Searching and evaluating information on the Web – an (experimental) psychological perspective

Yvonne Kammerer & Peter Gerjets
Knowledge Media Research Center, Tübingen

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In recent years the Web has evolved into a major information resource.

Easy access to huge amounts of information for everybody.

In particular Web search with regard to medical and health-related information has become very popular among laypersons (Morahan-Martin, 2004; Fox, 2006).

- 83% of American Web user (Pew Internet & American Life Project, 2009)
- 79% of German Web user (Health Care Monitoring, 2009)
Web search about a complex health-related issue

Image, a friend asks you for advice

Which of 2 therapies is better to treat Bechterew’s disease?
Web search about a complex health-related issue

Image, a friend asks you for advice

Does L-Carnitine supplementation enhance athletic performance?
High heterogeneity of information sources on the Web

Members of a class of drugs called TNF-alpha blockers nearly doubled the risk of herpes zoster, better known as shingles, among rheumatoid arthritis sufferers in study.
High heterogeneity of information sources on the Web

Trustworthiness of information sources varies considerably!
High heterogeneity of information sources on the Web.

Trustworthiness of information sources varies considerably!

Source evaluations
Information seeking process on the Web
(e.g., Brand-Gruwel, Wopereis, & Walraven, 2009)

- Define information problem
- Search information
- Scan information
- Process information
- Organize & present information

Evaluation phases
Gerjets, Kammerer, & Werner (2011)

- evaluation of search results
- evaluation of a Web page
- evaluation of documents collection
Information seeking process on the Web (e.g., Brand-Gruwel, Wopereis, & Walraven, 2009)

- Define information problem
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Evaluation phases: Gerjets, Kammerer, & Werner (2011)

- Evaluation of search results
- Evaluation of a Web page
- Evaluation of documents collection

Focus on early processes
However, previous research shows:

- **school students**, (e.g., Kuiper, 2007; Walraven et al., 2009)
- **university students**, (e.g., Ivanitskaya et al., 2010; Gerjets et al., 2011; Wiley et al., 2009)
- **adults** (e.g., Eysenbach, 2008)

... often do not critically evaluate the trustworthiness of information sources during Web search

**General research question:** Why not? Potential influencing factors?
Potential influencing factors of information seeking activities
(Lazonder & Rouet, 2008)

- **Individual variables:**
  - e.g., epistemic beliefs, prior knowledge, search skills

- **Resource variables:**
  - e.g., search tools and interface, amount and type of information

- **Contextual variables:**
  - e.g., training, instructions, time
Potential influencing factors of trustworthiness evaluations examined in our studies

Individual variables:
Epistemic beliefs

Resource variables:
Search engine interface

Contextual variables:
Web training
Analysis of evaluation processes occurring during Web search

Process measures:

- **Logfile data (Mouseclicks)**
  - selection of search results
  - time on Web pages

- **Eye-tracking data**
  - total fixation duration on an object
  - sequence analyses

- **Verbal protocols (Thinking-aloud data)**
  - cued retrospective reports

Search outcome:

- informed decision
- argument task

methodological triangulation (Denzin, 1970)
INDIVIDUAL VARIABLE
STUDY 1:
The influence of epistemic beliefs

Kammerer, Bråten, Gerjets, & Strømsø (submitted)
Internet-specific epistemic beliefs

- **Internet-specific epistemic beliefs** (Strømsø & Bråten, 2010)
  individuals' personal beliefs about what knowledge and knowing is like on the Web

- Assessed with ISEQ (Internet-Specific Epistemological Questionnaire)
  (Strømsø & Bråten, 2010)
Internet-specific epistemic beliefs

Certainty and Source of Knowledge (9 items, Cronbach’s $\alpha = .90$)
- **naïve beliefs:** Web is reliable source that provides correct knowledge
- **sophisticated beliefs:** doubts that knowledge on the Web is correct
- e.g. „The Web contains accurate knowledge about the topics I study.”
  totally disagree (1) – totally agree (5)

