

IS computational models and information needs

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Plan

- IS computational models and information needs
- Empirical data
 - Expertise
 - Environment
 - Emotions
 - Engagement
- Towards a model of information needs

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Foraging model

(Holling, 1959)

$$R = \frac{G}{T_B + T_W}$$

R = rate of gain of valuable information per unit cost

G = total net amount of valuable information gained

T_B = total amount of time spent between patches

T_W = total amount of time spent within patches

The ACT-IF model

(Pirolli & Card, 1999)

- The assessment of G is $g(c,s)$.
- The assessment $g(c,s)$ of the cluster summary text for the cluster c presented on screen s :

$$g(c,s) = \exp\left(\frac{\sum_{i \in Q} A_i}{T}\right)$$

- Where
 - The summation is over the activations of words, i , in the query Q
 - T is (an estimation of) the actual number of relevant documents in clusters

The ACT-IF model

(Pirolli & Card, 1999)

- The activation (A) of a query word i is

$$A_i = B_i + \sum W_j S_{ji}$$

A_i is interpreted as reflecting the log posterior odds that i is relevant

- Where

B_i = base-level activation of i

The log prior odds of i being relevant

S_{ji} = association strength between cluster word j and query word i

The log likelihood ratios that i is relevant given that it occurs in the context of word j

W_j = base-level activation of cluster word j

The Bayesian Satisficing Model

(Fu & Gray, 2006)

- A bounded rationality model : information seeking costs are traded off against the utility of information
- Information seeking can be:
 - An alternative to problem solving (if the cost of IS is lower than problem solving cost)
 - A mean to solve problems by action (*e.g.*, to evaluate alternative actions)
- Two rules:
 - The local decision rule decides when to stop seeking information
 - The global Bayesian learning mechanism updates the knowledge of the environment (utility of information) after actions are executed.

Information need in IS models

- Lack of knowledge => Information need
- Question:
 - What processes transform the lack of knowledge in an information need?
- Our rewording of this question:
 - What determines the assessment of expected utility of potential information?

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Data from expertise research

- Eye-tracking data : the Satisfaction of Search phenomenon (Berbaum et al. 1990)
 - Nodule detection lowered by salient cues
 - Nodules gazed longer than randomly chosen areas
- Behavioral data : from novices to super experts (Raufaste, Eyrolle, Mariné, 1998)
 - Most novices discovered the cue by using the standard exploration procedure
 - Basic experts failed to discover a cue
 - Super experts persisted longer enough to discover the problem

Information needs and expertise : other data

- The decision to seek occupational information increase when the person has previously sought occupational information (Millar & Shevlin, 2003)
- Those who most seek information about financing their retirement are the most informed and richest (Joo & Grable, 2001)
- The pupils with more lexical knowledge ask more useful questions and less useless questions about words (Van der Meij, 1990)

Conclusion

- Feelings that more investigation is needed are crucial
 - Violation of coherence
 - General attitude of cautiousness
- The relationship between expertise and the drive to seek for more information is non trivial

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Tricot & Lafontaine (2002)

- Experiment 1 : writing a definition
 - 46 pupils (from 9 to 11 years old)
 - A 6-page notebook with one word to be defined on each page. The words were: Epitaphe, Ecchymode, Didascalie, Escargot, Bouteille, Escalier.
 - The following instructions were given:

Hello, I'd like you to play the dictionary game. I'm going to give you a list of words. You know some of them and some you don't. You must try to write a definition for each word. So, two things are possible. You might think you need a dictionary so that you can look for the definition. But, watch out. I'm only going to give you one and a half minutes to find the definition. Then I'll ask you to tell me the definition. Or you might think that you don't need the dictionary and we'll go on to the next word.

Tricot & Lafontaine (2002)

- Below the initial definition, the pupils were asked whether they were certain, not very certain or totally uncertain about the definition of each word.
- The dictionary was closed after 1 minute 30 seconds or when the definition had been found.

Tricot & Lafontaine (2002)

- Experiment 2 : understanding a text
 - 30 pupils (from 9 to 11 years old)
 - Same words
 - Pupils were asked to read and to understand a short text, and to use the dictionary *if they needed it*

Condition 1 : target words are **not** underlined

Molière et les acteurs

Molière écrivait des pièces de théâtre. Il était aussi acteur de théâtre et jouait dans la plupart de ses pièces. Peu de gens savent que cela posait des problèmes. En effet, la plupart des auteurs de théâtre sont seulement auteurs. Dans le texte qu'ils écrivent, quelques didascalies suffisent aux acteurs pour jouer la pièce. Molière, lui, travaillait directement avec les acteurs, et les embêtait tout le temps : « Parle plus vite, on dirait un escargot ! » ; « Parle plus lentement, on ne comprend rien ! ». Un jour, il dit à un acteur qui devait faire jouer un prince en train de manger un délicieux repas : « Regarde comment tu tiens ta fourchette, on dirait un paysan qui tient une fourche ». L'acteur se vexa, il poussa Molière dans les escaliers du bord de la scène de théâtre. Molière s'en sortit avec quelques ecchymoses. Mais il continua toute sa vie à embêter les acteurs. Son épitaphe mentionnait ce fait, mais aujourd'hui elle est effacée. Alors on a tendance à l'oublier.

