

Crowding perception: A case study of developed systematic literature review procedure with multiple software programs as management and synthesis tools

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Abstract

The aim of this paper is to presents a case study that implements a proposed procedure for conducting a systematic literature review (SLR). The case study is in the field of crowding perception. Following the traditional data processing model, the proposed procedure consists of seven stages: 1) planning the review, 2) conducting the review, 3), organization and preparation for synthesis, 4) actual coding, 5) data extraction & organization, 6) data synthesis, and 7) reporting the review. In addition, the proposed procedure includes the usage of four software programs as supporting tools. The paper includes detailed steps on how each stage has been implemented to systematically review the crowding perception literature. The proposed SLR procedure and the case study presented in this paper offer an effective process of literature review. A specific contribution of this study to SLR is expanding the tools usage to include other software programs.

Keywords: Systematic Literature Review; Crowding Perception; Mendeley; NVivo; Microsoft Word; Microsoft Excel.

1. Introduction

The systematic literature review (SLR) has become a popular method to review previous studies. SLR offers researchers with a powerful tool to identify and synthesize related studies to a particular theme or subject [1]. Implementing a SLR contributes in increasing the scientific value of the review [2]. An effective SLR offers the possibility for knowledge advancement, theory development, highlights knowledge gaps [3]. However, there are several suggested procedures to conduct SLR. They vary in the number and order of the steps included in the procedure, which might cause confusions as they seem similar. In addition, recent SLR start to introduce software programs as supporting tools in managing and synthesizing the reviewed papers. This review aims in systematically reviewing the field of crowding perception. In order to do so, this paper summarizes and compares recent SLR steps in order to select an SLR approach for this study. Then, the rest of the paper will report the implementations of proposed SLR procedures to review the field of crowding perception.

2. Review of SLR process

There are several studies that implement different SLR process. However, there are three main SLR procedures that can be widely found in SLR studies. These three main procedures are presented with their steps in Fig.1.

Okoli [4] divides the process of SLR into eight steps and recommends the usage of bibliographical software to manage the references. Okoli's SLR process generally covers the steps that lead to obtain scientific review. Also, it offers the reviewer the flexibility to implement any required detailed activities under the eight steps. Nevertheless, the order of the steps tends to bring the data extrac-

tion step before the quality assessment. It is beneficial to apply quality assessment on extracted data, but the priority is the reviewed paper that contains the data. Rarely, the data extracted if they are not related to the review area. So, no quality assessment is required during extracting data. Instead, it is recommended to assess the quality of the papers and their contents before extracting the data [2, 5].

Whereas, Bandara *et al.*[5] propose SLR procedure in four phases. Also, they propose the use of reference manger software programs such as ENDNOTE and qualitative data analysis tool such as NVivo to organize the references and analyses the information. Strength of this SLR procedure is the utilization of software programs to support the review process. A second strength is the recommendations for detailed activities. For example, under phase three that concerns the coding and analysis, Bandara *et al.* [5] provide a discussion on approaches, such as inductive and deductive, to code the literature. However, the four phases of this SLR procedure do not include a planning phase. The planning phase is an essential stage in SLR as it guides the process via a review protocol [2, 4].

Kitchenham [2] proposed a disciplined steps to perform an SLR that incorporates the review activities under three main phases. This SLR procedure can be considered as a standard SLR process that might be implemented to a manageable number of papers. The needs for supporting software programs to help in managing the literature increases as the amount of papers increase. Whether the SLR covers few or a large number of papers, the use of software programs brings new steps in the process of SLR as presented by Bandara *et al.*[5].

Based on the presented comparison, this study develops an SLR procedure that integrates proposed procedures by Kitchenham² and Bandara *et al.* . The developed SLR process consists of seven stages and use four software programs as tools to organize the papers and to extract data (Figure.2).

