

Considering ‘What Might Be’

Reflections on a Qualitative Study of Academic Search

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Objective — To critically describe and evaluate an exploratory research project conducted by the author from 2012–2016. The project examined the academic search patterns of six scientists in four geographical locations who were observed using several qualitative methods, including visual ethnographic techniques.

Methods — This reflexive discussion, in case study form, provides insight into decision making about techniques researchers can use to observe people’s interactions within networked environments. It also provides a glimpse into the real-world service design process at a science, technology, engineering, and mathematics (STEM) library.

Results — Touching only briefly on theory, the article highlights how visual ethnographic techniques are useful, as an alternative to log or trace data, for observing interactions of individuals within the global networked academic environment (GNAE). Screenshots taken by research participants for this project were rich data sources and provided ‘snapshots’ of how scientists in the study conducted academic search in real-world settings.

Conclusions — While findings from the original research project cannot be used to make theoretical generalizations because of the small, non-random study cohort, the study — perhaps paradoxically — enabled the creation of popular services for early career researchers in a real-world setting. This paradox raises provocative questions about goal-setting in library and information science (LIS) research and ties between theory and practice.

Keywords — global networked academic environment, academic search, screenshots, visual ethnography, trace ethnography

»Was sein könnte«: Überlegungen zu einer qualitativen Studie des wissenschaftlichen Suchverhaltens

Zielsetzung — Der Beitrag beschreibt und bewertet ein exploratives Forschungsprojekt, das von 2012 bis 2016 von der Autorin durchgeführt wurde. Dieses Projekt untersuchte die Recherchegewohnheiten von sechs in vier geographischen Regionen tätigen Naturwissenschaftlern mit Hilfe mehrerer qualitativer Methoden, inklusive visueller ethnographischer Techniken.

Forschungsmethoden — Die vorliegende reflektierende Diskussion mit Fallstudiencharakter vermittelt Einblicke in Techniken der Entscheidungsfindung, die ein/e Forscher/in anwenden kann, um menschliche Interaktionen in vernetzten Umgebungen zu beobachten. Sie ermöglicht auch einen Blick in den realen Prozess des Dienstleistungsentwurfs in einer Bibliothek mit Ausrichtung auf Naturwissenschaft, Technik, Ingenieurwesen und Mathematik (STEM).

Ergebnisse — Während theoretische Aspekte nur gestreift werden, zeigt der Artikel hauptsächlich, wie visuelle ethnographische Techniken als Alternative zu Log- oder Trace-Daten bei der Beobachtung von Interaktionen von Individuen innerhalb des globalen vernetzten akademischen Umfeldes (GNAE) nutzbringend eingesetzt werden können. Von den Teilnehmern der Studie angefertigte Bildschirmkopien erwiesen sich als reichhaltige Datenquellen und lieferten »Schnappschüsse« davon, wie Wissenschaftler in einer realen Umgebung akademische Suchen durchführten.

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Young Information Scientist (YIS) wird vom Verein zur Förderung der Informationswissenschaft (VFI), Wien, herausgegeben. Alle Beiträge unterliegen einem Peer Review.
ISSN: 2518-6892

Schlussfolgerungen — Obzwar die Ergebnisse des ursprünglichen Forschungsprojektes aufgrund der kleinen und nicht zufällig ausgewählten Kohorte nicht zur Erstellung theoretischer Verallgemeinerungen genutzt werden können, ermöglichte die Studie – vielleicht paradoxerweise – die Schaffung populärer Dienstleistungen für Nachwuchsforscher/innen in einer realen Umgebung. Dieses Paradoxon wirft herausfordernde Fragen im Zusammenhang mit der Zielgestaltung in der bibliotheks- und informationswissenschaftlichen Forschung auf und verbindet somit auch Theorie und Praxis.

Schlagwörter — global vernetztes akademisches Umfeld, wissenschaftliche Recherche, Bildschirmkopien, visuelle Ethnographie, Internet-Ethnographie

Diesem Beitrag liegt folgende Doktorarbeit zugrunde / This article is based upon the following dissertation:

Krueger, Stephanie: Beyond the Paywall: A Multi-Sited Ethnographic Examination of the Information-Related Behaviors of Six Scientists. Dissertation, Humboldt-Universität zu Berlin, 2016.

URL: <http://edoc.hu-berlin.de/dissertationen/krueger-stephanie-2016-07-22/PDF/krueger.pdf>

1 Introduction

I work with students and researchers on a daily basis — not as a university professor, but as a designer of new academic services for a national science, technology, engineering, and mathematics (STEM) library. These individuals, from many different countries, range from secondary school students to post-doctoral researchers. Prior to my library-based position, I worked for the greater part of a decade designing, implementing, and disseminating the use of online scholarly tools within the context of projects — global in scope — originally funded by a large American foundation.

