Chapter 6

Persuasiveness of expert systems*

6.1 Introduction

Do users judge advice of expert systems by examining its contents? This chapter argues that users' beliefs about expert systems influence their evaluation of the advice. It is important to know how users assess advice of expert systems, because they have to neglect the advice when the expert system is incorrect (Berg, 1995; Chen, 1992; Hollnagel, 1989; Suh & Suh, 1993; Waldrop, 1987). Therefore, modern expert systems are equipped with explanation functions that give users the opportunity to examine the inference (Berry & Broadbent, 1987; Bridges, 1995; Waldrop, 1987; Wognum, 1990; Ye & Johnson, 1995). But do users consult these explanation functions? Are users interested in the argumentation behind the advice? Theory on persuasion shows that advice is often judged without an examination of the arguments. Beliefs held by a person about the adviser can influence his or her attitudes towards the advice (Petty & Cacioppo, 1986a, 1986b). Therefore, it is possible that user beliefs and attitudes influence the use of expert system advice.

In Management Information System research the topic of user beliefs and attitudes has been studied extensively (Barki & Hartwick, 1989, 1994; Baroudi, Olson & Ives, 1986; Ginzberg, 1981; Hartwick & Barki, 1994; Igbaria, 1993; Paré & Elam, 1995; Robey, 1979). Especially user satisfaction and perceived usefulness, are believed to be important factors for system use (Davis, 1989, 1993; Davis, Bagozzi & Warshaw, 1989; Galletta

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& Lederer, 1989; Gatain, 1994; Igbaria & Nachman, 1990; Igbaria, Schiffman & Wieckowski, 1994; Iivari & Ervasti, 1994; Ives, Olson & Baroudi, 1983; Keil, Beranek & Konsynski, 1995). But, user satisfaction will not always indicate whether computer support is desirable (Melone, 1990; Srinivasan, 1985; Szajna, 1993). Some studies underline that users can be wrong in their judgement on the usefulness of intelligent computer support. Kottemann, Davis, and Remus (1994) show that redundant what-if help increases users' confidence and Davis, Lohse, and Kottemann (1994) point out that irrelevant information in an information system weakens performance but increases the users' confidence. Similar results were reported by Aldag and Power (1986) and Will (1992). Cornford, Doukidis, and Forster (1994) warn for the influence an imperfect medical expert system might have on medical professionals in developing countries. Dijkstra (1995) found that the incompleteness and incorrectness of argumentations made by a legal expert system were hardly noticed by the lawyers who used it.

These studies show that users sometimes make judgements on expert system advice that are not supported by the contents of the argumentation. User acceptance of expert system advice is not always based on a thorough examination of the advice. This notion is supported by the Elaboration Likelihood Model (Petty & Cacioppo, 1986a, 1986b), a theory on persuasion that states that people are likely to make their judgement on peripheral cues if they are less motivated or unable to judge a message on its contents. Persuasiveness of the source of the message is an important peripheral cue. For example, a doctor's advice is believed to be important because it is made by a doctor, not because of a positive evaluation of the message by the patient. According to the Elaboration Likelihood Model, user acceptance of expert system advice without thorough examination of correctness or applicability might be explained by persuasiveness of the expert system.

The motivation to examine the contents of a message is triggered by personal relevance, responsibility, and need for cognition. Need for cognition indicates whether a person likes to examine an argumentation (Cacioppo & Petty, 1982; Priester & Petty, 1995). A person who does not like to study an argumentation is more likely to make a judgement on
Peripheral cues. Todd and Benbasat (1992, 1994a, 1994b) found that imperfect use of decision support systems occurs more often when users want to reduce their cognitive effort. Thus, need for cognition can be an important indicator of how a person will use an expert system.

The research presented in this chapter is on persuasiveness of expert systems. It tries to explain why users of expert systems sometimes put their trust into redundant or even incorrect information presented by an expert system. In line with the Elaboration Likelihood Model, it is thought that users have certain beliefs about advice given by an expert system that, regardless of its contents, makes them agree easily. This research tries to identify some of these beliefs that people might have about advice given by an expert system.

