CHAPTER 5: PRESENTATION AND DISCUSSION OF RESULTS

The aim of this research was to develop a model according to which relevance types in the information seeking and retrieval process may be "mapped". This "mapping" has been described in terms of various relations between the information objects on the one hand, and specific phases of the seeking and retrieval process on the other. The Ingwersen model of cognitive information transfer (Ingwersen, 1996) was assumed to be a valid construct to describe the elements and processes involved during information transfer. This model (as described in Chapter 3) formed the basis of a new relevance model, indicating the relationships involved in various relevance types.

The questionnaire which was developed as a tool to validate some of the aspects of the model has been described in Chapter 4. The purpose of the questionnaire was not only to provide data for this thesis but also to identify aspects of the subject for future research.

A detailed description of the results of the data gathered through the questionnaires in order to answer the research questions posed in Chapter 1 is provided in this chapter. In the first section of this chapter the sample profile has been summarised, and in the second part the results have been discussed for each research question individually. It should be noted that some of the questions are purely theoretical and have been discussed as such. When other questions have had to be supported by empirical evidence, appropriate tables and graphs have been used to describe the findings.

5.1. Sample profiles
The sample consisted of 33 respondents, who answered questions related to 467 documents in total. Initially there were four work task types represented. These were later reduced to three for statistical analysis as conference

papers and journal articles were deemed the same type of work task. The detail of the breakdown of the questionnaires is presented in Table 5.1.

Table 5.1. Summary of survey sample

Work tasks	Number of respondents	Number of documents evaluated		
		Section B: Relevant	Section C: Non-relevant	Total
Class assignments (undergraduate)	15	45	45	90
Conference papers and journal articles	5	95	19	114
Masters dissertations or doctoral theses	13	180	83	263
Total	33	320	147	467

All the respondents were undertaking research within the field of information technology, mostly within information science and informatics. They were chosen on the grounds that they have just finished their research project. This was necessary because it was important that all the researchers had to be at the same stage of information use in their work task. See also the discussion of the sample design in Section 4.4.

Most research projects studying the relevance judgements of users are longitudinal studies (Barry & Schamber, 1998; Borlund, 2000; Choi & Rasmussen, 2001; Fitzgerald & Galloway, 2001; Maglaughlin & Sonnenwald, 2002; Spink & Greisdorf, 2001; Vakkari & Hakala, 2000, etc.). This is an important approach, as it is well known that users' relevance criteria change as cognition regarding the work and search tasks changes.

In this empirical study, however, the final stage of information seeking and use were chosen (once the work task has been completed), because it is only at this stage of the process that users are able to state clearly which documents were sufficiently relevant to be used and cited, and which could be discarded (*even though they might have been useful to a certain extent at some stage during the work task execution*). For example, if the work task was not yet

completed, it may seem that a particular document was judged during use, but if that act leads to another iteration of searching and the document is not cited, then it was judged during the search task execution. It is therefore only at the end of the work task execution process that users are able to decide whether the information objects were judged during the work task as well as the search task execution, and whether the document was relevant enough to cite in their research.

5.2. Research questions: Data analysis and results

In this section, the main research question as well as the sub-questions have been discussed individually. Some of these are theoretical assumptions while other research questions had to be supported by empirical evidence. For the latter, as well as for questions combining theoretical and empirical aspects, complementary tables and graphs have been used to describe the findings.

In this chapter, reference is made to various "questions", namely the questions in the questionnaire, the main research question and derived questions, as well as the sub-questions as stated in Chapter 1. For clarity these are designated as:

- Questions from the questionnaire are shown in italics, for example, *Question 2.*
- The main research question is indicated as MQ and the two questions derived from the main research question as MQ_{D1} and MQ_{D2}.
- The sub-questions are shown as SQ_1 to SQ_6.

5.2.1. The main research question

The main research question (MQ) is:

How useful, in terms of understanding relevance, is it to define relevance types in terms of relations between elements in the process of information transfer?

This is regarded as mainly a theoretical question. The mapping of the relevance types as relations between elements in the process of information transfer depends on the definitions of the elements as well as the definitions of the relations. These definitions cannot be arbitrarily assigned, they have to, at least, be in accordance with other definitions in the field. These relations are those that have been mapped in Figure 3.3 and described in Sections 3.4 and 3.6.

The most contentious issues regarding this model where it was presented at conferences, doctoral workshops and publication (Cosijn & Ingwersen, 2000) were the following:

a)   Are the relevance judgements made on grounds of *topicality* different from cognitive, situational and socio-cognitive evaluation? (MQ_{D1})

b)   Can socio-cognitive relevance be seen as a category of relevance judgement separate to those of cognitive and situational? (MQ_{D2})

Although the main thrust of this question was regarded as a theoretical exercise, these two issues were supported by using empirical evidence.

The second question (MQ_{D2} – dealing with socio-cognitive relevance) has been discussed under sub-question 6 (SQ_6) in this chapter, where it was shown that the notion of socio-cognitive relevance does exist as a separate relevance category.

The first of these questions stated above (MQ_{D2} – dealing with the issue of topical relevance), was addressed by cross-tabulation of Variable 6 (V6 in *Question 2* of Section B), a purely topical relevance judgement, with other possible relevance judgements about the same document. It was assumed that if a respondent indicated that the document was used because it was topically relevant (chose V6 as an option), but also listed other types of relevance which (by definition) do not necessarily involve topicality, it shows that topicality does not preclude other levels of relevance judgements.

Of the total of 320 documents which were judged relevant, 138 were judged relevant on grounds of topicality (V6 was selected). These 138 documents were also in turn judged relevant for other reasons, as indicated by the respondents in *Question 2* (reasons for use) and *Question 5* (reasons for usefulness) in Section B of the questionnaire. The result of this was that in addition to topicality (V6), there were 391 other options selected in *Question 2* and a total of 120 in Question 5.

Tables 5.2 and 5.3 show the distribution of other relevance judgements made in *Question 2* and *Question 5* respectively. These were then sorted by relevance type (as defined in Chapter 3) and subtotals calculated for each of the relevance types.

It should be noted that the descriptions of the reasons for use (Table 5.2) or usefulness (Table 5.3) are not necessarily the same as those found on the questionnaire. The descriptions used in the tables have been standardised according to the pre-coded value in terms of Table 4.3. It should also be noted that *Question 2* offered scope for own reasons (open questions) which were post-coded, and these were included in the analysis below.

The first row entry in Table 5.2 is labelled "uncategorized" as it is not clear whether the fact that the respondent was familiar with the work of the author constitutes an affective relevance judgement or a cognitive relevance judgement. The option was originally included as an affective relevance judgement when the questionnaire was constructed, but without cross-tabulation with *Question 9* it is not clear whether the respondent has an *affective* relationship with the author. In this table, the value was therefore not included in calculations by relevance type.

Table 5.2. Analysis of topical relevance judgements together with other subjective relevance types in terms of reasons for use – Question 2

Reasons for use (Question 2)	Relevance type	N	%
Familiar with work of author	Uncategorized	75	19.18
Emotional response with regard to viewpoint congruence	Affective	2	0.51
Background information	Cognitive	5	1.28
Real needs in terms of hard data, facts, figures	Cognitive	14	3.58
Supports current state of knowledge	Cognitive	182	46.55
Enhances current state of knowledge	Cognitive	1	0.26
Sub-total for cognitive relevance		**202**	**51.67**
Hard data etc. required in work task situation	Situational	1	0.26
Sufficient detail/depth	Situational	4	1.02
Accessible/available within work task	Situational	42	10.74
Current/recent in terms of work task	Situational	1	0.26
Author's expertise in terms of work task	Situational	1	0.26
Usefulness of format in work task	Situational	6	1.53
Sub-total for situational relevance		**55**	**14.07**
Acceptable within domain	Socio-cognitive	18	4.59
Author's expertise in terms of domain	Socio-cognitive	2	0.51
Presentation/format acceptable in domain	Socio-cognitive	3	0.77
Socio-organizational acceptability on terms of quality	Socio-cognitive	3	0.77
Consistent or supported by others in domain	Socio-cognitive	31	7.93
Sub-total for socio-cognitive relevance		**57**	**14.57**
	Total	**391**	**100.00**

Table 5.3. Analysis of topical relevance judgements together with other subjective relevance types in terms of reasons for use – Question 5

Reasons for use (Question 5)	Relevance type	% N=120
Background information	Cognitive	23.33
Clarity in terms of information need	Cognitive	2.50
Real needs in terms of hard data, facts, figures	Cognitive	21.67
Supports current state of knowledge	Cognitive	15.83
Enhances current state of knowledge	Cognitive	16.67
Sub-total for cognitive relevance		**80.00**
Problem solving within research focus	Situational	10.00
Sub-total for situational relevance		**10.00**
Consistent of with or supported by others in the field	Socio-cognitive	10.00
Sub-total for socio-cognitive relevance		**10.00**
	Total	**100.00**

As can be observed from the tables, there is a significant distribution of relevance categories that were chosen in conjunction with topicality. It has to be borne in mind that multiple options could be selected and *Question 2* also included open-ended questions. The percentages by relevance category were calculated only for the sake of interest and should not be interpreted as an indication of which relevance category was chosen by most respondents.

The sub-questions (SQ) related to and derived from the main question (MQ) have been analysed in detail below. This has included their classification as either a theoretical or an empirical question.

5.2.2. Sub-question 1

Is this categorization of relevances as typified in the model a viable way of typifying relevance types? (SQ₁)

This first sub-question is viewed as a purely theoretical question. The matter of the viability of the modelling process is seen to be more objectively judged if it is compared with accepted research performed by other people, instead of

being forced into a new model. The research used was that of Barry and Schamber (1994) and Vakkari and Hakala (2000) as discussed in Section 3.9 of this study. It was found that if the relevance types as identified in Section 3.6 were retrospectively mapped back to this empirical work done previously, the model as depicted in Figure 3.3 is a viable way of typifying relevance types.

The further empirical testing of various aspects of the model as reported in this chapter, has confirmed the viability of this model.

