across these modes. Manual tagging of music items with metadata is likely to remain the key approach to dealing with music for some time to come.

Images
As with music, commercial search engines have to make do with using metadata or captions if they want to provide image search services. Although intensively researched, progress in retrieval of image content is limited. Image retrieval breaks down into a number of sub-topics, some of which have been more successful than others. Face recognition is one area where reasonable progress has been reported, however even here, face retrieval systems only work if a very large training set can be produced of the faces to be recognised or if faces are only to be recognised when lighting and orientation of a face are carefully controlled.

The main area where progress in image search is likely to be made in the near future is in the devices we use to capture images providing metadata when photos are taken. Already most digital cameras include data (conforming to the EXIF standard) into each image describing amongst other things the date/time a photo was taken, the status of the lens, exposure and aperture. Future cameras are likely to use GPS to tag where the photo was taken. Such information will help in the organisation and search of image collections.

3D objects
The final topic covered in the talk perhaps seemed an odd choice, but there are signs that three dimensional objects are going to become more prominent on the Internet. Already there are search engines, which allow querying for 3D objects based on a series of sketches (see http://shape.cs.princeton.edu/search.html). Currently the number and type of objects available for search are limited, however, means of capturing the shape of physical objects is becoming easier and in areas such as cultural heritage such diverse projects as capturing set designs or scanning the shape of statues is taking place. Once sufficient objects have been scanned, search of them will become an important topic.

Conclusion
From this brief overview it is clear that there is a wide range of search applications yet to reach the commercial mainstream. Search has a much richer and more diverse future than perhaps one might have thought.

Non-linearity and Human Information Behaviour

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Introduction
Human Information Behaviour is an area of research that is of particular significance to professionals interested in information skills and key skills instruction. Recent research suggests that patterns of ‘literate’ information seeking are self-reflective, context bound, pragmatic, flexible, and adaptable. In specific terms, the patterns are also defined as non-linear, dynamic, complex inter-relationships of behaviour, activity, and context. This paper briefly introduces one model from the Non-linear perspective of Human Information Behaviour, and describes some potential implications for library instruction that arise from the application of these principles.

The concept of non-linearity and the non-linear perspective
The focus of non-linear theories in the sciences is on understanding the complex inter-relationship of variables, and mathematically representing, the movement, or transformation, of

one complex entity into another related one (Gleick, 1987; Stewart, 1989; Waldrop, 1992; Kellert, 1993).

The development of a Non-linear Model of Information Seeking Behaviour that interprets Human Information Behaviour in terms of non-linear, dynamic, and complex inter-relationships of behaviour, activity, and context, is relatively new to the field of Information Science.

The development of non-linearity is represented prominently in Foster's Non-linear model of Information Seeking Behaviour (Foster, 2004), though some researchers (Erdelez, 1997; Cheuk, 1998; Spink *et al,* 2002) have mentioned some non-sequential features of information seeking previously.

Foster's Non-linear Model

The mechanics of non-linearity for Information Science are embodied within the Foster model of Non-linear Information Seeking Behaviour. Foster's Non-linear model is based around three core processes, Opening, Orientation, and Consolidation, and three Contextual elements represented by Internal Context, External Context, and Cognitive Approach, as shown graphically in Figure 1 (Foster, 2004: 232).