My impulse for conducting the research project I critically examine in this article arose from a sinking sense — even prior to my applied work in a library — that something was going deeply wrong in the world of academic search. Since completing my doctoral research and working in an applied library environment, this feeling has only intensified. Daily, I encounter students and researchers confident in their online searching skills but floundering when it comes to conceiving and completing scholarly writing tasks — a high school graduation paper, a doctoral dissertation, a scientific article. I encounter students adept at finding ‘bootleg’ versions of articles but unable to evaluate the quality of the articles they download. Students who have never opened a print book or who do not understand the concept of plagiarism. Early career researchers who have never encountered the phrase ‘academic integrity.’

What is going on here? Why don’t our library-based information literacy efforts appear to be working for everyone? How might libraries and information providers be responsible for widespread confusion surrounding access to academic information? What role has such confusion played in the spread of pseudoscientific views? How have I *personally* contributed to the morass of confusion? As a researcher and academic library practitioner, how might I conceive future research projects and applied interventions in ways that might contribute to improving this situation?

This article, through a reflexive, critical examination of a small-scale research project, sheds light on aspects of such big questions, identifying a potential need for a reexamination of LIS research goals in areas with applied, real-world aspects — *if* one considers our collective goal to be the creation of a sustainable, truly global scientific information infrastructure built to support academic inquiry based on scientific principles and resistant to pseudoscientific influences (see Hansson 2017 for a discussion of science versus pseudoscience).

As in this introduction, I will narrate most of this article in the first person so that readers can ‘draw on [my] direct experiences in the field’ and gain insight into a ‘world that might otherwise be unavailable or extremely difficult to access’ (Venkatesh 2013, p. 5). Primary inspiration for this first-person narrative approach came from Geiger and Ribes (2011) and their description of how and why they employed trace

In spurring discussion about this topic, I wish to exhibit *agency*, which Gonzales (2015, p. 304) citing Archer (2012) calls an act ‘of resistance, or at least, negotiation intended to advance...notions of the public good’ in relation to academic search.

2.1 Goal: To Observe Virtual Interactions in a Networked Environment

the research field. At the beginning of this project I asked myself — without methodological or even disciplinary restrictions — how I might gather data to observe real-world interactions within a networked environment.

A hand-drawn diagram titled "GNAE" enclosed in a rectangular box. Below the box is a large circle containing several points and labels. The labels include "Lib or Non-Lib", "info", "Scientist", "me", "Lib or Non-Lib", "info", "Lib or Non-Lib", "comm or Non-comm", and "FORMAT". The diagram appears to be a conceptual map or a network diagram. An arrow points from the label "me" outside the circle to a point inside the circle. There are also several "X" marks and "+" signs scattered within the circle.

What is notable here from the perspective of research design is that I was — from the outset — most keenly interested in observing *how and why* scholars interact with information (broadly defined) in the ever-changing global networked academic environment (GNAE) at the *point of interaction* of scholars with the network. This goal is illustrated in an early sketch (Figure 1).

Figure 2: Sample diagram, interaction of six scholars with GNAE resources

2.2 Quantitative Beginnings: Influenced by Scientists

Early on, I believed it would be possible to use log or trace data to observe virtual interactions within the GNAE. Over email, I asked Paul Ginsparg, physicist and founder of arXiv, for his advice (2013, pers. comm. 17 January). He pointed me in the direction of Velden and Lagoze's (2013) work on publication networks, which led me in turn to Pepe's (2010) investigation of scientific collaboration networks.

I concurrently learned more about trace ethnography, 'a powerful and flexible methodology, able to turn thin documentary traces into "thick descriptions" of actors and events that are often invisible in today's distributed, networked environments' (Geiger and Ribes 2011, p. 1).

In hindsight, I realize my prior experiences in web and software development inspired me to consider using log or trace data for this project because I had witnessed firsthand how helpful such traces are in agile design settings. In such settings, there is often no time to create theories about observed behavior; rather, data is used to observe aspects of a problem and then immediately solve it to the best of one's ability at a certain point in time.

While I felt (and still feel) log and trace data sources are incredibly valuable to researchers investigating networked environments, I did not ultimately end up using them for this small-scale project. Why?