5.2.3. Sub-question 2

Does the nature of the work task influence the application or non-application of documents in work task fulfilment? (SQ₂)

Essentially, this also queries whether the profiles of relevance judgements made within different work task environments vary.

This sub-question is viewed as an empirical question. In this empirical study, three different work tasks were identified:

- the writing of masters or doctoral theses (Variable V1 was coded as 1 in Sections B and C of the questionnaire),
- the writing of conference papers or journal articles (V1 was coded as 2 or 3 in Sections B and C of the questionnaire), and
- the writing of essays as a class assignment (V1 was coded as 4 in Sections B and C of the questionnaire).

See Table 5.1 for details about the numbers of relevant and non-relevant documents judged.

In order to answer this sub-question, the different codes for V1 (work task, as described above) were cross-tabulated with variables V5 - V10 in *Question 2* (reasons for using the documents), as well as with variables V16 - V24 in *Question 5* (reasons for usefulness of the documents). The assumption was that if the work tasks were compared in terms of the relevance judgements

made, it would be possible to establish whether the nature of the work task has an influence on the way that relevance judgements are made, and specifically on the type of relevance judgements made.

A summary of this data is presented in Table 5.4. The number of documents judged relevant by masters and doctoral students ($N_{M,D}$) was 180, by authors writing conference papers or journal articles ($N_{P,A}$) was 95 and by undergraduate students writing class assignments (N_{CA}) was 45. N_{Vx} in the second column refers to the number of documents judged relevant according to the variables (V) in *Questions 2* and *5* respectively, where x is the number assigned to the variable. Please note that the columns in the table do not necessarily add up to 100%, due to the fact that respondents could select multiple options.

A sufficient number of respondents selected each of the variables in *Questions 2* and *5* in order to make it possible to perform tests of statistical significance. For this particular research question, the limitations and assumptions for the chi-square test were met.

The null- and alternative hypotheses were therefore stated as follows:

- H_o: There is no relationship between the relevance types and the work task environments.
- H_a: The relevance judgements differ by work task environment.

The p-value for the chi-square test was set at 0.05 as is standard for two-tailed tests (Hernon, 1994). Note that the percentage values in the columns of Table 5.4 should be interpreted as not only the value listed, but also that the complement of the value (difference between the value and 100%) is implied. As can be observed from the chi-square test p-values in Table 5.4 (set at $p<0.05$), as well as the representation of the data contained in Figure 5.1, there are significant differences in the type of relevance judgements made within various work task situations. The null-hypothesis was therefore

rejected in most cases and it was concluded that there is a relationship between some of the relevance judgements within different work task domains. These differences have been discussed in detail by variable below.

For the sake of completeness, a more detailed table is presented in Appendix C, where the degree of relevance was also taken into account. In this case, the data in Table 5.4 were also analysed by the degree of usefulness, as indicated by Variable 14. However, the introduction of this further breakdown of the data had the result that the size of the some of the individual cells were too small to do any tests of statistical significance.

Appendix D contains a table of relevance types by work task, summarising the detailed information given in Tables 5.3 and 5.4, as well as a graphic representation of the aforementioned table.

Table 5.4. Reasons for use/usefulness of document by work task

Question	Variable(V)	Reasons for use/usefulness	Masters and Doctoral theses $N_{MD}=180$	Conference papers and journal articles $N_{PA}=95$	Class assignments $N_{CA}=45$	X^2-test p-value
Question 2 (Reasons for use)	5	Retrieval engine gave it a high relevance ranking $N_{V5}=94$	32.22	18.95	40.00	0.0172*
	6	The topic of the document is very similar to the topic of my paper $N_{V6}=138$	44.44	36.84	51.11	0.2433
	7	The viewpoint of this document supports my approach to the topic $N_{V7}=182$	55.00	58.95	57.78	0.8082
	8	The viewpoint of this document is in accordance with the approach of the conference theme $N_{V8}=31$	1.67	11.58	33.33	<0.0001*
	9	It was easy to obtain / I couldn't find anything else $N_{V9}=42$	16.11	5.26	17.78	0.0246*
	10	I know the work of this author $N_{V10}=70$	18.89	33.68	8.89	0.0014*
Question 5 (Reasons for usefulness)	16	It provided me with background information $N_{V16}=204$	62.22	63.16	71.11	0.5349
	17	It provided me with detailed information $N_{V17}=152$	47.22	41.05	62.22	0.0639
	18	It told me something I did not know $N_{V18}=145$	43.89	35.79	71.11	0.0004*
	19	It verified something I already knew $N_{V19}=135$	41.67	46.32	35.56	0.4735
	20	It changed the focus of my paper $N_{V20}=18$	3.89	3.16	17.78	0.0007*
	21	It helped me to solve a problem $N_{V21}=80$	24.44	15.79	46.67	0.0004*
	22	It helped me to make a decision $N_{V22}=81$	30.56	6.32	44.44	<0.0001*
	23	It is meaningful within the theme of the conference $N_{V23}=38$	2.78	22.11	26.67	<0.0001*
	24	The viewpoint of this document has an interesting/unusual perspective on the conference theme $N_{V24}=20$	5.00	6.32	11.11	0.3173

* Values marked with an asterisk in the right hand column indicate that differences in terms of work task are statistically significant

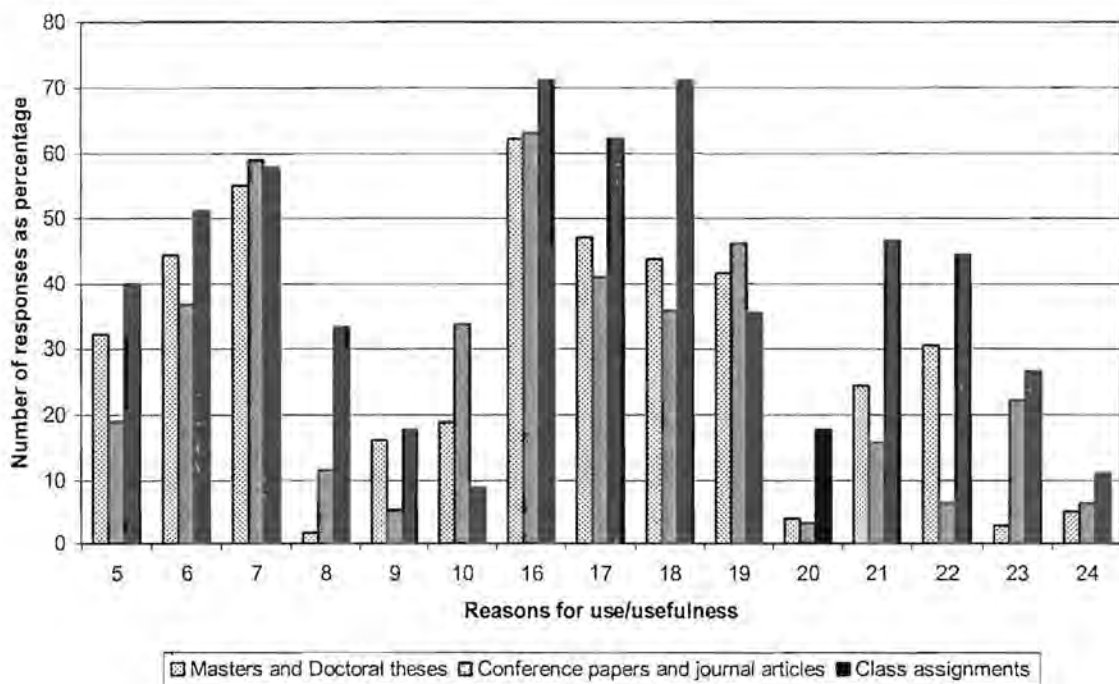Figure 5.1 below is a graphical representation of Table 5.4.

Figure 5.1. Reasons for use/usefulness by work task

The chart above (Figure 5.1) shows the distribution of the relevance types, with the values on the X-axis referring to the reasons for use/usefulness as listed in the preceding table.

In discussing the variations by work task for each of the variables (V) below, *possible* explanations for the significant differences have been presented. These should by no means be viewed as the only definite and final answers to the questions posed, but also as providing indicators for possible further research. The number in brackets after the "V" option title refers to the value of the relevance judgement as indicated in Table 4.3. Percentages have been rounded to the nearest whole number, in order to facilitate readability.

□ *V5. The retrieval engine gave it a high relevance ranking (30)*

This is a purely algorithmic relevance type, there is no subjective user evaluation present. 40% of the documents used by undergraduates, 32% of documents used by masters and doctoral students and only 19% of

documents used by respondents who were writing either a journal article or a conference paper indicated this as one of the reasons that a particular document was used.

The question, as it was phrased in the questionnaire could have been misleading, as it might have been perceived to be valid only if the document was found on the Web, or if a search engine was used. This particular variable was therefore not used in any calculations, and where it has been used in a representation of the distribution of data, it should not be interpreted as being indicative of algorithmic relevance judgements as interpreted by users in general.

A possible reason for the statistically significant differences between the different work tasks with regards to this type of relevance judgement is that the actual state of knowledge of the undergraduate students is relatively incomplete, and therefore they cannot make an informed decision about the value of a document to the work task. They therefore rely on search engines to indicate which of the documents have higher relevance to their queries.

Similarly, masters and doctoral students are expected to read "everything" on their topic in order to conduct a complete literature review. As their actual state of knowledge may also incomplete at the first stages of the work task, they rely on the algorithmic evaluations of the search engine to yield the largest number of highly relevant documents.

The actual state of knowledge of persons writing articles for journals of conference papers are typically more complete than for the other two work tasks, and searching is usually much more focussed. These persons therefore do not have to rely on search engine evaluation as much as the others.

V6. The topic of the document is very similar to the topic of my paper/thesis (31)

This is a topical relevance judgement and is partly reliant on algorithmic matching of the document and partly on user evaluation of the document. 44% of the papers evaluated by masters and doctoral students, 51% of papers evaluated by undergraduates and 37% of papers evaluated by authors of papers or articles indicated that this was one of the reasons for using a particular document.