Need for Justification (4 items, Cronbach’s $\alpha = .78$)
- **naïve beliefs:** Web-based knowledge claims can be accepted without critical evaluation
- **sophisticated beliefs:** Web-based knowledge claims need to be checked against other sources, reason, and prior knowledge
- e.g., “To find out whether the study-related knowledge that I encounter on the Web is trustworthy, I try to compare knowledge from multiple sources.”
  totally disagree (1) – totally agree (5)
Web search task and participants

- **Task:** Which of 2 therapies is better to treat the Bechterew’s disease?

- **Materials:** 2 mock Google pages with 9 Web pages each

- **Participants:** 80 university students (average age: 24 years)
Results

The greater participants doubts that knowledge on the Web is correct ...

• the more they **verbally reflected** on the **type or credibility of sources**
• the **longer they fixated** on the search results
• the more search results **at the bottom** of the SERP they selected

→ **Doubts that knowledge on the Web is correct** trigger source evaluations
Results

The stronger students’ beliefs that knowledge claims on the Web need to be checked against other sources, reason, and prior knowledge ...

... the more they verbally referred to the different parts of the search results (URLs, title, abstract)

Pro... Con...

the more they focused on both therapies in their argumentation (both sides of the controversy)

Beliefs that knowledge claims need to be justified trigger a more thorough and balanced evaluation
Sophisticated Internet-specific epistemic beliefs,

i.e., a **critical stance** about knowledge on the Web

seems to **stimulate source evaluations** during Web search

- Training to **foster such a critical stance**
CONTEXTUAL VARIABLE
STUDY 2: Source-evaluation training for non-academic adults

Kammerer, Amann, & Gerjets (2011, Conference of the European Association for Research on Learning and Instruction (EARLI))
Components of the training

Type of source

Expertise & Motives

Comparisons across Web pages
Characteristics of the training

- Web-based and self-paced
- Training duration: ø 20 minutes
- Training contains a mix of
  - declarative information
  - concrete examples
  - interactive exercises with feedback
An author who provides information on the Web can have different motives:

1. He/she wants to share his/her personal experiences and opinions.

Example

2. He/she wants to publish neutral facts and scientific evidence.

Example

3. He/she wants to promote a product or service.

Example
3. He/she wants to promote a product or service.

Example: Commercial Web page

Example: Intention of the information provider

The intention of this information provider is to promote a product or service. You should keep in mind, that therefore **positive aspects** might be stressed, whereas **negative aspects** might not be mentioned. Thus, the information might be **one-sided**, but not necessarily incorrect.
Excercise: What type of source am I looking for?

1. I’m looking for personal experiences and opinions.
   - To the excercise: What type of Web page do I need?

2. I’m looking for neutral facts and scientific evidence.
   - To the excercise: What type of Web page do I need?

3. I’m looking for commercial providers of a product or service.
   - To the excercise: What type of Web page do I need?
Exercise: What type of source am I looking for?

1. I’m looking for personal experiences and opinions

   - To the exercise: What type of Web page do I need?

Type of Web page: Please select A, B, or C

Click on the pages to enlarge them and then decide whether Web page A, B, or C provides personal experiences and opinions.
Correct!

If you are looking for other people’s personal experiences and opinions, a forum Web page can help.
Web search task and participants

- **Task:** Does L-Carnitine supplementation enhance athletic performance?

