
Interaction and Navigation Modeling of Interactive Systems: A Systematic Mapping of Literature

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Abstract

This technical report presents the protocol for conducting a systematic mapping to identify the notations, approaches and existing tools that support the interaction and navigation modeling of interactive systems during the design stage of the systems development process.

1 INTRODUCTION

During the use of interactive systems, it is common to observe some users with problems when interacting with these systems, for example, when the user does not know what to do and tries to find out what your next step in the system, or when the user does not have the feedback system and does not understand the result of her/his previous action. These problems may be related to the lack of concern about the user prospects during the design stage. As much as these systems have certain features that to be effective, these may not be understood by users. Thus, it is necessary to use approaches that support the design of interactive solutions that provide a positive experience for the user. To propose the development of any approach to support the interaction modeling between the user and system, as well as the navigability, it is necessary to characterize the notations, approaches and existing tools with such purpose. For this reason, we conducted a systematic mapping about notation, approaches and techniques proposed in the literature for the interaction and navigation.

A systematic mapping of literature is a type of systematic review used to provide a broad vision of a research area and to establish whether there is evidence of research on a particular topic (Kitchenham and Charters, 2007). Unlike informal reviews of literature, where the researcher does not follow a defined process for its conduction, a systematic mapping is conducted by following a pre-established protocol. Compared to informal literature reviews, systematic mappings require higher accuracy in its conduction. On the other hand, a systematic mapping result tends to be more reliable, since it makes use of a rigorous methodology and are auditable and repeatable.

This technical report is presented the protocol defined for conducting a systematic mapping on solutions for interaction and navigation modeling.

2 SYSTEMATIC MAPPING PROTOCOL

In the following sections, the protocol for conducting the systematic mapping is presented, based on the guidelines for conducting systematic reviews proposed by Kitchenham and Charters (2007).

Definition of the goal and research questions

First, the goal of the systematic mapping was structurally defined according the GQM paradigm (Goal-Question-Metric) proposed by Basili & Rombach (1988), as shown in Table 1. In this way, it was possible to direct the systematic mapping efforts to achieve the goal specified.

Table 1. Systematic Mapping goal according to the GQM paradigm.

Analyze	Scientific publications through a study based on systematic mapping
With the purpose of	Identify notations, support approaches, techniques and tools
In relation to	The support in the modeling of interaction and navigation
From the point of view of the	Of the researchers
In the context of	HCI design

The main research question of the systematic mapping was: Which notations, approaches, techniques and/or tools are used in the interaction and navigation modeling of interactive systems?

Additionally, the study sought to answer two questions of secondary research:

SQ1. Which notations, approaches, techniques and/or tools have empirical evidence to about its support for interaction and navigation modeling of interactive systems?

SQ2. What are the interaction and navigation elements considered in the identified notations?

Search strategy of primary studies

The search scope: We performed the search in Scopus and Engineering Village digital libraries for the following reasons:

- (i) These digital libraries allow the use of logical expressions for searches or similar mechanism to find publications by title and abstract;
- (ii) They have a good functioning and scope of their search machines, evidenced in some researchers, such as the Santos (2008), Schots (2010) and Costa (2011);
- (iii) They contain in their base, publications of a wide range of areas of knowledge;
- (iv) They offer full-text retrieval of publications;
- (v) Kitchenham and Charters (2007) state that Scopus is the largest indexing database of abstracts and citations.

Language: The chosen language was English, because it is adopted by the vast majority of international conferences and journals related to the topic of research.

Definition of the search string: For the definition of the terms of the search string, we determine the parameters PICOC (Population, Intervention, Comparison, Output and Context) and terms that instantiate each parameter, when necessary (Table 2).