The actual state of knowledge of the users could possibly, once again, be seen as a reason for the difference (though not statistically significant) between the undergraduate students and the authors of papers in this case. The undergraduates have a relatively low level of knowledge regarding a topic, whereas authors of papers and articles are generally experts in their field. Their ability to integrate past knowledge with current information is therefore much higher than that of the undergraduate students. Thus the aboutness of retrieved documents is probably not as important for the authors as it is for the undergraduates in making sense of the documents for application in the work task.

V7. The viewpoint of this document supports my approach to the topic (28)

This is a cognitive relevance judgement, in that there is a viewpoint congruence with regards to the document and the information need of the user. There were no significant differences between the judgements of the three groups: 55% of the papers evaluated by doctoral and masters students, 59% of the papers evaluated by authors of papers or articles and 58% of the papers evaluated by undergraduates indicated that this was one of the reasons a particular document was used.

V8. The viewpoint of this document is in accordance with the approach of the conference theme/journal focus/degree course (26)

This is regarded as a socio-cognitive relevance type as indicated in Table 3.7. There are quite major differences between the judgements made within the various work tasks with regards to this option. 33% of the papers evaluated by undergraduate students stated this option as one of the reasons why the document was regarded as relevant, while 12% of the papers evaluated by authors of papers and articles and only 2% of papers evaluated by masters and doctoral students stated this option.

A possible reason for this divergence is that undergraduates do not yet have the understanding of more experienced researchers to integrate different viewpoints into their own research, and may think that if the viewpoint of a document is in accordance with the course, then it should be relevant. Advanced students, however, are expected to read as widely as possible and then integrate and assimilate the information into a variety of categories. It is therefore acceptable, or even required to read different points of view and still regard these documents as relevant.

□ *V9. It was easy to obtain/I couldn't find anything else (5)*
This relevance judgement relates to the accessibility and availability of documents and is a situational relevance judgement. For this option, there is also a very interesting distribution across the three different work task categories: 16% of the papers evaluated by masters and doctoral students stated this as one of the reasons for using a document, 18% of the papers evaluated by undergraduates and only 5% of the papers evaluated by authors of papers and articles.

A possible reason for this distribution is that authors of articles and conference papers have to be more circumspect in the type of documents they cite. There is a much larger element of social/organizational acceptance involved in the judgements of such papers. The motivational factors for searching for relevant documents may therefore be seen to be greater in the case of these authors. Furthermore, due to the length of such papers compared to a thesis.

there is not much latitude for unnecessary debate. On the other hand, with regards to theses, it is expected that students read as widely as possible and there is an element of pressure regarding the length of the bibliography as an indication of the completeness of the literature survey.

□ *V10. I know the work of this author (24)*

This judgement related to the relationship of the user with the author of a document, whether personal or professional and is regarded here as an affective relevance judgement. One would expect that undergraduate students do not yet know the authors in the field and therefore would not often use this reason to use a document. This assumption was supported by the figures – only 9% of the documents evaluated by undergraduates stated this as one of the reasons why a document was used as opposed to 34% of documents evaluated by authors of papers and articles. 19% of documents evaluated by masters and doctoral students stated this as one of the reasons. This result accords with the assumption above – namely, the masters and doctoral students don't know the authors as well as the experts, but do so better than the undergraduate students.

□ *V16. It provided me with background information (1)*

This is a cognitive relevance judgement. Of all the options in *Questions* 2 and 5, this option had the highest number of responses from all three categories of work task. 71% of the documents evaluated by undergraduate students, 62% of the documents evaluated by doctoral and masters students and 63% of the documents evaluated by authors of papers or articles stated this as one of the reasons why a document was regarded as useful. Although the numbers are not significantly different, the fact that more undergraduate students chose this option may be ascribed to their actual state of knowledge being less complete than in the other two groups, and that more documents would provide background information to these students than to the other groups where the actual state of knowledge is more complete.

◻ *V17. It provided me with detailed information (11)*

This is also regarded as a cognitive relevance judgement and related to the users' real needs with regard to proven information, hard data, facts or figures required for the successful execution of the work task. This distribution was found not to be statistically significant ($p>0.05$). 62% of the documents evaluated by undergraduate students, 47% of the documents evaluated by masters and doctoral students and 41% of the documents evaluated by authors of articles or papers stated this as one of the reasons why a document was regarded as useful. The relatively high percentage of undergraduates who chose this option might also possibly relate to the fact that their actual state of knowledge is relatively incomplete, as in the case stated for the previous option.

◻ *V18. It told me something I did not know (29)*

This is a cognitive relevance judgement and refers to an enhancement of the current state of knowledge. It might be expected that the figure would be substantially higher for undergraduates, since their actual state of knowledge is relatively incomplete, and this was supported by the figures: 71% of the documents evaluated by undergraduates stated this as one of the reasons for using a document, whereas only 36% of the papers evaluated by the authors of papers and articles stated this option. 44% of the documents evaluated by masters and doctoral students stated this as an option, thereby further supporting the assumption above relating to the current state of knowledge of the respondents.

◻ *V19. It verified something I already knew (28)*

This is a cognitive relevance judgement and related to the support of the current state of knowledge. Whereas the figure for the previous option (V18 – novelty value) was relatively high for the undergraduates, in this case it was just the opposite. 36% of the documents evaluated by undergraduates, 42% of the documents evaluated by the masters and doctoral students and 46% of the documents evaluated by the authors of papers or articles stated this as

one of the options. These statistics support the assumption stated under the previous option, namely that the current state of knowledge is incomplete for undergraduates, more complete for post graduates and most complete for experts. Therefore the respondents with the lowest level of knowledge will learn more from a document, and the respondents with the highest level of knowledge will learn less, but will have more of his knowledge supported. It should, however, be noted that the distribution proved not to be statistically significant.

□ *V20. It changed the focus of my paper (8)*

This situational relevance judgement related to the usefulness of the document in terms of problem solving within the particular research focus. Of all the options in *Questions* 2 and 5, this one had the lowest response - only 18 responses over the entire population. Of these, 4% were documents evaluated by doctoral or masters students, 3% were documents evaluated by authors of papers or articles and 18% were documents evaluated by undergraduate students.   The fact that only the only significant percentage comes from the undergraduate students might possibly also relate to their incomplete state of knowledge, and that it results in relatively unfocussed work tasks. If the work task is not clear in the user's mind, then it is more likely that the focus will change through use of information.

□ *V21. It helped me solve a problem (8)*

This is also a situational relevance judgement, and lies in the same category as the previous option as indicated in Table 4.3. It related to the usefulness of the document in terms of problem solving within the particular research focus. For the assumption in the previous option (V20) to hold, the same relative percentage distribution would be expected over the different work tasks as above, and this was indeed found to be so. 47% of the documents evaluated by undergraduates, 24% of the documents evaluated by the postgraduate students and 18% of the documents evaluated by the authors of papers stated this option as one of the reasons for a document to be useful.

V22. It helped me make a decision (7)

Whereas V20 and V21 related to the clarity of the document within the situation of the work task, this option related to the clarity of the document in terms of the personal (real) information need, and is therefore regarded as a cognitive relevance judgement. The relative percentage distribution across the work tasks are somewhat similar to the two cases above - 44% of the documents evaluated by undergraduates, 31% of the documents evaluated by post graduates and 6% of the documents evaluated by experts stated this as one of the reasons for the usefulness of a particular document. As in the previous cases, this also might be due to the current level of knowledge of the undergraduates being very low, higher in the case of the post graduate students and much higher in the case of the experts writing articles or papers.

V23. It is meaningful within the theme of the conference/journal focus/degree course (26)

This is a socio-cognitive relevance judgement in the same category and therefore very similar to the question presented with Variable 8 above, and therefore one would expect the same relative percentages across the work tasks. Here once again, there are quite major differences between the judgements made within the various work tasks. The percentage distribution for the previous question (V8) have been listed in parenthesis next to the percentages for this question for easy comparison. 27% (33%) of the documents evaluated by undergraduate students stated this option as one of the reasons why the document was regarded as useful, while it was stated by 22% (12%) of the documents evaluated by authors of papers and articles and only 3% (2%) of documents evaluated by masters and doctoral students.

A possible reason for this distribution is again that undergraduates do not yet have the understanding of more experienced researchers to integrate different viewpoints into their own research, and may think that, if the viewpoint of a document is in accordance with the course, then it should be relevant.

Advanced students, however, are expected to read as widely as possible and then integrate and assimilate the information into a variety of categories. It is therefore acceptable, or even required to read different points of view and still regard these documents as relevant.

V24. The viewpoint of this document has an interesting/unusual perspective on the conference theme/journal focus/degree course (26)

This is regarded as a socio-cognitive relevance judgement, but in the context of this question any response might be interpreted as a negative socio-cognitive relevance. In other words, it could be interpreted as "going against the grain" of what is regarded as acceptable. This option was chosen by relatively few respondents, only 20 documents over the entire population. Of these, 4 were documents evaluated by doctoral and masters students, 5 were documents evaluated by authors of articles or papers and 11 were documents evaluated by undergraduate students. Due to the ambiguity of the interpretation of the question, no possible reasons have been sought to explain the result. The data were also found not to be statistically significant. However, an interesting study at a later stage might be to establish what other relevance judgements were made by respondents who wrote conference papers or journal articles because, in this context, socio-organizational acceptability is an important issue.

The conclusion that may be drawn from the data sets related to this research question is that the null-hypothesis are rejected in most cases and that there is in fact a significant variation in the profiles of relevance judgements made within different work task environments. From the discussion above stating possible reasons for these differences in relevance judgements, it would seem that this is mainly due to the actual state of knowledge and the ability of the users to utilize the information within a particular work task situation. Socio-cognitive relevance judgements also seem to play quite an important role in the decision to use a document within a particular work task.

A table of relevance types by work task summarizing the detailed information given in Tables 5.3 and 5.4, as well as a graphic representation of this table are presented in Appendix D.

