To search or to explore – that is the question: a study in mindful engagement

Jon Pearce
The University of Melbourne
Parkville, Australia, 3010
j.pearce@unimelb.du.au

Sofia Pardo
The University of Melbourne
Parkville, Australia, 3010
miriamp@pgrad.unimelb.edu.au

ABSTRACT
It's easy to attract someone's attention on the web – seductive animations using software such as Flash make this all too easy. But how do you retain their interest and, more importantly, keep their focus on the task at hand? We have approached this question by producing a research tool called *iFISH* that enables us to quickly construct environments in which users explore a range of outcomes based on their dynamic changes to personal preference settings, together with reflections on the consequences of these changes. We first describe a study using this tool in the context of students given the task of making a selection from a large range of university subjects, and later we introduce other uses of such a system.

Categories and Subject Descriptors
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design, Experimentation.

Keywords
Exploration, mindful engagement, search, play, recommender systems, multimedia.

1. INTRODUCTION
There are times when you know what you want and you turn to the Internet to find it. You most likely use a search engine, enter some parameters to narrow the search and then peruse a returned list of items to find the one you are after. But there are other times when you don't really know what you want, yet still turn to the trusty old search engine and maybe look further down the returned list, or enter numerous terms to see a wider variety of suggestions. The most suitable 'answer' can't be far away.

In the first case you are 'searching', also referred to as 'look up' [6], in the latter you are trying to 'explore' and find suggestions about what might suit your needs. While search engines are getting better and better at matching items to your search, there are not so many applications that aim proactively to support and encourage exploration – applications that take input from you and then return a broad range of items that encourage you to explore and interact with them.

If such applications exist, a question that is raised is how can we *encourage* users to explore, and *discourage* them from accepting the first option presented before an adequate exploration has been carried out? A possible answer to this question is to provide a highly engaging on-screen experience that encourages play and exploration. Yet it has been seen in other contexts that a user might interact with the 'interface' at the expense of the 'task'. For example, in a highly interactive learning environment evidence was found of some users becoming more engaged with the playful screen interactions than with the learning task that they were expected to carry out [10]. This is a question of affect and focus; of attracting a user through the use of engaging multimedia and animations, yet not to the extent that he or she is distracted from the task at hand. It is a question of encouraging persistent engagement rather than succumbing to a 'one-click' exit to the distractions of the web.

This paper describes some preliminary research into the role that affect plays in these situations. We have created a flexible environment through which we can explore various situations in which users enter information about their personal preferences and then are directed to explore the ranked consequences of these settings. We have made the environment playful by responding immediately to the user's actions and provided strong affect through the smooth animations of objects on the screen. Our aim is to encourage 'mindful engagement' [12] rather than 'mindless engagement' and to use a reflective feedback loop to help sustain the interaction.

2. BACKGROUND

2.1 Mindful engagement
The term 'mindfulness' is used to describe a state in which one performs a particular task [11]. This state is characterized by non-automatic and meta-cognitively guided mental processes that require mental effort. A mindfully engaged user will display higher order thinking behaviours such as strategic thinking, self-monitoring, evaluation of responses and reflection [14]. In contrast, a *mindless* state implies a trial-and-error approach that relies mostly on automatized processes. This state is evidenced by lower order thinking activities such as mastery of procedures, browsing and information seeking.

The construct of 'user engagement' has gained attention among researchers looking for ways to define, measure and promote it [7, 8]. A common denominator to these endeavours is the compound nature of user engagement that results from the interaction of particular systems and users' characteristics. In

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this sense, some of the systems characteristics considered to be key players in promoting engagement are challenge, interactivity, perceived user control and feedback. On the other hand, users' motivations and general disposition to be engaged are also fundamental for an engaging experience to occur.

Although the term of 'mindful engagement' may suggest the effortless co-existence of these two concepts, it is not without its challenges. Whilst characteristics such as feedback, control and interactivity may be associated with systems that are likely to promote engagement, they may not necessarily promote the mindful kind. The study reported in this paper addresses this tension in the context of searching and exploring behaviours.

