

## Gender-specific information search behavior

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## Abstract

*This paper presents an empirical gender study in the context of information science. It discusses an exploratory investigation, which provides empirical data about differences of information seeking activities by female and male students. The research focus was on whether there are gender-specific differences when people perform searches with the aid of general search engines and specialized Deep Web information services. It has been observed how the participants behaved in getting information and how the gender groups differ from each other. Which search system (search engine or professional information supplier) has been preferred by the gender groups at first? How did the gender groups search (applied operators, modifications of query formulations, targeted search)? How far were the users satisfied with their results? For data collection paper-questionnaires have been used and the answers have been statistically analyzed with the help of SPSS. The questionnaire consisted of four different search tasks each with seven sub-questions. The research and the obtained result data indicate at least in the choice of search sources, the satisfaction with this source and the results obtained a gender-specific difference. Men tried to use professional information services as well as search engines for search, regardless of the difficulty of the search task and its formulation. In contrast, women behaved cautiously in choosing search sources. They decided either on sources, which they knew skillfully or where their use was assigned. Women were generally more satisfied with the obtained results as men. These data can represent an initial approach for further analysis of gender-specific Web search behavior.*

## Keywords

*Information search behavior; Search engine; Information seeking behavior; Empirical gender study; Gender differences; Information retrieval*

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## Introduction

Information search behavior is a theme investigated extensively in information retrieval. How the information need is triggered and how people behave to fulfill it, are fundamental questions in the investigation of information search behavior. There are different studies that are treated with information search behavior. With regard to different aspects, they try to characterize and structure the user behavior and thus, develop conclusions in order to gain successful application on the World Wide Web. It should thus lead to improvements both in terms of training opportunities and services on the Web.

## Information search behavior on the Web

The users' interaction with information systems, information search in differently structured datasets, the influence of search problems to the formulation of search queries, decision behavior on result pages, the competence for the critical evaluation of results, the sense of the credibility of sources on the Internet, etc. are the topics that were explored in the context of information search behavior.

There are many studies on information search behavior. We only want to mention some of them. For Wilson (1997), active information search behavior is among others (e.g., passive attention) part of information seeking behavior and this is part of general human information behavior (Wilson, 1997, 551-572). Hölscher (2002) dealt with the behavioral analysis of experienced Internet users. In a study he attempted to describe the search behavior of Web experts who had used the Web for three years extensively every day in their occupation as an information source in order to create a descriptive model of information search for search engines (Hölscher, 2002).

In a study about Web searching, Jansen et al. (1998) analyzed a log file of the Excite search engine that includes a total of 51,473 queries which were posed by 18,113 users. Due to the rapid growth of Internet users, it can be assumed that probably the majority of users of Excite are rather novices than experts in handling the Web. Therefore, the data from this study are indices for the handling of the average Web user with search engines (Jansen et al., 1998, 5 -17).

In a further more extensive study of the search engine Excite, Spink et al. (2001) analyzed over a million search queries that were produced by 200,000 users. The results provided a better understanding of Web usage as well as search behavior of the public. They can be helpful for decisions on Web searching among others on structuring of Web interfaces and search engines (Spink et al., 2001, 226-234). In 2006, Jansen and Spink recapitulated on researches about Web searching. They prepared a comparison of the nine largest Web studies including studies about three

European and two American search engines on the Internet through seven years (Jansen & Spink, 2006, 248-263).

## **Gender-specific information seeking behavior**

There are few studies dealing with gender-specific differences in information search behavior. For Wilson (1997), gender is one of the intervening variables in information seeking behavior. Dubi and Rutsch (1998) examined the Internet information search behavior of students with different type of schooling in an exploratory study. In this study significant gender differences occurred. It was observed that the female students lacked self-confidence. They behaved with less certainty than the male students while using the Internet. They felt less competent in dealing with search engines, more often needed assistance from the teacher and described the systems as "too complicated" (Dubi & Rutsch, 1998).

Xie, Bao and Morais (2006) examined the gender differences in tourist information search behavior of Yellow Mountain and Guilin in China. They believed that the analysis of search behavior was a pivotal factor in effective formation of marketing and management decisions. The authors identified gender as a factor influencing information search. They attributed the observed behavior of the groups on the previous gender studies, that were based on the psyche and behavior of persons. They explained the characterization of men and women as reasons for the different behavior in information seeking. The confirmation and recognition that women needed as well as their uncertainty, led them to obtain information from other people along with seeking information comprehensively. Men were self-centered, self-confident and choosy so that they searched less comprehensively and only in certain sources (Xie et al., 2006).