5.2.4. Sub-question 3

Are some relevance judgements made during the process of seeking for information (search task) while others are made while using information during the execution of the work task? (SQ$_3$)

In Section 3.8 the difference between search task execution and the use of information in work task performance was discussed. The model as derived in Chapter 3 also stresses the distinction between the two types of tasks. In order to establish whether there is in fact a difference between the types of relevance judgements made during the execution of the two tasks, empirical data gathered through the questionnaires were used. This sub-question is therefore also regarded as an empirical question.

In order to answer this sub-question the data used for statistical analysis were as follows:

For Section B (documents used) variables V5 - V13 in *Question 2* (reasons for use) have been combined with variables V16 - V24 in *Question 5* (reasons for usefulness) and cross tabulated with variable V51 (indicating whether the judgement was made during work task or search task). The variables were then linked with the relevance types as listed in Tables 4.3 and 4.4. The percentage of relevance judgements made within each relevance type were then calculated and compared for work task and search task execution respectively. The results are presented in Table 5.5 below.

Due to a typing error in *Question 25* of Section C (non-relevant documents) the data collected will not be represented here. The question should have read "At what stage of your research did you decide that this document might not be useful?" instead of "At what stage of your research did you decide that this document might be useful?"

The limitations and assumptions for the chi-square test were met for SQ_3. The null- and alternative hypotheses were therefore stated as follows:

- H_0: There is no relationship between the relevance categories and the task type.

- H_a: The distribution of the relevance categories differ in relation to task type.

Table 5.5 includes the frequency (actual number of responses) by relevance type. In Appendix E (Table E.1) all the detail, including the actual frequency by work task as well as expected frequency by relevance type and work task for comparison with the actual frequencies. Table E.1 also includes both raw percentages (number of documents as percentage of 529) and row percentages, although only the row percentages as indicated in Table 5.5 will be used in the interpretation of the results.

The p-value was set at 0.05, as is standard for two-tailed chi-square tests (Hernon, 1994). The calculated chi-square value was 10.4085 and p=0.0341. The null-hypothesis was rejected due to the fact that p<0.05 and it was therefore concluded that the observed differences in the distribution of the relevance categories in relation to task type is significant.

Table 5.5. Relevance judgements by task type - documents cited

Relevance Type	N	Search task	Work task	Total
Affective	77	63.64	36.36	**100.00**
Cognitive	202	62.87	37.13	**100.00**
Situational	55	43.64	56.36	**100.00**
Socio-cognitive	57	54.39	45.61	**100.00**
Topical	138	66.67	33.33	**100.00**
Total	**529**			

It may be observed from the row percentage data in Table 5.5 that the only percentage higher for the work task than for the search task, is that of situational relevance. All other types of relevance judgement were made more often during the search task execution than for the work task execution. From this it may be concluded that situational relevance is more strongly associated with work task performance, whereas topical, cognitive, socio-cognitive and affective relevance judgements are more strongly associated with search task execution.

5.2.5. Sub-question 4

To what extant are the identified relevance types "nested"? (SQ4)

In other words, are certain relevance judgements by definition included within other types of relevance judgements?

From the stratified model of relevance types by Saracevic (1996) as well Borlund's studies (2000), it would seem that some authors in the field view relevance types as inherently "nested". It could be argued, for instance, that if an information object is judged as relevant on a cognitive level, it should also be relevant on a topical level. The assumption for this research question is that the relevance types as depicted in the model (Figure 3.3) are not necessarily nested.

In order to answer this sub-question, the data sets created were as follows:
It was assumed that if the respondent marked variable V5 (the search engine gave the document a high relevance ranking) in *Question 2* in Section B of the questionnaire, an *algorithmic relevance* judgement was made. However, 71% of the total sample did not select the option in *Question 2* that indicated that the document was algorithmically relevant. Since this was not a compulsory answer, it should not be concluded that documents are seldom algorithmically relevant. This value was therefore not included in the final calculations for this sub-question, as already explained in Section 5.2.3.

If the respondent selected V6 (the topic of the document is very similar to the topic of my paper), then it was assumed that a *topical relevance* judgement was made.

If the respondent selected any of the following, then it was assumed that a *cognitive relevance* judgement was made:
- V7 = 28 (supports current state of knowledge)
- V11 or V12 or V13 = 1 or 7 or 9 or 11 or 14 or 28 or 29 (these were open-ended questions which were post-coded according to Table 4.3. The values listed here signifies a cognitive relevance judgement)
- V16 = 1 (background or specific information need)
- V17 = 11 (real information needs – hard data, facts, figures)
- V18 = 29 (enhances current state of knowledge)
- V19 = 28 (supports current state of knowledge)
- V22 = 7 (clarity of presentation in terms of information need)

If the respondent selected any of the following, it was assumed that a *situational relevance* judgement was made:
- V9 = 5 (accessibility/availability)
- V11 or V12 or V13 = 2 or 3 or 5 or 8 or 10 or 12 or 15 or 16 or 18 or 21 (these were open-ended questions which were post-coded according to

Table 4.3. The values listed here signifies a situational relevance judgement)

❑ V20 or V21 = 8 (problem solving within research focus)

It was assumed that if a respondent selected either V32 or V33 (the acceptability of the viewpoint of the document or the quality of the document within the broader socio-organizational domain) then a *socio-cognitive relevance* judgement was made.

Table 5.6 below is a summary of the data of the cross-tabulation of the variables described above. Table 5.7 contains the same data as Table 5.6, but whereas the former is sorted by the number of occurrences within the various possibilities of nesting, the latter is a representation of the data showing the various possibilities of nesting, from a topically relevant perspective. A "Yes"-value in the cell is assumed to be a definite relevance judgement of the type indicated, whereas a hyphen, "-" is an indication that the box was not ticked when the questionnaire was completed.

Table 5.6. Nesting of relevance types by number of occurrences

Topical	Cognitive	Situational	Socio-cognitive	N	%
-	Yes	-	Yes	114	35.65
Yes	Yes	-	Yes	75	23.44
-	Yes	Yes	Yes	61	19.06
Yes	Yes	Yes	Yes	60	18.75
-	Yes	-	-	4	1.25
Yes	Yes	-	-	1	0.31
Yes	-	Yes	-	1	0.31
Yes	-	-	-	1	0.31
-	Yes	Yes	-	1	0.31
-	-	Yes	Yes	1	0.31
-	-	-	Yes	1	0.31
			Total	320	100.01

Table 5.7. Visualization of the nesting characteristics of relevance types according to empirical data

Topical		Cognitive		Situational		Socio-cognitive	
Yes	43.12	Yes	43.12	Yes	18.75	Yes	18.75
						-	0.00
				-	23.75	Yes	23.44
						-	0.31
		-	0.00	Yes	0.31	Yes	0.00
						-	0.31
				-	0.31	Yes	0.00
						-	0.31
-	56.87	Yes	56.25	Yes	19.37	Yes	19.06
						-	0.31
				-	36.88	Yes	35.63
						-	1.25
		-	0.62	Yes	0.31	Yes	0.31
						-	0.00
				-	0.31	Yes	0.31
						-	0.00
	99.99		99.99		99.99		99.99

From these tables it can be clearly seen that the relevance types are not nested, but due to the small sample size of some of the cases, tests of

statistical significance could not be performed. The statistical findings have therefore only been discussed within context.

39% (124) of the documents evaluated were considered to be situationally relevant. Of these only two documents were judged to be not socio-cognitively relevant. On the other hand, of the 61% (196) of the documents which were considered to be not situationally relevant, the majority (190) were considered to be socio-cognitively relevant.

99% of all documents used were considered to be cognitively relevant. This is a clear indication that the enhancement or support of the current cognitive state is an important factor when users judge the relevance of documents. Of these documents, 38% were also judged to be situationally relevant, while 61% were not considered such. Furthermore, of this 61% of the documents which were considered to be cognitively relevant, but not situationally relevant, 59% were also judged to be socio-cognitively relevant. It would therefore seem that the relationship between cognitive and socio-cognitive relevance is much stronger than the relationship between cognitive and situational relevance or between situational and socio-cognitive relevance. This area of the study requires further research.

Of the 99% of the documents which were deemed to be cognitively relevant, 43% were stated to be topically relevant. 56% did not indicate topical relevance as one of the reasons why the document was regarded as relevant. This should, however, not be interpreted that topicality is not an important relevance criteria, since this question was not a compulsory question.

The results of this study confirm that relevance types are not necessarily nested. There is a clear indication that both situational and topical relevance are independent from the other relevance types, as well as independent from each other. However, the data shows interesting relationships between the subjective relevance types of cognitive and socio-cognitive relevance and

these require further study. Section 5.2.7 attempts to address some of the aspects of the relationship between these two relevance types.

5.2.6. Sub-question 5

To what extent are affective relevance judgements made in conjunction with the other relevance types? (SQ$_5$)

In Section 3.6.6 affective relevance was described as the relation between the goals, intents and motivation of the user on the one hand, and the information object on the other. *Affective relevance should not be seen on the same scale as the other relevance types, but rather as another dimension that is assumed to have an influence on all the other relevance types.* See Figure 3.3.

Affective relevance are difficult to capture by means of a questionnaire and therefore, in order to answer this sub-question it was assumed that if any of the factors such as font size, font type, colours, layout or writing style of the document was evaluated *negatively* (*Questions 18-22* of Section B, the questionnaire dealing with relevant documents), then a definite affective relevance judgement was also considered to have been made. If all these factors were evaluated positively, it is debatable whether a *definite* affective relevance judgement was made, and was therefore not taken into account. Three new tables of data were generated, namely where all the affective relevance judgements made were cross-tabulated in Table 5.8 with reference to the reasons for use from *Question 2*, Table 5.9 with reference to reasons for usefulness from *Question 5* and Table 5.10 with reference to the terminology-related issues from *Question 17* of Section B of the questionnaire.

It was further assumed that if any of the factors such as font size, font type, colours, layout or writing style of the document was evaluated *negatively, even if the document was not used* (*Questions 20-24* of Section C, the questionnaire dealing with non-relevant documents), an affective relevance judgement was also considered to have been made. Another three tables of

data were generated, namely where the affective relevance judgements made were cross-tabulated in Table 5.11 with reference to the reason for usefulness (even if the document was not used) from *Question 3a*, in Table 5.12 with reference with reasons for non-use from *Question 3b* and Table 5.13 with reference to author-related issues form *Question 11* of Section C of the questionnaire.

