KTHB

Creative and critical literature reviews

A miniature handbook

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2011

INTRODUCTION

This text is meant to be used as course literature in the information searching course LI1101 given at the Royal Institute of Technology (KTH) and should in a simple way describe the author's experience of literature reviews and information gathering.

Before we proceed we need to define the concept of information competence:

> *Information competence is the knowledge and skills needed to choose an information source (often a database), search out the information needed and critically evaluate the quality and validity of the information found.*

This text is mainly concerned with the first and third part of the definition above. Together with a general discussion on literature reviews and their purpose, aim and structure the student should be able to meet the course requirements of LI1101.

Because of the need to keep the text as short as possible the subject matter will be discussed briefly. Please contact the author (bango@kth.se) if anything needs further explanation, typos are found or if the text needs to be updated in any other way.

This text starts off when the first 1.5 credit part of the course is completed and the original documents have been collected. This is when it's time to start the evaluation process and the information need is meant to be satisfied (that is: the question posed answered).

WHY SHOULD YOU WANT TO WRITE A GOOD LITERATURE REVIEW?

Often you will use your texts to communicate results within your specific field of study to experts within that field. What possible reason could there be to write a thorough (but not too long) background section (that is literature review) to your paper?

The first reason might be the best one. We want the reader to appreciate our texts and use it (that is cite it) in her/his own works. This is because a researcher's level of excellence is often measured by the number of citations her/his articles, papers, etc. receive in the scientific community. One way of measuring this is with the h-index[1] (Hirsch, 2005).

If someone really understands what you're writing it seems plausible to assume that the chance that your works will get cited is higher than if your text is hard to understand. One way of increasing the readability of your text is to write a well written and thorough literature review as the introduction to your paper. This ensures that the reader has all the background knowledge that is needed to understand your results. If the reader is already well versed in the subject he or she can just skip the background information and go straight for the results. If you suspect that your results may be important to researchers in a different field, you may benefit a lot from writing a more comprehensive literature review so as to make the paper available to these people who are not experts in the field. Often a journal publisher will place serious restrictions on the scope of the article, both in terms of number of words and how much background

[1] An author's h-index is the number of publications written by her/him that has been cited ≥ h times by other authors.

information is deemed needed for their readers; this means that it is imperative that your literature review is short, comprehensive and informative.

The second reason for writing a good literature review is that an author who is to write such a review has to be very familiar with the subject matter. It seems reasonable to think that a literature review of that kind requires a lot of reading and thinking, which should have a positive effect on the researcher's work as a whole.

The third reason is that sometimes it can be positive if individuals from outside the field, without the information filters and mindsets of an expert, can read and comment on a result. In this way new ideas can become transferred to other fields or born from the non expert's way of thinking outside the box. It also helps Universities to fulfill the *third assignment* which states that the faculty should participate in educating the Society in general (with popular science, etc.).

Unfortunately one often sees poorly worked literature reviews that make the article unreadable except for a few experts in the subject.

Remember that the key here is not to write a long literature review, but a good one. The way to judge if the review is good or not, is to see how well it measures up to the needs of the *intended reader* of the text. Remember your intended reader when you start writing and what your goals are with your text. Do you want to reach the uttermost experts? Is your purpose to reach everyone and all with your magnificent writing? Do you want to educate your students in the process (throw in a couple of hard word while you're at it)? It's your choice but be aware of it's existence.

ASKING QUESTIONS

Whether your research is done by request (like for example your master's thesis written for Scania), is a part of the hot topics (the subjects most discussed among your peers) or just aimed at scratching a mental itch (you just need to know), you will need to think about how to make your question into a fully grown research project. Some people have said that the most common reason for a research project is a small question that someone posed which later grew, sometimes into a whole field of research.

> *Why do cats rub their faces against us? Why does a coffee spill dry in the shape of a circle?* That's how a lot of research begins – not with a big question that attracts everyone in a field, but with a mental itch about a small one that only a single researcher wants to scratch.
>
> (Booth et al., 2008:35)

Try to make your study project as narrow as possible and make sure that you have a measurable outcome. With measurable we mean an outcome that is in some sense answers the question posed in the research project.

HOW TO READ SCIENTIFIC LITERATURE

When you have settled for a research question, identified one's information needs and found all the literature needed to start the project, it's time to evaluate the sources you have found. Just because a source looks great in a reference list in a database, this does not mean that the source should be used in your research. First you must read and analyze the articles, books and other sources you have found. Reading the literature is an important part of the research and deserves a short discussion.