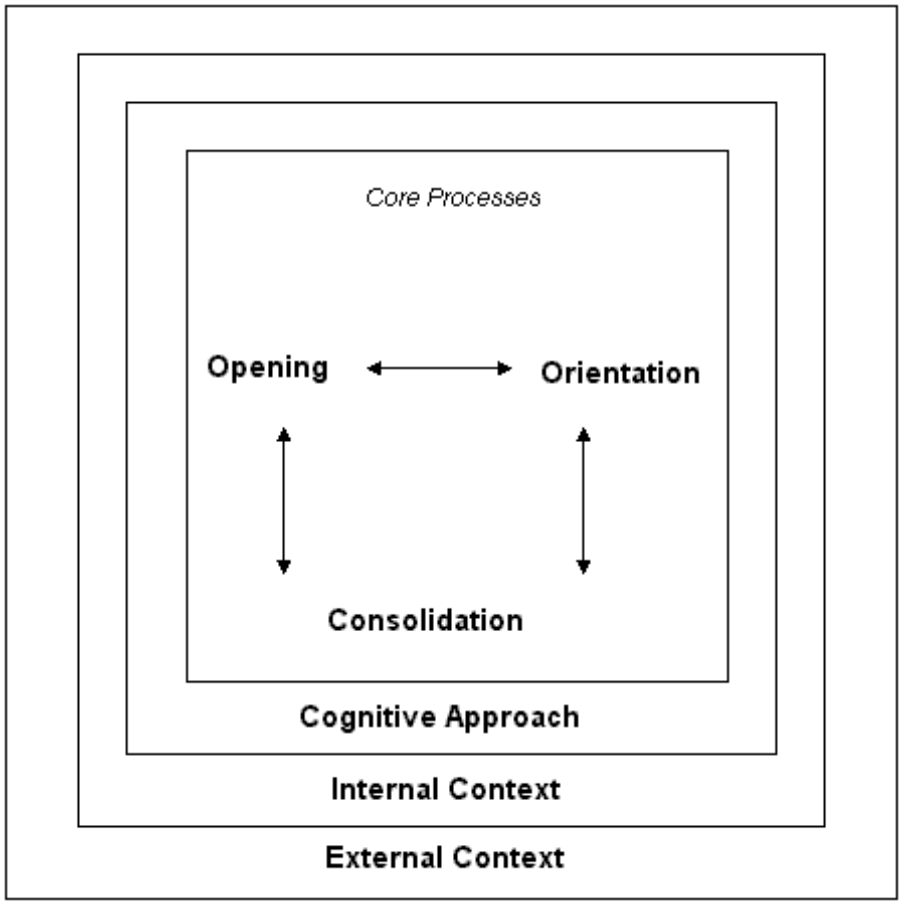

Figure 1. Non-linear Model of Information Seeking Behaviour (Foster, 2004: 232).

Each of the three core processes, Opening, Orientation, and Consolidation, continually interact: internally with themselves, and externally with the information seeker's Cognitive Approach, Internal Context, and External Context. An activity that forms part of Opening, can potentially lead to any other activity within the same core process, or within any other core processes.

The processes illustrated in Figure 1 are composed of multiple activities, influences, strategies, and sub-processes; these are listed in Table 1, and further elements are listed in Table 2 below (Foster, 2004).

Opening	Orientation	Consolidation
Breadth Exploration	Problem Definition	Knowing Enough
Eclecticism	Picture Building	Refining
Networking	Reviewing	Sifting
Keyword Searching	Identify Keywords	Incorporation
Browsing	Identifying the Shape of Existing Research	Verifying
Monitoring		Finishing
Chaining		
Serendipity		

Table 1. Core Processes of the Non-linear Model (adapted from Foster, 2004: 232)

The following sections provide an overview of the core processes, contexts, and cognitive elements of Foster's Non-linear model.

Opening
Opening, as a core process, corresponds to activities connected with actively and passively seeking, exploring, and revealing information.

The term "Opening" was derived from interview transcripts as an expression of an information seeker's "opening up a topic" through a variety of activities, amongst which Breadth Exploration, Eclecticism, and Serendipity are notable as complex strategies (Foster and Ford, 2003).

Orientation
The Orientation process has a wide remit within the model and represents the activity involved in, as Foster (2003) suggested, "making sense" or "finding which way was up". The activities are primarily directed towards identifying ideas, sources, reviewing that which is already known, and setting goals for further explorations.

Consolidation
Consolidation, involves judging and integrating elements of the work in progress (involving relevance criteria and judgements), deciding and continually questioning whether sufficient material to meet the present information need had been acquired (Foster, 2005a).

Context and Cognitive Approach
Foster's model states that information seeking is more than an interaction of the activities described in the Core Processes, but is in addition an interaction of the Core Processes, Context, and Cognitive Approach (see Table 2). These elements define the opportunities, limitations, knowledge, and the ways of thinking that shape information seeking.

External Context	Internal Context	Cognitive Approach
Social and Organisational	Feelings and Thoughts	Flexible and Adaptable
Time	Coherence	Openness
The Project	Knowledge and Understanding	Nomadic Thought
Navigation Issues		Holistic
Access to Sources		

Table 2. Contextual Interactions of the Non-linear Model (adapted from Foster, 2004: 232)

Interpreting the model

As a complete entity, Foster's model forms a complex map of Human Information Seeking Behaviour.