The small sample sizes of some of the data sets precluded significance tests, but from the tables below it can clearly be observed that affective relevance judgements are used to evaluate documents in terms of both use and non-use.

Table 5.8. Negative affective relevance judgements made together with reasons for document use

Reasons for use	Relevance type	% N=106
I know the work of this author	Uncategorized	9.43
Sub-total for uncategorized		**9.43**
Emotional response with regard to viewpoint congruence	Affective	0.94
Sub-total for affective relevance		**10.37**
Machine matching	Algorithmic	14.15
Sub-total for algorithmic relevance		**14.15**
Specificity in terms of background or specific information	Cognitive	1.89
Tangibility in terms of proven information, hard data or facts	Cognitive	2.83
Supports current state of knowledge	Cognitive	22.64
Sub-total for cognitive relevance		**27.36**
Usefulness with regards to specificity or depth	Situational	0.94
Accessibility or availability within work task or situation	Situational	10.38
Current or recent in terms of work task or situation	Situational	0.94
Tangibility in terms of work task - hard data, facts	Situational	0.94
Sub-total for situational relevance		**13.2**
Acceptable within a socio-organizational domain	Socio-cognitive	9.43
Consistent with or supported by others in the field	Socio-cognitive	5.66
Sub-total for socio-cognitive relevance		**15.09**
Topicality / aboutness	Topicality	19.81
Sub-total for topical relevance		**19.81**
	Total	**100.00**

Question 2 in Section B allowed respondents to state their own reasons for using a document in addition to the pre-coded options offered. The nature of the distribution of variables over all the relevance types as defined in Chapter 3 can be seen in Table 5.8 above. The sub-totals for each of the relevance types should, however, not be taken to be an indication of the distribution of relevance types in general. The most unexpected result from these data was the fact that a relatively high percentage of the affective relevance judgements were made in conjunction with algorithmic relevance. Tracing back the individual questionnaires showed that these were mainly documents found on the Web. It can therefore be deduced that there is a greater possibility of

electronic documents being evaluated negatively on an affective level than print documents. Possible reasons could be inferior lay-out, use of fonts and colours on the Web.

Table 5.9. Negative affective relevance judgements made together with reasons for regarding a document as useful

Reasons for usefulness	Relevance type	% N=152
It provided background information	Cognitive	25.66
It provided detail information	Cognitive	13.16
It told me something I did not know	Cognitive	18.42
It verified something I already knew	Cognitive	11.83
It helped me make a decision	Cognitive	10.53
Sub-total for cognitive relevance		**79.6**
It changed the focus of my paper	Situational	3.95
It helped me solve a problem	Situational	7.89
Sub-total for situational relevance		**11.84**
It is meaningful within the theme of the conference theme/degree course/journal focus	Socio-cognitive	4.61
It has an interesting/unusual perspective on the conference theme/degree course/journal focus	Socio-cognitive	3.95
Sub-total for socio-cognitive relevance		**8.56**
Total		100

Table 5.10. Negative affective relevance judgements made together with stated knowledge of the terminology of a document

Aspect related to the terminology used in the document	Relevance type	% N=134
The terminology is known to me	Cognitive	30.59
Terminology not known before reading the document	Cognitive	8.96
Use the same terminology	Cognitive	26.12
I will consider using this terminology in future	Cognitive	8.96
Sub-total for cognitive relevance		**74.63**
Similar to terminology in the field	Socio-cognitive	25.37
Sub-total for socio-cognitive relevance		**25.37**
Total		**100**

Table 5.11. Negative affective relevance judgements made together with reasons for regarding a document as useful – not cited

Reasons for usefulness	Relevance type	% N=32
Provided background information	Cognitive	34.38
Similar theoretical viewpoint to my research	Cognitive	28.13
Provided particular focus/approach	Cognitive	6.25
Sub-total for cognitive relevance		**68.76**
Author has an interesting, but different approach to the problem	Socio-cognitive	31.25
Sub-total for socio-cognitive relevance		**31.25**
	Total	**100.01**

Table 5.12. Negative affective relevance judgements made together with reasons for not using a document

Reasons for not using the document	Relevance type	% N=91
Taught me nothing new	Cognitive	10.99
Provided good overview, but too elementary/superficial	Cognitive	9.89
Viewpoint of document does not support approach to the topic	Cognitive	12.09
Sub-total for cognitive relevance		**32.97**
Could not use the information in a meaningful way	Situational	28.57
Not familiar with author's work	Situational	7.69
Not accessible/available in work task/situation	Situational	2.20
Sub-total for situational relevance		**38.46**
Topic of document is different from topic of research or the viewpoint is not in accordance with conference theme/journal focus/degree course	Socio-cognitive	19.78
Someone else commented negatively on the document, it was not cited in any other document or I read another document that commented negatively on this one	Socio-cognitive	8.79
Sub-total for socio-cognitive relevance		**28.57**
	Total	**100**

Table 5.13. Negative affective relevance judgements made together with stated relationship with the author of a document – not cited

Aspect with regard to the author	Relevance type	% N=29
I know the author personally	Affective	0.00
Sub-total for affective relevance		**0.00**
I will consider using this author's work again	Cognitive	55.17
Sub-total for cognitive relevance		**55.17**
I am familiar with the author's work	Socio-cognitive	10.34
I have used this author's work before	Socio-cognitive	34.48
Sub-total for socio-cognitive relevance		**44.82**
	Total	**99.99**

It should however be noted that, due to the stated aims and consequent structure of this questionnaire, the distribution of relevance types over these tables should not be taken as a representation of relevance distribution in general.

From the findings in this sub-question (SQ$_5$), it has been demonstrated that there are elements of affective relevance present in all other relevance types. It is therefore concluded that *affective relevance*, as modelled in Figure 3.3 and discussed in Section 3.6.6, is another dimension of relevance judgements that may be associated with other subjective types of relevance, albeit in a random way.

5.2.7. Sub-question 6

Does socio-cognitive relevance exist separately from cognitive relevance? (SQ$_6$)

In Section 3.6.5 socio-cognitive relevance was defined as the relation between the situation, the work-task or problem at hand in a given socio-cultural context on the one hand and the information object on the other, as perceived by a cognitive agent. Cognitive relevance was defined in Section 3.6.3 as the relation between the state of knowledge, or cognitive information need of the user, and the information objects as interpreted by that user.

In order to answer this research question, it was necessary to establish whether or not *socio-cognitive relevance* is an important consideration when evaluating documents for use. See also the second sub-question under the main question (MQ_{D2}) in Section 5.2.1. above.

In order to establish the validity of this premise, the data sets from variable V33 in Section B and V36 in Section C (both binary statements answering the question of whether the academic standard of the document will be viewed favourably by the peers of the respondent) have been used to generate two new tables. The data set in Table 5.14 (see also Table F.1 in Appendix F) was used to establish the importance of the (perceived or real) evaluation of the document by peers (as representative of a socio-cultural or socio-cognitive domain) in the decision by the respondent to use a document. The data set regarding the socio-cognitive relevance was cross-tabulated with issues dealing with

- the importance of the document in the formulation of the research focus,
- the respondent's relationship with the author of the document,
- the degree of viewpoint congruence between the respondent and the author of the document,
- the perceived or real importance of the document in terms of the work task execution, and
- the socio-cognitive impact of the document within the domain.

Some of these issues dealt with graded relevance assessments, and others with socio-cognitive acceptability of the quality of the documents. The data set in Table 5.15 indicated just the opposite, namely the importance of the (perceived or real) evaluation of the document by peers (as representative of a socio-cultural or socio-cognitive domain) in the decision by the respondent not to use a document.

Table 5.14. The impact of socio-cognitive relevance considerations on document use

Description of variable	The academic standard of the document will be viewed favourably by my peers			Total %
	N	Yes %	No %	
This paper was very important in the formulation of your research problem	104	100.00	0.00	100.00
This paper was fairly important in the formulation of your research problem	151	91.39	8.61	100.00
This paper was not really important in the formulation of your research problem	65	84.62	20.31	100.00
The document is meaningful with the conference theme	38	97.37	2.63	100.00
The viewpoint of this document has an interesting/unusual perspective on the conference theme	20	75.00	25.0	100.00
I agree fully with the viewpoint of the author	129	99.22	0.78	100.00
I agree with most of the viewpoint of the author	159	93.08	6.92	100.00
I agree with some of the viewpoint of the author	31	64.52	35.48	100.00
I don't agree with the viewpoint of the author at all	1	100.00	0.00	100.00
I am familiar with the author's work	144	95.14	4.86	100.00
I know the author personally	47	97.87	2.13	100.00
I have used the author's work before in my papers	97	97.94	2.06	100.00
I will consider using the work of this author again	233	95.71	4.29	100.00
The terminology is similar to the terminology used in other documents in this field	222	93.24	6.76	100.00
I could not have completed my paper without this document	96	98.96	1.04	100.00
I would have been able to complete my paper without this document, but it would have been difficult	145	95.86	4.10	100.00
I would have been able to complete my paper without this document with no difficulty	79	79.75	18.99	100.00

Table 5.15. The impact of socio-cognitive relevance considerations on the non-use of documents

Description of variable	The academic standard of the document will be viewed favourably by my peers			Total %
	N	Yes %	No %	
The author has an interesting, but different approach to the problem	27	88.89	11.11	100.00
The viewpoint of this document is not in accordance with the conference theme	11	81.82	18.18	100.00
Someone else had read this document and commented negatively on it	5	40.00	60.00	100.00
It was not cited in any other document	6	66.67	33.33	100.00
I read another document that commented negatively on this one	1	100.00	0.00	100.00
The terminology is similar to the terminology used in other documents in this field	99	80.81	19.19	100.00

As can be observed in Table 5.14, a very small percentage of documents used by the respondents would not have been viewed favourably by their peers. This may be interpreted that it is a matter of concern to respondents whether or not the document used will be acceptable within a particular socio-cognitive domain. The percentages in Table 5.14 for documents that would not have been viewed favourably by the respondents peers are substantially higher than in Table 5.15. However, these documents were not used, once again supporting the assumption that it is important for respondents that the document will be acceptable within a particular domain. It may therefore be concluded that the notion of socio-cognitive relevance does exist and it is an important consideration when users judge the relevance of documents. This conclusion also effectively answers the derived question MQ_{D2} posed at the beginning of this chapter. Refer also to the discussion of SQ_4 above for more detail on the socio-cognitive relevance type.