Reading scientific literature is not like reading a novel, so there is absolutely no point in waiting until you've read the whole story before seeing how it ends. On the contrary it is often a good idea to read the results first to see if they are useful to your study. Also look at figures, read section titles and skim through parts of the text that look interesting. If you want to use the results, you should go back to earlier parts of the text and *check the actual science*.

When selected parts of the text is skimmed:

1. Summarize the article/book/paper in a few words.
2. Read selected parts of it again more thoroughly.
3. Identify and write down key points.
4. Identify and write down theories and/or results which conflict with other things you have read.
5. Write down new insights that you may have gotten from reading the text.
6. Identify and write down things you might not have understood.
7. Save a complete bibliographic reference.

When reading this type of literature, often the most important thing is to have *a* plan for active reading; sometimes it takes too much time to come up with the perfect plan or to follow someone else's recipe for reading, so read in a way that suits your learning style.

As a reader it is easy to end up in a position where you are a receiver of information and not a critical user of it. Scientific texts are almost always written in a way that aims to persuade the reader of the validity of the results with overwhelming evidence and arguments. We would like to avoid this and become critical, thinking, users of information. One way of becoming a critical reader is to read the results before you read the argumentation for why the results are

valid. Otherwise you might be convinced of the validity of the results before you even reach them in the text.

Try to always read with pen in hand and a notebook in your proximity. There are two reasons for this. The first is, of course, that you can scribble down what you find interesting and go back to it later. The second reason is that you are more active when reading if you sit with a pencil since the way you carry your body affects your brain (and thereby your concentration) just as your brain can control and affect your body (Chiel et al., 2009).

There is an abundance of literature on reading techniques and you are strongly encouraged to read up on some of these before starting a larger project (such as a master's thesis or Ph.D. studies).

LITERARY CRITICISM

It seems plausible, and will be taken as a starting point in this part of the text, that one may have use of *three* skill areas when critically evaluating information sources.

- Subject knowledge.
- Epistemology and philosophy of science.
- Communication of scientific knowledge.

These three main branches will be treated in separate sections and in the case of the later two main concepts will be briefly discussed in order to give you, the reader, an overview of these important and useful topics. In order to further develop your literary criticism skills you are encouraged to read more on epistemology – or why not take a course in philosophy of science?

Subject knowledge

Here two forms of knowledge will be contrasted. These are formal knowledge, gained from structured experience (university, work, etc.), and everyday knowledge, gained through induction from a few instances of experience. The difference really is the context in which the knowledge and skills are learned and whether the "experiment" from which data is collected can be duplicated by another person.

No one comes empty handed to their first literary criticism. If you do not possess deep formal knowledge of the subject area, you will anyway have some inkling of where to start because of everyday knowledge. Remember though that everyday knowledge, although it can tell you where to start, is almost always wrong in the details. The world is so much more intricate than our everyday knowledge might suggest.

If you are writing your literature review you should pose yourself the following questions:

- Is the result presented in the information source reasonable?
- How does it fit into what I already know?
- Is there a different way to interpret the results, data, etc. than the one presented?

The list can probably be expanded or each point made more precise, but the most important thing is that some sort of reflective activity is present when reading and thinking about information sources. So make up your own plan, use the one presented here or use another, but *do* have a plan for how you aim to use your subject knowledge in your literary criticism. The enthusiastic reader will now give some thought as to how he/she will handle these problems when reading *this* text.

Epistemology – theory of knowledge

In everyday speech it's common to hear someone say: "I think that…" or "According to my way of seeing things…" Comments such as these have no place in scientific tradition. Truly objective knowledge may be impossible to achieve, but let's for arguments sake take the idealized standpoint that it is attainable within the realm of science research (at least as an approximation of the results of its activities). In science we try not to give in to speculation or personal fancy, but use objective methods for determining the building blocks of our knowledge. This being said one can always argue that all interpretations of data are inherently subjective. The important thing about science is that someone else should be able to arrive at the same conclusions if they have access to the same knowledge and data to analyze.

Within the framework of *good* science one strives to achieve three basic criteria: *reproducibility, completeness* and *objectivity* (Bock and Scheibe, 2001). In relation to literary criticism these three criteria give rise to as many questions, which should all be reflected upon.

1. Does it seem plausible that someone else would be able to reproduce the experiment/research that forms the basis for the evidence presented in the article/book/report?
2. Does it appear that the author has presented all the conditions that affect the results of the study? Without this, the criterion of reproducibility is not fulfilled either.
3. Is the author in some position of bias? In other words: are there any possible hidden agendas that affect how the results are presented?

