

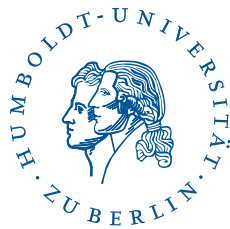
HUMBOLDT UNIVERSITY OF BERLIN

INSTITUTE FOR LIBRARY AND INFORMATION SCIENCE

**Seeking Research Software. A Qualitative Study of Humanities  
Scholars' Information Practices.**

RONNY GEY

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## **Zusammenfassung**

Zusammenfassung

**Abstract**

Abstract

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# 1. Introduction

Today, software is a central component of science. Throughout the entire research life cycle, researchers use software tools for data collection, transformation, analysis and presentation as well as for generating hypotheses, managing literature and writing scientific papers (Kethers et al., 2017; Pan et al., 2016; Wolski et al., 2017). Software has changed the way we actually do science. The complexity of the analyses carried out by researchers has increased, as has the amount of data that researchers can process. Software supports the documentation of the research process and enables reproducibility (Dallmeier-Tiessen, 2016; Waltemath and Wolkenhauer, 2016) and accuracy of results.

Due to the increased importance of research software for research (Katz, 2017) and the increase in the sheer number of software, it is all the more important for researchers to identify suitable software and select the one which best fits the research problem, the actual step in the research process, or the research data which has to be processed, and, in consequence, which satisfies the researchers information need (Wilson, 1994). In addition to increased efforts, difficulties in seeking software can also endanger the scientific reproducibility of studies or even lead to multiple developments of software with identical functions instead of reusing existing software (Hucka and Graham, 2018).

Information seeking of researchers is generally of great interest within the field of information, be it information behavior (Ahmadianyazdi and Chandrashekara, 2018; Barrett, 2005; Campbell, 2017; Catalano, 2013; Ellis, 1993; Hemminger et al., 2007; Korobili et al., 2011; Liyana and Noorhidawati, 2017; Rimmer et al., 2006; Rupp-Serrano and Robbins, 2013; Wang et al., 2008, e.g.) or information practices (Bøyum and Aabø, 2015; Bulger et al., 2011; Fry, 2006; Given and Willson, 2018; Roos, 2015, e.g.). However, seeking software is still rather challenging for researchers (Howison and Bullard, 2015). In a recent study, Hucka and Graham (2018) surveyed scientists and engineers from several fields to better understand their approaches and selection criteria for seeking software. They found out that "*finding software suitable for a given purpose remains surprisingly difficult*". Even in the domain of software development, the main challenge for software reuse are difficulties in finding software artifacts as Bauer et al. (2014) revealed in a study on code reuse at Google. Grossman et al. (2009) identified users unawareness of specific software tools. These results are all the more surprising because the participants in the cited studies come from a group with a greater affinity for software (software developers, engineers).

The lack of awareness of specific software tools among researchers has been addressed by several technical solutions. Code aggregators, specialized search engines, programming language package repositories, code and application repositories, research repositories (e.g. Zenodo or Figshare), and curated web lists and catalogues aid users in discovering software (Struck, 2018). Standards and tools for citing software enable re-

searchers to identify, cite and reuse software (Niemeyer et al., 2016; Smith et al., 2016; Soito and Hwang, 2017, e.g.). Research funding agencies and research organizations (Haupt et al., 2018; Katerbow and Feulner, 2018; Scheliga et al., 2019, e.g.) adopt guidelines for the development and use of research software with the aim of increasing the reusability and quality of the software artifacts developed. In turn, the technical solutions presented are also aimed more at a technically experienced audience, often even at software developers directly. For researchers with less experience in the use of software, e.g. from the humanities (Rimmer et al., 2006), seeking software remains a difficult undertaking.

The information-seeking behavior of humanities scholars in general has been addressed widely (Barrett, 2005; Bronstein, 2007; Bronstein and Baruchson-Arbib, 2007; Catalano, 2013; Ellis, 1993; Given and Willson, 2018; Korobili et al., 2011; Liew and Ng, 2006; Rimmer et al., 2006, e.g.). In his pioneering work on Grounded Theory in information-seeking, Ellis (1993) identified patterns of information-seeking of social sciences, sciences, and humanities scholars. In 2005, Barrett (2005) analyzed information-seeking habits of graduate student researchers in the humanities. Korobili2011 examined factors influencing information-seeking behavior at the philosophy faculties. While studies in information behavior draw on the cognitive viewpoint, information practice studies are guided by the ideas of social constructionism and collectivism (Savolainen, 2007; Talja et al., 2005; Talja and McKenzie, 2007). Humanities scholars information-seeking practices have also been addressed in several studies (Benardou et al., 2013; Bulger et al., 2011; Given and Willson, 2018; Palmer and Cragin, 2009). In previous studies, however, the classic research process of humanities scholars has been examined, which is mainly based on literature research. Although the information-seeking in the humanities is also based on software tools, e.g. databases, web-based editions, search engines, or online journals (Barrett, 2005; Rimmer et al., 2006), the search for software itself is rarely discussed. One of these rare examples, however a non-humanities one, is Hepworths et al. (2017) study of journalism professors' information-seeking behavior. While seeking new online tools, journalism professors rely on other journalism professors, followed closely by media-related foundations, media professionals, and conferences.