Schmidt and Stock (2009) studied for the first time in the research area of emotional information retrieval the possibility of consistent indexing of basic emotions with the goal to use these indexing results in retrieval systems. In this study differences between female and male users in the emotional tagging of images were exposed. The standard deviation of the results of female test persons was slightly higher than the males' values. This suggested that men behaved a little bit more consistently in emotional tagging than women (Schmidt & Stock, 2009, p. 863-876).

In a study by Laroche et al. (2000), the authors examined the gender specific information seeking behavior especially in the purchase of Christmas presents, based on an examination of pertinent literature (sources) in the consumer and shopping context. According to Laroche et al. there were distinct differences between men and women. It was observed that women tended to make elaborate, extensive, detailed analysis of existing information. They searched in multiple information sources, both

online shopping and more in the store (in-store information sources: advertising, product packaging, signage, point-of-purchase displays etc.). On the contrary, men behaved less interested. Laroche et al. explained the different social and ideological backgrounds as possible reasons for behavioral differences (Laroche et al., 2000, p. 863-876).

Jansen and Solomon (2010) evaluated the effect of gender in analyzing the performance of sponsored search advertising. They examined a log file of a search engine marketing campaign from a major US retailer that includes nearly 7,000,000 records. They differentiated between the gender-orientation of key phrases and key phrases that were gender neutral. They classified key phrases with a probability of being targeted for a specific gender and then compared the consumer actions (behavior) using the critical sponsored search metrics of impressions, clicks, cost-per-click, sales revenue, orders, and items sold. The main research results concluded that gender-oriented key phrases do not increase sales revenue. It can be more expensive and it costs more for advertisers relative to gender-neutral queries. But the authors also found that “the female-oriented key phrases generate more average revenue than the corresponding male-oriented categories” (p. 837). In fact, by all metrics examined, the key phrases that were gender neutral and less personalized performed the best overall (Jansen & Solomon, 2010, p. 863-876).

In another gender study, Steinerova and Susol (2007) explored the information seeking behavior of library users (predominantly students and teachers) in 16 academic libraries in Slovakia. They dealt in more detail with gender differences and were also of the opinion that the obtained data confirmed the traditional gender stereotypes (Steinerova & Susol, 2007). Hupfer and Detlor (2006, p. 1105-1115) discussed the roles of gender, sex and self- and other-orientation in Web information seeking.

Large, Beheshti and Rahman (2002, p. 427-443) found that groups of boys significantly used fewer words per search and more one-word searches than groups of girls. Roy and Chi (2003, p. 335-348) compared gender-specific search patterns with behavioral patterns to learning outcomes. In an eye-tracking study, Lorigo et al. (2006, p. 1123-1131) observed that men had greater average fixation durations on selected Web documents than females and that women submitted significantly longer queries to the Google search engine than men. In a theoretical analysis of the information behavior of women, Urquhart and Yeoman (2010, p. 16) discuss gender "as a moderating influence on some factors affecting information seeking".

According to the different gender studies which were stated above, the behavior of the examined persons is based on their gender-typical characteristics and their usual gender roles. Many studies characterized the behavior of women, in contrast to men,

as complicated, expensive and comprehensive. These findings are related to the gender-specific behavior of women.

## **Gender-specific information search behavior on the Web**

Our study combines research on (general) information search behavior ("How do people perform searches on the Web?") with research on (general) gender-specific information seeking behavior ("Are there gender-specific differences when people seek for information?"). Our research interest is: "Are there gender-specific differences when people perform searches on the Web?" To our knowledge, this study is one of the first attempts to analyze Web (including Deep Web (Bergman, 2001)) search behavior from a gender perspective.

## **Materials and Methods**

### **Empirical study**

This exploratory study provides empirical data about differences between genders in information search. This data can be used as an initial approach for further analysis of search behavior in information science contexts in the field of information retrieval. In order to replicate known methods in general information search behavior (see Jansen et al., 1998; Spink et al., 2001; Jansen & Spink, 2006), the present study tried to answer the following research questions (RQ):

- RQ1: Are there gender-specific differences in the preference to use Web search engines and professional information services in the Deep Web (e.g., Web of Knowledge)?
- RQ2: Are there gender-specific differences in the use of operators (e.g., AND, OR, NOT) in the searches?
- RQ3: Are there gender-specific differences in the modifications of the search arguments?
- RQ4: Are there gender-specific differences in the finding of search results by accident?
- RQ5: Are there gender-specific differences in the grade of satisfaction with the used search engine or Deep Web information service?