In the experiment, subjects had to judge advice on several cases. Some subjects were told that the argumentations were made by expert systems and some were told they were made by humans. In the expert system group, half of the subjects got argumentations in natural language (the same as in the human group), the other half got them in production rule format (see Table 6.1). Subjects were asked to fill out a questionnaire on what they thought of the argumentations and conclusions. If subjects base their judgement only on the contents of the advice, this evaluation will not differ when the adviser is said to be a human or an expert system. However, it is hypothesised that an expert system is a persuasive message source in comparison with human advisers. Research has shown that the advice of an expert system can be convincing even when its arguments are weak (Dijkstra, 1995; Kottemann & Remus, 1987). Thus, it is expected that the expert system groups will score higher on the persuasiveness factors ($H_1$). Furthermore, arguments presented in a production rule format are more difficult to judge because people are not used to reading production rules. Therefore, it is hypothesised that subjects who got the argumentation of the expert system in a production rule format will score higher on the persuasiveness factors than subjects who got the argumentation in natural language ($H_2$). In addition, it is expected that subjects with a low need for cognition are less motivated to study the argumentation and, consequently, are more likely persuaded by an expert
system. Thus, subjects with a low need for cognition will score higher on the persuasiveness factors in the expert system conditions than subjects with a high need for cognition (H3).

Table 6.1 The experimental groups.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Human advisor</th>
<th>Expert system advisor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Natural language</td>
<td>Production rules</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

6.2 Method

6.2.1 Subjects

Students were asked to participate in the experiment through an advertisement in a local university newspaper. They were paid 12 Dutch guilders (8 U.S. dollars). Eighty-five students from several faculties participated. After randomly assigning the subjects to the conditions 28 subjects were told that the argumentations were made by a human, 28 subjects were told that the argumentations were made by an expert system, and 29 subjects received the same argumentations in a production rule style and were told that they were made by an expert system.

6.2.2 Apparatus and procedure

Table 6.2 gives an overview of the 5 phases of the procedure. The procedure started with a pretest on subjects' experience with computers and the knowledge domains involved (Phase 1). Subjects' need for cognition was tested with a questionnaire developed by Cacioppo and Petty (1982) and translated into Dutch by Pieters, Verplanken, and Modde (1987). After the pretests, subjects carried out a simple number-circling task (Phase 2). Subjects were asked to circle every 1, 5, and 7 in a table of 875 random
numbers. This test was used as distraction to reduce the effect of the pretest. The test was also used as a check on the need for cognition test (see Phase 4).

**Table 6. An overview of the procedure.**

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Phase 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretests</td>
<td>Distraction</td>
<td>Main Test</td>
<td>Distraction</td>
<td>Recall</td>
</tr>
<tr>
<td>- sex, age, study (3 items)</td>
<td>simple number-circling test</td>
<td>4 cases in random order with after each case a questionnaire of 23 items</td>
<td>difficult number-circling test and a short questionnaire on the number-circling tests</td>
<td>8 recall questions on the cases</td>
</tr>
<tr>
<td>- knowledge on: dyslexia, cardiology, train tickets, law (4 items)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- computer experience (4 items)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- need for cognition (14 items)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the main part of the test (Phase 3), 4 cases with a conclusion and argumentation were handed out. In each case, a person's problem was presented. The problem was described, with an advice on it said to be given by either an expert system or a human (for an example see the Appendix). The cases were on dyslexia, cardiology, law, and train tickets. After each case, the subject filled out a questionnaire on the conclusion and argumentation. All subjects evaluated, in random order, the same cases with the same argumentation and conclusions. The only difference between Conditions 1 and 2 was the message source mentioned (a human in Condition 1 and an expert system in Condition 2). In Condition 3 the same argumentation was presented as in Conditions 1 and 2 but in a production rule style and with an expert system as message source mentioned (see Table 6.1 and the Appendix).

