

Chapter 4

Developing Your Literature Review



Abstract This chapter covers your literature review. The first topic is related to finding the right references. We discuss how broad and how deep you should be reading to explore the literature in your field. You get tips for finding references. After the part about finding the references and reading them comes the topic on how to process the references. We encourage you to start writing as early as possible. An example of something you can start writing after reading your first paper, is a short summary, together with a discussion of the paper, and some questions to discuss with your supervisor. In this way, you can shape the literature review report in an organic manner. Students often ask: “When am I done with reading for my literature review?” We analyze this question, and identify when you are ready to finalize your literature review. But behold, you are never “done” with reading, and we discuss the importance of keeping up-to-date with the scientific output in your field of study. Finally, we discuss briefly how you can turn your literature review report into a dissertation chapter or into a journal paper, depending on which format your institution requires for graduation.

Keywords Literature review · Literature survey · State-of-the-art · Academic reading · References · Reference management

4.1 Introduction and Learning Goals

This chapter covers the literature review, which is typically the first research activity you carry out during your PhD. By the end of this chapter you will have learned how to go from reading your first papers, to writing your literature review report, to summarizing this information into the literature review chapter of your dissertation or into a review paper.

To find interesting papers for your research, you need to learn how to browse the academic literature. You will learn how to find papers, and how your reading changes from the beginning, when you need to study your research topic, to the end, when you can engage with the scientific literature of your research topic. After reading a reference, it is important you store it in such a way that you can find it back whenever you need it. You will set up your storage protocol in an exercise.

To write the literature review report, there are a number of different ways to organize the material you have worked through. These different approaches are discussed, and specific ideas for interdisciplinary research topics are given. Finally, we discuss how you can summarize the information from your literature review report into a chapter of your dissertation or into a review paper.

4.2 Browsing the Academic Literature

4.2.1 *How to Find References*

At the beginning of your PhD trajectory [1], most likely your supervisor will give you at least something to get you started with reading. You can start your search into the literature based on the references in the document(s) that you get from your supervisor,¹ and then again look at the references in these references, and so on and so forth. If your supervisor is too busy to get you started, ask other PhD students, post-docs, and colleagues in your research group for recommendations.

Additionally, I suggest you start to browse your research topic based on keywords in search engines such as Scopus or Google Scholar to find relevant articles, see Fig. 4.1. You can miss these references if the original documentation from your supervisor follows one school of thought. If you have never used a search engine for academic publications before, contact your library staff. They often organize workshops or short trainings to teach you how to access the publications your library is subscribed to.

Another good starting point is a review paper written by an authority in your field (often an emeritus professor looking back on the past decades of research on a certain topic), or a document on this topic published by a technical committee. Look up which organizations in your field form technical committees, which of these are relevant to your research topic, and which documents they have produced. Review papers and technical documents typically include a large number of references for you to check out.

For books, I recommend you to visit your university's library and browse the available books relevant to your research. Check out these books, and then look up the references of these books. You can also use the digital tools of your library, and read these books online, but who doesn't enjoy escaping into the library to browse books and enjoy the silence, or reading a print book in a quiet corner of the library or in a café with a good espresso?

If you need to find a reference, but your library does not have access to the document, try a general search in Google. Many scholars provide PDFs of their articles on their personal webpages. Alternatively, the article can be hosted on a dedicated site such as ResearchGate or Academia.edu, see Fig. 4.2. If the reference was published not too long ago, chances are that the author(s) are still working at the same place that is listed as their affiliation on the article. You can look up the author(s) on

¹Promotor, advisor.

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Document title	Authors	Year	Source	Cited by
1 Refined finite element modeling of a damaged bridge with virtual distortion method coupling solid superelement	Liu, Y., Tan, Z., Yang, C.	2017	Mechanical Systems and Signal Processing 93, pp. 559-577	0
View abstract <input type="checkbox"/> E-Content <input type="checkbox"/> Full text <input type="checkbox"/> Related documents				
2 Growth rate dependent prediction of pile set-up and its application in driven pile foundation construction	Wang, J.X.	2017	Geomechanics and Geoengeering 12(2), pp. 86-106	0
View abstract <input type="checkbox"/> E-Content <input type="checkbox"/> Full text <input type="checkbox"/> Related documents				
3 Static and dynamic field load testing of the long span Nissibi cable-stayed bridge	Bayraktar, A., Türker, T., Tedfa, J., Kurgun, A., Erdig, A.	2017	Soil Dynamics and Earthquake Engineering 94, pp. 136-157	0
View abstract <input type="checkbox"/> E-Content <input type="checkbox"/> Full text <input type="checkbox"/> Related documents				
4 In-service condition assessment of a long-span suspension bridge using temperature-induced strain data	Xia, Q., Cheng, Y., Zhang, J., Zhu, F.	2017	Journal of Bridge Engineering 22(3),04016124	0
View abstract <input type="checkbox"/> E-Content <input type="checkbox"/> Full text <input type="checkbox"/> Related documents				
5 High frequent total station measurements for the monitoring of bridge vibrations	Lienhart, W., Ehrhart, M., Grick, M.	2017	Journal of Applied Geodesy 11(1), pp. 1-8	0

(a)

Google

Scholar Ongeveer 13.000 resultaten (0,10 sec)

Artikelen Tip: alleen in het Nederlands zoeken. U kunt uw zoektaal bepalen in Instellingen voor Scholar.