The next phase was to address what could be considered the main issue regarding this sub-question (SQ_6), namely whether or not socio-cognitive relevance exists separately from cognitive relevance. This was tested as follows:

Where respondents indicated in Section B (relevant documents) that their peers would not approve of either the viewpoint (V32) of the document or its quality (V33), it was assumed that a definite socio-cognitive relevance judgement had been made. These data sets on socio-cognitive relevance judgements (positive as well as negative) were then cross-tabulated with the following data sets regarding cognitive relevance judgements obtained from in *Question 2* (reasons for use) and *Question 5* (reasons for usefulness) from Section B of the questionnaire.

- V7 = 28 (supports current state of knowledge)
- V11 or V12 or V13 = 1 or 7 or 9 or 11 or 14 or 28 or 29 (these were open-ended questions which were post-coded according to Table 4.3.)
- V16 = 1 (background or specific information need)

- V17 = 11 (real information needs - hard data, facts, figures)
- V18 = 29 (enhances current state of knowledge)
- V19 = 28 (supports current state of knowledge)
- V22 = 7 (clarity of presentation in terms of information need)
- V24 = 26 (although this is strictly speaking not a cognitive relevance judgement, the cross-tabulation yielded interesting results and is therefore included in the discussion)

Two tables were generated: Table 5.16 contains the results of the cross-tabulation of the data set for V32 (judgement of the peers regarding the viewpoint of the document) with the data set for the cognitive relevance judgements as described above. Table 5.17 contains the results of the cross-tabulation of the data set for V33 (the judgement of the peers regarding the quality of the document) with the same data set for cognitive relevance. Due to the small sample sizes in some instances, it was not possible to perform statistical significance tests, and the results have been discussed within context.

Table 5.16. Cognitive relevance judgements made in conjunction with socio-cognitive relevance regarding academic standards of documents

The academic standard of the document will be viewed favourably by my peers	Work tasks								
	Theses			Articles/Papers			Class assignments		
	N	Yes %	No %	N	Yes %	No %	N	Yes %	No %
V7=28 Supports current state of knowledge	99	95.96	4.04	56	96.43	3.57	26	88.46	11.54
V11=1 Background/specific information need	3	100.00	0.00	5	100.00	0.00	1	100.00	0.00
V11 or V12=11 Real needs - hard data, facts, figures	10	100.00	0.00	3	100.00	0.00			
V11=28 Supports current state of knowledge	1	100.00	0.00						
V11=29 Enhances current state of knowledge	1	100.00	0.00						
V16=1 It provide me with background information	111	86.49	13.51	60	96.67	3.33	32	90.63	9.38
V17=11 Real needs - hard data, facts, figures	85	96.47	3.53	39	97.44	2.56	28	100.00	0.00
V18=29 It told me something I did not know	79	88.61	11.39	34	100.00	0.00	32	90.63	9.38
V19=28 Supports current state of knowledge	75	90.67	9.33	44	100.00	0.00	16	93.75	6.25
V22=7 Clarity in terms of information needs	55	94.55	5.45	6	100.00	0.00	20	90.00	10.00
V24=26 The viewpoint of this document has an interesting/unusual perspective on the work task	9	77.78	22.22	6	100.00	0.00	6	60.00	40.00

Table 5.17. Cognitive relevance judgements made in conjunction with socio-cognitive relevance regarding viewpoint congruence of documents

| The viewpoint of the document will be viewed favourably by my peers | Work tasks | | | | | | | | |
| | Theses | | | Articles/Papers | | | Class assignments | | |
	N	Yes %	No %	N	Yes %	No %	N	Yes %	No %
V7=28 Supports current state of knowledge	99	95.96	4.04	56	87.50	12.50	26	96.15	3.85
V11=1 Background/specific information need	3	100.00	0.00	1	100.00	0.00			
V11=2 Sufficient detail/depth				4	100.00	0.00			
V11 or V12=11 Real needs - hard data, facts, figures	10	100.00	0.00	3	100.00	0.00			
V11=28 Supports current state of knowledge	1	100.00	0.00	2	50.00	50.00			
V11=29 Enhances current state of knowledge	1	100.00	0.00						
V16=1 It provide me with background information	111	91.89	8.11	60	93.33	6.67	32	96.88	3.13
V17=11 Real needs - hard data, facts, figures	85	97.65	2.35	39	92.31	7.69	28	100.00	0.00
V18=29 It told me something I did not know	79	91.14	8.86	34	94.12	5.88	32	96.88	3.13
V19=28 Supports current state of knowledge	77	96.00	4.00	44	90.91	9.09	16	100.00	0.00
V22=7 Clarity in terms of information needs	55	94.55	5.45	6	66.67	33.33	20	100.00	0.00
V24=26 The viewpoint of this document has an interesting/unusual perspective on the work task	9	77.78	22.22	6	100.00	0.00	5	80.00	20.00
V11=4 Acceptable within socio-organizational environment (accuracy/validity)	12	75.00	25.00	6	100.00	0.00			

From the aforegoing analysis it may be concluded that socio-cognitive relevance judgements seem very important when evaluating documents. There is a consistently high percentage in the columns where socio-cognitive relevance judgements are made (the "yes" columns in the two tables above).

However, there are some interesting deviations which are statistically significant and that show that positive cognitive relevance judgements are sometimes made within a negative socio-cognitive relevance judgement. These will be discussed below. Please note that these data sets should not be compared with the data sets in Table 5.7 (nesting) since the data described here are related to cross-tabulation of specific questions in the questionnaire. Whereas Table 5.7 indicates a very high incidence of both socio-cognitive and cognitive relevance judgements in general, the data sets described here shows some aspects of the actual relationship between these two types of relevance judgement.

It may be deduced from Table 5.16 that respondents who wrote articles and papers will very seldom cite a document that is not of acceptable quality within their domain. Students on the other hand, both undergraduate and post-graduate, will cite documents of dubious quality if they learnt something new from that document (V16, V18) or if they considered that it supported their state of knowledge (V7, V19).

It may be deduced from Table 5.17 that respondents who wrote articles and papers will cite documents whose viewpoint they consider will not be judged favourably by their peers, provided that these documents support their current state of knowledge (V7, V11, V19). Undergraduate students will not readily cite documents of which the viewpoints are not acceptable in their domain. Masters and doctoral students are likely to cite these types of documents only if it enhances their current state of knowledge (v16, V18).

From the aforegoing analysis there is a strong indication that cognitive relevance does exist separately from socio-cognitive relevance. Judging by the data gathered (see also discussion under SQ_4), both cognitive and socio-cognitive relevance play a significant role in the evaluation of documents, and the exact relationship between these two relevance types needs further investigation.

A further interesting observation is the relatively high percentage of students (both postgraduate and undergraduate) who indicated that even if neither the viewpoint nor the quality of the document would be acceptable within the domain, the document was still used because it had an interesting or unusual perspective on the work task (see the data in the shaded lower section of Tables 5.16 and 5.17). On the other hand, none of the respondents who were writing papers cited the document if it was not acceptable within the domain. Furthermore, the respondents who in the open questions listed a "4", namely acceptable/accurate within socio-organizational domain as a reason for document use, had a similar distribution (see Table 5.17 above). Although the number of responses to these questions were relatively low, this phenomenon was sufficiently interesting to initiate a reiterative review of the reasons stated in the original answer sheets. The 12 documents evaluated by masters and doctoral students and the six documents evaluated by authors of papers stated that either the supervisor (or other third party) advised them to use the document, or that the document was regarded as a seminal or "classic" text. In the case of the post graduate students, three out of the 12 considered that even though the document was used, the viewpoint would not be viewed favourably within the domain, whereas all six the documents evaluated by the authors of papers or articles indicated that it would.

A possible explanation for the fact that sub-standard documents are readily used and cited by students but not by authors of papers or articles is that students have to prove that they have undertaken a comprehensive literature review. They will therefore read and cite documents if their cognitive state has

been supported or enhanced, whereas authors of papers are expected to move to a next level where research is reported succinctly, and should not include a report of the groundwork.

On the other hand, authors of papers will more readily cite documents which supply and alternative viewpoint, even though it may not be accepted by their peers, because they might want to stimulate debate, open new avenues of research, etc. Students do not normally speculate in this manner, because lecturers expect them to know the basics of the subject before they can start experimenting.

5.3. Summary of findings

In this chapter various aspects of the model derived in Chapter 3 were tested empirically, based on the research questions posed in Chapter 1. The main findings were the following:

- Through the process of mapping relevance types and relevance attributes to derive a model of relevance types, it has been shown that these relevance types can be identified in terms of relations between elements in the process of cognitive information transfer. It was also shown that the model is a viable way of typifying relevance types, firstly through back-mapping of existing research, and then by testing some aspects of the model through new empirical research.

It was found that the type of work task performed has an influence on the type of relevance judgement that is made. This is specifically so that situational relevance judgements are associated with work task execution and that affective, topical, cognitive and socio-cognitive relevance judgements are associated with search task execution.

It was also shown that the relevance types are not necessarily nested, as previously assumed. Certain interesting correlations between

relevance types were observed, notably that between cognitive and socio-cognitive relevance, and this aspect should be studied in more detail.

Elements of affective relevance were found to be present in all the other relevance types – algorithmic, topical, cognitive, situational and socio-cognitive relevance.

- Finally, it has been demonstrated that socio-cognitive relevance as a manifestation does exist, that acceptability within a particular socio-cognitive domain is regarded as very important and that socio-cognitive relevance exists separately from the manifestation of cognitive relevance.

