Collaborative Information Seeking: On tracability, sensemaking and recommendation

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INFORMATION SEEKING
AN INFORMAL DEFINITION…
Information Seeking

Information seeking is the process or activity of attempting to obtain information in both human and technological contexts. [Wikipedia]

Wilson’s nested model of information behavior areas (Wilson, 1999)
Information Behaviour

By information behaviour is meant those activities a person may engage in when identifying his or her own needs for information, searching for such information in any way, and using or transferring that information. [Wilson, 1999]

Wilson’s extended version of information behavior [Wilson, 1996]
Byström and Järvelin’s Model

The Information Seeking Surface Model [Byström and Järvelin, 1995] takes into account task complexity and problem solving aspects of information seeking in a work environment.
More on seeking...

- Models are rather complementary than contrary and can focus on different aspects, e.g.:
  - Kuhlthau’s more phenomenological model with 6 stages and corresponding activities [Kuhlthau 1991, 1994]: Initiation, Selection, Exploration, Formulation, Collection, Presentation
  - [Ellis 1989, 1993] empirically categories or “features”: Starting, Chaining, Browsing, Differentiating, Monitoring, Extracting, Verifying, Ending
  - Models can be aggregated, e.g. by [Wilson’1999] and can be used for HCI–Design

- Some models are rather seen as instance or a class of information-seeking behavior, e.g.:
  - Exploratory Search
EXPLORATORY SEARCH
AN INFORMAL DEFINITION…
Exploratory Search

Exploratory search is a specialization of information exploration which represents the activities carried out by searchers who are either:

- unfamiliar with the domain of their goal
- unsure about the ways to achieve their goals
- or even unsure about their goals in the first place

[Wikipedia, 2015]

Exploratory search is a highly dynamic process (of a user) to interact with an information space in order to satisfy an information need that requires learning about structure and/or content of the information space.

[Gossen et al., 2012]
Learning as Part of Information Seeking

[Marchionini, 2006]
Relationship between learning activities and searching difficulty based on a user study by [Jansen et al, 2009].
Exploratory Search

- The user’s goal is to learn, to investigate, to understand, to conceptualize, …

- Therefore, we need methods to
  - search, navigate and browse
  - sort, structure, filter (interactively)
  - change perspective
  - …

- Remark: For some cases ideas and approaches from exploratory data analysis can be transferred
An Example: Visual Berrypicking

- **Motivation:**
  - Support Users in Exploring big collections of documents (here: Images)
  - **Main Goal:** Provide overview and context

USER INTERFACES

HOW TO EFFICIENTLY INTERACT WITH INFORMATION…
The HCI aspects of usability...

**Effectiveness:**
The accuracy and completeness with which users achieve certain goals

**Efficiency:**
The relation between (1) effectiveness and (2) the resources expended in achieving it

**Satisfaction:**
The users’ comfort with and positive attitudes towards the system

[ISO 9241-110]
HCI Aspects of Information Seeking

- Ultimate goal: Support all steps of seeking processes

![Diagram showing the stages of information seeking with labels: Initiation, Selection, Exploration, Formulation, Collection, Action.]

Designing for Information Seeking

- Some fundamental requirements on seeking tools:
  - Open-ended exploration
  - Information management
  - Monitoring
Information Seeking: Open-ended Exploration

- User in initial phase deals with uncertainty
- Help users to explore
Foodily, a recipe search engine, allows users to save their favorite recipes and organize them into meal plans [Russell-Rose & Tate, 2013]
Information Seeking: Monitoring

- Towards the end of the journey
- Monitor for new opportunities given the same criteria
  - Automatically
  - On demand
A Different Perspective...

- **Exploratory Search** (How)
- **Complex Search** (What)
- **Professional Search** (Who)

**Actions:** Lookup, Learn, Investigate (Marchionini)

**Information about:** Problem, Domain and Problem-Solving (Byström & Järvelin)

**Business Context:** Plan, Collaborate, Summarize
Complex and Professional Search: Stages

- Plan
  - Repeating search topics (evolving domains, updates)
  - User roles during search

- Explore, Collect and Collaborate(!)
  - Share ideas and findings
  - Contribute
  - Discuss and evaluate

- Summarize
  - Synthesize and contextualize
  - Formulate for decision makers
Enhancing the Search Experience

Complete Search Process Integration

Search Behaviour Models

Search Task

Plan

Explore

- Facetted Browsing
- Search History Visualizations
- Recommendation Systems
- Adaptive UIs

Make Sense

- Bookmarking
- Document Tagging
- Snippet Extraction
- Snippet Organization

Summarize

...
Exploratory Search

- Search History Visualization
- Query Suggestion
- Facets
- Context
- Adaptive UI

2012: https://chrome.google.com/webstore/detail/visual-history/emnpecigdjglcgfabfnmlphgfdifaan

Evaluation of a Scatter/Gather Interface for Supporting Distinct Health Information Search Tasks, Zhang et al., 2014
Complex Search

- Multistage Search Sessions

Complex Search

- Multistage Search Sessions
- Tagging and Content Organization

Sewing the Seams of Sensemaking, [Hearst and Degler, 2013]
Complex Search

- Multistage Search Sessions
- Tagging and Content Organization
- Search Aspects

An interface that displays „aspects“ of search results for better evaluation ([Villa et al., 2009])
COLLABORATIVE INFORMATION SEEKING
HOW TO SUPPORT COLLABORATING SEARCHERS…
Collaborative Search: A definition

- Collaborative search is a set of search activities that make use of social interactions with others before, during and/or after the search [Evans & Chi, 2008].

- These interactions may be explicit or implicit, co-located or remote, synchronous or asynchronous [Evans & Chi, 2008].

