Information problem solving and mental effort

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Information problem solving

- Skills, knowledge and attitude to
  - define the information need;
  - identify sources;
  - judge and select relevant information from the sources;
  - organize the information found;
  - present the information into a coherent product;
  - construct knowledge.

(Brand-Gruwel & Stadtler, 2011; Brand-Gruwel & Gerjets, 2008; Brand-Gruwel, Wopereis, & Vermetten, 2005).

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Research in IPS

- The process of IPS.
- Instructional design to foster IPS.

The process of IPS

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Unraveling the IPS-process

- Feddes, R., Vermetten, Y., Brand-Gruwel, S., & Wopereis, I. (2003). Strategische kennis over het oplossen van informatieproblemen: een exploratief onderzoek [Strategic knowledge about information problem solving: an explorative study]. *Pedagogische Studiën, 80*, 210-225.

- Brand-Gruwel, S., Wopereis, I., & Vermetten, Y. (2005). Information problem solving by experts and novices: analysis of a complex cognitive skill. *Computers in Human Behaviour, 21,* 487-508.

- Brand-Gruwel, S., Wopereis, I., & Walraven, A. (2009). A descriptive model of Information Problem Solving while using Internet. *Computers & Education, 53*, 1207-1217.

- Argelagos, E., Brand-Gruwel, S., Jardozki, H., & Pifarre, M. (2012). *Web search processes: how to measure them? An exploratory study comparing methods.* Manuscript in submitted.

2005: the Expert-Novice study

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Participants: expert-novice study

- Experts:
- 5 PhD students in the field of Educational Technology in their final year

- Novices:
- 5 Psychology freshmen from the University of Maastricht

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Set up: expert-novice study

Task:

- write in 90 minutes an article for a consumers magazine (± 400 words) about food that is out of date and use MS Word and Internet

Instrument to analyze the thinking aloud protocols:

- for development a inductive-deductive method was used
- three columns were scored simultaneously
    - main skills
    - sub skills
    - regulation

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Information Problem Solving

a skill decomposition

Regulation

Regulation

Orientation on task	Orientation on time	Monitoring / steering	Evaluate process	Evaluate product
Define information problem	**Search information**	**Scan information**	**Process information**	**Organise and present information**
Read task	Internet skills	Internet skills	Read info	Formulate problem
Concretise problem	Derive search terms	Scan site	Elaborate on content	Outline the product
Activate prior knowledge	Judge search results	Elaborate on content	Judge processed info	Structure the product
Clarify task requirements		Judge scanned info		Formulate text
				Elaborate on content

Analysis

Synthesis

Significant difference: experts spend more time on this sub skill

Significant difference: experts do this more often

Process of evaluating sources and information

Walraven, A., Brand-Gruwel, S., & Boshuizen, H.P.A. (2009). How students evaluate information and sources when searching the World Wide Web for information. *Computers and Education, 52*(1), 234-246.

Walraven, A., Brand-Gruwel, S., & Boshuizen, H.P.A. (2011). *Teachers and the World Wide Web: How teachers evaluate search results, information and source.* Manuscript submitted for publication.

Brand-Gruwel, S., & Stadtler, M. (2011). Solving Information-based Problems: Searching, Selecting and Evaluating Information. *Learning and Instruction, 21,* 175-179.

2009: Students‘ evaluation behavior (secondary education)

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Set up: evaluation behavior study

- Participants: 23 students from secondary education
- Tasks: 12 tasks: 4 science / 4 geo. / 4 language
  - example: Young people use MSN and SMS a lot. Does this have an influence on their language proficiency?
- Procedure: each student accomplished 2 tasks while thinking aloud (30 per task)

Results: evaluation behavior study

- Students do not evaluate in a sophisticated way
  - Sources are hardly evaluated on usability and reliability
  - Information is being judged on the connection to the task, the amount of information and the language

Process of evaluation and role of prior knowledge

Brand-Gruwel, S., Kammerer, Y., Van Meeuwen, L., & Van Gog, T. (2011). The use of evaluation criteria when searching the WWW. Manuscript submitted for publication.