2.2 Recommender Systems

In the Human Computer Interaction (HCI) community, systems that help people find information are often referred to as 'recommender systems'. These differ from search engines in that they help users discover items that they might not have found with a targeted search, whilst also helping them to cope with information overload.

Recommender systems follow two broad approaches: *content-based* and *collaborative filtering*. Content-based systems, such as Amazon's book recommendations, rely on matching information about the characteristics of the items specified, while the collaborative approach employs the user's social environment to make recommendations – for example, people having similar tastes. One approach to recommender systems is to employ 'social navigation' [2]. Such systems rely on feedback, either *explicit* or *implicit*, in order to draw on the collective wisdom of a community to help improve the accuracy of the system and provide a better experience for the user. *Explicit* feedback relies on the user to rate items as interesting or relevant; *implicit* feedback relies on information extracted from user interactions to provide information about the quality or relevance of those items. Although they might present the user with unexpected results, these systems tend to narrow down a search in an effort to match the user's characteristics.

Whereas explicit feedback is considered a more accurate method, it raises the challenging question of how to encourage users to make their contribution the system [3]. The I-Spy search engine [13] relies on users returning to a Web site and re-ranking their search results. But this is problematic for two reasons. First, there is a tendency for users to not bother to contribute their recommendations. Second, there are many situations in which users can't assess the value of their choice until *after* they made it and left the system. This is a problem with systems like Amazon's book recommendations: whilst it might accurately tell you "customers who bought this item also bought these…" it doesn't tell you whether those "customers who bought this item" actually *liked* the item. It's too late – they have made the purchase and left the site to read the book!

This is an issue for the situations discussed in this paper. We will describe a system to help students in exploring the vast range of subjects that a university makes available to choose from. However, it is hard to use collaborative data to drive such a system as, by the time students have completed studying the subject, they are not inclined to return to add their opinions to the system for the benefit of others. At least one study suggests a solution to this problem by increasing the level of fun via better user interfaces. We embrace this suggestion in the work described here.

3. AN APPROACH TO EXPLORATION

The approach that we have taken in this research is very different to that of others. Whilst the recommender systems described above rely on social trails and explicit user feedback in order to improve performance, we are relying on an animated ranking of findings that respond dynamically to users varying a set of personal preferences relating to the topic at hand. To encourage exploration, as opposed to searching, these preferences are somewhat removed from the specifics of what they might be looking for – a *meta level* kind of preference – and are presented as sliders on the screen making it easy to make a change, reflect on the consequence, and make subsequent changes to further the exploration.

The context of this study is a university in which students are required to study one quarter of their degree in areas outside their major speciality (referred to as 'breadth' studies). These students will be exploring an unfamiliar domain in which we want them to *broaden* their search rather than narrow it down. Rather than a student saying "I am majoring in arts, so I will take my breadth in science; I like animals, so I'll take Biology 101", we would like a student to engage with and explore a much broader range of studies that he or she might not even know exist. For example, we would rather hear the reasoning "I am majoring in arts, I need something different, maybe more quantitative and with a business flavour but with a cultural influence. I came across *Accounting practices in the Middle East* while exploring – sounds interesting – I'll take that".

Hence we ask the question: how can we design a system that encourages active exploration in order to explore a set of data that the student knows little about and hence has little motivation or knowledge with which to explore? The aim of the project described here is to design such an exploratory system. We take concepts from recommender systems, principles of interaction and engagement from HCI and flow theory, and use them to explore the design of a system that encourages the exploration of a large, complex data set in an educational setting. The aim is not to find a set of results that matches a student's profile, but for the student to discover new ideas, relevant to themselves, resulting from an extended exploration of the data.

The system described is called *iFISH – interactive Foraging In the Subject Handbook* – and is aimed at students searching for breadth subjects within particular university guidelines. It is not intended that *iFISH* be a complete application in itself, but rather we plan to use *iFISH* to help us gain a better understanding of the *process* of discovery as students explore the data and reflect on their own feedback in order to stimulate further exploration.

