On the use of computerised decision aids
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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2006

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):

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Download date: 07-12-2018
Chapter 1

Introduction

Expert systems are computer programs that can help their users to solve problems. Parsaye and Chignell (1988) define an expert system as "... a computer program that has a wide base of knowledge in a restricted domain, and uses complex inferential reasoning to perform a task that usually only a human expert could do." Thus, an expert system is a kind of artificial expert. When a user gives an expert system a problem, it will give a solution to the problem.

Expert systems were one of the first products to commercialise artificial intelligence. They have been developed for all kind of disciplines including medicine, law, chemistry, engineering, etc. and have outgrown their laboratory settings (see Durkin (1994) for an overview). People actually use expert systems to make decisions.

However, an expert system is not a perfect problem solver. The restriction of the knowledge domain is an important limitation (Boden, 1990). An expert system regarding traffic law might miss some rules of criminal law that should be used in certain traffic law cases. Consequently, conclusions of the expert system reached for these cases may be inadequate. An expert system for wine advice will not give the advice to drink beer with your food, although this could be the best alternative. Furthermore, the knowledge of the expert system could be out of date. Also, alternative ways to solve a problem might not have been modelled into the expert system. Therefore, the solution of an expert system should be treated as advice, and there is the implicit assumption that the user will judge the applicability of this advice.

Since the user has to judge the advice of the expert system, it is important to have a good user-interface. Most expert systems have explanation facilities to explain their conclusions, so the user can look into
the reasoning process to find out how the expert system deduced the advice (Dhaliwal & Benbasat, 1996). Also, the user can look up the knowledge sources and the facts on which the expert system has based its findings. Human-Computer Interaction (HCI) research concentrates on designing interfaces that make access to user-requested information as easy as possible. Software and hardware facilities should provide high-quality service to their user. Often, the term `user friendliness' is used to refer to this aim (Shneiderman, 1992).

Yet, what information does the user want? How do users judge the relevance of the advice of an expert system? HCI research focuses on user friendliness; it does not explain how people evaluate the advice of an expert system. To answer this question we must adopt a different point of view than HCI's information processing approach. In social psychology there is a vast body of research on how people respond to advice. Research on persuasion explains what makes people accept or reject advice. Models from social psychology on persuasion describe how people evaluate messages, and researchers on expert systems can also use these models to study the users' evaluation of expert system advice.

The Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986a 1986b) is a widely used model to study persuasion. It identifies two ways in which people evaluate messages. First, people can follow the central route to persuasion. That is, persuasion is likely to result from a person's careful examination of the information contained in the message. A person examines a message this way when he or she is highly motivated and able to judge the message. Most HCI research on expert systems implicitly assumes that this is the way people interact with expert systems. Expert system developers try to make the access to information about the advice-derivation as easy as possible, and they expect that the user will study this information carefully.

However, people can also follow the peripheral route to persuasion. This means that people use simple decision rules or cognitive heuristics to formulate their judgements. They come to a judgement without a careful examination of the message. For instance, many people accept the advice of a doctor because an expert gives the advice, not because they have carefully examined the advice and have evaluated it as being correct advice. For the
same reason, people may be persuaded by an expert system to uncritically adopt its advice. If this is true, users may easily accept incorrect conclusions from an expert system.

There are reasons to presume that people use the peripheral route when they judge the advice of an expert system. Eagly and Chaiken (1993) think that people want to solve problems in the most efficient way. Their least effort principle says that people prefer less effortful to more effortful information processing. In other words, people will prefer the peripheral route over the central route to persuasion, unless they are motivated to make an effortful examination. Some studies show that people use computer support to decrease the effort of decision making, not to increase the quality of the decisions (Todd & Benbasat, 1992, 1994a, 1994b). Thus, users of expert systems may follow the peripheral route to persuasion.

Furthermore, some studies report that people have difficulties with evaluating computerised advice. Users are not always aware of the system's incorrectness or redundancy (Kottemann, Davis & Remus, 1994; Kottemann & Remus, 1987). If users examined the advice of a computer more carefully, then they would notice when the advice is not useful. However, it seems that people put too much trust in expert systems. An expert system makes information look more credible (Murphy & Yetmar, 1996; Waern & Ramberg, 1996). According to the ELM model this effect is the result of a peripheral judgement. It is based upon the expected credibility of the message source. It is not based upon a careful examination of the message. However, there are no studies of the peripheral persuasiveness of expert systems. The main purpose of the study reported in this thesis is to examine the persuasiveness of expert systems.

Chapter 2, 3, and 4 provide a theoretical background for the experiments on persuasiveness of expert systems presented in Chapter 5, 6, and 7. Chapter 2 outlines the functioning of an expert system and discusses some of the problems that designers of expert systems encounter. Next, Chapter 3 explains the Elaboration Likelihood Model and reviews some studies of users' misinterpretation of information provided by computers. Chapter 4 covers an overview of constructs that have been used to study the user's attitudes towards computers, such as computer anxiety, computer self-
efficacy, and computer playfulness.

The first experiment examines the persuasiveness of expert systems. In the experiment lawyers judged nine legal cases supported by one of two expert systems. The expert systems had different (incomplete) knowledge models, and they consistently gave opposite advice on each legal case in question. Chapter 5 describes this experiment in detail. The objective of the experiment is to show that lawyers can easily be misled by the incomplete and incorrect advice of a legal expert system.

Chapter 6 provides a study of the peripheral cues associated with expert systems. The main purpose of this experiment is to explain why users sometimes put their trust into the incorrect advice of an expert system. In the experiment subjects evaluated advice that was said to be given by either an expert system or by a human adviser. When the subjects' evaluation regarding the advice of the human adviser differs from the evaluation regarding the advice of the expert system, then this difference would be caused by a peripheral evaluation, because the advice of the human adviser and the advice of the expert system were exactly the same.

Chapter 7 covers an experiment on the factors that moderate the peripheral persuasion of expert system users. Subjects were tested for beliefs related with computers use, such as computer self-efficacy and computer playfulness. A mental effort test and a recall test were taken to find support for the ELM.

Chapter 8 provides a general discussion of the findings in the three experiments. It is concluded that expert systems are persuasive message sources and that the ELM is a suitable model to study this phenomenon. Users of expert systems will often use the peripheral route to judge the advice of the expert system. Consequently, these users will have difficulty noticing when an expert system gives incorrect advice. The chapter concludes with some implications that this behaviour of expert system users may have for expert system development.