First, while physicists and mathematicians were eager and willing to assist me with improving my understanding of network science, I did not feel my mathematics or physics background was sufficient to enable me to conduct the robust quantitative analysis necessary for working with such data sources. That said, I did enlist the assistance of a physicist and a mathematician in creating all graphs and visualizations based on qualitative data for the project.

Furthermore, I realized early on it would be impossible for me to gain access to log or trace data from *multiple resources* for this project within my three-year research timeframe. While getting data from one resource might have been possible, I did not want to focus on only one resource within the GNAE; I was interested in observing the larger picture. I therefore switched approaches, changing to a qualitative approach (Section 2.4 below).

2.3 Current Problems with Log Data

However, before I discuss qualitative techniques, I feel it is important here to comment briefly about the current problems associated with gaining access to log data.

First, while log data is available for tools and sources supported by academic infrastructures — employed in the metrics branch of IS inquiry as well as in studies of academic search for individual sources (Li and Rijke 2017) — data regarding movement of individuals *across* sources or from multiple sources is exceedingly difficult to obtain. Not only are there problems in mapping individual user data across logs (to be discussed directly below), but data for sources beyond academic paywalls is held in the hands of a broad array of commercial and non-commercial entities. High price tags — ethical as well as financial — are often placed on commercial data from some entities, as seen in the recent case of Facebook/Cambridge Analytica (Grassegger and Krogerus 2017; Lewis 2018).

Second, even if researchers purchase (or otherwise obtain) log data from proprietary entities, matching logs from different entities in order to observe the *movement of individuals* across log sources would be problematic, due to challenges in differentiating users in logs. Even for one resource, this process is problematic, as Li and Rijke (2017) describe in relation to ScienceDirect query logs and internet protocol (IP) addresses:

Many institutions use proxies or firewalls so that their IP is recorded instead of the terminal device. Therefore it is not possible to differentiate these IP-users. We are only confident in an ID-user one-to-one mapping when they [users] log in or access the search engine from outside the institution (pp. 149-150).

To the best of my knowledge, no one has yet resolved such individual behavior mapping problems.

What does this mean? Right now, researchers can observe how scholars conduct academic search *only for those sources to which they have log access*. Until two key challenges are resolved: (1) access to proprietary data and (2) the difficulty of matching user-level data from different sources, researchers can say virtually nothing, using actual log data, about why and how searchers move *across* multiple sources.

2.4 A Qualitative Workaround: Screenshots Taken by Participants

I developed my own qualitative approach for overcoming the aforementioned challenges, influenced by Hartel and Thomson (2011), Geiger and Ribes (2011) and Spinney (2011) and their investigations of *environments*, physical or virtual places where social and organizational phenomena intersect with individuals.

Hartel and Thomson (2011) inspired me with their discussion of visual approaches for examining physical 'immediate information spaces' (p. 2214), with visual methods being able to 'act as one data-gathering technique within a multi-method study' (p. 2215). Particularly useful for me were their descriptions of how still images could be analyzed and coded (p. 2220).

From Geiger and Ribes (2011), I learned how data traces can be decoded in order to gain 'an ethnographic understanding of the activities, people, systems, and technologies which might contribute to their production' (p. 1).

Finally, looking beyond the methodological literature for LIS, I found inspiration in mobility research, which concerns itself with 'movement within geographical and sociological enquiry' (p. 161). This may seem to be an odd choice, but the mobilities field is well-developed and has, as noted by Spinney (2011), evolved to a point at which 'the more representational and readily articulated aspects' of mobility are fairly well-understood, provoking researchers to ask new research questions about phenomena which do 'not readily lend [themselves] to apprehension through quantitative or verbal accounts' (p. 162). Spinney, referring to Laurier (2009), notes that video artifacts — particularly those taken by research participants — can enable researchers to 'be' in contexts 'without actually being there,' allowing them to understand 'ordinary and fleeting aspects of everyday life' which might have been 'missed or glossed over in the production of more static texts' (p. 166). Additionally, video 'data embodies the movement which the fixity of photographs and written texts so often fail to evoke' (p. 167).

For my project, I originally hoped research participants would be able to provide me with videos illustrating their movements through the GNAE. Videos, I hoped, would complement the more traditional data-gathering approaches and enable me

to 'see' actual interactions within the GNAE. In the end, the project participants did not feel comfortable providing me with video, so I employed a pragmatic workaround which incorporated aspects of the three techniques touched on above: I asked research participants to provide me with screenshots illustrating academic search, from their perspectives.

In retrospect, I feel two aspects of this screenshot technique are important for future researchers to consider. First, screenshots served as an important point for comparison between what participants told me they were doing and their actual behaviors. Second, screenshots served as a satisfactory alternative to log or trace data, particularly in cases where participants provided me with a series of screenshots which I could employ — as someone accustomed to analyzing log data — to imagine their 'flow' or movement within the GNAE.