Author(s)	SLR Steps	Tools
(Okoli, 2015)	<ol style="list-style-type: none"> 1. Identify the purpose 2. Draft protocol and train the team 3. Apply practical screen 4. Search for literature 5. Extract data 6. Appraise quality 7. Synthesize studies 8. Write the review 	bibliographical software
(Bandara <i>et al.</i> , 2015)	<p>Phase 1: Extraction of Relevant Literature Selection of Sources Search Strategy Evaluation of the "Quality" of Literature Included in a Review</p> <p>Phase 2: Organization and Preparation for Analysis</p> <p>Phase 3: Coding and Analysis Coding Literature Using an Inductive Approach Coding Literature using a Deductive Approach</p> <p>Phase 4: Presentation of Results</p>	ENDNOTE NVivo
(Kitchenham, 2004)	<p>Phase 1: Extraction of Relevant Literature Identification of the need for a review Development of a review protocol</p> <p>Phase 2: Conducting the Review Identification of research Selection of primary studies Study quality assessment Data extraction & monitoring Data synthesis</p> <p>Phase 3: Reporting the Review</p>	Reference Manager

Fig.1: Key SLR approaches

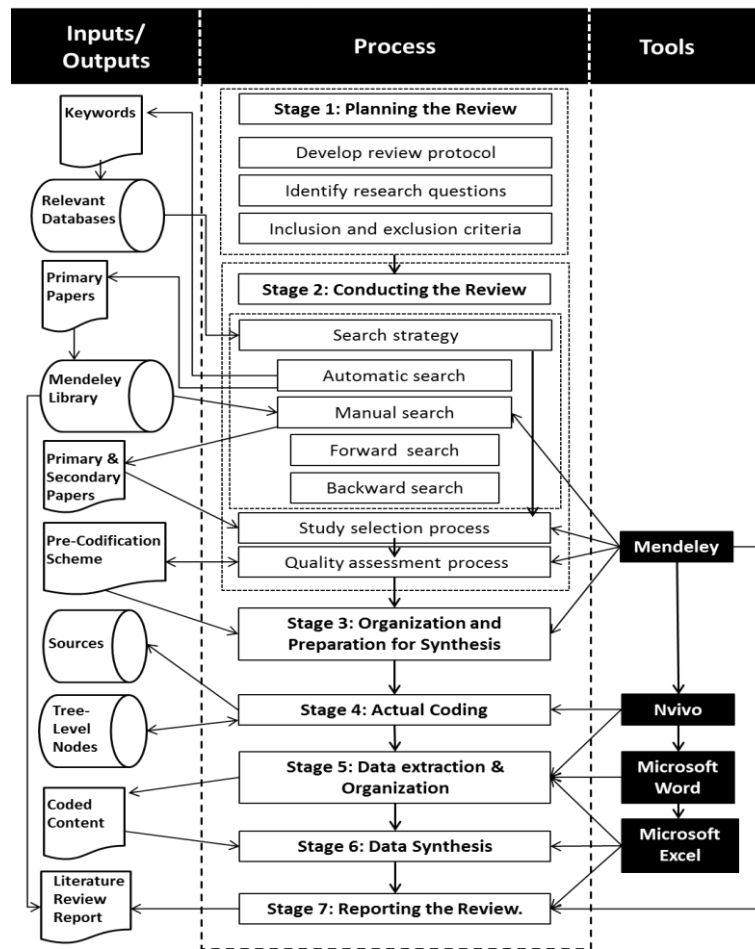


Figure.2 Proposed SLR procedure with data processing model

3. The proposed SLR stages

3.1. Planning the review

By using the data processing model, the planning stage is divided into three activities. These activities are: develop a review protocol, identify research questions, and develop inclusion and exclusion criteria. The review protocol is regarded as an important step in conducting a SLR. The goal of having SLR protocol is to minimize the research bias [3]. It covers the preparations of review questions, search strategy, study selection process, quality assessment, data extraction, and analysis of extracted data [2]. In the current study, the SLR protocol is developed within the proposed SLR procedure that is presented in (Figure.2).

The review questions are proposed to guide the SLR. In the current SLR, these questions were derived from the need to develop the conceptual model, which was used in other researches [6, 7]. Four key questions have been developed. These questions are:

- I. What is crowding perception?
- II. What are the dimensions of crowding perception?
- III. What are the most studied influential factors of crowding perception?
- IV. What are the influences of crowding perception on other factors?

An inclusion and exclusion criterion ensures relatedness of selected papers in the current study. Since this review concentrates on understanding crowding perception as well as the influential factors on crowding perception and crowding perception impacts on other factors, this review only considers studies written in English language and published in journals, conferences, and book chapters. The search duration of papers is from 1970 to 2017. The reason for selecting this period is because the distinction between crowding and density has been introduced during the 1970s by Stokol [8]. Since that time, the focus on crowding perception has been increasing. The inclusion and exclusion criterion for the current review is presented in Fig.3.