### **Research participants**

The study was conducted in October 2007 at the Heinrich-Heine-University Düsseldorf and aims at figuring out how female and male information science-students proceed in getting information on the Internet (using Web search engines and information services in the Deep Web) and how their behavior differs from each other. All students were in the first term of their information science studies and their

mean age was about 20 years. So the test persons' knowledge on information retrieval was (more or less) on the same level. Among the students were 26 male and 19 female. Therefore, the proportion of female and male participants amounted 42.2 and 57.8 percent of the total number of participants, respectively.

## Questionnaire and report

The questionnaire consisted of four search tasks, divided into seven sub-questions (see Appendix). The four tasks were heterogeneous composed, so that they differed both in their subject and in their difficulty. Approximately 20 minutes were planned for each task. There was a pre-test of the questionnaire with staff members of the Information Science Department (N=2). Additional to the questionnaires, the test persons were asked to report on their activities in a (search) protocol: Each step of the search process should be described in detail.

The following information was obtained by the seven sub-questions:

- Details about the search engines and the related information services. Here, the user should show that s/he has understood and recognized the problem of searching. The user should have the competence and skill to limit and narrow the search query and thus to be able to make a decision on the selection of an appropriate search service. Indicators for self-confident behavior during search tasks, courage for using more complicated services as well as evidence for the state of knowledge in information retrieval are reflected by the searchers' awareness of an existing problem and the ability of generating possible solutions as well as of deciding which database should be used for solving the search task.
- Information about the formulation of the search queries and the related operators. The specification of the query was again an indication of how far the problem was perceived, and the use of the operators required a certain expertise. Some search tasks do not require the use of operators or a special formulation of queries. It is important for the searchers to understand the task and then to formulate the appropriate query.
- Information about the detailed search process and the accidental discovery of information. This information is illustrated by the used search strategies.
- Information and details about the modification of the search query. This suggested, among others, the ability of the participants on the assessment of the results relevance. The first results act as a feedback for the further search. The participants should have the skill to use these received information and with new query formulations obtain more relevant results. This data is also an indication of how quickly the participants are satisfied with results, whether

they ever use the option of query modification and how accurately they behave while searching.

- Information about the selection of results and about general evaluation of the search. The feeling of satisfaction by estimation of results is an indication of a successful use of various search systems and a confirmation of required cognitive ability and the expertise of the participant.

## **Search tasks**

The first question represented a more general question that can be managed with simple-structured search engines without any specific knowledge of information retrieval. The second question required the use of operators in the formulation of the query. This was observed in the context of the question. The use of a simple search engine like Google was also sufficient. The third and fourth questions were divided into two and three parts. The first part of the questions could be answered by the use of search engines. The result should be used for further searches in scientific databases (e.g., Web of Science, Scopus, etc.) by formulation of queries. The inquiry was constructed in a way so that the participants could give both short and detailed answers.

## **Statistical analysis**

For collecting data, paper-questionnaires and protocols were directly completed after performing the search tasks. The answers were statistically analyzed using SPSS (Statistical Package for the Social Sciences). All data were nominally scaled. Due to the (not very high) number of test persons (N=45) we applied Fisher's exact test (two fold) and the Fisher-Yates test for the calculation of statistical significance.