Conclusions regarding the model and the empirical findings have been stated in Chapter 6.

CHAPTER 6: CONCLUSIONS REGARDING MODELLING AND EMPIRICAL DATA

The following conclusions can be drawn from the research into the background to the problems of relevance research, the development of the model in this study and the empirical research in support thereof.

6.1. Conclusions from the literature review

It is clear from the literature review in Chapter 2 and the historic development of relevance research that there are gaps in the research. Relevance research is fragmented and there is a lack of common direction. Studies have identified a multitude of relevance types and there are clear overlaps between many of them, but researchers appear to be vague on the linkages between the studies. It was concluded that there is a need to pull relevance research into a comprehensive, holistic framework, and that it was necessary to develop a model of the type as described in Chapter 3.

6.2. Conclusions regarding the model developed

The model described relevance as relations between information objects as perceived and the various stages of the information seeking and retrieval process. It was based on an existing and widely accepted model of information transfer. It was initially pre-tested by back-mapping previous empirical research and it was then concluded that the model is a viable tool for relevance research. Subsequent empirical research supported the relationships described. It may therefore be concluded that the framework of the model is clearly capable of providing a comprehensive description of the interactions in relevance judgements.

From the specific empirical work in support of various aspects of the model it may be concluded that:

The type of work task performed has an influence on the type of relevance judgements made. Topical, cognitive, socio-cognitive and affective relevance judgements are made more often during search task execution, and situational relevance is more strongly associated with work task execution.

Relevance types are not necessarily nested, although interesting correlations between certain relevance types were observed. This particular issue requires further study.

- Affective relevance judgements may be made together with all other relevance judgements, even algorithmic.
- Even though socio-cognitive relevance exists separately from cognitive relevance, the former is regarded by users as a very important criterion when judging the relevance of an information object.

6.3. Conclusions for future research

It is essential to understand the manner in which relevance is judged in order to improve the representation of and access to information. It would thus be advantageous in current and future research to address each relevance type in terms of the holistic approach postulated by this model. This has been done in overview in the next chapter in order to provide some guidelines for future work.

CHAPTER 7: IMPLICATIONS OF THE MODEL FOR IR RESEARCH

Traditionally, the focus of IR research is on topicality as the deciding criterion for relevance. This study has confirmed that users also judge relevance on levels other than topicality. The question then is: *How can systems be improved in order to help users to make relevance judgements on other levels as well?*

The purpose of this chapter is to review the larger significance of the results regarding the implementation of the findings in terms of the possible applicability of the framework defined by the model as defined in Chapter 3.

It is essential to understand the manner in which relevance is judged in order to improve the representation of, and access to information. The analysis presented here provides a guideline for future research on relevance, and should be seen as a possible contextualisation of the model (as proposed in this thesis) within current research projects. The research in the field has been mapped to the model in order to expose the "bigger picture" of what is being done within relevance research. Although the list of studies reviewed below cannot be regarded as being comprehensive, all the studies mentioned already have as underlying theme the understanding of various types of relevance judgements as made by users of IR systems.

Each of the relevance types has been discussed briefly in order to re-establish the parameters of the definitions of the relevance types. These definitions are important, because these are the parameters in which the argument will take place. It is acknowledged that relevance is a fuzzy concept and that definitions vary, but by defining each manifestation clearly and only arguing within those parameters, misunderstandings should be minimized.

For each of these studies, the recent and current research into facilitating these relations in the search process has been analysed, with the focus on the more subjective relevance types of cognitive, situational and socio-cognitive relevance.

7.1. Algorithmic relevance

In the model as depicted in Figure 3.3, the relation is defined as that between the query and the information objects. This relation is system-oriented to a very large extent, as it depends on the degree of similarity between the features of the query and the features of the information object. This type of relevance is by nature system-dependent. It is not influenced by the user, nor is it related to any subjective information need the user may have.

System or algorithmic relevance is measured in terms of the comparative effectiveness of logical or statistical similarity of features inferring relevance. There are various models of matching the query (as a representation of the user's need) to the information objects (whether as full-text or as representations). Systems may be Boolean (exact match) or best-match (for example vector space, probabilistic, etc.) in nature, or a combination of both. See Figure 3.1 for a classification of retrieval techniques. Although it was stated that this study will limit its scope to the more subjective types of relevance judgements, the concept of algorithmic relevance is, nevertheless, included in the model and therefore a brief review of recent projects aiming to increase the comparative effectiveness of the relation between the query and the information objects has been given.

One of the most enduring debates within the systems approach to IR is the use of natural language versus controlled vocabulary to improve retrieval. A recent study in this field was done by Tomaiuolo and Packer (1998). A subset of this type of research is the work of researchers such as Sanderson (2000) on sense disambiguation. Other researchers concentrate on improving relevance feedback methods, for example the research by Voorhees (1998)

on the role of assessors in measuring relevance feedback, Lee (1998) on multiple evidence from relevance feedback methods, Lam-Adesina and Jones (2001) on summarization techniques for term selection in relevance feedback, Voorhees (1999) on the validity of TREC for using relevance as a measurement of retrieval effectiveness and Voorhees (2001) on the role of highly relevant documents in system evaluation. Another recent area of research within the systems relevance is that of partial or graded relevant assessments, for instance the work of Järvelin and Kekäläinen (2000) on discounted cumulative gain which incorporates multiple relevance levels into a single measure and Kekäläinen and Järvelin (2002) on graded relevance assessments in IR evaluation.

The focus of the studies mentioned above is algorithmic relevance in the model derived in this study – the relation between the query and the information objects. Traditional Boolean systems facilitate binary relevance judgements, whereas best match systems, or a combination of best match and Boolean systems, are able to rank retrieved information by relevance. It is clear that even in systems relevance research there has been a move away from the traditional binary relevance judgements and a greater appreciation for the fuzziness of relevance judgements made by users and the need for interactive information retrieval (IIR). Therefore, research on retrieval systems improvement should focus more on facilitating fuzzy relevance judgements.

7.2. Topicality

Topical relevance is defined as the relation between the topic of the query and the topic of the assessed information objects. The finding of focus during the formulation of the request by the user, which is then transformed into a query by the system, is the criterion whereby topicality is inferred. The assumption is that both request and the objects may be assessed by a cognitive agent as being about the same or a similar topic, which implies a degree of subjectivity. The assessment is even less reliable if the information objects are represented by human-indexed terms.

Improving the relationship between the request and the information objects in terms of topicality is the focus of IR systems. Interesting new developments in the field of information representation, might prove to be useful in assisting users to judge potentially useful documents on a topical level.

Although not empirically supported, Ford's (1999) discussion of the possibilities offered by machine processing of similarities through high order knowledge representation and fuzzy (or parallel) IR is summarised here as a case in point.

7.2.1. High order knowledge representation

Relatively high order knowledge representations may be facilitated by linguistic analysis whereby similarity relationships at a relatively high level of abstraction can be made. A system such as DR-LINK "... can retrieve related articles that would not be found in a Boolean search because they contain the ideas, not the precise words, that were requested" (Feldman as quoted in Ford, 1999). This is still not enough, for current research, according to Ford (1999), is focussed (*within narrow subject domains*) on:

- the computation of argumentation (components and structures of arguments are represented in such a way that patterns of argument and counter-argument may be mapped onto each other and compared for similarities and differences);

- analogy-based representations and processing to support case-based reasoning (similarities are represented and then matched between stored cases of solved problems so that solution structures of known problems may be applied to new ones);

- the direct modelling of analogical reasoning (attempts to model human analogical reasoning to computers as well as commercial analogical problem-solving systems); and

- information abstraction (structured knowledge representation of complex events, situations or relationships are created and then populated with text extracted from unstructured natural language texts).

The common thread in these studies is the specification of relationships between structural components at a level of abstraction higher than mere morphological or syntactical analysis, "and of more complex semantic patterns than relative simple thesaural links" (Ford, 1999).

7.2.2. Fuzzy and parallel IR

Often neural networks (employing fuzzy, parallel processing though pattern matching), focus on sub-semantic levels (e.g. image processing). Some systems, however, also use nodes to represent keywords and documents on a semantic level. Examples of these representations are taxonomies and ontologies (Welty & Guarino, 2001) and topic maps (Pepper, 2000). Knowledge of the relationship between query and documents is then stored in the pattern of links between the nodes (Ford, 1999).

By using higher order knowledge representation and fuzzy and parallel IR, systems tend to become more intelligent. Although this type of research is relatively new, it is quite feasible that technologies such as those described above, may aid users in the judging of topically relevant information, by supplying wider information content than simply that which was requested through the query. Typical projects on these matters are for instance those related to sense disambiguation (Sanderson, 2000), Park's (1995) work on inferential representation of documents within subject fields and Choi and Rasmussen's (2001) work on image retrieval based on topicality.

7.3. Cognitive relevance / pertinence

Pertinence is measured in terms of the relation between the state of knowledge, or cognitive information need of the user, and the information objects as interpreted by that user. The *criteria* by which pertinence are inferred are cognitive correspondence, informativeness, novelty and information preferences. For instance, a paper may be topically relevant but

repeating what the user already knows. Cognitive relevance is clearly a very subjective judgement, as opposed to algorithmic and topical relevance as discussed above. The question on how to induce and facilitate the novelty value of information to users, must therefore by addressed on an entirely different level.

Traditional IR systems allow users to modify queries according to their own understanding of the problem. This, in turn, depends on the user's conceptual knowledge background and his understanding or perception of his information need. Toms (1998) uses an interesting set of analogies to describe this aspect of seeking: "Sometimes people seek a target with the precision of a cruise missile. Sometimes they seek a target with the imprecision of a Christmas shopper."

The fact that the success of a query to retrieve cognitively relevant information depends on the user's understanding of both the system and the user's own problem space, tends to limit the possibility of the user finding relevant information. In recent research, however, there has been attempts to induce and facilitate serendipitous information retrieval. To continue with Toms' (1998) analogy: "Sometimes a target appears - unexpected and unsought, such as the five dollar bill fluttering in the fall leaves."