2.4.1 Screenshots: Real Behavior vs. What Was Reported

Screenshots provided me with a very clear picture of how participants were conducting academic search and opened my eyes to how real behavior can vary from what participants report in good faith in interviews and follow-up discussions.

To provide one example, one participant (Participant 6) insisted in fieldwork — even when asked follow-up questions — that she was using Google Scholar with library links enabled (Figure 3). But this was not the case, as I discovered when testing what she should have seen. Figure 4 re-creates the original test; institutional information blacked out to protect the participant's privacy.

2.4.2 Screenshots: Satisfactory Substitutes for Log/Trace Data

Screenshots proved to be a satisfactory alternative to log or trace data and I was very pleased with the richness of information I was able to observe and decode using these data sources. Through screenshots, I was able to easily interpret how research participants were interacting with the GNAE and compile a picture of the 'activities, people, systems, and technologies' which contributed the academic search experiences of research participants.

Figure 5 and Table 1 below provide illustrations of the richness of the data afforded by screenshots. One participant (Participant 4) also provided me

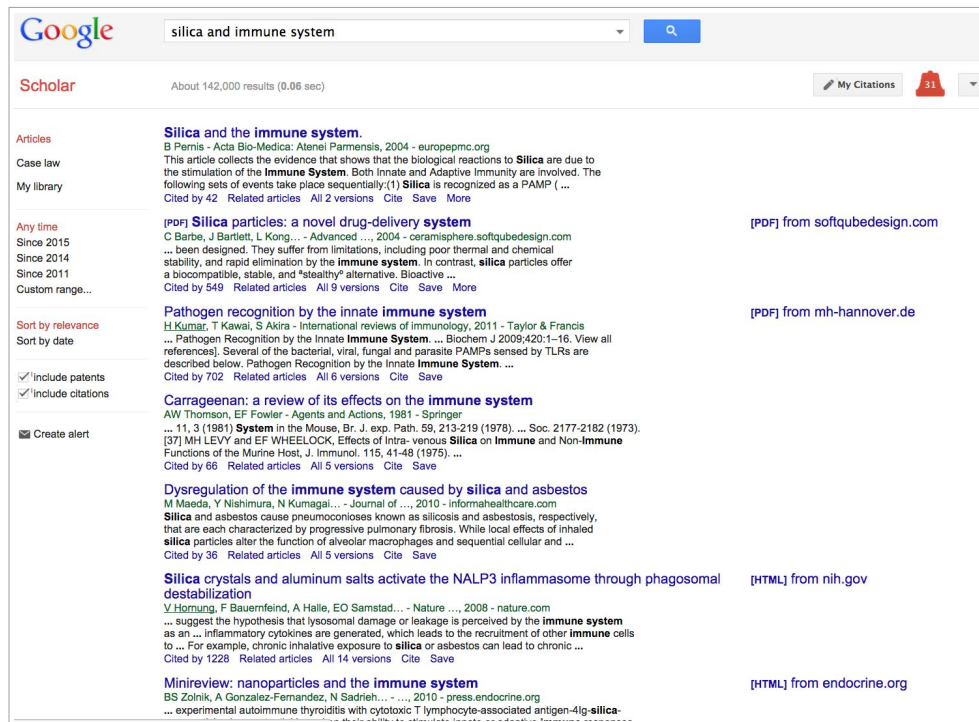


Figure 3: My 'library is connected to my google scholar searches and brings up availability automatically' (Participant 6, 2015, screenshot data, 6 August).