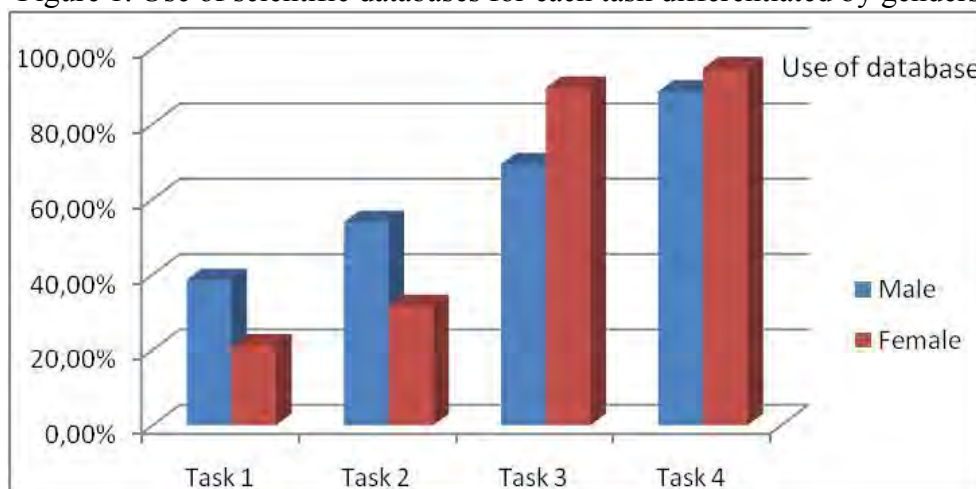
## **Results and Discussion**

### **The selection of online services (RQ 1)**

The first two investigation tasks were rather general questions that could be easily processed without the access to scientific databases. In the analysis of the first two questions, it was observed that men despite the possibility of using simple search engines, and accessed scientific databases more than women. In the first task, 38.5 percent of male participants compared to 21.1 percent of females (Figure 1) tended to use scientific databases for the search (which is a statistically significant difference;  $P=0.026$ , Fisher's exact test) and in the second task the relation was 53.8 percent of men to 31.6 percent of women ( $P=0.131$ , Fisher's exact test).

As Steinerova and Susol (2007) described, this may be traced to a pattern of self-conscious attitude of men towards their knowledge. The self-confidence and self-trust dare men to take a step higher than is necessary. By contrast, during the processing of the last two questions, the proportion of women in the use of databases was higher than men. In the third question, 89.5 percent of the women used databases for their search. The amount of men was 69.2 percent ( $P=0.154$ , Fisher's exact test). And in the fourth question, 94.7 percent of women and 88.5 percent of men used Deep Web databases for the search ( $P=0.627$ , Fisher's exact test). It should be mentioned that the reference for using databases, in contrast to the first two questions, was stated in the question explicitly. The gender studies pointed to a comprehensive, detailed search behavior of women. Also here, gender-typical characterizations as well as comprehensive search behavior, and the attention of the women as possible reasons for such a distribution can be applied: The use of databases was required in the processing, and women kept using databases as they were told.

Figure 1. Use of scientific databases for each task differentiated by genders



Significance (Fisher's exact test): Task 1: 0.028 (s); Task 2: 0.131 (ns); Task 3: 0.154 (ns); Task 4: 0.627 (ns).  
s: significant (0.05 level); ns: not significant (0.05 level).

## Process of searching. Part I: Operator use (RQ 2)

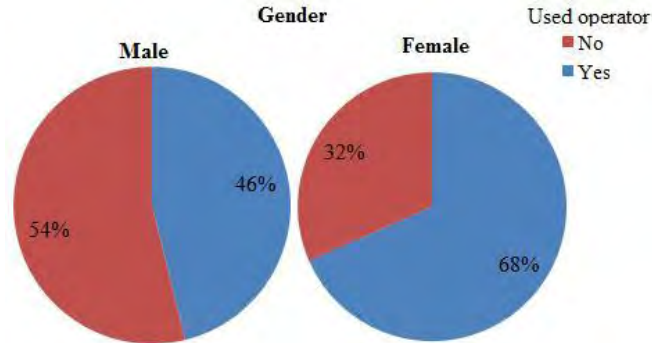
The search process includes the investigation of the used operators (RQ 2), the frequency of modifications (RQ 3), and the targeted search (RQ 4). For the targeted search, it is important that the participants search and find their results purposefully. It means that they are not accidentally landed on the results page.

In the part of search queries, in which operators were used or modifications were done, there was a tendency to the influence of the use expertise. In the analysis of the used search operators, a subtle difference was assessed. Women altogether used more



operators in the formulation of their search query. This difference was remarkably apparent (but not statistically significant;  $P=0.238$ , Fisher-Yates test) in the last question. 68.4 percent of women compared to 46.2 percent of men used the query search operators in the formulation (Figure 2). However, in the second question, where the task referred implicitly to the use of the "minus operator", there was no meaningful difference. The percentage of male to female students was 69.2 percent to 73.7 percent, respectively.