According to Toms (1998) there are essentially three ways to acquire information:
1. searching for information about well-defined and known objects;
2. searching for information about an object that cannot be described, but which will be recognized on sight; and
3. accidental, incidental or serendipitous discovery of an object.

She contends that current information retrieval systems are based on the assumption that users know (or partially know) the object of their search, and that serendipitous information retrieval is largely ignored in information system development and research (Toms, 2000).

According to Figueiredo and Campos (2001), classic problem solving first requires a recognition of the problem, then some sort of divergence taking place and ultimately converging into a novel solution for the problem. Serendipity, on the other hand, is a creative process, whereby an attempt to solve a problem leads first to a divergence, and then to a new problem or a solution to a problem that was not known to exist. Serendipity is also defined by Quéau (quoted in Figueiredo & Campos, 2001) as "the art of finding what we are not looking for by looking for what we are not finding".

It is generally acknowledged that qualitative research sometimes contains "good fortune", but according to Fine and Deegan (1996), serendipity consists in how this fortune is transformed into substantive discovery. Serendipity is therefore not only a "chance encounter" (Toms, 2000), but more than that – it is the "unique and contingent mix of insight coupled with chance" (Fine & Deegan, 1996). Furthermore, Spink and Greisdorf (1997) found that highly relevant documents do not often change the user's cognitive or information space, but partially relevant documents do.

Serendipity rests on the three principles of insight, chance and discovery (Fine & Deegan, 1996). The principles of chance and discovery could be built into systems, for example though improved browsing facilities (see Toms (1998) for an example of such a system). However, the first principle, that of insight, rests solely with the user. To quote Louis Pasteur: "Chance favours only the prepared mind" (Oxford Dictionary of Quotations, 1979).

Although the research focus of serendipitous retrieval is not necessarily that of helping users that cannot formulate their own information need satisfactorily, it is plausible that it may be utilised as an aid to users who cannot express their query to a sufficient degree. Research, such as that of Toms (1998; 2000) is very important in terms of the improvement of IR systems in order to assist users to judge relevance on a cognitive (personal) level.

Another important contribution within this focus of cognitive relevance judgements, is the research on profile building for information filtering. Coupled with browsing, personalization of information retrieval can help people to find information with potential value to their information needs. With regard to the internet, Bowman et al. (1994) note "at least 99% of the available data is of no interest to at least 99% of the users". Personalization of information delivery relies on systems that selectively weed out the irrelevant information based on the user's preferences (Quiroga & Mostafa, 2001). Although this has been said in a different context, it is clear that *cognitive relevance* is implied.

7.4. Situational relevance

Situational relevance describes the relationship between the perceived situation, work task or problem at hand and the usefulness of the information objects as perceived by the user. The criteria by which situational relevance is inferred are usefulness in decision-making, appropriateness of information in problem solving and the reduction of uncertainty.

According to Borlund (2000) "... the judgement of situational relevance embraces not only the user's evaluation of whether a given information object is capable of satisfying the information need, it offers also the potential of creating new knowledge which may motivate change in the decision maker's cognitive structures. The change may further lead to a modification of the perception of the situation and the succeeding relevance judgement, and in an update of the information need".

Subjective relevance types, including situational relevance, are generally accepted to be both dynamic and multidimensional in nature. In the information seeking process, these relevance types are continually and interactively assessed. This assessment is not binary, but rather judged as degrees of relevance. In order for systems to support the searching

behaviour of users in this context, it must allow for interactive information retrieval. See Borlund (2000) for the evaluation of such systems, and Savage-Knepshield and Belkin (1999) for a historical overview of trends in interactive IR (IIR).

Situational relevance in this study was found to be more strongly associated with work task execution than with search task execution. Therefore, interactive IR should also support searching over more than one session, and complex profiling should be able to dynamically include changing situational factors as well.

7.5. Socio-cognitive relevance

Socio-cognitive relevance is, together with cognitive, situational and affective relevance, regarded as a subjective relevance type. Socio-cognitive relevance describes the relationship between the situation, the work-task or problem at hand in a given socio-cultural context on the one hand, and the information objects on the other, as perceived by one or more cognitive agents. The social or organizational domain, or cultural context in which the individual finds himself is defined by a paradigm, which dictates what problem explanations may be found to be acceptable.

Retrieval of information limited to particular paradigms or socio-cultural or socio-cognitive domains may not be easily solved by improvement to systems. Facilitating serendipity or IIR may yield somewhat improved results, but in general the nature of socio-cognitive relevance is such that metadata would probably be the best solution to this particular problem.

The purpose of metadata is to describe the structure of the content data, and more importantly, to capture any additional properties that may characterise it. Metadata formats are divided into three categories: simple, rich and structured (Hakala, 2001):

❑ *Simple formats* are proprietary and based on full text indexing. This type of data is created by search engine crawlers. They are easy to use, but are weak for information retrieval purposes, as they do not support field searching.

❑ *Rich formats* are associated with research and scholarly activity, and require specialist subject knowledge to create and maintain. These formats are usually based on international standards, e.g. MARC (Machine-Readable Cataloguing), FGDC (Federal Geographic Data Committee), ICPSR (Interuniversity Consortium for Political and Social Research – an SGML codebook initiative describing social societies), CIMI (Computer Interchange of Museum Information), EAD (Encoded Archival Description) and CERIF (Common European Research Information Format).

❑ *Structured formats* are a compromise between simple and rich formats, specially developed for Internet usage. These include data that contain a detailed enough description to allow a user to assess the potential utility or interest of a resource without having to retrieve it. The data are structured and support field searching, but are still domain specific. Some structured formats are the IAFA (Internet Anonymous FTP Archive) templates; RFC (Internet Request for Comments) 1807 (format for bibliographic records); SOIF (Summary Object Interchange Format); and LDAP (Lightweight Directory Access Protocol) Data Interchange Format (LDIF). However, the Dublin Core Metadata Element Set (http://dublincore.org) is one of the first truly universal formats. This metadata element set is intended to facilitate the finding of electronic resources, originally conceived for author-generated descriptions of web resources.

The *de facto* standard for metadata, especially on the Web, is Dublin Core (DC). Dublin Core is a general set of metadata elements and is often enriched by application domain-dependent additions, such as the NDLTD (Networked Digital Library of Theses and Dissertations) and the LOM (learning object

metadata). The elements and definitions of DC are based on the official standard for the element set of DC (ANSI/NISO Z39.85-2001). The elements can be seen as describing three different dimensions of metadata, i.e. describing the content or *data*, describing the *source*, and describing the *collection process* to collect the content. This subdivision is very important, since it describes the reality of the aboutness, isness and processing of the information objects (Cosijn, et al., 2002).

It is especially the data elements that are related to the source that may be of importance for improving access to *socio-cognitively relevant* information objects. Metadata elements such as the following DC elements have great potential to help users to judge the relevance of retrieved information objects with regard to a particular situation, or within a particular socio-organizational domain during the search task:

- Type: Nature or genre of the content of the resource
- Format: Physical or digital manifestation of the resource
- Identifier: Unambiguous reference to the resource within a given context
- Source: Reference to a resource from which the present resource is derived
- Language: Language of the intellectual content of the resource
- Relation: Reference to a related resource, and
- Coverage: Extent or scope of the content of the resource.

Another technique that may be used to facilitate socio-cognitive relevance is that of co-citation analysis. Patterns of co-citation can help a searcher to understand which publications and authors may be grouped together in terms of their approach to a subject. This may then give an indication of acceptability within a particular socio-organizational domain.

An interesting study by Yuan and Meadow (1999) showed another possibility of improving access to socio-cognitively relevant documents. Authors in

different fields use different words to describe concepts, for example *data* and *information* is used differently in the fields of computer science and information science. Yuan and Meadow (1999) found that when two individual papers, or two authors over several works, use the same variables (or terms), it indicates a *similarity in approach* to the subject. According to them, if authors use the same variables, "such usage may be a stronger indication of similarity than co-citation because it represents what the authors did, rather than what they say" (Yuan & Meadow, 1999).

In traditional systems, both topicality and socio-cognitive relevance types were facilitated purely by human input. However, by using technologies such as described above, both these relevance types may be partially facilitated at a systems level.

7.6. Affective relevance

Affective relevance is described in terms of the relation between the goals, intents and motivations of the user and the information objects. Affective relevance should not be seen as the ultimate subjective relevance in a scale of relevances, but rather as another dimension of relevance judgments that may be associated with the other subjective types of relevance. As such, it is probably not possible to improve systems (other than profiling) or information representation to expressly facilitate this manifestation of relevance.

7.7. Conclusions

This study has aimed to improve our understanding of relevance by providing a model for understanding the concept of relevance in terms of relations between information objects on the one hand and the various aspects of the information seeking and retrieval process on the other.

In the historic development of IR as a field of study, three main research paradigms can be clearly identified – the systems approach, the user approach and the cognitive approach (Ingwersen, 1999). Recently the

emergence of a (tentative) fourth approach has become evident – the socio-cognitive or epistemological approach (Hjørland, 2002).

As stated in the first chapter, relevance may be regarded as the central and most fundamental concept within the field of information science. We are studying relevant information, not just any information. As such, relevance should not be studied from a limited perspective. Systems may be improved by making their algorithmic relevance scores better correlate with the subject, but users judge relevance from a much broader perspective – not only from a cognitive perspective, but also within an epistemological framework.

The model developed and tested in this study defines the various relevance types and their interconnectivity. From the additional information provided on the various manifestations in this concluding chapter it should be clear that these relevance judgements, either individually or jointly, may be and indeed need to be facilitated in some way by improving systems to make intelligent, interactive IR possible.

Relevance should be the one issue connecting the various approaches within information science. No single research paradigm should claim relevance for its own. In order to understand relevance, it is necessary to view the concept from a holistic perspective, taking into account the systems, the users, the cognitive overlaps of the role players within IR as well as the influence of the epistemological framework in which IR takes place. It is critical that future research in the field of IR should take all these factors into account.