

A Systematic Review Heuristic to Literature Review

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Abstract. This article explores a systematic review heuristic to develop literature review that is to be used in scientific publications. A heuristic is a method to solve a problem, and is usually informal including intuitive judgments and educated guesses. A heuristic is intended to lead to the best possible answer, implying that there is no single answer. Literature reviews must be written with an aim in mind. A literature review for scientific publications is intended to position the author's contribution to a field of science. We explain that a heuristic to create a literature review would differ from one used to solve a number-based logic placement puzzle, like Sudoku. In comparison, both require intuitive judgments and educated guesses. But a literature review does not have one outcome, but is the foundation of a research process and is constructed of sources of various quality and relevance.

Introduction

Literature review is a required part of scientific publications. The aim of the literature review in a Masters or PhD thesis will be to express broad knowledge of the field of study, and recognition of all relevant prior work. However, in a scholarly publication, such as a journal article, the aim of the literature review is to position the author's new contribution to the scientific field. This article presents a heuristic for the development of this type of literature review. First, in the next section we present some former work on creating a literature review. Second we make analogy to logic based number placement puzzle to compare this

approach to one used in scanning large data sets. Last, we explore an evaluation heuristic, based on an evidenced based approach to literature review design.

Former Work on Literature Review

As stated in the introduction, the purpose of the literature review in the scholarly article is to position your unique contribution. That is sources are selected to present a heuristic, a model or theory in the given research paper. These usually present only the relevant and lead research in a selected field. The references are organized logically and not necessarily in chronological order. The important contributions are presented by avoiding repetitive sentence structure, such as stating throughout an article, “Author-A and author-B (1999) did this” and “author-C and author-D (2003) did that”.

The approach to doing literature review is most commonly divided into two activities, that of selection and evaluation. Hart (1998, p.13) defines it as, “The *selection* of available documents (both published and unpublished) on the topic, which contain information, ideas, data and evidence. This selection is written from a particular standpoint to fulfill certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective *evaluation* of these documents in relation to the research being proposed.”

In the initial phases of the literature review one may read broadly on a topic. The review is a presentation of relevant points from relevant documents, and as such must relate to and explain your research topic. The field of Information Systems has been criticized for having few theories and examples of quality literature review. (Webster and Watson, 2002) To support theory a methodological analysis of the literature to determine quality is recommended by (Barnes, 2005). He and others suggests the quality of the source is determined by factors such as: the validity of the study, the reliability of results, is the sourced by others and has generated new studies, and the source enables validation of original theories. (Barnes, 2005; Ngai and Wat, 2002) Straub stresses that results are repeatable through validated instruments. (Straub, 1989) Further, he states that the literature review should build on a solid theoretical foundation that assists the practitioner. Finally, (Ngai and Wat, 2002), prescribe that the literature review should aid in the selection of the methodology for the study. It should support the researcher to compare other research methods, why they are better or worse to a newly proposed method.

The development process may begin as concept centered. Bem (1995) suggests that many reviews are just lists of citations and this detracts from meaning because such listings do not relate to the present researchers storyline or plot. It is important to keep in mind that an exhaustive list of all prior research is not needed to begin with your own. To present a new concept, the literature review only needs to provide a foundation to legitimize your research and to

contribute to its validation. Lastly, the review of relevant literature may be presented throughout an article, and so not confined to a “literature review” section. We will also present relevant sources throughout this article.

Research Method

This article proposes a general heuristic for literature review. By the meaning of “heuristic” we do not test any single model. Our method follows a critical rationalism philosophy, which is the design process of building a “literature review” does not contain absolute certainties, but indicators for best outcomes. Through our literature review and discussion we present a comparison of logical approaches to “literature review” design that can be studied, explored, and tested in further research in the field of Information Systems. We suggest this discussion may be used to develop new exploratory questions.

Heuristic for Information Seeking

In a later section we will emphasize the importance of effective evaluation technique for critical appraisal in literature review. Here we describe the prior step of information seeking or scanning that is necessary to make initial selection of sources. Although tools such as search engines like Google produce large recall sets on keywords, the precision of searches are difficult to determine without actually reading the sources. However, the researcher must perform “scanning” in the earliest phases. At this initial phase it is advisable to have in mind the type (level of publication) and scope of literature sources that are sought to support the central concept.

In the step before critical appraisal of the source, a strategy is needed to reduce the data set. We make an analogy to the solving of a number puzzle like Sudoku, to communicate a strategy for scanning of large result sets. We do not however, propose to use Sudoku to analyze scanning strategies.