Figure 2. The use of the operators differentiated by gender (task 4)

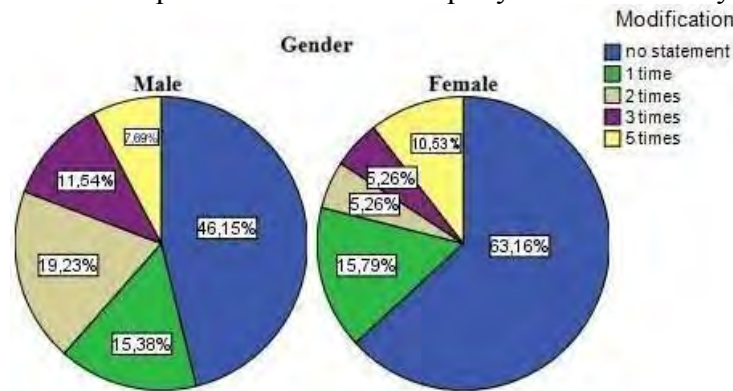


Significance (Fisher-Yates test): 0.238 (ns).

### Process of searching. Part II: Search term modifications (RQ 3)

In the investigation of search query modification, both experimental groups behaved almost identically except in the first question. The analysis of the first question showed a (statistically not significant;  $P=0.646$ , Fisher's exact test) difference which was 53.8 percent of men to 36.8 percent of women. The amount of the women that modified their search query was a little bit slighter than the amount of men (Figure 3). The reason for such a difference could possibly relate to the point that the first question was a simple investigation task which could be resolved without modification and with a single search query formulation.

Figure 3. Modification frequencies of the search query differentiated by gender (task 1)



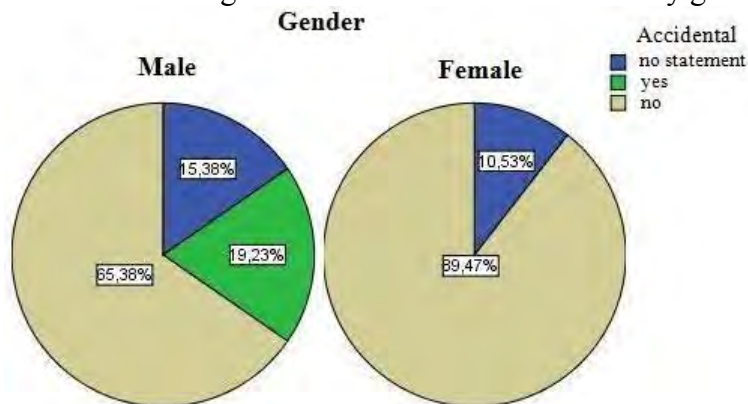
Significance (Fisher's exact test): 0.646 (ns).

In the investigation of the modification frequencies (all four tasks), it was also assessed that male participants modified their search query altogether more than women. The collected data showed that the modification frequencies of men with "1 time", "3 times" as well as "4 times" were higher than the women. It means that the male students modified their search queries more often than women. Women, in comparison, mostly modified their search queries either "2 times" or "more than 5 times". On the one hand, the modification of the query up to 5 times in terms of search task difficulty could be very helpful and pointed to a confident and determined attitude of the researchers in the search task accomplishment. These characteristics were the gender-typical features of men behavior which were confirmed here. Moreover, an interaction between perception competence and use expertise was assessed. On the other hand, the modification of query in "more than 5 times" pointed out the uncertainty of the user. Xie, Bao and Morais (2006) described women in the behavior analysis as unsteady and this statement was also confirmed in this case.

### Process of searching. Part III: Targeted search (RQ 4)

Accidental finding of the result pages in the investigation was assessed that women did their search more targeted and did not come accidentally on the result pages. In the last question, this difference was markedly clarified showing that 89.5 percent of the women in comparison with 65.4 percent of the men advanced in the investigation structurally and purposefully ( $P=0.118$ , Fisher's exact test) (Figure 4). The last question was composed of several sub-tasks, so that a change of the search system with previously acquired information and their use for the further search was necessary. The mastering of such a task needed a structured and purposeful procedure that women presented in their information search.