## 2. Theory

### 2.1. Information Seeking

- Information Science briefly described
  - Seeking, Searching, Retrieval
  - Information Seeking Research (Ingwersen2005) – Concepts: Strategies – Collaborative IS: Shah2013
  - Distinction between behaviour and practices:
    - the concepts of information behavior and information practice emerge from different discourses that open alternative viewpoints on information seeking. Savolainen2007
    - Bates2010 - information behaviour, Case2007 - information behaviour
  - behaviour: wilson, ellis, kuhltau, Niedzwiedzka2003 – different conceptualizations: intra/inter/extrapersonal (Feinman – transgender ib: pohjanen2016
  - practices: McKenzie and Talja

### 2.2. Information Practices

- Introduction: Savolainen2007, Talja2007
  - The social constructionist paradigm puts emphasis on social practices, “the concrete and situated activities of interacting people, reproduced in routine social contexts across time and space” (Rosenbaum, 1993, p. 239). A focus on practices rather than on behaviour shifts the analysis from cognitive to social and is consistent with the study of information seekers within their social context (for examples, see Rothbauer (2002), McKenzie and Davies (2002)).
  - Starting with McKenzie McKenzie2003, 2003a
  - and Talja
  - further examples of Information Practices: Savolainen 2007 - LitReview

### 2.3. Research Software

- definition - examples - importance for research, in the research process

#### 2.3.1. Information Practices towards research software

- examples of studies, what has been studied yet

## **2.4. Domain Analysis: Humanities/Philology**

- short: humanities, long: philology - definition - characteristics: subjects, work procedures, tools, ...

### **2.4.1. Information Practices of Humanists**

- examples of studies, what has been studied yet - bisher nicht viel gefunden, practices of other scholars, but humanists seldom

## 3. Research Design

Since "[u]nderstanding the nature of information practices and their relation to the production of scholarship is important for both theoretical and applied work in library and information science (LIS)" (Palmer and Cragin, 2009, p. 165) this thesis sets out to study information practices of humanities scholars and their seeking for research software to better understand humanists needs and future LIS services (Case, 2008; Cunningham, 2010). With information practices we mean practices of seeking, managing, giving, and using information in context (Palmer and Cragin, 2009). I chose an exploratory study design (Rinsdorf, 2013) where the personal realm of experience of each interviewee lies in the center of the analysis. The aim of this work is to investigate the information-seeking practices of early-career philologists when seeking research software. This research focuses on philologists problems, contradictions and barriers in finding information and their information sharing about research software. Special emphasis will be placed on the respondents' recourse to their own research process and the knowledge and practice structures in their field (Hjørland and Albrechtsen, 1995) which are socially constructed. The empirical

- RQ1:** What information seeking practices humanities scholars engage in when looking for software to use with research data?
- RQ2:** How do domain specific structures shape the information practices of humanists?

All data generated during the concept, survey, analysis, and writing phases is publicly available on GitHub<sup>1</sup>, as long as it meets research ethics standards (e.g. interview audio records and unanonymized interview transcripts are excluded).

### 3.1. Methods of Data Collection and Processing

Interviews are the main data gathering technique which are applied in a semi-structured manner, guided by interview guidelines, and implemented in a face-to-face manner (Bryman, 2004) in German language. With the interviews I obtain emotions, thoughts, and intentions of the participants and discover their perspective of the social world (Patton, 2002). I will conduct 4-6 interviews of about 60-90 minutes length.

Interviews - zweistufig - every interviewee interviewed twice - due to corona - no experience with videoconferencing: schneller erfahrungen sammeln, mehr interviews/längere dauer profitieren davon - aufmerksamkeitsspanne geht schnell nach unten - meine Präferenz aber auch die ersten beiden angefragten Personen fanden es in ordnung - flexibilität:

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<sup>1</sup>[https://github.com/geyslein/Masters\\_Thesis](https://github.com/geyslein/Masters_Thesis)

möglichkeit der analyse des ersten interviews und dann anpassungen möglich (grounded theory anteile) - rekursion auf letztes interview möglich bei den interviewees, reflektion in der zwischenzeit - leitfadenkonstruktion - interview consent form link auf github doc

At the beginning of the interview guide, there are questions about studies, doctorate, previous work experience and the current position. It is followed by questions about the contents, the methods used and the theories of the own research. Afterwards, the field of investigation is approached by discussing the search process in general, using the example of one's own literature research. And on the other hand, the not very familiar topic of software will be opened up by means of easy introductory questions (Section A). Section B focuses on the sources that are used in the search for software. The largest of the sections, Section C, focuses on information practices in the search for and use of software. Based on the literature on information practices, the section is divided into Seeking, Scanning, Monitoring, Proxy, Context and Avoiding. In Section D, the last part of the interview guide, follow-up questions for the second interview are provided, which are chosen depending on the respondent and the course of the first interview. The complete interview guide is listed in the appendix (A).