3.1 Aims of the system

The exploratory system described here is unconventional and innovative in two aspects. First, we are dealing with students exploring a data space in an unfamiliar domain – one in which they have no clear idea of what they are looking for. This is not unique to this particular context. Government departments confront this problem when they attempt to provide improved services for citizens who don't really know or understand what services are on offer. We met this issue in a previous research project aimed at helping people understand what they could do to improve their chances of finding employment after being out of work [9]. This challenge was to design a system that not only

facilitated the exploration of an unknown government information space, but that also kept the users sufficiently engaged to obtain meaningful output from it. This current research builds on that experience.

Second, our aim is to maintain the students' engagement with the system long enough to encourage ongoing exploration. This is in contrast to a search system where the student enters information and narrows down to a result (or list of results) and then exits. We want the students to make adjustments to their input values, observe and reflect on the consequences of their changes, then make further changes to see their impact, and so on. To maintain these repeated cycles of students exploring the consequences of their actions, we need to design a system that is novel, playful, and encourages 'flow' experiences [1].

3.2 Pilot study

Before developing *iFISH*, we carried out a pilot study to help us understand how students go about exploring the university's current online subject handbook in order to find subjects to study. We brought five students into our usability lab and gave them questionnaires, scenario-based tasks and held a short discussion session at the end. From this study we concluded that the online handbook at the time was, due largely to its hierarchical nature, clumsy to use and not conducive to exploration.

During this pilot study we also discussed with the students what features of a system they would find conducive to supporting exploration. We presented the idea of 'meta' descriptors, or 'themes', being used to help explore the subject data space. These themes would be dichotomies such as: practical vs theoretical; qualitative vs quantitative; light on imagination & creativity vs dense on imagination & creativity; factual vs conceptual; etc. It was suggested to students that these descriptors could label sliders that the student would vary to discover subjects suggested by the system. The responses by the students to this idea were positive and they made useful suggestions that we have implemented. One of these was that they wanted to be able to see subjects appearing and disappearing in *real-time* in order to see the consequences of their adjustments. They students indicated that a *playful* system would encourage them to explore for a longer time – that their engagement would be deeper if the experience was a *rich and fun* one.

3.3 *iFISH* – the system

The *iFISH* system was created to allow students to explore and choose from a database of 2500 subjects. Figure 1 shows the layout of the screen running within a web browser. Subjects are represented by the elements to the left and are grouped under three year levels. These subjects are ranked by how well they match the combination of slider values visible at the bottom left. A 'wish list' area to the right allows students to drag subjects to keep for later reference. A list of university faculties is located to the right of the sliders allowing faculties to be excluded from the search. The behaviour of the system is that subject titles 'float' up and down as the sliders are changed. All student activities are logged to a server during operation.

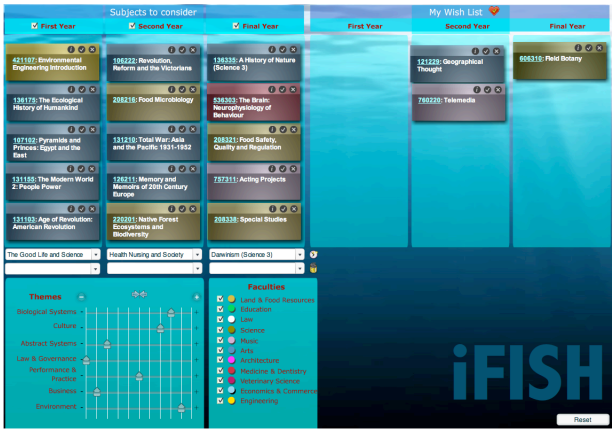

Figure 1: A screen-shot of *iFISH*.