Sudoku is a number puzzle that uses logic based technique for resolution. The typical grid uses 9x9 spaces (although other variants such as 16x16 are allowed). The 9x9 spaces are made up of 3x3 blocks or regions. The modern 9x9 puzzle was invented by an American architect, Howard Garns, in 1979 (Galanti, 2008) The word itself is an abbreviation of a Japanese phrase meaning that only one number can appear in a given place. The basic rules include that a number from 1-9 cannot be repeated in any row, column or block. This implies, there is only one correct solution. The strategy for solving the puzzle is to use techniques of scanning and analysis that includes “candidate elimination” and “what-if” analysis. By eliminating what cannot go in a space, it can be deduced what can go there. The “what-if” approach means to try one of two candidates, and to backtrack if the tried candidate does not work out, such as a basic rule is violated. The techniques for solving the puzzle are the same regardless of the grade of puzzle: easy, medium or difficult. The difficult puzzles apply more difficult

reasoning, such as since x cannot go there, then y is the only thing that can go there.

5	3			7					5	3	4	6	7	8	9	1	2
6			1	9	5				6	7	2	1	9	5	3	4	8
	9	8					6		1	9	8	3	4	2	5	6	7
8				6				3	8	5	9	7	6	1	4	2	3
4			8		3			1	4	2	6	8	5	3	7	9	1
7				2				6	7	1	3	9	2	4	8	5	6
	6					2	8		9	6	1	5	3	7	2	8	4
			4	1	9			5	2	8	7	4	1	9	6	3	5
				8			7	9	3	4	5	2	8	6	1	7	9

Figure 1. Sudoku example, Source: Wikipedia (2008)

While the point here is not to be able to solve Sudoku puzzle, we wish to make a comparison with information seeking for literature review to demonstrate scanning logic that is independent of the content (of any particular literature review). In Sudoku there are:

- Basic rules, and if a number is guessed without checking against the basic rules, then there is only a random chance of solving the puzzle.
- One must sometimes know what cannot go in one place, to deduct what must then belong in another place.
- One must scan the field and look for combinations, guess, try and back track if the guess was wrong.

In literature review these points are similarly relevant:

- There are many possible solutions, but still you may look for basic organizational structures around the theoretical statement such as: chronological, trend related, thematic, methodological, currency, standardized methods, etc. It is a good idea to look for theoretical “rules of thumb”.
- One of the motivations of literature review is to discover what you do not know. You can begin searching from a known concept, model or theory, while assuming there are no absolute truths.
- In literature review, you must scan a field, and select to read relevant works. Usually this involves reading some of the work, and assess relevancy of work for basis of your further work. Eventually when

relevant concepts are recognized, it can lead to depth searches instead of breadth searches. This technique of following trails of references from one article to another can improve a researcher's knowledge on a particular topic and improve their ability to be able to use the information in another problem area. In the Bloom taxonomy of learning this is the ability to synthesize and evaluate information. (Bloom, 1956) The ability to relate references back to your own research is the primary goal. The in-depth search is more beneficial after a testing of the breadth of the field.

After the phase of information seeking, the next phase of evaluation or critical appraisal of the quality of the information is needed.

Heuristic for Systematic Review

Sources of academic research will vary in degree of quality and relevance towards the research question. The Information Systems community is also composed of a broad spectrum research methods. It includes broad theoretical basis, various approaches to synthesizing information and disseminating information to practitioners. Sources of information may include independent trials or reliance on sources of expert opinion. All sources will vary in terms of quality, bias and validation. One may point out there is a pressure by a partially non-academic community to rely sometimes on anecdotal data to make decisions. That is practitioners can be driven to use incomplete information in decision making by the need to deliver on time and within budget. But, even academic research is challenged by expanding volumes of literature, and a need for effective evaluation.

The field of medicine has been particularly notorious for a large literature corpus; noting over 2 million articles published each year in over 20,000 biomedical journals (Mulrow and Cook, 1998). Atkins and Louw (2000) have recommended that an evidence based practice of critical appraisal of literature that is currently applied in health sciences should also be applied in Information Systems research. They claim, "IS professionals are concerned with the effective use of resources and are faced with a bewildering amount of conflicting guidelines and statements of best practice. Consequently, there is a real danger that critical decision may be based on incomplete or untested "knowledge" and that considerable effort may be invested in re-inventing, if not the wheel then certainly, the internal combustion engine."(p.40). Atkins and Louw (2000) propose a comprehensive infrastructure is needed in the field of Information Systems to support an evidence based approach to research.

Atkins and Louw propose (2000, p. 41):

- a) An appropriate systematic review methodology.
- b) Critical appraisal guidelines.
- c) A recognized coordination mechanism.
- d) A library of accessible and maintained databases of: current reviews, on-going review, review updates
- e) Validated and appraised good quality studies
- f) A strategy for creation of usable practice guidelines.