Mijn bibliotheek PDF] researchgate.net

Proof load testing for bridge assessment and upgrading
 Miftah, D., McGraw, M.G. Stewart - Engineering Structures, 2009 - Elsevier
 Bridge deterioration with time and ever increasing traffic loads raise concerns about reliability of aging bridges. One of the ways to check reliability of aging bridges is proof load testing. A successful proof load test demonstrates immediately that the resistance of a bridge
 Geciteerd door 63 [Verwante artikelen](#) [Alle 5 versies](#) [Citeren](#) [Opslaan](#)

Dynamic load testing of highway bridges PDF] trb.org
 R Cantieni - 1984 - onlinepubs.trb.org
 ABSTRACT Between 1958 and 1981 the Swiss Federal Laboratories for Materials Testing and Re-search (E1 4PA) performed dynamic load tests on 226 beam and slab-type highway bridges, most of them were concrete structures. Test procedures as well as measurement
 Geciteerd door 68 [Verwante artikelen](#) [Alle 2 versies](#) [Citeren](#) [Meer](#)

Laser-based instrumentation for bridge load testing
 PA Fuchs, GA Washer, SB Chase... - Journal of Performance of ..., 2004 - ascelibrary.org
 This paper describes the developments and application of a laser-based instrument used to experimentally load test bridges. The instrument is used to quickly and unobtrusively measure bridge girder deflections under static loading. The system can be set up in the
 Geciteerd door 49 [Verwante artikelen](#) [Alle 3 versies](#) [Citeren](#) [Opslaan](#)

Load testing of an FRP bridge deck on a truss bridge PDF] bls.gov
 S Alampalli, J Kunin - Applied Composite Materials, 2003 - Springer
 New York State has constructed a fiber reinforced polymer (FRP) bridge deck as an experimental project. The goal of the project was to improve the load rating of a 50-yr old truss bridge located in Wellsburg, New York. The FRP deck weighs approximately 80-
 Geciteerd door 43 [Verwante artikelen](#) [Alle 12 versies](#) [Citeren](#) [Opslaan](#)

Experimental load rating of a posttensioned bridge PDF] udel.edu
 MJ Chajes, DR Metz, B Commander - Journal of Bridge ..., 1997 - ascelibrary.org
 ... Load testing and GPR assessment for concrete bridges on military installations." Construction and Building Materials, 10 1016/j.conbuildmat.2010.09.044, 1255-1269. Online publication date: 1-Jan-2013. Seo, J., Phares, B., Lu, P., Wipf, T., and Dahlberg, J. (2013). "Bridge ...
 Geciteerd door 80 [Verwante artikelen](#) [Alle 5 versies](#) [Citeren](#) [Opslaan](#)

(b)

Fig. 4.1 Search for “load testing” AND bridges. Compare the results from (a) Scopus and (b) Google Scholar

Google, look for an e-mail address (almost all universities provide contact information of their academic staff), and ask them if they would be so kind to send you the article. Most researchers are happy to hear from someone conducting research in their field, and are willing to share their article with you, as well as answer questions you may have about their publication.

There are no real shortcuts to know which references are important [1], and to find the “right” references. If you start to see a certain paper referenced many times, it means that it has been rather influential in your field. To know which paper is going to be the cornerstone on which you start building your work, you need to have

The screenshot displays the ResearchGate profile of Eva Lantsoght, a researcher at Delft University of Technology. The profile features a navigation menu with options like Overview, Contributions, Timeline, Info, Stats, Scores, and Network. Below the profile information, there is a section for 'Your research' with a search bar and a list of articles. Two articles are highlighted: 'PROOF LOAD TESTING OF REINFORCED CONCRETE SLAB BRIDGES IN THE NETHERLANDS' (a Conference Paper from Jan 2017) and 'DEFINING LOADING CRITERIA FOR PROOF LOADING OF EXISTING REINFORCED CONCRETE BRIDGES' (a Conference Paper from Nov 2016). A sidebar on the right provides statistics for the user's research, including 73 articles, 100% RG score, and 39 full-texts available.

Fig. 4.2 Articles available for direct download via ResearchGate

defined your research question clearly. But in order to flesh out your research question, you need to have a good grasp of the literature in your field. You will need to explore the literature to look for open ends that require further research, and for contradictions in your field. If you find topics on which authors disagree, and can identify which piece of information they are missing to conclude their discussion, you've just found the pond of the research question fish.