Condition 2 : target words are underlined

Molière et les acteurs

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Results

Unknown words	search	find
<i>Writing a definition</i>	100 %	96 %
<i>Understanding a text</i>		
- <i>not underlined words</i>	92 %	90 %
- <i>underlined words</i>	90 %	86 %

Results

Known words	search	find
<i>Writing a definition</i>	73 %	69 %
<i>Understanding a text</i> - <i>not underlined words</i> - <i>underlined words</i>	0 % 100 %	0 % 100 %

Conclusion

- Information need can be the need to check something known
- Information need can be induced by marks of relevance

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Information need and anxiety

- Information seeking in cancer patients (Mesters et al. 2001) :
 - Information seeking increases with anxiety, depression and psychological suffering.
 - Information seeking is directed
 - towards action
 - towards knowledge about the disease.
 - In the course of time, the needs concerning the disease and the treatment are decreasing. Those concerning the access to assistances not.

Conclusion

- Emotions and stress have effects on quantity and content of information needs

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Information need and decision

- The more one is committed in a decision (*e.g.* Jonas et al., 2001) or in an opinion (*e.g.* Wright, 1998), the less one seeks potentially contradictory related information

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Information need...

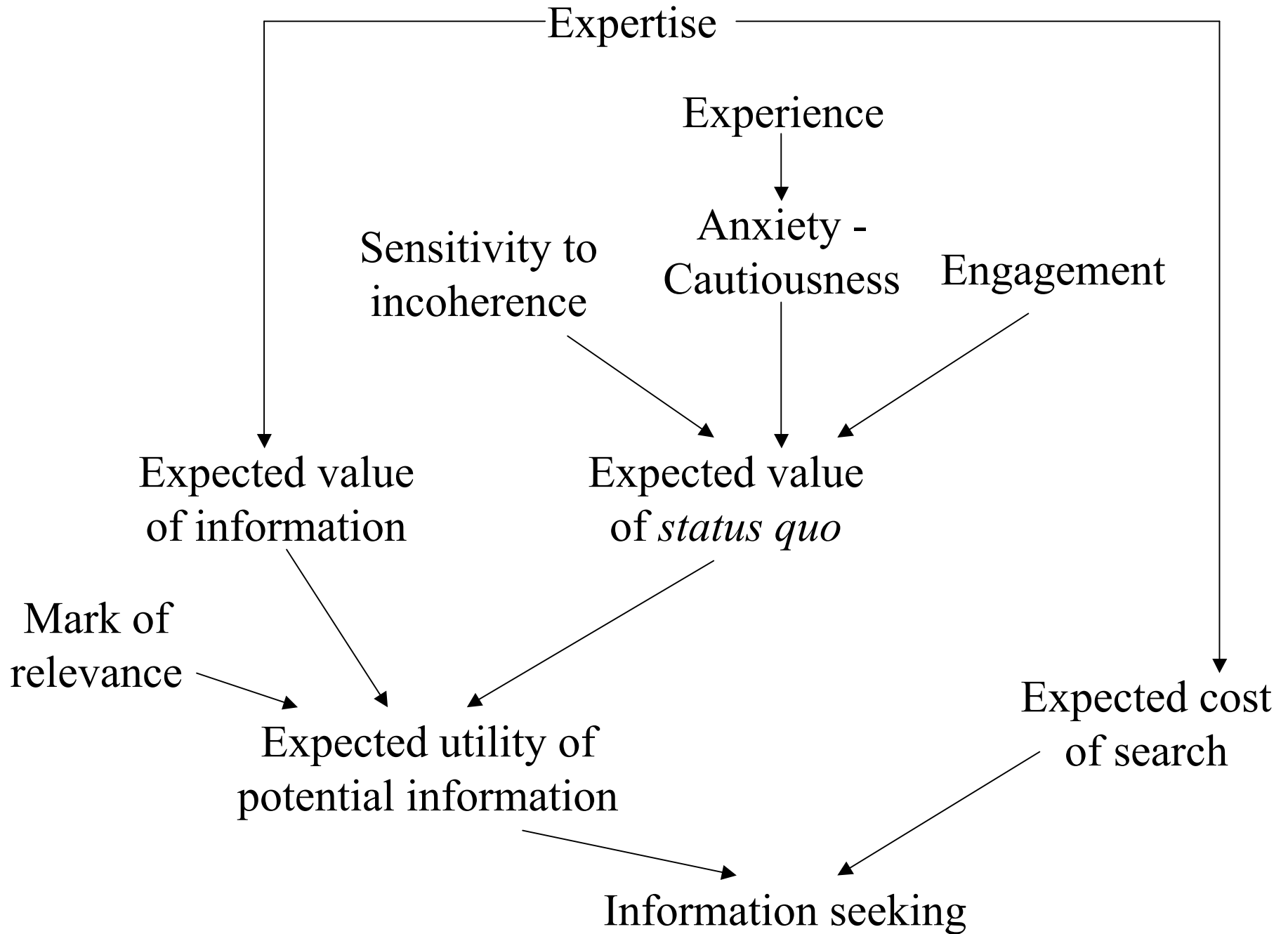
... is a paradox: a person must have knowledge to be aware about his lack of knowledge

... is influenced by

- Expertise (yet nonmonotonically)
- Environment: marks of relevance, affordances
- Emotion: anxiety, stress, psychological suffering
- Engagement: a person feel less the need of information that contradict his opinion or decision if he is strongly engaged with this opinion or decision
- Individual characteristics might affect “fear of the dark”

Five kinds of information needs

- Need for obtaining new knowledge
- Need to confirm existing knowledge
- Need to complement existing knowledge
- Need to be in conformity with the situation
(*e.g.* implicit goals, social constraints)
- Need triggered by detection of relevance marks in the situation



Questions

- How is it possible to model individual differences about “fear of the dark”?
- How is it possible to model the role of relevance intuitions?