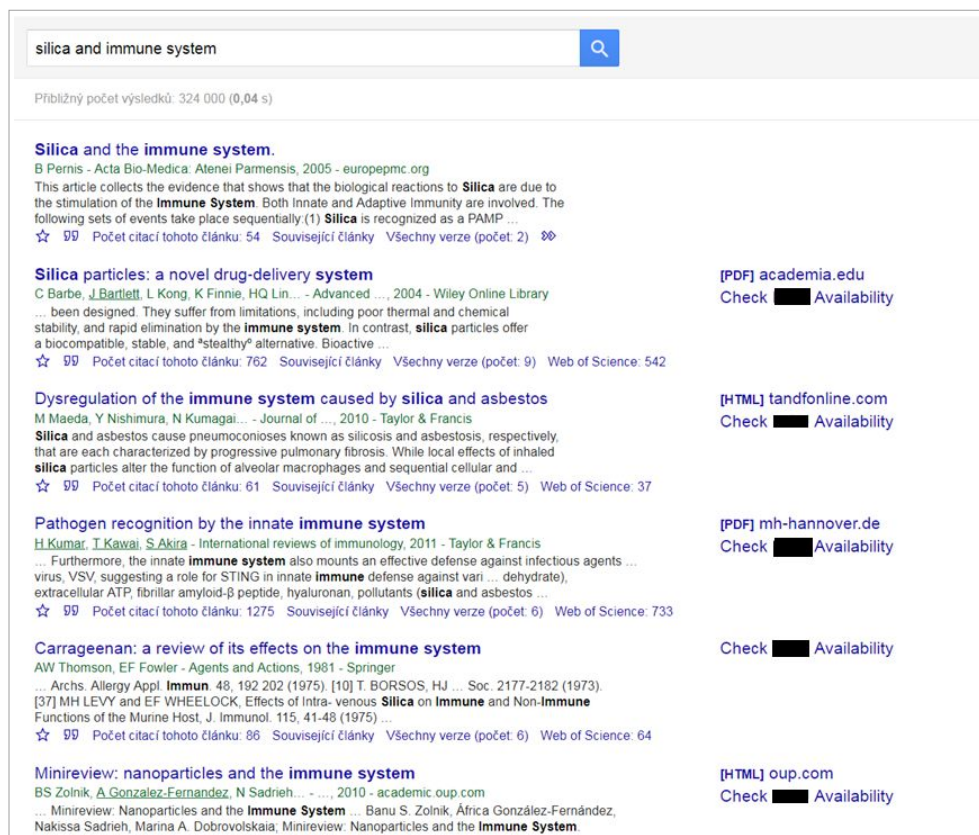


Figure 4: More full-text options with Google Scholar library links enabled (2018, screenshot re-creation, 15 May)

with commentaries for each screenshot. These commentaries allowed me to understand *why and how* he had made each screenshot. This helped me not only to see *what he saw*; I was also able to witness his ‘embodied feelings,’ what Spinney (2011) — building upon the work of Latham (2003) and Järvinen (2006) — calls ‘feeling there’ (p. 168).

Screenshots also enabled me to imagine the movement of participants through the GNAE as well

as through topics and queries. Here is another example from Participant 4 in which he explains, through his comments, why he modified a search query for one particular academic search session (Figures 6 and 7).

This kind of contextual approach could easily be employed to complement quantitative studies of academic search, such as explorations of topic shift and query reformulations (Li and Rijke 2017).

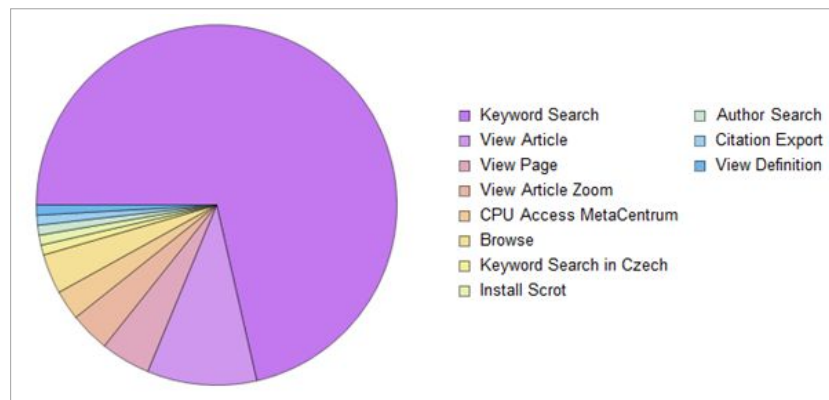


Figure 5: Sample search activities, Participant 4

3 Discussion: Future Research Directions

3.1 Deeper Understanding of the GNAE

My small exploratory project showed the feasibility of studying interactions within the GNAE, even without log or trace data.

One avenue future researchers could explore would be continuing to deepen our understanding of the GNAE as a whole — to understand ‘what it is,’ to use Skolimowski’s (1966) definition of science. Future quantitative and qualitative studies could be performed in order to describe its characteristics. Larger studies — particularly ones in which cross-resource log data could be obtained — would be helpful in this process.

However, in the course of writing this article, I had a nightmare in which I imagined hundreds of future researchers replicating my project, conducting small-scale ethnographic research studies using screenshot data. I was terrified when I asked myself: What, as an applied practitioner, could I gain from a canon of perfectly valid, reliable, and gen-

eralizable studies describing a dysfunctional GNAE and confirming what I already observe in the field: An unnecessarily confusing online research environment, big commercial entities buying up scientific resources and driving up their price tags, students advocating ‘vaccination is bad for children’ based on an article they found in a pseudoscientific journal, and so on.