- During collaborative search all participants have the same searching goal and actively conduct a specific search together in order to achieve this goal [Gossen et al., 2011].
Dimensions [Golovchinsky et al., 2008]

- Intent
  - Explicit
  - Implicit (collaborative filtering)
- Depth of mediation
  - User interface
  - Algorithm
- Concurrency
  - Synchronous
  - Asynchronous
- Location
  - Co-located
  - Remote
SearchTogether by Microsoft
Professional Search

What is needed to support a team of searchers?

- Traceability
  - Understand joint search strategy and findings

- Sensemaking
  - Bottom-up approach

- Recommendation
  - Exploit prior information and strategies (of yourself and other users)
Traceability

- Traceability in collaborative search describes a team's ability to understand the contents and semantics of their joint search strategy
  - How did the team approach a search topic?
  - What search directions did they take?
  - How did they find novel/relevant information?
  - What did they make of this information with respect to their search goal?

- Traceability can be seen as an extension of awareness in an information seeking task (e.g. group, workspace, contextual, and peripheral awareness, Liechti and Sumi, 2002)
An interface visualizing a teams joint search activity as an horizontal tree of search actions, Stange and Nürnberger, 2014
Sensemaking

- Process through which people assimilate new knowledge into their existing understanding [Russell–Rose & Tate, 2013]

- From internal to external schemas
  - The mental image of the world around you... is a model
  - People use selected concepts and relationships to represent the real system
Sensemaking as finding a representation that organizes information to reduce cost of an operation in a search task, Russell et al., 1993
Sensemaking: Four stages

1. Search
   - Locate documents that may be meaningful for investigation

2. Extract
   - Meaningful information must be extracted from those documents

3. Encode
   - Extracted ideas must be integrated into user’s semantic memory
   - Construction of domain schema

4. Analyze
   - Analyze the schema to gain insights
Sensemaking

From internal to external schemas...

- Sophisticated information tasks demand that one’s internal semantic model be disseminated into an external schema.

✓ Designing for sensemaking
  - Shoebox
  - Evidence file
  - Schema
Sensemaking: Shoebox

- Add documents to a collection/shoebox as rapidly as possible, e.g. using:
  - Text link
  - Checkbox
  - Icon

Google shopping: stores intermediate results in a list
Sensemaking: Evidence file

- Provide clues to how and why information or documents have been considered as being relevant to the information need

- More thorough examination of the curated collection
  - E.g. extract and save snippet to the evidence file
Collaborative Sensemaking

Workspace View in SearchTogether

Collaborative sensemaking using a Tabletop Display, Morris et al., 2010

Making notes and compiling reports with Coagmento, Shah, 2010
Sensemaking: Schema
Sensemaking for Teams in SCOT

- Making sense of collected information during a search task

- Co-searchers work together to interpret and contextualize the information they retrieve.

- Relationships between entities are restricted to what is specified in a domain ontology.
Recommendation

- Recommender systems are about **discovery**
Recommendation

- A good recommender brings up items that are
  - Relevant
  - Novel
  - Surprising

Common approach: Collaborative Filtering

- Task of predicting user preferences on new items by collecting “taste” information from a large number of other users
Recommendations

- How can we make recommendations more interesting?
  - increase serendipity!

- An example
  - create an environment where serendipitous recommendations become more likely
  - leverage the effect of bisociations!
Bisociations

Arthur Köstler: *The Act of Creation* (1964)

“the perceiving of a situation or idea, L, in two self-consistent but habitually incompatible frames of reference, M₁ and M₂. The event L, in which the two intersect, is made to vibrate simultaneously on two different wavelengths, as it were. While this unusual situation lasts, L is not merely linked to one associative context but bisociated with two.”

- simultaneous mental association of an idea or object with two fields / frames of reference ordinarily not regarded as related

- combine two different views on a music collection
Bisociations by Bridging Graphs

= path that connects ideas or objects
  a) of different domains (ordinarily not regarded as related)
  b) by incorporating another domain

For further discussions on exploration using bisociations see, e.g., [Gossen et al, 2012]
Combining Orthogonal Similarity Spaces

projection weights
- dynamics: 0.0
- rhythm: 1.0
- timbre: 0.0

distortion weights
- dynamics: 1.0
- rhythm: 0.0
- timbre: 1.0

S. Stellmach, S. Stober, A. Nürnberg, R. Dachselt, *Designing gaze-supported multimodal interactions for the exploration of large image collections*, In: Proc. of 1st Conf. on Novel Gaze-Controlled Applications (NGCA), 2011
Bisociations in Graphs

- bridging concepts
  - established by ambiguous terms or metaphors
  - word-plays (context switching leads to a surprising outcome often perceived as joke)

- bridging graphs
  - connect concepts from different domains by inducing one or multiple paths between those concepts.
  - either the two concepts must lie in different domains or the path must contain at least one vertex in a different domain

- structural similarity
  - common structures in the context of each concept, i.e., similar subgraphs
  - may lead to same / very similar abstraction of both concepts
Similarity Space + Linked Data (Graph)

projection: content-based similarity

nearest neighbors: graph traversal
Conclusions

- Collaborative Information Seeking is still far from being well supported by IT systems

- Main challenges:
  - How to model user interests? (Yes, still an issue!)
  - How to model users search strategies?
  - How to visualize in order to support efficient traceability and sensemaking?

- Research requires close collaboration between IR, ML and HCI communities.
References (1)


References (2)


[Stellmach et al.] S. Stellmach, S. Stober, A. Nürnberger, R. Dachselt, Designing gaze–supported multimodal interactions for the exploration of large image collections, In: Proc. of 1st Conf. on Novel Gaze–Controlled Applications (NGCA), 2011