To ensure the reproducibility of the interviews, they were recorded with a standard voice recorder and, in parallel, with a voice recording app for an android smartphone. The interviews were recorded without disturbances as far as possible and could be transcribed almost completely due to good linguistic quality.

Once the interviews were conducted, I orthographically transcribed the interviews recordings using EasyTranscript, an open source transcription software<sup>2</sup>. The transcription system used for this purpose should be based on the specific research objective (Edwards, 2003). The aim of this work is an evaluation of the discussions in terms of content and topic. A sophisticated transcription system, which is required for a conversation-analytical examination, was therefore not necessary. I chose a verbatim and partially annotated transcription system, which considers several para- and non-verbal aspects. The following conventions were applied:

(lachen)	Laughter
ähm	Non-lexical utterance (uh, erm, um)
[Anony]	Anonymized parts of the transcript
(DESCRIPTIONS)	Further Explanations if text was anonymized or not considered (off-topic)

I did not check the finished transcripts for correct spelling after the transcription for reasons of time economy. Further, I will translate the relevant text passages for the final thesis into English anyway, whereby attention will then be paid to the correct use of spelling and grammar.

In the next step, the interview transcripts were anonymized from information regarding person, institutes, university, thesis and research topics, and criticism expressed during the interview. This was done at the request of all interview participants. They attached great importance to this step already before we conducted the interviews. Fur-

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<sup>2</sup><https://www.e-werkzeug.eu/index.php/de/produkte/easytranscript>

ther, they intensively controlled the transcripts after the anonymization. On request, I then anonymized further aspects in the interviews.

The process finally results in 12 hours and 22 minutes of audio recordings and 162 pages of interview transcripts (Arial, 12pt).

## 3.2. Process of Data Analysis

After I received consent from all participants for the anonymized research transcripts, I analyzed the transcripts with a qualitative content analysis to explore qualified hypotheses (Kohlbacher, 2006; Krippendorff, 2012; Mayring, 2000, 2014). It enables the researcher to include textual information and to identify its properties systematically. In detail, I chose a qualitative content analysis according to (Mayring, 2014). For the analysis process I used an open source software called QualCoder<sup>3</sup>, which supports coding, annotation and category building.

In a first step, I approached the material using systematic open coding (Corbin and Strauss, 1990) to conceptualize and categorize the interview data. For this purpose, I have deductively identified categories from the knowledge about information practices, the field, and the process of compiling the interview guide. During the analysis, I inductively derived codes and categories and constantly revised the existing ones. The previously established category system is thus constantly modified and further developed, taking into account the demand for openness and flexibility of the research process.

Mayring (2014, p. 65) describes three basic interpretation techniques: Reduction, Explication and Structuring. With the analysis I aim to *reduce* the material to the core statements. For the interpretation of the present interview data I have chosen the *inductive category formation* as a form of data reduction. In contrast to summarizing, the other and very extensive reduction method, inductive category formation considers only those parts relevant for the research question and the step of paraphrasing is skipped (Mayring, 2014, p. 79). The final category system can be looked up in the Appendix (B).

Consequently, the findings are derived from accounts of information practices and not from observation of information practices as it happened.

- description of process [p. 80] - first run, second run - hypotheses as memos

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<sup>3</sup><https://github.com/ccbogel/QualCoder>

## 4. Findings

### 4.1. Introduction of interview partners and their institute

the institute, small, family like....

table name interviews duration education

## 5. Discussion

- classical philologists do not reflect much on the research process - which is why they do not regarding software use either =, as a matter of fact, the analysis focus is on information practices in the widest sense
  - tool selection is very much trust based (recommendations/consulting from colleagues and friends/family)
  - negative experiences in digital humanities projects induce skepticism towards digital tools
- [van Zundert \(2012\)](#) large scale digi infrastructures as dead end [Neuefeind et al. \(2020\)](#)
- Sustainability Strategies for Digital Humanities Systems
  - difficulties in formulating the right search terms (what they describe as well as what I could listen to during the interviews) == [Savolainen \(2015\)](#): cognitive barriers to information seeking - Inability to articulate one's information needs; Poor search skills
  - [Constant et al. \(1996\)](#) - kindness of strangers [Edmond \(2005\)](#) - role of prof intermediaries [Gunning \(1978\)](#) - librarian should participate in research process [Monroe-Gulick et al. \(2013\)](#) - librarians as partners