I encourage everybody to read a lot. Read recent issues of important journals in your field cover to back. Read classic papers in your field. Read books and technical documents. The more you read, the more tools you develop in your mind. This advice on reading a lot does not only apply to beginning PhD students – it is a basic premise for all scholars, and it is the first step that is required for every research project. If you start with a limited understanding of the scholarly output in a certain field, and you start to do research on a topic, you risk building something on a poor foundation. In other words, you are risking the whole house to slowly sink into sloppy soil. I'm a big fan of peripheral reading to broaden your knowledge in your field.²

A final issue here is language. While the majority of scientific publications are written in English, there are large bodies of work available in other languages (in my field, especially in German). If you can, search for literature references in several languages, and explore the important journals in your field in foreign languages. Most journal articles that are not published in English include the abstract in English, and sometimes the figure captions. Even if you don't speak the language of the article, looking at the figures sometimes already gives you an idea of what the paper is about, and if you should ask a friend who speaks that language to have a look at it (I do this when I come across an interesting paper in Chinese, for example).

²My Endnote library, which I started to build in 2010, currently holds a little less than 2400 references.

4.2.2 *On Reading Broadly and Deeply*

When carrying out your literature review, you should read both broadly and deeply. You need to gain an understanding of your research topic in depth, so you should study the references that are important in your field in a detailed way. Additionally, you need to gain an understanding of a number of tangentially related problems, so you need to read across a broad spectrum of disciplines. For these publications, you don't need to read to the level of analyzing line per line, equation per equation, but you need to read to grasp a general understanding of these fields. If you are carrying out interdisciplinary research, there might be a number of topics for which you need to read deeply, and then a whole host of topics for which you need to read broadly.

In order to read deeply and broadly, it is important that you understand which publications are the key publications in your field (the papers you need to study thoroughly), and which papers require less of your mental space and focus. The key publications can be a subset of papers that your supervisors hands over to you, if you are lucky. If you have no help in getting started with your literature review, you will need to do a bit of exploratory reading before you can identify which papers are crucial for your research, and which help set the general background of the problem.

There are different ways in which we read, depending on how we interact with the academic literature [2]. I've divided the different approaches into six categories, or stages of reading:

1. **The novice:** The novice has just started to explore the scientific literature on a certain topic, or is perhaps even completely new to reading technical papers at all. As a novice, you may spend more than a week working your way through the first paper on your research topic. You read and reread almost every sentence, and still feel you don't full understand the contents. You doubt if you are qualified to do research on this topic. Hold on tight, keep working, keep scribbling down notes, and see where it takes you.
2. **The apprentice:** After being a novice for a while, you will reach the point where you finally start to grasp the research topic and learn the concepts. The energy of the apprentice still goes into understanding what the topic is exactly about, which parameters are important, and which researchers played an important role in the development of the field and/or currently shape the field. However, the apprentice has developed a basic understanding of the topic.
3. **The sponge:** Once you have gained the basic tools and understood the basic concepts, you reach the stage in which you start to absorb information like a sponge. You find yourself taking a fair amount of notes, but reading starts to be a bit faster than in the beginning. The concepts finally seem familiar to you. At this point, as you start picking up speed, you need to start archiving and building a database about the information you read, see "processing references". At this stage, when you read a paper, your focus is fully on the contents of the paper itself, in a rather narrow sense. Sponge-mode typically lasts a few months.

4. **The concluder:** As a concluder, you start to engage with the scientific literature more directly. Once your brain has taken in the information from a fair number of papers, it starts to play a more active role. You start to see similarities between a set of papers, and start to draw some conclusions from what you have read so far. The concluder-stage is a good point to start writing about your observations and conclusions in your research journal.
5. **The interrelater:** In the interrelater-stage, you start to put together information from the entire range over which you have been reading, across decades and disciplines. You start to see your own work in the light of the field or fields that you are studying. You start to see how certain tools from a different discipline can be valuable for your work. The bigger lines and schools of thought appear, and you are now fully engaging with every document you read. As a novice and apprentice, you sit and listen to a paper. As an interrelater, you sit and have a conversation with a paper.
6. **The mongrel:** Dr. Inger Mewburn³ described this stage of reading in a blog post [3], describing how with this method you simply go for what you need in a document. When you need a select piece of information from a paper or document, you can dive into it and grab what you need – quickly. If a topic is not fully the focus of your research, but interesting enough to chew through a few papers on this topic, you can scan these papers quickly and steal the good parts. Go for the quick-and-dirty approach: read the abstract and conclusions, look at the pictures, and skim through the beginnings and endings of the paragraphs to find what is useful for you. With this method, you can tear through a paper in 15 to 20 minutes. In this stage, you are more oriented on yourself and your research than on the contents of the paper itself. As an interrelater, you were sitting down and having a conversation with a paper, while as a mongrel, you barge into the kitchen of the author, munch down a big piece of cake, and leave again.