Inclusion Criteria	Exclusion Criteria
Full-text	Uncompleted studies
Published within defined period of time (1970-2017)	Not published in selected time period
Published in online databases	Duplicated studies
The language of the manuscript is English	Non English
In the field of crowding perception	

Fig.3: Inclusion and exclusion criteria for this review

3.2 Conducting the review

This stage includes three main activities. These activities are: search strategy, study selection process, and perform quality assessment. The search strategies implemented in the current review are automatic and manual search strategies.

The automatic search strategy depends on the usage of keywords (strings) related to the crowding perception. The automatic search performed via different online databases such as Thomson Reuters (WoS), Scopus and Google Scholar. More than 400 papers have been identified and downloaded. Then, they have been imported in a reference manager program named Mendeley. Mendeley library has been created to organize the downloaded papers (as primary papers). Each reference has the full text attached to it in a PDF format in the Mendeley library. In order to remove unrelated papers and duplicated papers as part of applying the inclusion/exclusion criteria, Mendeley has been used to skim the abstract and conclusion of each paper according to recommendations of Kitchenham [2]. A total of 89 papers have been removed.

After that, a manual search has been performed using the papers in the Mendeley library in order to expand the coverage of the review to include secondary papers. The manual search includes

forward and backward search approaches originated by Webster and Watson⁸. The forward search approach search papers that have cited the primary papers. The forward search implemented in the current review includes two steps: forward references titles search and forward authors names search [9]. The backward search process depends on reviewing the paper's references. This process includes backward search by references titles, backward search by authors names and search by formerly used keywords [9]. The secondary papers are identified (n=36) and imported to Mendeley library. Similar to primary papers, unrelated papers have been removed according to the inclusion/exclusion criteria.

In the process of study selection, the remaining primary and secondary papers (n=347) have been full-text scanned to remove papers that are not clearly related to the subject of this review and to the four review questions as mentioned earlier.

In parallel, a quality assessment has been carried out for each paper. The quality assessment is an essential activity to ensure the quality of papers used in this review [2]. It enhances the confidence and credibility of the reviewed papers. The quality assessment consists of instruments that can be a set of questions or check list of factors [3]. In the current review, a set of questions as quality instruments has been adapted and modified from Busalim and Hussin [3]. These questions are:

- I. Is the topic addressed in the paper related to crowding perception?
- II. Does the paper have a clear description of research methodology?
- III. Is the data collection method described in the paper?
- IV. Are the data analysis steps clearly described in the paper?

Studies that fully and partially fulfilled the quality questions have been included in the review (n=270). A total of 77 studies have been eliminated as they did not meet the quality requirements of this review.

3.3 Organization and Preparation for Synthesis

This stage concerns decisions related to what to code and how to organize and prepare for the synthesis [5]. It is a highly iterative stage to ensure a comprehensive and reliable synthesis. The decisions related to coding include the development of a pre-codification scheme. In this review, a pre-codification scheme has been developed based on the review questions, process of study selection, and quality assessments. Mendeley includes feature that allows adding tags to each paper and search the library based on the tag name. During the study selection process and quality assessments, a full-text scanned has been performed and each paper has been tagged by keywords. The keywords reflect the important contents of the papers that are related to the review questions. These tags helped in determining pre-codification scheme for this review. Fig.4 presents the core themes in pre-codification scheme of this review.

- | | |
|----------------------------------|---------------------------------|
| • Crowding perception definition | • Impact of crowding perception |
| • Human crowding perception | • Theories and Models |
| • Spatial crowding perception | • Settings of studies |
| • Socio-demographical factors | • Specific literature review |
| • Personal factors | • Research methods |
| • Physical factors | • Future work |

Fig.4: Core themes in pre-codification scheme.

A second decision related to the coding is the selection of coding tool. Although there are several software programs that are known as qualitative data analysis tools with embedded coding features such as Atlas and MAXQDA, the selected tool for this review is NVivo 10. It contains features that support the literature

review and the analysis of extracted data. A detailed discussion on NVivo advantages as a tool for literature review is addressed in many studies [1, 5, 10].

In order to prepare the papers to the coding stage, the Mendeley library has been exported (with the references full text PDF files) to Mendeley file format (ris) that is compatible with NVivo 10.

