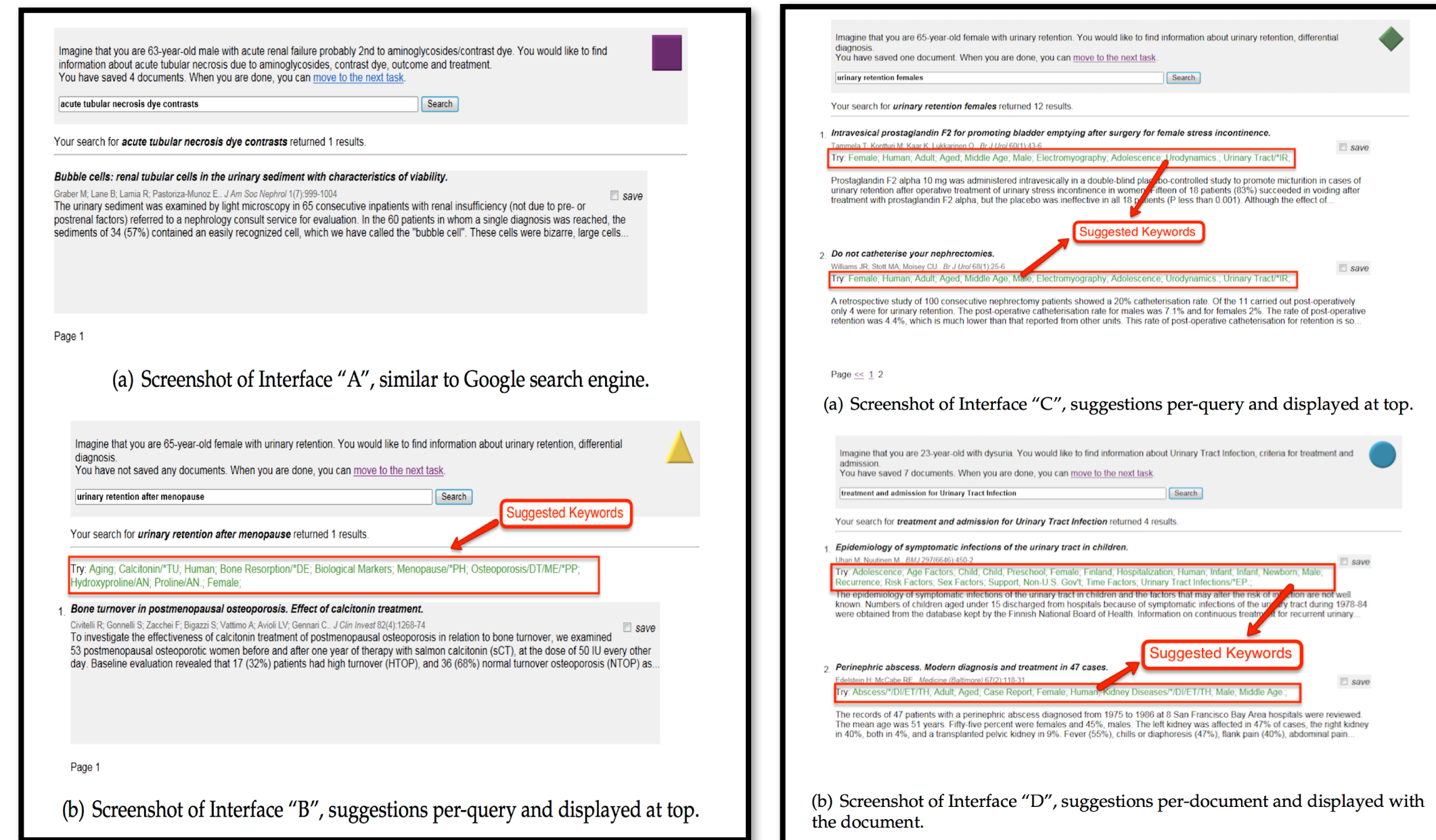
Search Interfaces

(a) Screenshot of Interface "A", similar to Google search engine.

(b) Screenshot of Interface "B", suggestions per-query and displayed at top.

(a) Screenshot of Interface "C", suggestions per-query and displayed at top.

(b) Screenshot of Interface "D", suggestions per-document and displayed with the document.