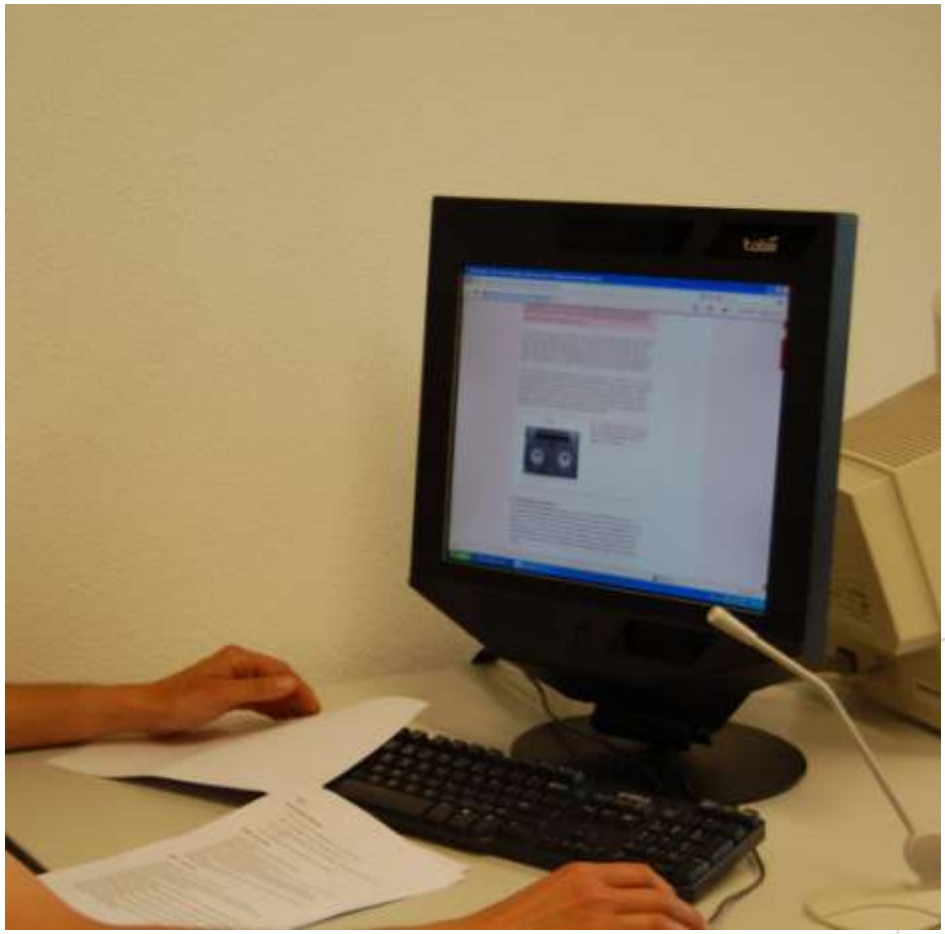
2011: evaluation behavior of novices and experts in a domain

Set up: evaluation and prior knowledge

- Participants:
  - 20 psychology students (freshmen) (12 men and 8 women; age M = 20.2, SD = 4.07)
  - 17 psychology teachers (University) (7 men and 10 women; age M = 39,5, SD = 12.33)

- Task:
  - Two tasks (reliability of human memory and altruism)
  - Each task had a Google-like result page (SERP) with 17 links
  - select and prioritize information and finally rank the best five sites in 10 minutes