> "With each information seeking experience, or contextual change, the opportunity and need for information seeking change too. The relationship of core processes and developing context interact freely to allow each core process to feed into any other, and to be reiterative over time....the concepts, represented in the interactivity of the core processes, and the absence of stages in the model, are analogous to an information seeker holding a palette of information behaviour opportunities, with the whole palette available at any given moment. The interactivity and shifts described by the model show information seeking to be non-linear, dynamic, holistic, and flowing" (Foster, 2004:235).

In Foster's Non-linear Model of Information Seeking Behaviour, information seeking is conceived of as a long-term progression through life that forms a continuously evolving personal profile defined as the sum of previous knowledge and experience, including previous information seeking, their external context, and their evolving cognitive dimensions. Simply: life and information seeking activity affect an individual's further information seeking behaviour.

Implications

Multiple implications for research arise from a consideration of Human Information Behaviour as non-linear. In this paper, the potential to apply the Non-linear model to information skills instruction will be discussed.

Non-linearity implies a new approach to information skills training. Specifically, a non-linear and holistic approach has potential to be used as a rationale and framework to guide the teaching of information skills.

There is a considerable, and more than occasionally overwhelming, volume of literature in existence describing multiple interpretations of how to teach information skills using various linear models. Many traditional approaches have worked with the assumption that teaching should involve breaking information seeking down into stages, stages which must be completed or repeated, before moving on to the next step. These approaches are a good tool to structure teaching in some contexts, perhaps to novice information seekers in particular (Swain, 1996).

The Non-linear perspective offers an alternative way to view the creation of an information literate individual. In approaching the task of teaching from a non-linear perspective, the core processes and contexts, and cognitive approach become important. The core principle is the

interaction between different activities, and the multiple ways that they may be combined in information literate information seeking behaviour.

This raises some interesting questions for information professionals, particularly in thinking about how you might teach a non-linear approach. The beginnings of an answer to this problem have used Foster's model (2004) to outline an approach to teaching.

The first problem is to consider which skills, and the order in which to introduce them. In Foster's model, three core processes represent the activities necessary to complete information seeking: an information literate person is able to successfully perform a version of this triumvirate of three core processes. Learning the purpose and logic of each of the three core processes is potentially the first conceptual element to teach.

The educator may demonstrate the existence of the full range of activities possible, but the number and range of skills taught will be determined by the learner's initial level of skill that may be readily explored with diagnostic assessments. In Foster's model, the concept of a skill level is defined by the Contextual elements.

A useful analogy

In deciding how to approach the task of teaching, a simple analogy has been useful to structure a curriculum (Foster, 2005b). In this analogy, a simplified non-linear framework for a novice information-seeker, analogous to a children's paint set, with a limited paint brush, provides a beginning level of information seeking representing the most basic aspects of Opening, Orientation and Consolidation, e.g. browsing, or keyword searching. More advanced information seekers learn that complex mixtures of colours (activities) provide better results, and using different brushes (activities, sources, strategies), increases the scope for refined and complex outputs. Taking the analogy to its logical conclusion, expert searchers would choose from a complete set of paints and a full set of broad and fine brushes, representing training in complex strategies, information sources, and approaches to problem solving. For a given context, it is necessary for the professional to determine the level of component activities required.

Trials of the technique involving the training of academics and Masters students for electronic information sources and refreshing information skills showed that the non-linear model offered a flexible tool with which to introduce strategies and activities which the learners could incorporate into their previous knowledge of searching. The result was adoption of new methods, quick integration of previous experience with new ways of searching for information, and an increased level of reflective information seeking practice: suggesting information literate behaviour.

The approach provides information-seekers with a flexible framework that reflects the way people in real situations find it necessary to think about, and perform information seeking.

Conclusion

This brief paper outlined some of the elements that contribute to a Nonlinear understanding of Human Information Behaviour. Ultimately, the non-linear perspective may offer an opportunity to package information skills in a manner that reflects real-world solutions, and in this may be acceptable to a diverse groups for whom traditional information skills training is unsuitable.

Further research, and the work of leading edge practitioners, will be valuable in exploring how non-linearity might contribute to practical information skills instruction amongst those with different education, culture backgrounds, and coming to information skills within different contexts.

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