Rather than manually 'tag' each subject with values to correspond to these sliders, we performed a linguistic analysis of the short (200 word) handbook description of each subject. This was far from ideal and the resulting clustering of subjects lead to themes that we less generic and less 'meta' than originally hoped for.

3.4 Designing the Interaction

The visual design of this system is not simply an interface issue but is an integral component of the experience. Its role is to maintain the student's engagement with the system long enough to discover the hidden resources that they are seeking. This is a delicate balancing act. An interface can have a very playful nature and promote strong positive affect. However, it can only hold one's attention for a limited amount of time before the novelty wears off and boredom moves the student to another location. The balance required is to maintain the student's engagement with the *content* of the system and not just the interface. The distraction of the interface – sometimes described as a balance between 'task' and 'artefact' – has been observed previously in studies in learning contexts [4, 10].

4. RESEARCH

4.1 An initial study

The status of this research is as follows. The *iFISH* system is designed and operating. We have carried out, but not yet analysed, experiments with seven users in our usability lab. These people were given four scenario-style tasks over a one-hour period. Two of the tasks related to using the university's online handbook (which had been significantly improved in its support for students choosing breadth subjects since the pilot study!) and the other related to using *iFISH* for similar tasks. They were given questionnaires relating to their use of the system as well as a measure of playfulness.

Although the analysis of this study is not yet complete, there are some interesting issues arising from the survey data and an initial look at interview data. These issues relate to the degree of fit between the tasks and the tools presented, the confidence in using a system like *iFISH* and the degree of reflection carried out by the users.

The data we collected suggest that the tasks we presented to the users fits better with the support offered by new university's online handbook than with an exploratory system like *iFISH*.

One of the reasons for this is that the handbook allows users to enter course, year level and areas of interest (essentially 'faculties') and then provides a list of all allowable offerings. Users can then see a *complete* list and, although quite long, they have a feeling that nothing is 'hidden' from them. *iFISH* only shows the top five offerings at any year level and many users want to 'scroll down' and see what lies below. As expressed by one participant, there was a 'sense of closure' in the handbook that was lacking in *iFISH*. This of course, was not what we were aiming for – we were looking for 'exploration' of offerings, rather than presenting a definitive list. This preliminary finding agrees with a type of user task identified by Herlocker, *et al* [5]where users expect to find all good items and are not willing to overlook some good items in order to filter out bad ones.

For similar reasons to above, there was some indication of a lack of confidence in the subjects presented by *iFISH* compared to the handbook. However, there was evidence of users being more reflective and finding some subjects that they might otherwise not have found.

4.2 Ongoing work

One of the limitations of the version of *iFISH* used in this experiment was its dynamic behaviour – due to the way in which the large number of subjects was handled, there was a delay between moving sliders and seeing response of the subjects displayed. This was an indirect consequence of using linguistic analysis to calculate 'tag' values from which the program worked. We have produced a highly customisable generic version of *iFISH* that allows new sliders, labels, data sets, layout and behaviours all to be defined from two XML files. This version has a smooth, immediate response synchronised with the slider motion. It is being explored in various contexts, such as exploring exhibitions choices before visiting a museum.

A further refinement we are exploring is to respond to concerns raised in our pilot study as to 'who determines the weighting of subjects and their preference values?'. For example, a lecturer's view of where a subject sits on a continuum from practical to theoretical might be very different from a student's. We are modifying *iFISH* to allow user input so that the system 'learns' as users reflect on their experience and enter their ratings into it.

5. CONCLUSION

We have described a system that is being used to explore the vexed issue of encouraging persistent, explorative behaviour in a world filled with distractions and others ways of finding 'the right answer'. The challenge is one of balancing affect and focus on task; of attracting users to a task and then maintaining their engagement over an extended period. The system described, *iFISH*, is playful and flexible, and offers many possibilities in pursuing this challenge. It encourages users to think at a meta level and nurtures reflection as a stimulant to mindful engagement. Our research in this area is ongoing with the development of more flexible environments that can be readily set up to explore different situations.

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