Figure 4. Accidental finding of the result sites differentiated by gender (task 4)

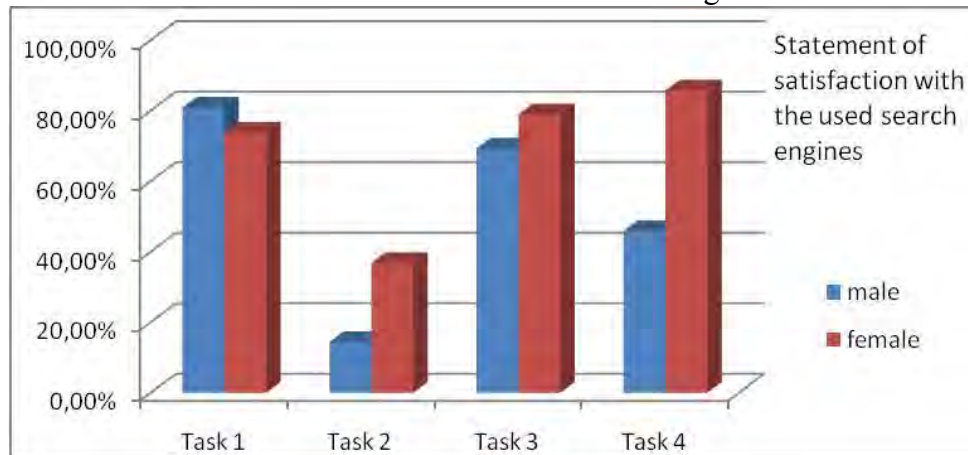


Significance (Fisher's exact test): 0.118 (ns).

## Satisfaction with search results (RQ 5)

Positive assessment of the results as well as the satisfactory statement on the search source selection, the used search strategies (possible answers: satisfied – not satisfied – partly satisfied), and the obtained results were possible indicators for a successful search. According to the raw data, women were a little bit more satisfied with their search than men. With the selection of search engines, with the handling of them and found results, the feminine participants were, in average, more satisfied (but not statistically significant, except for task 4; here:  $P=0.040$ , Fisher's exact test) (Figure 5).

Figure 5. The statement of satisfaction with the used search engines differentiated by gender

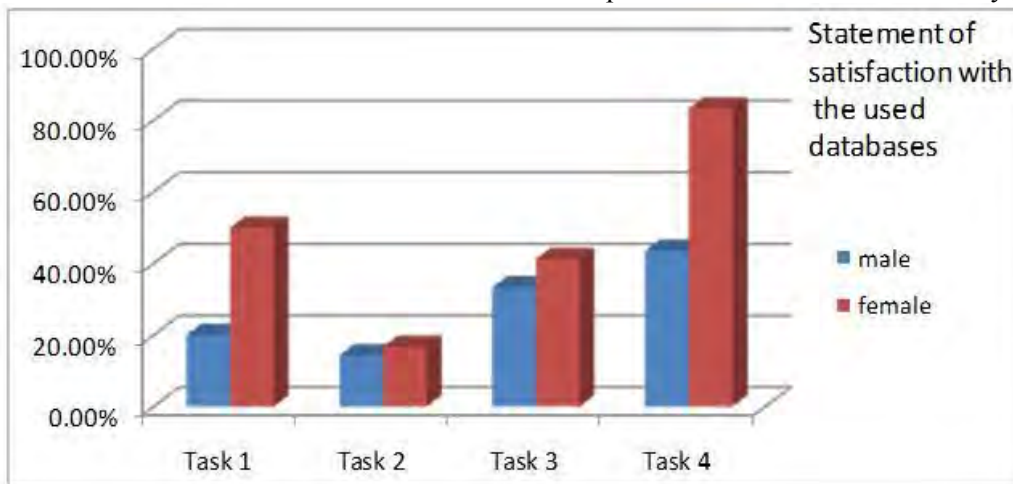


Significance (Fisher's exact test): Task 1: 0.152 (ns); Task 2: 0.144 (ns); Task 3: 0.845 (ns); Task 4: 0,040 (s).

The evaluation of Deep Web databases was similar to the assessment of search engines (Figure 6). In the first two questions, the difference was not effective, since the amount of the participants who made an assessment was too low (task 1:  $P=0.402$ , task 2:  $P=0.881$ ; Fisher's exact test). From 10 male participants who used databases for the search, only 20 percent of them voted the search as satisfactorily and from 4 female participants, only 50 percent did. Due to the complex structure of scientific databases, using them for answering a simple question could be misleading. In contrast, an important difference emerged in the last two questions. Women evaluated the results and therewith the search as more satisfactorily than men did. In the third task 41.2 percent of women appreciated their search with the databases as a successful one, compared to 33.3 percent of men ( $P=0.483$ , Fisher's exact test). In the fourth task from 23 male participants, who searched in scientific databases, 43.5 percent of them described the search as successful and satisfactory – in stark (and statistically significant;  $P=0.017$ , Fisher's exact test) contrast to women. Here, about 80 percent of the women were satisfied with the results.