Exercises

1. Go to the library and find five books that are related to your research field. Read the interesting chapters, and look up the references given at the end of these chapters.
2. Look at the references you have collected so far. Which ones require deep study, and which ones help you get a broader understanding of your research field and connected fields?
3. Identify at which stage of reading you are. Write a short paragraph, preferably in your research journal, and discuss the following:
 - (a) How you currently are reading,
 - (b) Which preparation and/or training you already have related to reading scientific papers, and
 - (c) How you currently are analyzing the material in your field.

³If you haven't done so yet, subscribe to her blog, the Thesis Whisperer.

4.3 Processing References

4.3.1 *Storing References*

Once you have started to download, copy, and/or print references, you need to think about how you will keep your references accessible and searchable. Remember how we discussed setting up your data storage protocol in Chap. 2? Having your data structured, easily searchable, and regularly backed-up so that you don't lose anything, is just as important for your references as for any of your other documents.

How will you save your references? Will you print out each article, and save them in large binders? Having physical copies can be pleasant for taking notes, but if you move elsewhere at the end of your PhD, binders and boxes full of articles can be impractical.

If you want to keep your physical copies organized, I recommend you sort your copies alphabetically by first author in binders. Organizing hard copies by topic can become convoluted if publications fit into different categories of topics [4]. I had initially started to organize my hard copies by topic, but decided to redo my storage after having read about 300 papers. While reorganizing the papers, I could see more clearly the links between the articles, and how my research fell into three major categories (slab bridges, one-way shear, and two-way shear). The afternoon that I spent on reshuffling all papers was actually really productive, as I started to become more aware of the basic assumptions, paradigms, differences, and similarities between the different publications.

Build a digital archive of your articles. Consider how you will name your files (Title-Author-year.pdf or Year-Author.pdf, for example), and how you will keep your documents structured (for example, in subfolders per topic).

Additionally, you should build a database with your references. There are specific software packages that you can use for this purpose (EndNote, Zotero, Mendeley...) [5], see Fig. 4.3, and these tools are essential to doing research. Start building your database as early in your PhD trajectory as possible.⁴ These software tools make your database of references easily searchable by author, title, keywords, and more, and you can add your own notes to the database entries as well. Long gone are the days of making overview tables in MS Excel, lists of references in MS Word, or boxes with index cards for your references. An additional (and important) advantage of building your database of references is that these tools come with plug-ins for your word processing software, which allow you to easily insert citations and build a list of references for an article in the right output style. If you prefer to read from your hard copies, you can still use your database software to look up who was the first author of the paper you want to revise, and then locate the hard copy in your binder [4].

⁴In fact, I encourage my undergrads to start building a database of the literature.

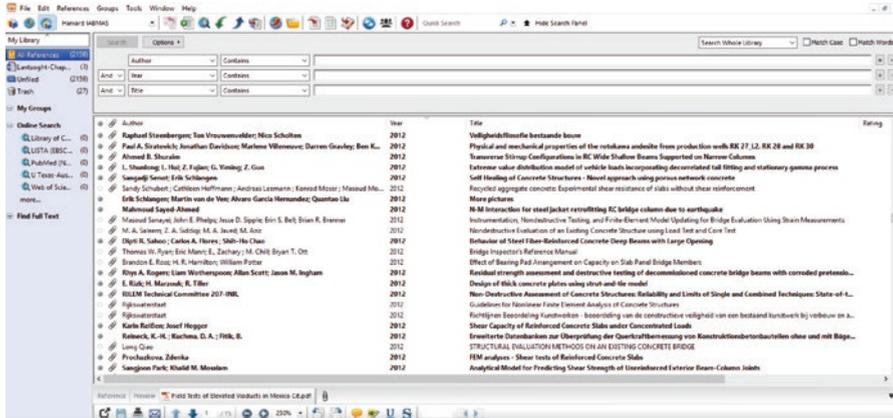


Fig. 4.3 Organizing references in Endnote. The paperclip shows which references have a digital attachment with the original publication

4.3.2 Engaging with the Literature

Don't sit down and read for months on end. Engage with the literature from the beginning. If you sit with the literature for months, it is difficult to bring material to meetings with your supervisor. Start producing short documents about the material you read so that you have something tangible showing your progress. These documents will eventually be the first building bricks of your final literature review document. Starting to write out your thoughts about the publications you read is a good way to get started with writing from the beginning. Don't wait with writing until you need to deliver your literature review report, or, if your PhD program only requires the dissertation in the end, don't wait with writing until you have reached the point in which you feel you have all the information to start delivering your dissertation. You won't have the right tools to start writing if you don't practice. Start writing as early as possible, start receiving feedback from your supervisors about your writing early, and take enough time to find your writing voice before you actually tackle your full dissertation. We'll discuss this topic in depth in Chapter 7. An excellent method on engaging with the literature is presented in "Becoming an academic writer" [6] (2nd edition), where a matrix is presented on integrating writing with reading the literature.