Table 2. Terms used to instantiate PICOC parameters

Parameter	Search terms used
(P) Population: papers published in conferences or journals reporting notation and/or languages, techniques and approaches used in interaction and navigation modeling.	“user system design” OR “hci design” OR “user interface design” OR “user interface development” OR “system development” OR “system design”
(I) Intervention: languages and/or notation, techniques and approaches in the interaction and navigation modeling.	“notation” OR “language” OR “model” OR “technique” OR “framework” OR “approach” OR “method” OR “pattern” OR “process” OR “evaluating” OR “evaluation” OR “assessment” OR “assessing” OR “assess” OR “inspection”
(C) Comparison: it does not apply because it is a characterization review.	-
(O) Output: interaction or navigation modeling of interactive systems.	“interaction design” OR “modeling interaction” OR “interaction modeling” OR “dialogue modeling” OR “interaction flow” OR “navigation modeling” OR “navigation design” OR “navigation flow” OR “navigability modeling” OR “navigability design” OR “navigability flow”
(C) Context: academic environment or industry.	-

The terms were described in English, because this is the language used by search machines. The terms used when combined with each other, form the search string (Fig 1).

(“notation” OR “language” OR “model” OR “technique” OR “framework” OR “approach” OR “method” OR “pattern” OR “process” OR “evaluating” OR “evaluation” OR “assessment” OR “assessing” OR “assess” OR “inspection”) AND (“user system design” OR “hci design” OR “user interface design” OR “user interface development” OR “system development” OR “system design”) AND (“interaction design” OR “modeling interaction” OR “interaction modeling” OR “dialogue modeling” OR “interaction flow” OR “navigation modeling” OR “navigation design” OR “navigation flow” OR “navigability modeling” OR “navigability design” OR “navigability flow”)

Fig 1. Search string used in systematic mapping.

Criteria for selection of papers

During the systematic mapping, only those publications relevant to the research question must be selected for further analysis. Kitchenham and Charters (2007) suggests the definition of inclusion and exclusion criteria for papers returned by the search string. Thus, were defined the criteria described in Table 3.

Table 3. Criteria for selection of papers.

Type	Identifier	Description
Inclusion criteria	[Inc1]	The paper should describe a language or notation for interaction or navigation modeling of interactive systems.
	[Inc2]	The paper should describe approaches to support interaction or navigation modeling of interactive systems.
	[Inc3]	The paper should describe techniques for the evaluation of interaction or navigation modeling of interactive systems.
	[Inc4]	The paper should describe empirical studies that evaluate a language or notation for interaction or navigation modeling of interactive systems.
	[Inc5]	The paper should describe empirical studies that evaluate an approach to support interaction or navigation modeling of interactive systems.
	[Inc6]	The paper should describe empirical studies that evaluate a technique for evaluation of interaction or navigation modeling interactive systems.
	[Inc7]	The paper should compare languages or notations for interaction or navigation modeling of interactive systems
	[Inc8]	The paper should compare approaches to support interaction or navigation modeling of interactive systems.
	[Inc9]	The paper should compare techniques for the evaluation of interaction or navigation modeling of interactive systems.
Exclusion criteria	[Exc1]	The paper does not attend to any of the inclusion criteria.
	[Exc2]	The full version of the paper is not available among the selected sources.
	[Exc3]	The language of the paper is not English.

In order to be included, a paper should be available from selected sources, written in English and attends at least one of the inclusion criteria. On the other hand, a paper would be excluded if it attends at least one of the defined exclusion criteria.

Procedures for the selection of papers

To systematize the process of selecting papers, we defined a three-step procedure: (1) performing automatic search; (2) first selection; and (3) second selection. The Fig. 2 illustrates the steps in the procedure. During the execution of the search, the researcher responsible for the systematic mapping used the search string in the selected sources and stored the set of references retrieved in the tool Start ¹. The tool indicates duplicate papers when there were.