It was one big, bad nightmare.

3.2 Applying Findings to Practice

Which brings me finally to the paradox I encountered after I completed this research project. While, as indicated, findings from the original project cannot be used to make theoretical generalizations because of the small, non-random study cohort, the study paradoxically enabled the creation of popular services for early career researchers in a real-world setting, an academic library primarily serving STEM

Activity	Occurrence	Resource(s)	Examples
Keyword search	80	Google CZ	methyl triphenyl phosphonium bromide python postgresql
View Article	11	<i>Journal of Investigative Dermatology</i> - Wikipedia (English) <i>Journal of Medicinal Chemistry</i> - PubMed - Sigma-Aldrich <i>All Things Metathesis</i>	Rational ligand-based virtual screening and structure-activity relationship studies in the ligand-binding domain of the glucocorticoid receptor- α . Methyltriphenylphosphonium bromide Metathesis: Ruthenium-Based Metathesis Catalysts
View Page	5	- StackOverflow - PostgreSQL Database Adapter Support	Metathesis: Ruthenium-Based Metathesis Catalysts Select rows which are not present in other tables Bug #412000; comment: <i>The time-honored tradition of copying an encountered programming error into google, verbatim It usually works.</i>
View Article Zoom	4	Wikipedia (English)	Dexamethasone GR knockout mice; comment: <i>Looking for what happens to mammals without working glucocorticoid receptor.</i>
CPU Access Meta-Centrum	3	MetaCentrum	[no commentary; illustrations of access to data platform]
Browse	4	- PostgreSQL documentation - Student Information System <i>Journal of Cheminformatics</i>	<i>Journal of Cheminformatics – Latest Articles</i>
Keyword Search in Czech	1	Google CZ	spravna vyrobi praxe (good manufacturing process)
Install Scrot	1	Unix interface	Comment: <i>After installation, I tried to run the command (the last role of the console) and it snapped this screenshot of the whole desktop.</i>
Author Search	1	Reaxys	‘sindelar, vladimir’
Citation Export	1	Reaxys	134 citations
View Definition	1	<i>Journal of Cheminformatics</i>	definition of chemical similarity

Table 1: Details, sample search activities

students and researchers. My dissertation as well as Krueger (2014) and Krueger (2017) provide descriptions of services improved using the knowledge I gained from this project. Here, I will only provide brief reflections about my experiences which may be of interest to researchers and practitioners alike.

First, conducting an ethnographic research project over the course of several years with scientists provided me with a deeper understanding of how deeply invisible libraries — as institutions — are to researchers who primarily conduct online academic search. This is exemplified in an exchange I had with Participant 1, a mid-career theoretical physicist.

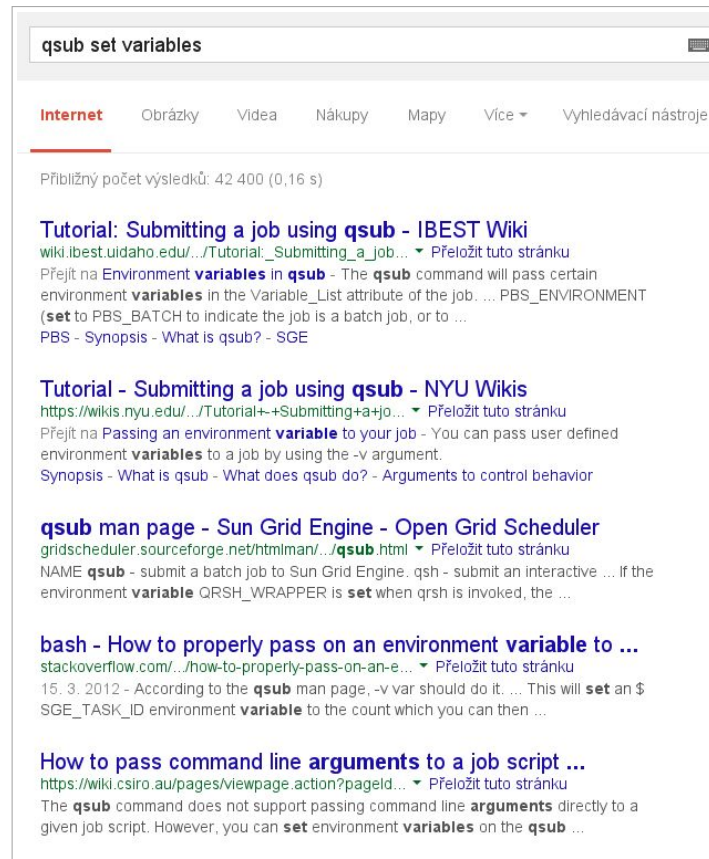


Figure 6: ‘I wanted to know more about the “qsub” command used by MetaCentrum to queue up computation requests, as I wanted to specify some environment variables for my scripts to lean on.’ (Participant 4, 2014, screenshot data, 2 August)