- **Materials:** 2 mock Google pages with 9 Web pages each

- **Participants:** 51 adults (average age: 43 years)
  26 received training, 25 not
Results and Conclusion

Training group shows better source evaluation than control group:

- Training leads to more thoughtful selection of Web pages (longer time on Google)
- Training stimulates Web users to focus on objective information:
  - both during search
  - and also with regard to the decision made

➢ A short training seems to be able to foster source evaluation skills
RESOURCE VARIABLE
Search engine interface

STUDY 3
Kammerer & Gerjets (2010, *ETRA proceedings*)

STUDY 4
Kammerer & Gerjets (2012, *Behaviour & Information Technology*)
Two characteristics of standard search engine interfaces

**Standard interface:**

- High salience of search engine ranking (vertical list)
- Low salience / lack of source information

**Alternative interfaces:**
Grid interface with reduced salience of the ranking
Two characteristics of standard search engine interfaces

**Standard interface:**

1. High salience of search engine ranking (vertical list)

2. Low salience / lack of source information

**Alternative interfaces:**

- High salience of search engine ranking
- Low salience / lack of source information

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**Rheumawelt - Rheuma Service Center - [Archiv]**

Die Hinweise zeigen, dass eine Behandlung mit Morbus-Bechterew-Patienten bei www.rheumawelt.de/rheuma/home_e.htm

**1. High salience of search engine ranking (vertical list)**

**2. Low salience / lack of source information**

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**Warnung vor Strahlenbelastung - Radon-Therapie - Experten sehr skeptisch**


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**Johannesbad - Gesundheitszentrums**

Das Edelgas Radon regt durch seine Gesundheitszentrum Bärenhöf zu ...

www.johannesbad.de/Seiten_MorbusBechterew.aspx

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**VITAPARC Rheinland-Pfalz/Saarland - Arrangements - Morbus-Bechterew**

Morbus-Bechterew - Ein gutes Beispiel für die Treiber einer Anzahl von ...

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Im letzten Bechterew-Journal war ein Bericht über die Wirkungsweise ..... Ich wollte

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**Objektive Informationen**

- Symptomatische Behandlungen
- Morbus-Bechterew
- Radon-Heilstöcke
- RA and Radon Kur in Geisenheim

**Kommerzielle Informationen**

- Behandlungserfolge
- Morbus-Bechterew
- RA and Radon Kur
- RA and Radon Kur in Geisenheim

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**Subjektive Informationen**

- Anfänge des Radon-Heilstöckens
- Morbus-Bechterew
- RA and Radon Kur in Geisenheim

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**Wirtschaftliche Aspekte**

- RA and Radon Kur in Geisenheim
- Morbus-Bechterew
- RA and Radon Kur

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**Rheuma Service Center - [Archiv]**

Bei der Frage nach möglichen unerwünschten Wirkungen einer RA and Radon Heilstöckenkur zur Behandlung des Morbus-Bechterew muss zwischen den ...

www.rheuma-online.de/therapie/natuerliche-therapien/radon-gibt-es-nebenwirkungen.html

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**Johannesbad - Gesundheitszentrum Bärenhöf**

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**Warnung vor Strahlenbelastung Radon-Therapie Experten sehr skeptisch**

### Source categories
(according to Finn & Kushmerick, 2006)

<table>
<thead>
<tr>
<th>commercial information</th>
<th>subjective information</th>
<th>objective information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locomotor - Carlsbad Spa - Nature is the Answer</td>
<td>ankylosing spondylitis - Rheumatoid Arthritis Forum</td>
<td>Unbound MEDLINE</td>
</tr>
<tr>
<td>Water analysis: Sulphur water. Water containing radon ... (Arthritis, polyarthritis, e.g. PCP, spondylarthitis Bechterew's disease). ...</td>
<td>Is my daughter sick too? - Bechterew's Support Forums</td>
<td>Study on endocrinological effects of radon spelotherapy on...</td>
</tr>
</tbody>
</table>
Two characteristics of standard search engine interfaces

Standard interface:

1. High salience of search engine ranking (vertical list)
2. Low salience / lack of source information

Alternative interfaces:

1. High salience of search engine ranking (vertical list)
2. Low salience / lack of source information
STUDY 3: Grid interface

Kammerer & Gerjets (2010, *ETRA proceedings*)
Grid Interface: cf. „Viewzi“ or „Horizobu“
Web search task and participants

- **Task:** Which of 2 therapies is better to treat the Bechterew’s disease?