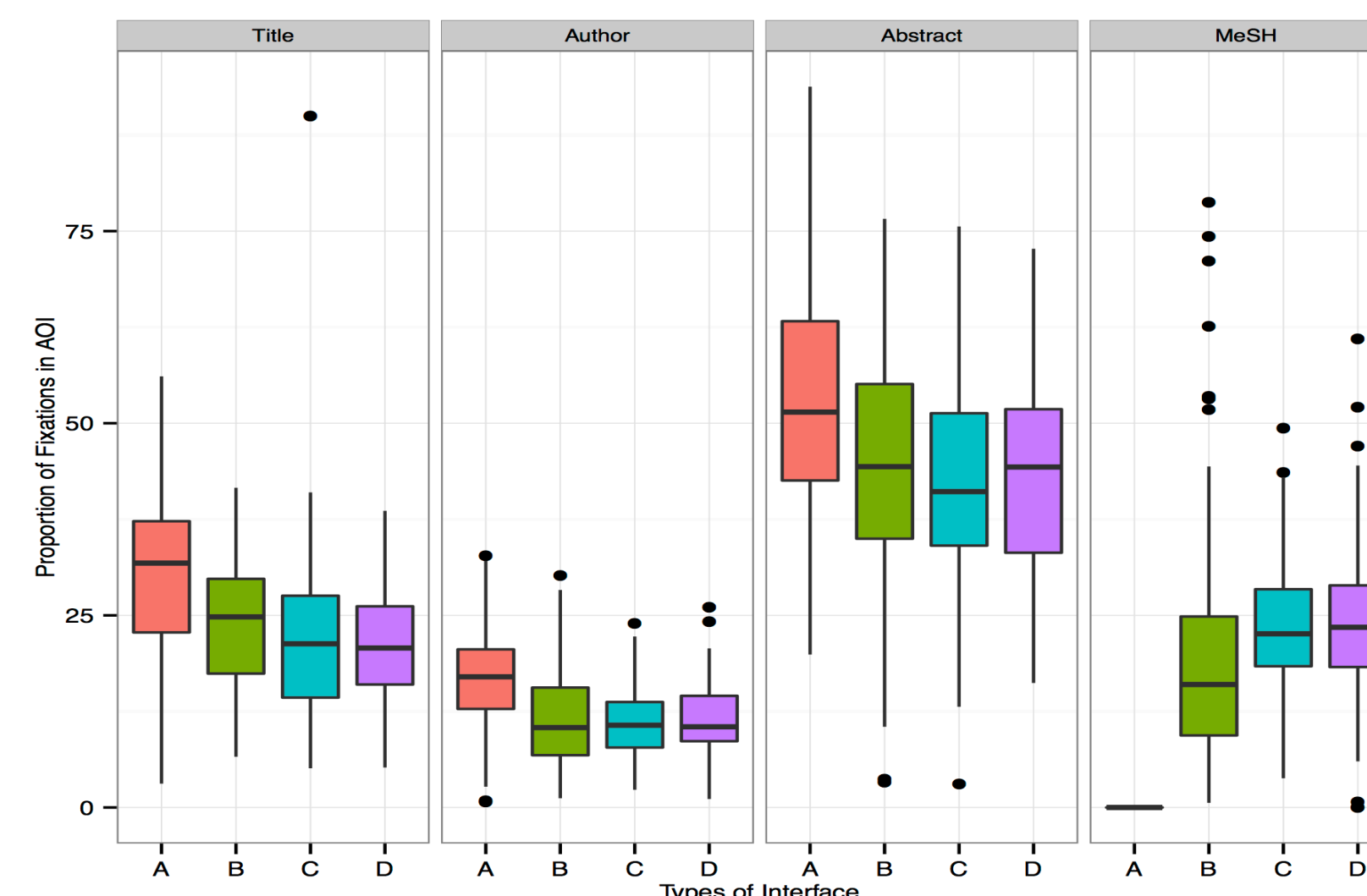**Figure 1: Search interfaces distinguished by display and generation of MeSH terms**

Findings

Figure 2: Fixations by area of interest (AOI), for each interface

Table 1: *Summary of the relationship between user perceptions and gaze*

	Task Difficulty	System Usefulness	Notice of Keywords Interface B	Interface C	Interface D	Use of Keywords Interface B	Interface C	Interface D
Title	O	O	O	O	O	O	O	O
Author	O	—	O	O	O	O	O	O
Abstract	O	●	—	—	—	—	—	●
MeSH	O	—	—	—	—	—	—	—

Note. The relationship is not statistically significant (—), positively significant (●), or negatively significant (O).

Table 2: *Summary of the relationship between individual differences and gaze patterns*

	Domain Knowledge Undergraduate	Postgraduate	Search Experience Search Engine	Online Database	Cognitive Style
Title	—	O	—	—	—
Author	—	—	●	—	—
Abstract	—	—	O	—	—
MeSH	—	—	—	—	—

Note. The relationship is not statistically significant (—), positively significant (●), or negatively significant (O) at 95%).
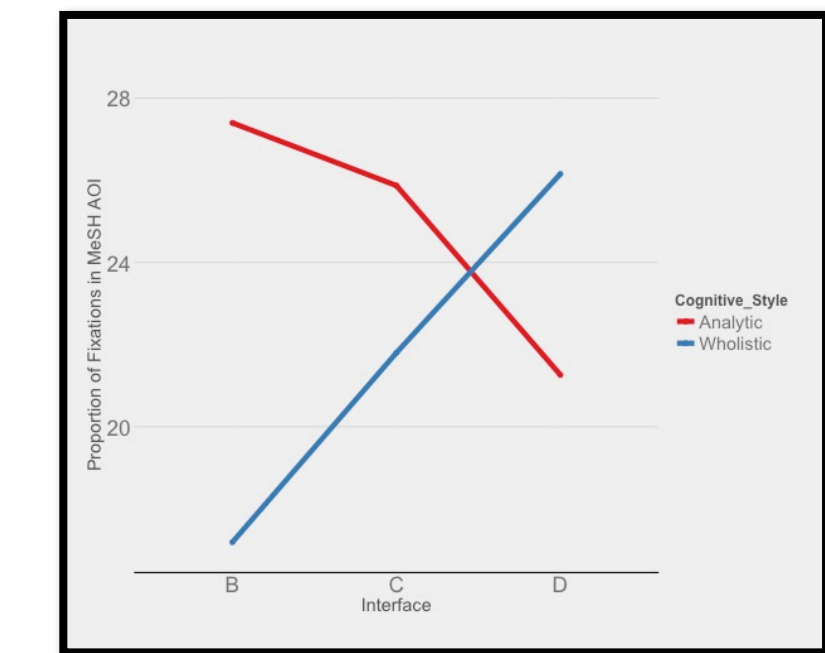

Figure 3: Interaction plot of interface and cognitive style, in time spent looking at MeSH terms.

Future Research

- Effect of cognitive styles and search behaviours on cognitive load
- The relationship between eye gaze behaviour and search performance

Email: **yingliu@csu.edu.au**