When asked if she could comment on how libraries might be useful to her, she answered only: ‘I will have to think a little on this one’ (Participant 1, 2013, fieldwork transcriptions, 4 November). As a result of this project, I have systematically worked to strip all references to terms used by information scientists or library professionals from our online and physical service offerings and rephrased/retargeted all services to concepts STEM scholars understand. To date, no one has complained.

Second, participants in my study were very eager to participate in the process (with the exception of providing videos to me, as noted above). Participants 2 and 4 notably mentioned to me on several occasions how important it was for them to make

their voice heard; they told me they wanted to explain the challenges faced by scientists today to a broader audience. Working together in the context of my research project provided a mechanism for bridging our disciplinary differences and for talking about a commonly-shared dream: a better, even more dependable academic search environment.

As a result, I have since been asking myself what I can do to make the lives of students and scholars better. Individually, I can (and do) create service interventions which ‘demystify’ aspects of interacting with the GNAE. But what I cannot do alone is design and implement a better academic search environment.

4 Conclusion: What Might Be?

In the course of writing this article, I stumbled across a new essay in which Remy et al. (2018) propose a

model for evaluating Sustainable Human-Computer Interaction (SHCI) research. This model, consisting

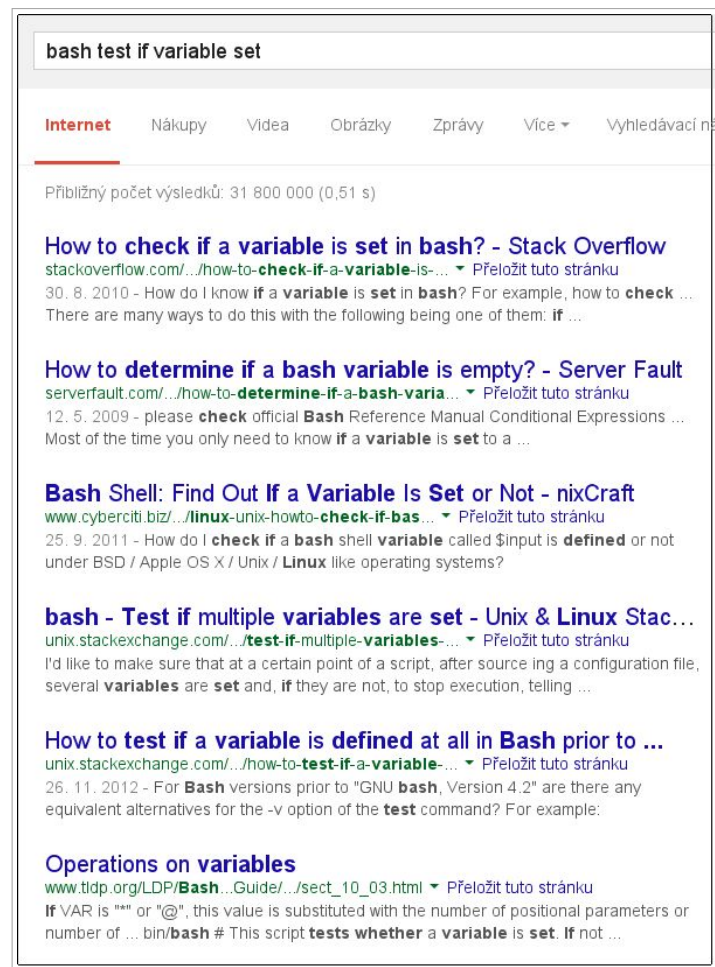


Figure 7: ‘Related to my previous query, I wanted a way for the scripts to test whether all required variables are set, and perhaps have some sane defaults.’ (Participant 4, 2014, screenshot data, 2 August)

of five so-called ingredients (goals, mechanisms, metrics, methods, and scope; Figure 8¹), was created in order to spur discussion in the SHCI community about how to create ‘a set of concepts for justifying and debating evaluation of HCI research *beyond usability*’ (p. 2) at a time when ‘the threat of climate change has made scientific communities aware that our status quo cannot be maintained, and we have to move towards a more sustainable future’ (p. 4).