¹ StART: ferramenta de apoio ao planejamento e execução de revisões sistemáticas. Disponível em: http://lapes.dc.ufscar.br/tools/start_tool

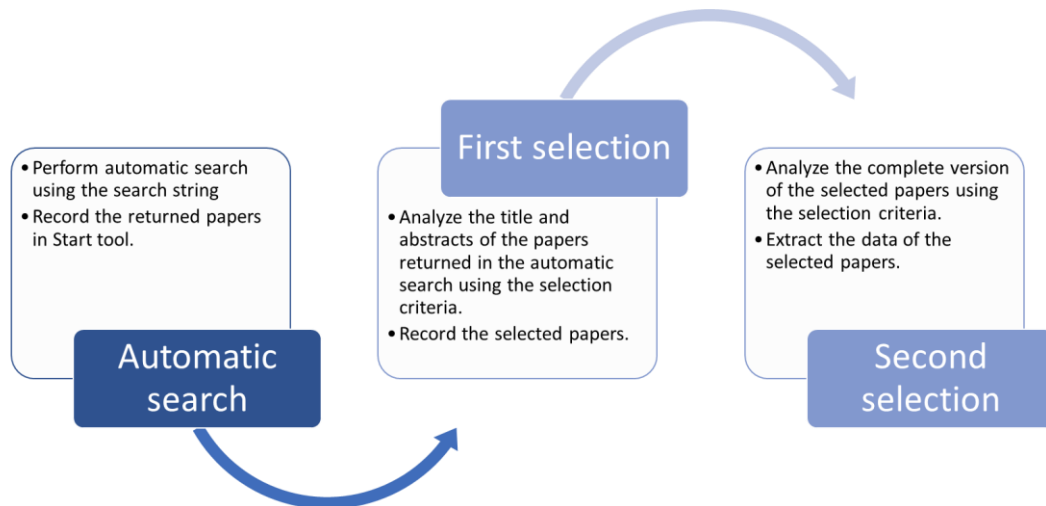


Fig 2. Procedure for the selection of papers.

In the first selection, the researchers involved in the systematic mapping analyzed the papers returned in the automatic search considering the inclusion and exclusion criteria, reading the titles and abstracts of the papers. The decision to select or not a paper was recorded by each researcher for further verification between researchers.

During the second selection, the researchers read the complete version of the papers selected in the first selection and analyzed them again in relation to inclusion and exclusion criteria. The researchers excluded the papers whose content does not answer the inclusion criteria, justifying the decision. After checking the results of the second selection, the data extraction of the selected papers was conducted.

Procedures for the data extraction of selected papers

The data from the selected papers were extracted. In order to perform this stage in a more objective manner possible, we elaborated an extraction form to record the necessary information from each paper, reducing the probability of the researcher bias.

The extraction form must allow to record all the relevant information to answer the research questions. In this sense, the extraction form of this systematic mapping is described in Table 4.

Table 4. Items of data extraction form

Extract item	Description
General Information	The reviewer's name, paper code on Start tool, title, published venue, authors and their affiliations, year of publication.
Type of solution	(a) notation or language for interaction or navigation; (b) support approach for interaction or navigation modeling; (c) technique for evaluation of interaction or navigation modeling.
Origin of the solution	(a) New; (b) based on existing models in HCI; (c) based on existing models in ES.
Purpose of the solution	Description of the purpose of the solution.
Interaction and navigation elements considered	In the case of notations, describe the elements considered in the notation.

Tool support	Does the solution provide a tool support? (a) Yes; (b) No.
Empirical evaluation of the solution	Was the solution empirically evaluated? (a) Yes; (b) No.
Purpose of the evaluation	If the solution has been empirically evaluated, what was the empirical evaluation purpose?
Methodology adopted in empirical evaluation	(a) case study; (b) controlled experiment; (c) survey; (d) simulation.
The evaluation environment	(a) Academy; (b) industry.
Number of subjects in the evaluation	Number of subjects who participated in the evaluation of the solution.
Advantages of the solution	What are the advantages of adopting the solution?
Limitations of the solution	What are the limitations of the solution?

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