3.4 Actual Coding

Since the literature is processed as qualitative data, three approaches of coding can be implemented in this stage. These approaches are: deductive, inductive and mixed approaches. The deductive approach includes coding the content of the literature according to predetermined codes generated from coding schemes. The inductive approach generates codes based on the contents of papers. The mix approach integrates the deductive and inductive approaches. In this approach, a high-levels of predetermined codes can be entered (as first-level coding), then new codes or sub-codes can be created based on the content of the literature (as second-level coding⁵). This review implements the mix approach to code the papers under review because it provides a flexible and open coding system.

The coding stage starts by importing the Mendeley library into NVivo 10. Then, the pre-codification scheme has been entered in Nvivo 10 as Nodes. The Nodes are blank folders to codify the required information in papers. Node allow to recall all information related to a specific theme or concept from coded papers into one screen that can be exported to several file format, which includes Microsoft Word and Microsoft Excel.

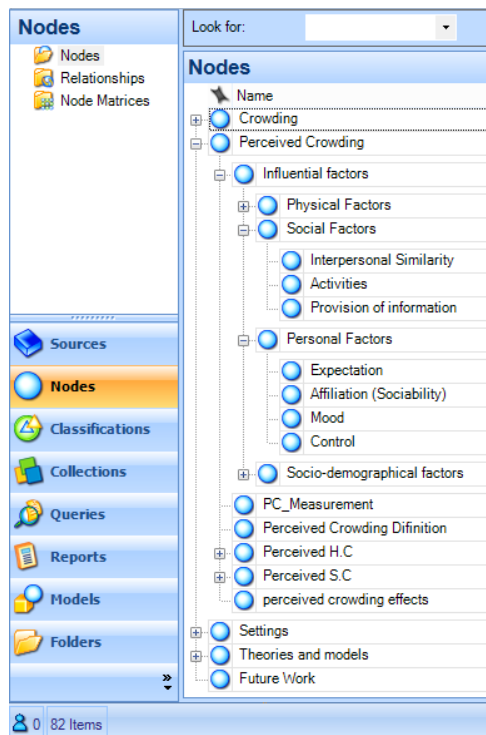


Fig.5: Nodes tree for this review

While reading through papers (n=270), the relevant texts are selected and captured in one or more nodes. Also, sub-nodes for the predetermined codes and new nodes have been created for new information in the papers that are related to the review questions of this review. Furthermore, some nodes have been merged with other nodes. The coding stage ends up with a total of 82 nodes, which are 5 main nodes and up 77 of four-level sub-nodes (Fig.5).

3.5 Data extraction and organization

This stage aims to precisely extracts and records data obtained from the reviewed papers [11]. Usually, the process of data extraction includes the usage of Mendeley and Microsoft Excel spread-

sheets to manage and organize extracted information as a raw materials for the synthesis stage [3, 11]. In this review, each Node in NVivo has been exported to Microsoft Word file as raw materials. After that, they have been organized into tables in Microsoft Word and spreadsheets in Microsoft Excel.

Extracted information related to definitions, theories, process, and importance of specific dimensions or factors, which have been discussed in literature sections in reviewed papers, have been organized into tables in Microsoft Word. A total of 14 Microsoft Word files have been created. They include 12 Microsoft Word files related to the influential factors and two Microsoft Word files for perceived safety and perceived comfort. In each Microsoft Word file there is a table that consists of three columns. These columns are authors, the extracted information, and remark (to classify the information into groups). The purpose of having these Microsoft Word files is to support the writing phase as they provide well organized information according to each theme.

Whereas, empirical studies concentrated on the impact of crowding perception and the influential factors have been organized into spreadsheets in Microsoft Excel. 5 Microsoft Excel files have been created with a total of 22 spreadsheets. Each spreadsheet in Microsoft Excel consists of eleven columns (Fig.6). The paper information in the first three columns has been obtained from the Mendeley library. The other eight columns information has been obtained from raw materials that were exported to Microsoft Word. The settings columns includes the context of the study such as retail/shopping or tourism contexts. The impact column only includes the type of impact if any, and colored red for negative impact and green for positive impact, which was assessed based on the findings of the reviewed paper. The remarks column is for the finding that supports the type of impact. The methods column includes the methodology, instruments, and sample size. The items column includes the items used to measure the factor in the reviewed paper. The notes column includes further explanations and suggestions on findings. The literature review column contains related finding or literature related to the reviewed factor presented in the reviewed paper. The Microsoft Excel spreadsheets are created to help in the information synthesis in the next stage.