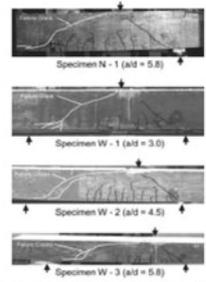
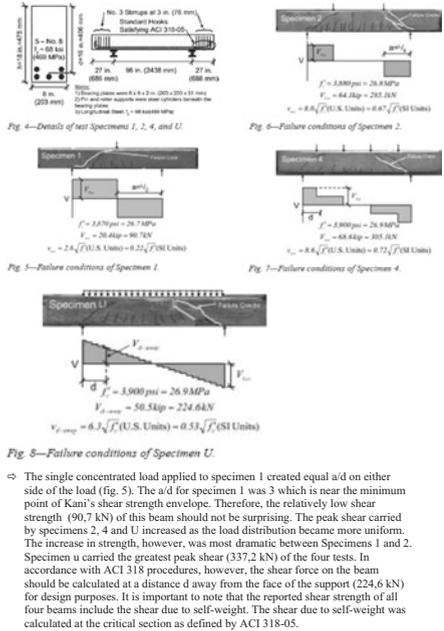
There are many ways in which you can start engaging with the literature from the moment you start reading. Here are some examples:

1. **Summary:** write a short summary of the paper you read. Include an introduction situating the paper into the general scope of your field, a summary of the material you read, and then a discussion of the material. Write down what were the main

assumptions of the research, and emphasize anything that strikes you as interesting, particular, or odd.

2. **Discussion of set of papers:** after reading a set of papers from the same school of thought, you can summarize these papers together. Alternatively, if you have read a few papers from different schools of thought, you can summarize the main ideas of each theory, and try to find the main similarities between the theories, and the main differences. Include your observations and thoughts in a separate section.
3. **Discussion of a certain parameter:** if you have looked at a number of papers reporting on experimental results, you can start to organize the material based on each parameter that was varied in experiments. Not only will such a discussion serve you to get an understanding of the literature, it will also help you set up your own experiments, and then help you analyze your results in the light of the published literature. If you think you don't have time to write the discussion just yet, or if you feel like you have not read enough on the topic yet, you can take a screenshot of the most important part of a paper on the topic, and already add this information to the document that contains the discussion of a certain parameter in the future, see Fig. 4.4.
4. **List of questions to discuss with your supervisor:** whenever something strikes you as interesting, strange, particular, or odd, write it down to discuss it with your supervisor. While you may not have time to discuss every single observation, documenting your thoughts is a good beginning to critically analyze the literature.
5. **Description of short calculation:** perhaps you find an interesting theory in paper X, and an interesting set of experiments in paper Y. Then, in a short document, you can outline how you checked the results from the experiments from paper Y to the theory from paper X. While this study technically already goes a bit further than the pure literature review, it is an essential part in going from sitting and observing the literature to actually engaging with the literature, and helps you transition smoothly from just reading to taking a step further and doing research with the available material. We will discuss other methods of engaging with the results from the literature in Chap. 5.
6. **Derivation of theory:** if you read a theoretical paper, and some steps in between the derivations are missing, you first need to assess to which level you need to understand the theory. If it is crucial for your research, you need to sit down, and do all the intermediate calculation steps. If it is a paper that falls more into the "reading broadly" category, then it is less important for you to sit and document the derivations. The same category also contains important papers with calculations: for these publications, you need to take a sheet of paper, make the calculations yourself, and see if you can arrive to the same results.

By developing small documents discussing papers, you are gradually shaping your final literature review report. When the day comes to start writing your litera-



∞ failure occurred at the side with the large a/d, direct strut action for a/d = 1,7 but authors found this surprising

Zsutty, T. (1971). "Shear Strength Prediction for Separate Categories of Simple Beam Tests." *ACI Journal Proceedings*, 68(2), 138-143.

formula: $v_c = 1670 (f_c')^{0.26} p^{0.41} \left(\frac{d}{a}\right)^{1.50}$ as a/d decreases below 2.5, the short beam arch action of load and support blocks creates strengths greater than predicted with the equation for slender beams. The easiest way to take this into account would be through a linear arch action factor given by: limit of a/d for slender beam action/short beam a/d or arch description = 2.5/a/d $\Rightarrow v_c = 150 (f_c' p)^{1/3} \left(\frac{d}{a}\right)^{1.3}$

Clark, A. P., 1951, "Diagonal Tension in Reinforced Concrete Beams." *ACI Journal Proceedings*, Vol. 48, No. 10, pp. 145-156.

∞ first to determine the position of the load as an important factor

∞ test data with small a/d < 2" the results of this study with tests under five different loading conditions show definitely that the loading condition is an important factor

Fig. 4.4 Taking screenshots and adding comments of different references that discuss the effect of a certain parameter (a/d) in the reported series of experiments

ture review, you won't be staring at a blinking cursor on a white screen, but you will have material available that you start to rearrange and interconnect to develop your full literature review report.