Procedure: evaluation and prior knowledge



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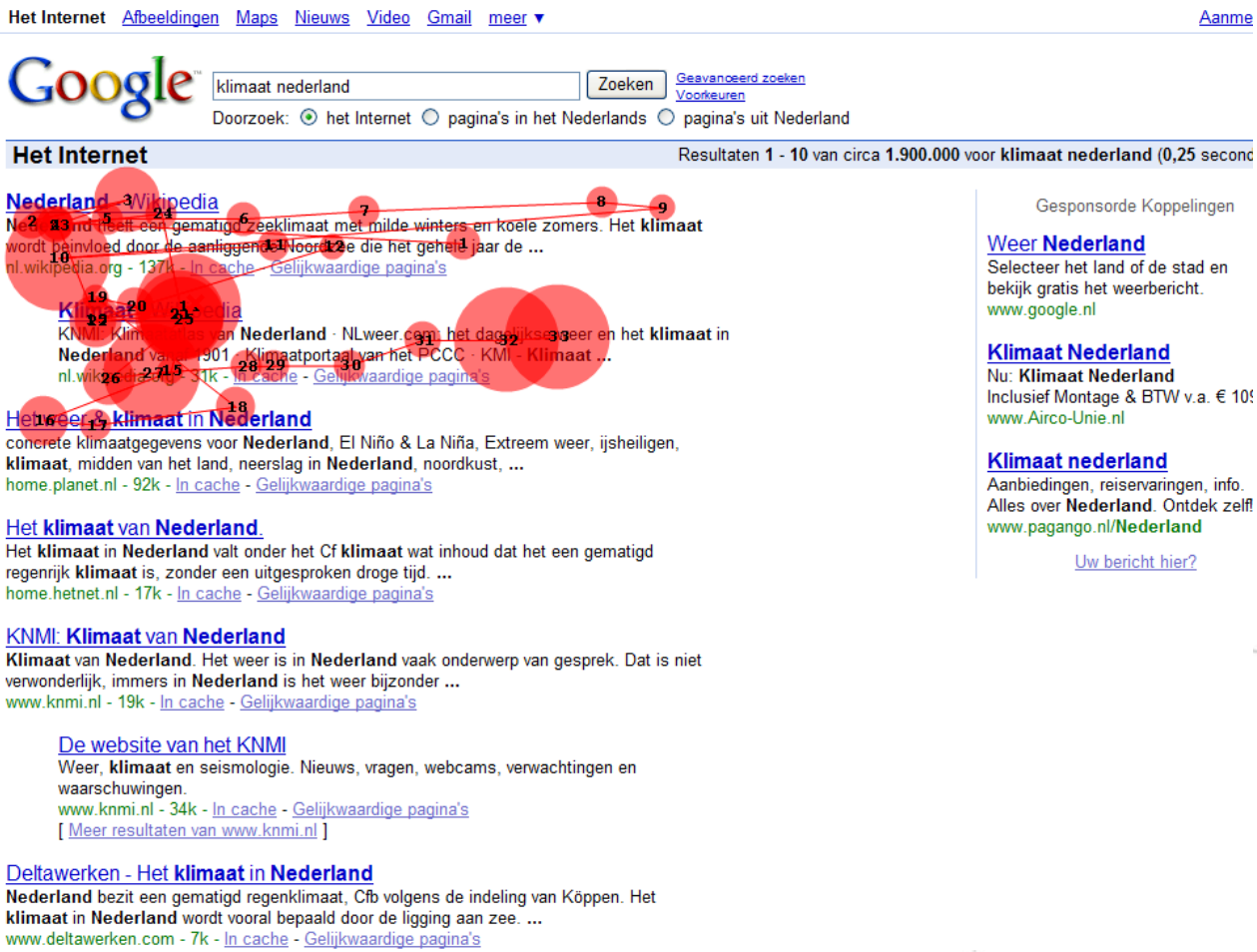
Eye-movements



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Results: evaluation and prior knowledge

- The domain experts do evaluate the reliability of the sites significantly more often than the novices
- The novices used more superficial criteria for evaluation (statements like: this seems ok, or that may be useful)
- The selected sites of the experts were of a higher quality and a relation with the use of sophisticated criteria

- *Data of the eye-movements will be analyzed together with Yvonne Kammerer (KMRC-Tübingen)*

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Future research: PhD-students

Milou de Smet: Students' use of electronic outline tools for writing and learning.

Johan van Strien: Multiple document comprehension: impact of epistemic beliefs and attitude on intergrating information from different (conflicting) sources

Jaap Walhout (RdMC): Adaptive Instruction to foster students' information problem solving skills: learning to organize digital information.

Jimmy Frèrejean: The integration of the lifelong learning skill 'Information problem solving' into higher education: Effects of different types of feedback and guidance on IPS and mental effort.

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Project Jimmy Frerejean: evaluating instruction

Effect of different kind of support (prompts, worked examples or a combination) on

- learning performance
    - Information problem-solving skill
- mental effort

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Measuring mental effort

- self-rating scales
- dual-task methodology
- physiological measures

Self-rating scales

pro's:

- easy to administer
- easy to analyze

cons:

- subjective
- *after* learning phase

Dual-task methodology

pro's:

- real-time measure
- objective measurement

cons:

- difficult to design:
    - same modality, but not disruptive
- *Is it possible to combine a dual-task approach with eyetracking?*

Physiological measures

pro's:

- real-time measure
- objective measurement

cons:

- difficult to implement (equipment needed)
- difficult to analyze
- disruptive

Eye tracking parameters

pupil dilation

fixation duration

number of fixations

saccadic amplitude

blinking

scanpath (area's of interest)

Are these parameters (or others) related to mental effort?

Do they correlate with other measures of mental effort?

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