As a student at a technical university one is introduced to a scientific tradition governed by the natural sciences. This is seldom contrasted to the distinctive character of

technological science. Scientific knowledge is experimental and based on empirical data (Flick and Lederman, 2004). Concerning this knowledge it is important to remember that even though our models are very good at predicting events in nature we still do not have *a priori* insights into the actual nature of these events and their constituents (Hofweber, 2004). For example, we cannot know what an electron *is*, except that it behaves in ways that affect our measuring equipment in specific ways. Flick and Lederman (2004) describes this as:

> […] scientific concepts, such as atoms, black holes, and species, are functional theoretical models rather than faithful copies of reality.
>
> (Flick and Lederman, 2004:305)

One of the most important differences between natural and technical science are the objects of study within the discipline. In science of technology the object of study is also the desired result, some manmade product. The design and creation of the study object is a part of the project. When analyzing texts in the field of technical science it can be important to keep in mind that the objects of study are specified by their *functional* and *category specific properties* For the natural scientist this can seem strange and is closer in method of study to the social than natural sciences (Hansson, 2007).

In the field of technical science one can therefore accept an argument of why a product is successful based on personal preferences of a number of users, a method of inquiry which is not used by and alien to the natural sciences. Therefore a technological scientist might want to add a couple of tools from social science to her or his toolbox.

Bock lists four types of knowledge in his book *Getting it right* (Bock and Scheibe, 2001). These are:

- **Speculative knowledge:** that is made up of fancy and dogma, simply not a category of knowledge we want to be using in our science.
- **Presumptive knowledge:** that can be said to contain more well-founded fancy. In this case we are dealing with *axioms, laws* and *assumptions*. Knowledge within this category is regarded as universal truths. Typical for this type of knowledge is that it is often taken to be true because it makes no sense to be false.
- **Stipulative knowledge:** can be split into the subsets *fact, convention* and *definition*. The knowledge in these sets is considered to be true since active participants within the area of study have come to conclusions concerning them based on scientific methods without finding any contradictions.
- **Conclusive knowledge:** is often based on statistical evidence. Within this category the really big contributions to science are to be found, but they are often based on the elements of presumptive and stipulative knowledge. In this way, whether a theorem (conclusive) is true or not depends on a number of axioms (presumptive).

It can be of great help during a literary criticism to think in terms of knowledge categories. If, for example, an author's logical arguments are flawless one must always also analyze the basic building blocks that make up the knowledge that is used in the conclusions. The basic building blocks can either be made up by highly debated data or widely accepted facts. Remember that the term fact has different meaning in

different traditions, ranging from always true to always under debate. In this text the view will be held that there is always reason to question accepted “fact”, but not to a point where nothing is true (pure skepticism).

If the author has based his or her reasoning on empirical data collected in study you should critically discuss the method by which this was done.

In the book *Varför vetenskap?* [Why science?] (Bjereld et al., 2009) the author describes two different classifications of data collection methods. These are *qualitative* and *quantitative* methods of research. Within the natural science praxis one almost never use the qualitative methods and the converse can be said for social sciences where almost only qualitative methods are used. Less experienced researchers with a strong devotion to one of the two methods tend to describe the other in almost caricature form (Bjereld et al., 2009). The conscientious researcher should not reject any method of inquiry on such loose grounds as personal fancy among peers.

Quantitative methods: try to describe hidden patterns between different categories of phenomenon. This is done by answering the questions “how many”, “how much” or “to what degree” and expressing them in numbers subject to statistical analysis. **Qualitative methods** on the other hand are a collection of methods that have in common the fact that they are not quantitative. Examples of qualitative methods are interviews, participating observations and field studies (Bjereld et al., 2009).

Qualitative studies can give insights into the reasoning of individuals while quantitative methods can tell you how a lot of people have chosen to act. The qualitative method can tell us about thinking individuals while the quantitative method tells us about people. Since it’s hard to ask an atom, black hole, etc. questions qualitative methods are not useful in natural science. In science of technology on the other hand

one can benefit from research on how an individual (for example the end user) interacts with the product of the project.

Ways of communicating science

Within science, technology and medicine, the communication of knowledge is mainly done via journal articles. After that comes conference proceedings and communication through books is not common at all. In the social sciences books are much more important.

This means that we can have some expectations on which types of publications we should find. This can be of help when validating our information sources. This will be illustrated by an example.

Suppose that you've found a piece of scientific information in your course literature, or a similar book. If you cannot find a single article published with this information you should proceed with caution. This is because a journal article has almost always gone through a more scrupulous peer review process than that of a textbook. Sometimes it can be positive to gather articles that oppose your claims that are poorly written and contain methodological errors in order to contrast them to your own excellent work and thus strengthening your argumentation.