It was noted that, by some tasks a smaller number of women compared to men, had dare to use databases, but a large number of them could manage and conclude a successful database search and evaluated it as satisfactory. The uncertainty of women in information search behavior, which has been verified in some studies, can count also here as a possible reason for such behavior at the beginning of a search. Their carefulness, attentiveness, and thoroughness in searching for information, led however to a complete and satisfactory search. The influence of use expertise plays a prominent role.

Figure 6. The statement of satisfaction with the used Deep Web databases differentiated by gender



Significance (Fisher's exact test): Task 1: 0.402 (ns); Task 2: 0.881 (ns); Task 3: 0.483 (ns); Task 4: 0.017 (s).

## Conclusions

The aim of this study was to find out whether differences between women and men occur in their information search behavior. The research and the obtained result data showed a small difference at least between the choice of search sources and the grade of satisfaction with these sources as well as the obtained results. We have to handle our results with care, for only few results are statistically significant. The danger of an over-interpretation of the data is given.

In short, our main results are:

1. Men use scientific databases more often than women in cases where it was not necessary.
2. Women tend to use more operators while formulating a search query.
3. Sometimes, men tend to find search results accidentally; women search more targeted.
4. Women are more satisfied with the search results, regardless of using search engines or scientific information services.

Men tried to use both professional information services and search engines, regardless of the question and its formulation. But owing to the complicated structure, the handling of such databases (for beginners) is not very easy and since an incorrect decision by the choice of search sources could be misleading, in few cases the search will be completed without success. That can be partly a sign of the boastful character and the overestimating behavior of men. They want to certify and emphasize, that the handling and operation with the scientific databases is easy for them. The search, however, proved mostly the opposite. In contrast, women behaved cautiously in choosing search sources. They decided either on sources, which they knew skillfully or when their use was assigned. When they were asked to use scientific databases, they tried to enforce both by the different functionalities and tools of the databases, as well as by their complicated structure. With the search strategies, they processed the search decisively and terminate it predominantly successfully.

Thus it could be concluded that men in contrast to women overrated their ability to search for information, because of their inflated self-esteem. This could be considered as a possible reason for an unsuccessful search. In the completion process of query formulation, the use of search operators and the modification of the request, there were also differences but they were very minor and insignificant. So precise statements could not be made about how important these results were and whether these small differences were not based on contingency.

The traditional presentation of "masculinity" and "femininity" are reflected here at some parts and can be interpreted as a reason for certain actions and behavior. Excessive self-assessment, self-confidence and determined attitude of the men become obvious in the choice of search sources and the modification frequencies of a query. The complexity, thoroughness as well as the carefulness of the female character leads to a thorough and usually successful search.

Our study has limitations. The sample of test persons is biased: All participants were students of information science at only one university. Additionally, the size of the sample was very low (which leads to problems of formulations of results which are statistically significant). Further research should work with a larger sized sample and with a representative cross-section of the population.

A huge array of previous research has been focused on the topic of (general) information search behavior and on (general) gender differences in information seeking. In our study, we combined both approaches. But experimental and theoretical studies on gender-specific information search behavior on the Web (including Deep Web databases) are still in their infancy. So our paper is only a first and preliminary step into this new research area located in the intersection of information science and gender studies.

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## Appendix Tasks

1. What is relativity theory?
2. Search for studies in anatomy, but without topics of botany and of medicine!
3. (a) Who are the founders of Google? (b) Search for literature by these authors! Use for part (b) professional information services!
4. What are folksonomies? Give at least four examples for systems applying folksonomies! Search for documents on information retrieval and folksonomies in professional information services!

## 7 sub-questions

1. Which search engines do you use?
2. Which databases do you use?
3. Which search queries? / Describe your search practice!
4. Which operators do you use?
5. How often do you modify your search query?
6. Do you find accidentally the result pages?
7. Are you satisfied with your search results?

## The used search engines

Google, Google Scholar, Yahoo, Scirus

## The used Deep Web databases

Infodata, LISTA, Scopus, Wiso-net, Web of Science

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