While all of these infrastructure elements are needed, many of the elements are not in place in the field. The authors give example of another framework that is maintained within the field of health by the National Health Service Centre for Review and Dissemination (NHSCRD), The Cochrane Collaboration. The NHSCRD provides a framework that aids researchers in finding quality studies. They indicate a “hierarchy of evidence” that weights studies on criteria such as randomization, cohort studies, comparison studies and expert opinions. (CRD, 1996) Such a hierarchy would be used to produce systematic review of research. While several “IS hierarchy of evidence” could be developed, based on different IS research questions, they will at least be different from those used in health sciences. It would therefore be useful for the IS academic community to develop appraisal guidelines that give consistent and non-biased review of research design. Secondly as indicated by several points in the above list, a well managed and commonly accessible database of reviews is needed. Universities with ties to health science, like Massey University in New Zealand have been interested in such initiatives. They have recommend development of interest groups that would develop methods used in systematic reviews process, and specific collaborative groups to maintain a corpus of reviews on particular themes. Such themes, we imagine, could be: e-government, systems design, and change management.

This leaves us also with a difficult question: how can the individual IS researcher apply a systematic review approach to literature review while a holistic framework does not exist? We suggest the following approach.

- First the researcher should examine the taxonomy of methods used in IS research. An IS taxonomy is outlined in (Järvinen, 2004, p.10). The research method appropriate to your research question should be identified. Depending on the specific topic there may be a great body of preexisting studies or it may be a relatively new theme within a field. As an example, there may be a great number of case studies on e-government in the area of e-services, while there may be few published studies on e-participation. Several international resources (databases of journals) exist and the Association for Information Systems is a good starting point (<http://home.aisnet.org/>). Another meta-resource is Google Scholar (<http://scholar.google.no/>).
- Second, the researcher should try to develop their own “hierarchy of

evidence” if one cannot be found to preexist in their research area. An example of a “hierarchy of evidence” can be found in (CRD, 1996). Whether your research is based on theory-testing, theory-creation, conceptual analytical approaches, innovation building or evaluation or mathematical approaches, all of this will determine the type of study that one finds valuable. For example, in certain empirical studies, a source using a qualitative comparative analysis may be ranked higher than one using a formal statistical method. The researcher must decide the type of study that validates the research question.

Source Type	Source Description
Randomized trial:	I Well-designed randomized controlled trials
Other types of trial:	II-1a Well-designed controlled trial with pseudo-randomization
	II-1b Well-designed controlled trial with no randomization
	II-3 Well-designed case-control (retrospective) study
Cohort Studies	II-2a Well-designed cohort with concurrent controls
	II-2b Well-designed cohort with historical controls
	II-2c Well-designed cohort (retrospective study) with concurrent controls
Comparisons	III Large differences from comparisons between times and/or places with and without interventions
Expert Opinions	IV Opinions of respected authorities based on experience; Descriptive studies Reports of expert committees

Table 1. An Example of a Hierarchy of Evidence, Source: CRD (1996)

- Third, the researcher can also attempt to identify critical appraisal guidelines. Atkins and Sampson (2002) give an extensive review on former work on guidelines used to conduct high quality interpretive research. They claim that the set of criteria are often in the form of a checklist that can be used to assess a piece of research. While many checklists exist for quantitative studies like clinical trials and cohort studies. There are fewer such guidelines for qualitative research. An example of one guideline that is presented is in Table 2 (Greenhalgh, 1997). Other kinds of guidelines have been developed for other types of research. For example, McKay and Marshall (2000) provide a set of guidelines for the conduct and appraisal of action research.

Guidelines

1	Did the paper describe an important clinical problem addressed via a clearly formulated question?
2	Was a qualitative approach appropriate?
3	How were the setting and the subjects selected?
4	What was the researcher's perspective, and has this been taken into account?
5	What methods did the researcher use for collecting data, and are these described in enough detail?
6	What methods were used to analyze the data, what quality control measures were implemented?
7	Are the results credible, and if so, are they clinically important?
8	What conclusions were drawn, and are they justified by the results?
9	Are the findings of the study transferable to other clinical settings?

Table 2. Nine Guidelines for evaluating qualitative papers, Source: Greenhalgh (1997)

Atkins and Sampson (2002) go further and analyze practical guidelines for actually undertaking case study research. Our three points related here are intended to outline a generic but nevertheless “systematic review approach” to literature review design. We believe that even a self designed systematic approach can aid the researcher in evaluation of the best sources for literature review.

Concluding Remarks

This article suggests a simple and general argument for how to approach literature review design, in essence a heuristic. It is a heuristic because we can see no strict strategy for all of IS research. This article noted that the field of Information Systems is broad in the type research methods used, and that some research is valued as based on its applicability to a practical domain. Therefore there are many types of resources that must be evaluated. The literature review can be examined in two activities that may take place nearly simultaneously: the first phase is scanning or information seeking and the second phase is source evaluation. We recommend a technique for scanning that is independent of the content. Then we suggest, evaluation of the content is best approached by first identifying the type of research method that will be used. Appraisal guidelines may then exist within the category of the research theme. Finally, organizations such as AIS could serve as future resources for review databases. Managed and publicly accessible review databases would be a great resource for IS researcher.

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