## 6. Conclusion



## **7. Zusammenfassung (German Conclusion)**

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# Appendices

## **A. Interview Guide**



# **Interview questionnaire**

## **Personal questions**

- Study, doctorate
- Work experience, current position
- Field of expertise: Contents, methods, theories

## **A Entry questions**

### **Search in general**

- Describe the process of your own literature research
  - Procedure Which sources are used? (search engines, databases, colleagues, publications, events, service providers, social media)
  - Which tools are used?

### **Software usage**

- Which software do you use in your everyday scientific work?
  - Since when?
  - Motivation - For what?
  - Experience?
- Which software was last integrated into your own research process?
  - When?
  - Motivation - For what?
  - What was the impulse for it?
  - Experience by now?
  - What has changed as a result?
  - satisfaction?

## **B The search for software - sources**

- Describe the process of searching for software tools
- Which sources are used? (Friends, Colleagues, Within the institution: working group/professorship/faculty, Outside the institution: national vs. international, subject vs. non-subject, special catalogues, search engines, service providers: library, subject information services, subject specific websites, social media, software repositories)
- Which tools are used? (special catalogues, software repositories, social media, search engines)
- What are the hurdles?

## **C Search and use of software - information practices**

### **Seeking**

- What kind of software have you already been looking for for your work?
- What sources have you ever consulted when searching for software? (once/regularly)
- What sources have you identified that could help you in your search but do not have it yet?
- How do you proceed with the active search? (strategies, lists, preparation for talks)

### **Scanning**

- Where do you come across references to used software in your everyday work (journals, conferences, meetings, students...)?
- Which relevant source have you already come across and how did you deal with it?
- If applicable, how do you observe other researchers during their work (looking over your shoulder while talking, explanations)

### **Monitoring**

- What sources of information (newsletters, websites, newspapers, social media) do you regularly monitor?
- In which everyday situations could you encounter information about interesting software or hints for its use?
  - Within your workplace?
  - Outside?
  - If difficult: using literature as an example

### **Proxy**

- What is the role of information providers? (Connecting)
  - Someone with the necessary knowledge about software identifies you as an information seeker (once/regularly)?
  - Someone refers you to a potential information source?
  - Someone makes recommendations (once/regularly)?
- How does this someone interact with you? (interacting) Informing through stories or experience
  - Advising, instructing, guiding

### **Context**

- What role does context play in the search for software?
  - Field: Classical Philology
  - Institute, Colleagues
  - Personal life situation: family, friends, leisure groups

## **D Follow-up questions for the second interview**

### **Follow-up first interview (interval: approx. 2 weeks)**

- What topics have you been thinking about until today?
- What do you want to add to the last interview?
- Depending on the context: (Add at the point)
  - ...

## **B. Category System**



Name: ..... Vorname: .....

Matr.Nr.: .....

### Eidesstattliche Erklärung zur

- ☐ **Hausarbeit \***
- ☐ **Bachelorarbeit \***
- ☐ **Masterarbeit \***
- ☐ **Abschlussarbeit im Bibliotheksreferendariat \***

\* Die eingereichte PDF-Datei ist mit den Printexemplaren identisch.

Ich erkläre ausdrücklich, dass es sich bei der von mir eingereichten schriftlichen Arbeit mit dem Titel

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um eine von mir erstmalig, selbstständig und ohne fremde Hilfe verfasste Arbeit handelt.

Ich erkläre ausdrücklich, dass ich *sämtliche* in der oben genannten Arbeit verwendeten fremden Quellen, auch aus dem Internet (einschließlich Tabellen, Grafiken u. Ä.) als solche kenntlich gemacht habe. Insbesondere bestätige ich, dass ich ausnahmslos sowohl bei wörtlich übernommenen Aussagen bzw. unverändert übernommenen Tabellen, Grafiken u. Ä. (Zitaten) als auch bei in eigenen Worten wiedergegebenen Aussagen bzw. von mir abgewandelten Tabellen, Grafiken u. Ä. anderer Autorinnen und Autoren (Paraphrasen) die Quelle angegeben habe.

Mir ist bewusst, dass Verstöße gegen die Grundsätze der Selbstständigkeit als Täuschung betrachtet und entsprechend der Prüfungsordnung und/oder der Fächerübergreifenden Satzung zur Regelung von Zulassung, Studium und Prüfung (ZSP-HU) geahndet werden.

Datum .....

Unterschrift .....