Notable about these statements is the recognition that uncoordinated research agendas are no longer sufficient *when the stakes are very high*, in an era when the global threat of climate change necessitates a coordinated international scientific response

in order to achieve globally-articulated Sustainable Development Goals (SDGs) (United Nations 2018).

Currently, SHCI research has yielded ‘a rather low proportion of tangible solutions and hardly any evidence for a measurable impact on real-world practices’ (p. 1). By keeping their eye on broader overall goals, SHCI researchers — with the new model — ‘can aim to validate their work ... [and] also help to frame research and how it is assumed to contribute towards sustainability’ (Remy et al. 2018, p. 5).

LIS, like SHCI, currently does not have a clearly articulated, overarching research agenda; the field — with and without the ‘L’ — has gone through several decades of examination and debate which have not yet resulted in unifying paradigms, theor-

1 Note: Christian Remy (2018, pers. comm., 26 March and 6 April) was made aware of the article and had no objections to the publication of Figure 8 and the summary text.

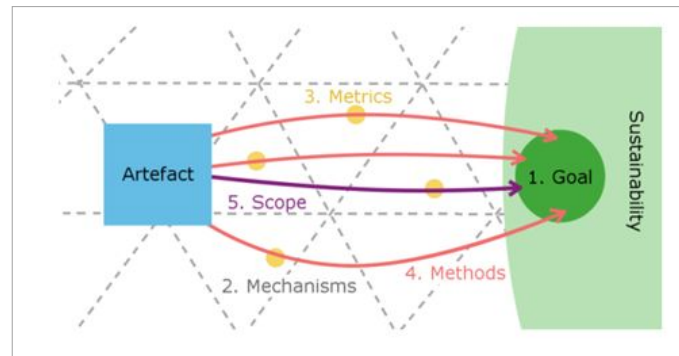


Figure 8: Remy et al. (2018, p. 8) SCHI validity model

ies, or methodological approaches (Bawden et al. 2015; Cibangu 2013; Cronin 2008; Saracevic 2009).

Because of this, (L)IS research — like SHCI — has many shapes and forms, and evaluation of resultant research artifacts is challenging. As with SHCI, the applicability of research outputs to practice is often subject to debate (Bawden 2015; Miller et al. 2017).

More broadly, a global contextual threat to traditional LIS principles has emerged: the purposeful distribution of misinformation for commercial or political gain facilitated by a worldwide networked infrastructure. Berners-Lee (2017, under 'It's too easy for misinformation to spread on the web') summarizes the situation:

Today, most people find news and information on the web through just a handful of social media sites and search engines. These sites make more money when we click on the links they show us. And they choose what to show us based on algorithms that learn from our personal data that they are constantly harvesting. The net result is that these sites show us content they think we'll click on — meaning that misinformation, or fake news, which is surprising, shocking, or designed to appeal to our biases, can spread like wildfire. And through the use of data science and armies of bots, those with bad intentions can game the system to spread misinformation for financial or political gain.

As a result, scholars and information professionals are thrust — like it or not — onto the front lines

of the so-called information wars, as noted by Anderson (2017):

It's time to wake up to the fact that the Information Age is undergoing a period of information warfare. From science under siege by conspiracy theories driven by dark money and shadowy players to attacks on the democratic norms that have fostered the tolerance and globalism so valuable to scientific research and communication to the very definition of what is true and what is false, it is all in play now. We, as citizens, scholars, and information providers, are involved.

In such an environment, one could argue the LIS status quo cannot be maintained due to direct attacks on key principles such as intellectual freedom and the freedom of access to information (The International Federation of Library Associations and Institutions (IFLA) 2016). While the LIS research community may not yet see the ripple effects of misinformation campaigns, many of us working in applied settings, as touched upon in this article, are already dealing with the downstream effects of purposeful misinformation efforts.

Taking such urgent contextual issues into consideration, what if a clearer articulation of LIS goals were to exist? With goals in place, might LIS researchers and practitioners be able to focus their efforts and collaboratively work towards building a better, trusted academic search environment? I don't have answers here, but I believe it is time to start asking ourselves such questions.

Acknowledgements

I am grateful to the participants in my study, including reviewers of this text; to Christian Remy and his co-authors for their inspirational model; and to those who assisted in reviewing the final manuscript: Kaitlyn Haines (University of Michigan), Lisa Janicke Hinchcliffe (University of Illinois), Max Marmor (Samuel H. Kress Foundation), and Sasha Skenderija (National Library of Technology in Prague).

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