3.6 Data synthesis

This stage is an important stage as it includes many activities such as aggregate, arrange, compare, and compose the extracted information [4]. These activities highlight contested findings and research gaps as well as prepare the reviewed information to the writing stage [12]. There are several synthesis approaches that can be used in this stage such as synthesis by aggregation, integration, interpretation, and by explanation [12]. These approached can be used as a mere approach or as combination of two synthesis approaches. The selection of the synthesis approach depends on the nature of reviewed studies, whether they are qualitative or quantitative studies or both [4].

The current review contains quantitative and qualitative studies. So, this review implements the synthesis by integration and synthesis by explanation, as recommended by [12]. Synthesis by integration focuses on collecting and comparing data and findings to investigate patterns across reviewed studies with mixed data methods. The synthesis by explanation concentrates on describing and discussing the contribution of the paper to the reviewed subject or to a specific set of questions [12].

These two approaches have been employed in this review to reveal counterintuitive tendencies in crowding perception studies. For example, in the Microsoft Excel spreadsheet for the impact of crowding perception, the empirical studies have been integrated by the settings of the studies. Reviewed papers have been grouped based on their settings. Furthermore, they have been grouped based on factors under investigation in the study. Then, these groups have been synthesized by explanation approach. For example, the papers have been grouped under each setting based on the crowding perception impact on the studied factor, which in-

cludes the explanations and suggestions of such impact. As a result of the two synthesis approaches, two tables have been created in Microsoft Word. The first table includes four columns, which are the study settings, the author(s), the main findings, and the methods. The second table includes three columns, which are settings, the author(s), and the findings explanations and suggestions. Applying the suitable synthesis approach(s) enhances the review outcomes in the writing stage.

3.7 Reporting the review

In this stage, the writing phase depends on reporting two aspects.

Year	Author(s)	Title	Location	Settings	Impact	Remarks	Methods	Items	Notes	L.R.
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Fig.6: Columns titles used in Microsoft Excel spreadsheets.

The first aspect is the stages and steps of the review. The second aspect is to structure the review outcomes and their theoretical contributions. In this review, five main dimensions have been reviewed (Fig..7). Therefore, the writing has been structured according to the review outcomes. It covers the crowding phenomena, crowding perception and its dimensions, the influential factors and its four domains, and the impact of crowding perception with specific focus on the impact on perceived safety and perceived comfort. Moreover, this review ends up with the development of a conceptual model that includes the most frequently studied factors in previous studies and the impact of crowding perception on perceived safety and perceived comfort.

Domain	Sub-domain (factors)	Reviewd Papers
The Crowding Phenomena	The Crowding Phenomena	28
	Distinction between Density and Crowding	15
crowding perception		22
	Perceived Crowding Definitions	7
	Perceived Crowding Measurements	14
Dimensions of Perceived Crowding	Dimensions of Perceived Crowding	18
	Perceived Human Crowding	16
	Perceived Spatial Crowding	9
Socio-Demographic Factors	Socio-Demographic Factors	36
	Gender	16
	Age	11
	Living place	4
	Education	9
	Experience	12
	Marital status	5
	Length of Stay	10
	Entry Mode	6
Personal Factors	Personal Factors	81
	Expectations	21
	Control	24
	Sociability	18
	Mood	23
Social Factors	Social Factors	43
	Interpersonal Similarity	14
	Provision of Information	16
	Activities	17
Physical Factors	Physical Factors	73
	Orientation strategies	21
	Route strategies	18
	Spatial anxiety	14
	Disorientation causes	22
	Coding and signage	13
Impacts of Perceived Crowding	Impacts of Perceived Crowding	67
	Impact of perceived crowding on perceived Safety	6
	Impact of perceived crowding on perceived comfort	7

Fig.7: Main topics cover by the review and the number of reviewed papers

4. Conclusion

The reported case study establishes the validity and applicability of the proposed SLR procedure. It systematically reviews the field of crowding perception. The paper implements a SLR procedures that were developed based on SLR steps proposed by Kitchenham² and Bandara et al. [5] . The developed SLR procedure used in this paper contributes to the current SLR in two areas. First, it offers seven stages to conduct a SLR. The seven stages include most recommended activates to ensure a quality SLR. In comparison with eight steps SLR offered by [4], the proposed SLR proce-

dure offers further detailed steps to search and extract information. The seven stages provide easy process that can be followed and implemented in other files. Second, it expands the usage of software programs as supporting tools. Specifically, it offers the use of Microsoft Word as main container for extracted information as well as to prepare the information for the synthesis and writing stages.

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