Here are some things to think about concerning communication channels in science when analyzing your literature:

- **The author:**
    - What do I know about the author?
        - Personal dispositions
        - Education
        - Political orientation
    - What organization does the author work for?

        - How does this affect how the findings are presented?
- **Journal:**
    - How are the journal articles reviewed?
    - Who does the reviewing?
- **Conference proceeding:**
    - Who is the sponsor of the conference?
    - Who are invited to give a talk?
    - How are they linked to the sponsor?
    - Who were not invited (that maybe should have been)?
- **Web site:**
    - Who sponsors the web site?
    - Might there be a hidden agenda?
- **Oral information:**
    - What is my relation to this person? How do I feel about her/him?

In this part of the validation process it might seem like one has to become some sort of conspiracy theorist and this is not far from the truth. *No* information can be taken at face value.

Always remember to check how old the information is. What was accepted as true in the past might be highly disputed today.

Another important thing to remember is to look at how many times your reference has been cited. If it has too few this can indicate that the foundation of the result presented can be weak. In some databases (for example Scopus, Web of Science and Google Scholar) one can see how many other texts indexed in the database cite the reference at hand. This can be a useful help when determining the validity of a source.

TO MAKE AN ARGUMENT

In the book *Craft of Research* (Booth et al., 2008) Booth et al. give a systematic description of and theory for the process of argumentation. They say that the question one must answer when making an argument is:

1. What is my **claim**?
2. What **reasons** support my claim?
3. What **evidence** supports my reasons?
4. Do I **acknowledge** alternatives/complications/objections, and how do I **respond**?
5. What **principle** makes my reasons *relevant* to my claim? (We call this principle a **warrant**.)

(Booth et al., 2008:109)

The warrant described above can be thought of as a bridge between that which is claimed and the reason why the claim is made. This can be compared with Kuhn's views on science.

In his book *De vetenskapliga revolutionernas struktur* [The Structure of Scientific Revolutions] he gives reasons for questioning the view where science is taken to be the ultimate arena for free thinking. He says that normal scientific work is carried out and governed by a controlling *paradigm.* This paradigm decides which problems are to be attempted and even the conceptual tools with which the attempts at solving them should be made. An example of this is the transition from classical Newtonian mechanics to relativity theory. Before Einstein one simply did not discuss the idea that time could be relative (at least not very loud) but now this is common practice for physicists. The transition from classical to new physics lead to a *paradigm shift* in the subject field (Kuhn et al., 2009).

Kuhn writes that the paradigm gets its value through being more successful than its rival systems of thought in solving

some problems that the scientists in the field find to be fundamental (Kuhn et al., 2009).

This all taken together means that arguments in our texts will to a great extent be governed by warrants which in turn are guided by the paradigm. This should be considered every time an author makes a claim in a text (like now) both so that we remember to reflect on the validity of the arguments and also so that we won't reject an argument straight off just because it does not fit into the paradigm of our field.

STRUCTURE OF A LITERATURE REVIEW

Abstract

The main purpose of your abstract is to capture your reader. It will often determine whether your article will be read or not. Remember that people in today's society have little patience and you need to think of capturing the individual person. Therefore think about:

- Who will read this text? Adjust your language and explanations to the intended reader.
- Why should this person read my text? What are your most interesting results and conclusions?

Remember to be precise and brief, but not boring! To identify and visualize your reader, think of someone you know that matches the characteristics of your intended reader. For example if you are writing a popular science article maybe you can try writing for a younger sibling.

Introduction

Here you should present your work and the reasons for it. You may be a little bit more personal here. Tell the reader

why you first became interested in the problem (maybe some enthusiasm will rub off). Explain why your work is important.

Background
Here you give the background information so that your reader is ready to understand what you've done. You also make your arguments ready for the discussion of your conclusions.

Results
Here is where you put your collected data if the literary review is a part of a larger research project.

Discussion
Here you tie all your arguments, that you've gathered in order to answer your initial question, together. Don't forget that all literary reviews benefit from having a question needing an answer although many are just a summary of the research up to the present. In the databases a literary review is often called a review article.

STUDENTS OWN NOTES:

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FINALLY

I would like to thank Göran Hamrin, Roger Bishop and Mikael Danielsson at ECE/KTH for reading and giving feedback on the text.

Thanks also to Therese and Pippirull for reading and feedback.

To my students: please give feedback on the text!

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