Exercises

1. If you haven't already done so, download a reference management software, and add all the papers you have read so far. Don't skip this step – the more papers you read, the harder it becomes to find time to sit down and do this, or worse, to find back that paper you read three months ago but of which you can't remember the first author's name.
2. Take the last five papers you read, and decide how you will interact with these papers. Either write a short summary of each paper separately, or start with a document outlining the similarities and differences between these papers.
3. Make an appointment with your supervisor to discuss the document you just wrote. If you feel insecure about your writing, find peers within your research group or department who are in the same situation, and form a supportive writing group. Get together to write, and exchange feedback on your writing.

4.4 Finalizing Your Literature Review

4.4.1 *When Have You Read Enough?*

PhD students often ask: “When am I done with reading?”[7] Let’s rephrase this question as “When am I ready to write my literature review report?” The answer to the first question is, obviously, never. You are never ready with reading, as you will need to stay up-to-date with the scholarly output in your field as long as you want to consider yourself a self-respecting scholar. But this does not mean that you will never be ready to produce your literature review report.

As discussed previously, you will feel yourself going through different phases of reading. Once you have reached the phase of the interrelater, you are in the right mindset to see the connections between the publications you have analyzed. If you are engaging with the literature, you move away from writing summaries of papers separately, and you move towards writing pieces that bring together a number of references. If you have reached this level of overview of the literature, you have enough material to bring it all together and write your literature review report.

Another indicator for knowing that you have read enough, is when you feel confident you have covered all the important references. Reading all the published output on the topics you are studying is of course impossible, but when you review the list of references of a paper, and you recognize the majority of the authors and publications, you have come a long way. When you read a new article, and you find yourself nodding in agreement or frowning in disagreement while you are reading, you have reached a level of understanding of your field that will allow you to write a good literature review report.

When you have read a good number of papers, and produced a few pieces of smaller writing to engage with the literature, you have had a chance at wetting your feet. However, for many PhD students, the literature review is the first large report they produce during their PhD trajectory. This effort requires a level of writing you have not needed before. If you wrote a comprehensive Master’s thesis, and received good feedback from your supervisor on your writing, you already have some good tools in your hands to go and tackle the literature review. If not, don’t despair: acknowledge that the literature review is a long and technical process. Writing a literature review is a skill you can learn. If you need further support on this topic, there are good reference books that can guide you in the process and teach you the ropes of writing a literature review [8–12], and websites like <http://www.howtodoaliteraturereview.com/> are dedicated to the topic.

4.4.2 *Bringing Everything Together*

When you feel ready to bring everything together [5], decide how you want to outline⁵ your literature review. There are a number of possible ways to organize your overview of the existing literature:

- **Chronologically:** if you study a rather narrow field, you can give a chronological overview of the main achievements in this field over time, and how the research field has developed since its beginnings.
- **By theme:** if your research is interdisciplinary (for more information, see below), you need to subdivide your literature review into smaller sections that each discuss the different topics and themes necessary for your research.
- **By school of thought/theory:** as you read theoretical work in your field, you might identify how different scholars follow different schools of thoughts, adhere to different assumptions, or have developed different theories. Organize your literature review by discussing each set of papers that focus on a single school of thought, and give a clear overview of the main standing theories in your field.
- **By type of experimental setup:** if you have looked at experimental research, you can subdivide the experiments that you read about based on the different elements or samples that were tested, and discuss similar experiments together.
- **By studied parameter:** if you have looked at experimental research, you can arrange the experiments on similar elements or samples based on the different parameters that were studied.

In a second part of your literature review, you can discuss how you have engaged with the literature. You can discuss the different assumptions, the similarities, and differences between theories. You can perhaps include your opinion in a separate paragraph, together with a discussion on how you will implement what you have learned from the literature review into your own research. If experimental results are important, you can compile a database of existing experimental work that you can use for comparison to your results later in your research. An example table of contents of a literature review⁶ is given in Fig. 4.5.

If you feel like you are not ready yet to find the right outline of your literature review report, make a mindmap to get an overview of the different topics you have read about. While making this mindmap, try to see the connections between the different topics, or identify which topics should be discussed separately. An example is given in Fig. 4.6.

If you are not a visual person, take your research journal, and write down how you currently see the literature. Just have a brainstorming session, and tell yourself (your research journal) what you have read so far, what were the main topics that you looked at, and ask yourself how you would structure this information. If you feel that

⁵Note that outlining does not work for everybody.

⁶The outline of this document grew organically – and that may be the way outlining works for you: as a starting point, but not as something that is set in stone.

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Fig. 4.5 Example literature review

writing gives you too much pressure, then use the recording app of your phone and just talk to yourself, or to your pet, or a friend while you let your thoughts flow.

For those of you who have a research topic (Topic B) that falls right in between two topics (Topic A and Topic C), or if you are combining a methodology from one field with research in another field, and there are very few references that discuss your actual topic, organizing your literature review can be a bit more of a challenge [13]. In this case, you should discuss Topics A and C separately first, without discussing your own thoughts, or without mentioning how your Topic B is related to these topics. Then, you can add a next section that is a “discussion”, in which you highlight the similarities and differences between Topics A and C, and explain how Topic B fits in there. Subsequently, you can add a next section that is a “discussion”, in which you highlight the similarities and differences between Topics A and C, and explain how Topic B fits in there. Then, you can add an “outlook” or “future research” section in which you your plans for researching Topic B based on what you learned about Topics A and C. You can find an example of an outline of such a literature review in Fig. 4.7.