- **Materials:** 2 mock Google pages with 9 Web pages each

- **Participants:** 40 university students (average age: 24 years)
  
  20 participants received list interface, 20 received grid interface
Results

With grid interface more free exploration of search results
... than with list interface

more **heterogeneous** and **nonlinear viewing sequences** on Google page
→ viewing sequence of majority of grid-interface users
  neither line-by-line nor column-by-column

More **equal attention distribution** across all search results
→ **less focus** on the search results **on the top** of the Google page

Increased selection of **most trustworthy** search results at the bottom
STUDY 3: Tabular interface

Kammerer & Gerjets (2012, *Behaviour & Information Technology*)
Web search task and participants

• **Task:** Which of 2 therapies is better to treat the Bechterew’s disease?

• **Materials:** 2 mock Google pages with 9 Web pages each

• **Participants:** 58 university freshmen (average age: 20.5 years)
  29 participants received list interface, 29 received tabular interface
Results

With tabular interface more source evaluations
... than with list interface

- decreased attention to commercial search results
- reduced selection of commercial search results
  / increased selection of objective search results
- more utterances related to the type of source
Conclusion

- A search engine interface that
  - increases the salience of source information
  - and/or decreases the salience of the ranking of the search results

fosters the selection of trustworthy information during Web search
**Supplemental carnitine and exercise**

www.ajcn.org/content/72/2/610S.full

by EP Brass - 2000 - Cited by 131 - Related articles

Carnitine supplementation has been hypothesized to improve exercise performance.
... Carnitine (L-3-hydroxytrimethylamminobutanoate) is an endogenous .... Published studies of carnitine supplementation to modify exercise performance in ...

**L-carnitite fat burner or myth?** - Mr Supplement Bodybuilding Forum

www.bodybuildingforum.com.au > Bodybuilding > Supplements

14 posts - 11 authors - 28 Nov 2011

There seems to be alot of people talking about L-carnitine these days and how ... Firstly, from the studies alone, it is suggested that we get generally get more ... and actually taking L-carnitine it improves athletic performance ...
Current Google interface: Menu with filtering options

Search

About 129,000 results (0.15 seconds)

Glycine Propionyl-L-Carnitine and Athletic Performance
www.jarretmorrow.com/glycine-propionyl-l-carnitine/
2 Nov 2010 – from Supplement Updates, shares a study Carnitine affects Athletic Performance. The study

Carnitine (L-carnitine)
www.umm.edu › Medical Reference › Complementary l
Some small studies suggest that people who take L-carnitine are often taken to boost exercise pe

L-Carnitine - Linus Pauling Institute at Oregon
lpi.oregonstate.edu/infocenter/othernutes/carnitine/
The rate of L-carnitine biosynthesis in humans was the potential of L-carnitine supplementation to improv

30 years later: L-carnitine supplementation c
www.nutraingredients.com/Research/30-years-later-L-carnitine suppl. can increase and boost athletic endeavour, UK researchers have for

Carnitine: The Science Behind a Conditiona
General conclusion: all three types of variables important factors

- Individual variables: Epistemic beliefs
- Resource variables: Search engine interface
- Contextual variables: Web training

Under certain external conditions/with certain cognitive prerequisites, searchers DO EVALUATE the trustworthiness of search results and of Web pages.
Contact: y.kammerer@iwm-kmrc.de
Backup
Theory of multiple documents representation
(Perfetti et al., 1999; Rouet, 2006)

Documents Model

Situations Model

Intertext Model

Source evaluation:
- Type of source?
- Who is the author?
- Expertise? Motives?

→ Weight of arguments

Document A

Content A

Argument A1

Argument A2

Document B

Content B

Argument B1

Argument B3

Source A

contradicts

Source B

supports

Relationship between Doc. A & B