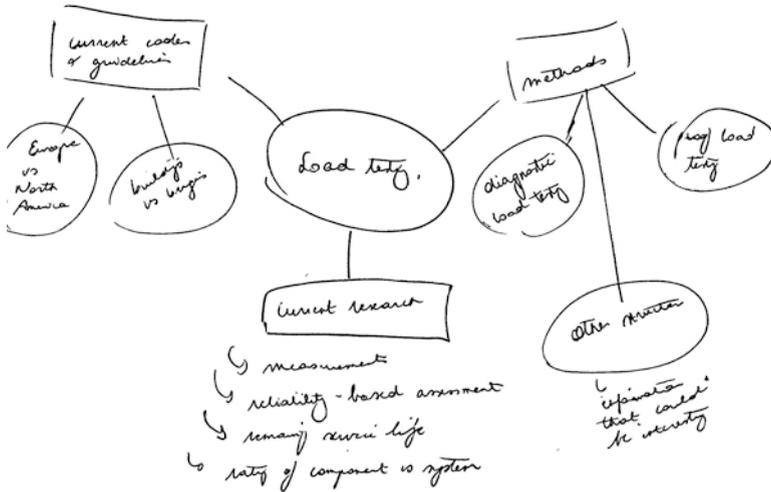


Fig. 4.6 Example of sketching a mindmap, related to the outline from Fig. 4.5

Dr. Ben Libberton, the founder of the LiteratureReviewHQ website, which is fully dedicated to the topic of doing a literature review,⁷ stresses that the literature review is a scholarly skill that can be learned, and outlines his three main tips for writing the literature review [14] as follows:

1. **Alter your perspective:** consider the literature review as a creative challenge instead of an unsurmountable task. Think of the literature review as an interesting challenge, instead of something you dread. We are free to observe the entire problem before making judgments, and we are free to step away and think.
2. **Plan more than you do now:** Planning is not just a vague exercise – outlining your thoughts is the first step of writing. Firstly you plan and work out exactly what it is you want to say. Then, when you write, you simply decide how you are going to say it. The beauty is that doing it this way, before you sit down to type, you already know exactly what you are going to say.
3. **Feedback:** Give and seek feedback at every stage of your writing. Seek feedback by explaining peers what your problem is and what you are trying to do. Giving feedback is a powerful way to improve your writing by learning from the work of your colleagues and reading it critically. By reading different writing styles and learning to spot mistakes, you will improve your own writing and your literature review as you edit the document.

⁷The website contains excellent information, but it seems like it is not being updated anymore.

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Fig. 4.7 Example of outline of literature review of interdisciplinary topic

4.4.3 Keeping Track of the Literature After Finishing the Literature Review

After finishing your literature review, you need to keep up-to-date with the scientific output in your field of study. At this point, it is not necessary to sit down for days on end and plow through dozens of papers at a time, but you still need to know what is going on in your field, and stay informed about the recent developments. While the scientific output is ever-growing, and reading every single new paper is virtually impossible, there are a number of strategies you can use to stay informed about the advances in your field [15]:

- **Use an RSS feed for your keywords.** You can use an RSS feed for a few keywords so that you get automatic updates of papers that are published with these keywords.
- **Subscribe to updates of your favorite journals.** Identify the most important journals in your field, and subscribe to their new publications through e-mail updates. Some organizations give free or very cheap student memberships, which include access to all or a part of the publications. They then send you an e-mail when the latest issue of the journal is published, granting you instant access to the latest publications.

- **Follow your favorite researchers.** Set up an account with LinkedIn, ResearchGate, and Academia.edu (you can find more about the use of these websites in Chap. 9), and follow your favorite researchers. You will receive updates and notifications when they have published new research. Do you consider all the additional e-mail as annoying and unhelpful? Then unsubscribe from the e-mail notifications, and check the websites once a week.
- **Google Scholar recommendations.** If you don't have a Google Scholar profile yet, make one now – it's very easy and fast. Once you have your own Google Scholar profile, you will see custom recommendations for new publications based on your own publication record whenever you visit Google Scholar.
- **Attend conferences.** New research is first presented at conferences, and then published in journals. If you want to stay informed on the latest tendencies in your field, it is important you attend conferences (and present your work, and engage with other researchers, of course). For more about conferences, see Chap. 10.
- **Don't forget to explore the history.** While you might be focused on keeping informed about the recent publications in your field, it is important you also keep reading more papers that were published in the past. Don't forget about the roots of your research field. You could be surprised when reading the work of pioneers in your field to find out how many useful ideas still can be found in this early work.
- **Don't just pile – read!** Whenever you find an interesting article, don't just print it and place it on a pile, or save it in a "to-read" folder. You should have some time, at least once per week, to sit and read the papers you came across. In the planning recommendations from Chap. 3 I recommended to reserve time regularly for reading. You can plan your reading session during the week, and perhaps make it a nice event for yourself by taking your e-reader or printed articles, and go sit in a café while reading and enjoying a good coffee. I currently like reading in the weekend, in the company of my cat. In the past, I set aside at least three evenings per week to read two to three papers.
- **Volunteer as a reviewer.** Towards the end of your PhD, you can be considered as a reviewer for conferences and/or journals, which is an excellent way to learn about recent research, and engage in the scientific discussion. Dr. Veronika Cheplygina [16], Assistant Professor at Eindhoven University of Technology, has the following recommendations on starting to review papers: mention your interest to senior academics, create accounts on the websites of journals you are considering submitting to or reviewing for (without necessarily planning to submit a paper any time soon), and maintain an online presence with your university page and Google Scholar (and/or ResearchGate, Academia.edu, LinkedIn).

Exercises

1. Make a mindmap of the literature you have read so far. Which areas need further reading, and which parts have you covered well so far?
2. Decide how you will keep track of the literature in the future. Set up an RSS feed, subscribe to mailing lists, or add a reminder in your to do list to search the literature at least once a week.
3. Decide when you will set aside time for reading the references you have harvested. Leave at least one timeslot in your weekly template for reading.

4.5 The Next Step: Turning Your Literature Review into a Dissertation Chapter and Journal Paper

4.5.1 Turning Your Literature Review into a Dissertation Chapter

What is your requirement for graduation: a full-length dissertation (the “big book”-style PhD thesis), or a collection of journal papers? If you need a big book style thesis, you will need to include a literature review chapter into your dissertation. If you need a collection of journal papers, each paper you publish needs a literature review section to frame the work in the body of knowledge of your field. Alternatively, you can publish your literature review as an entire paper, a so-called “review paper”. This subchapter focuses on writing a chapter in your dissertation, whereas the next subchapter focuses on writing a review paper.

If you need to write a literature review chapter for your dissertation, the challenge lies in taking your information from the literature review report, and condensing it into an overview of 10–20 pages. A literature review chapter is a summary of the literature review report, and can refer to this report for further details. Compare the outline of Figs. 4.7 and 4.8: the general outline of the chapter follows the outline of the report, but the information is more condensed. In your literature review report, it is generally accepted⁸ to use printscreens of figures from the different literature sources you read. In your dissertation chapter, however, you will need to redraw and reinterpret the most important figures, so that the quality is high enough for printing.

⁸When in doubt, ask your supervisor, library, and/or office of academic affairs.

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Fig. 4.8 Example of literature review chapter in dissertation

4.5.2 *Turning Your Literature Review into a Journal Paper*

When your requirement for graduation is a certain number of journal papers, you can develop a review paper as you get closer to graduation. While review papers are usually written by an authority (an emeritus professor looking back on the past decades of work in a certain field), writing a review paper is not impossible. I would not recommend that the first paper you write is a review paper, since writing a review paper requires writing with authority about your topic. You can tackle this challenge towards the end of your PhD. Alternatively, you can coauthor the paper with your PhD supervisor, and ask for his/her critical input and guidance on your review paper, so that you can submit a well-written draft that brings together the major important thoughts and theories from your field of study. Even if your requirement for graduation is a big book thesis, I would recommend you to develop the literature review chapter from your dissertation into a journal paper [17]. From the overview in Fig. 4.8, I developed a review paper on the existing theories for one-way and two-way shear, their similarities and differences [18], as well as a paper about the database of experiments I collected from the literature, with some additional calculations [19].

To write a review paper, you have to go a step further than summarizing your literature review report. You need to make sure you have something new to say, or something that warrants publication. A collection of discussions of papers you read is not enough. If your research is interdisciplinary, you can discuss the main ideas in the fields you study, and then provide a discussion on how these fields can be combined, and how you see the convergence or divergence between the fields. If you engaged with the literature by compiling a database of experimental results, by analyzing the effect of a number of parameters, or by comparing experiments to predictions according to a certain theory, then you can show this analysis in a paper. Granted, such an analysis is already one step ahead of an overview of the current literature, but it does not involve your own experiments or modeling yet, and it flows right out of the results from your literature review.

4.6 Summary

In this chapter, we covered the process of the literature review: from reading your first articles, to writing your dissertation chapter about the literature and/or writing a review paper. You've learned how to find references, and how your reading changes as you gain more understanding of your research topic. We've discussed what to do with your references in terms of storage and engaging with the literature. Then, the question "When am I ready to write my literature review?" is discussed: we've seen how you can bring everything together into a literature review report, and how, after finishing the report, you can remain up-to-date with the scientific output in your field. Finally, we discussed how to develop the literature review chapter for your dissertation, and how your literature review can serve as a starting point for a review paper.

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