The items used in the questionnaire were based on research on interpersonal persuasiveness and on qualities people expect from expert systems. Important interpersonal persuasiveness factors are credibility (competence and trustworthiness), liking, similarity, and consensus (O'Keefe, 1990; Petty & Cacioppo, 1986b; Worchel, Cooper & Goethals,
Qualities people associate with expert systems are objectivity and rationality (Berg, 1995; Boden, 1990). Items were designed for all these constructs, with two items on the difficulty of the case, making a questionnaire of 23 items (see Table 6.3 for item wordings). A factor analysis was used to distinguish factors thought to be important for judging expert system advice.

At the end, subjects carried out a complex number-circling task (Phase 4). They had to circle every 3, every 6 when a 7 followed, and every second 4 in a table of 600 numbers. It was expected that subjects with a high need for cognition liked the difficult number-circling task better than the simple one. The final questionnaire (Phase 5) was a recall test on the information presented in the dyslexia, cardiology, law, and train ticket cases.

6.2.3 Construction of the need for cognition scale

For the construction of the need for cognition scale, 13 of the 18 items from a test developed by Cacioppo, Petty, and Kao (1984) were used. Pieters et al. (1987) dropped Items 5, 13, and 16 after translating and testing the scale in Dutch (for item wording see Cacioppo et al. 1984). Item 18 was dropped because, in a small pilot study, subjects thought it was incomprehensible. Of the 14 items used in the test, Item 9 was dropped because it correlated very low with the other items (the corrected item total correlation was .11). Cronbach's alpha was .79 for the 13 items used. As suggested by Cacioppo and Petty (1982), the need for cognition scale was constructed by collapsing the item scores. The 33% and 67% percentiles were used to make groups with a high, average, and low need for cognition.

With two 6-point Likert scale items subjects were asked whether they liked the difficult number-circling task better than the simple one (Phase 4, see Table 6.2). Cacioppo and Petty (1982) used a similar test to verify the need for cognition scale. As predicted, subjects with a high need for cognition ($M = 8.1$) liked the difficult task better than subjects with a low need for cognition ($M = 6.8$), $t(49) = 2.44, p < .01$. Also, scores on the recall questions (Phase 5, see Table 6.2) were used to test the need for cognition scale. According to the Elaboration Likelihood Model, a high need
for cognition would invoke a thorough examination of the cases. Therefore, subjects with a high need for cognition were expected to score better on recall in comparison with subjects with a low need for cognition. The recall scale was constructed by taking the number of correct answers on 8 good/wrong recall questions. As predicted, subjects with a high need for cognition ($M = 6.1$) scored better on recall than subjects with a low need for cognition ($M = 5.5$), $t(49) = 2.02$, $p < .05$.

6.2.4 Construction of the computer experience scale

A scale for computer experience was constructed by using 4 questions from the pretest (Phase 1, see Table 6.2). The first question was on frequency of computer use (never, monthly, weekly, several times a week, daily; scoring 0 to 4). The second question was on diversity of computer use ("Do you use a computer for: word-processing, databases, electronic mail, programming, games"; scoring the number of applications: 0 to 5). The other two questions were 6-point Likert scale items on computer expertise and expert system knowledge. A Principal Component Analysis (PCA) showed one factor, accounting for 65% of the variance. Cronbach's alpha was .81. The PCA factor scores were taken as an indication of computer experience. Although not hypothesised, a significant correlation was found between need for cognition and computer experience, $r = .36$, $p < .001$; subjects with a high need for cognition had more computer experience.

6.2.5 Construction of the persuasion scales

In the main part of the test, subjects had to judge 4 cases. After each case they filled out a questionnaire (Phase 3, see Table 6.2). Thus, subjects scored each item 4 times. Simultaneous Component Analysis (SCA; Kiers, 1990; Kiers & Ten Berge, 1989) with a varimax rotation was used for summarizing the items by means of a small number of components. In SCA, component weights are found that define components that optimally account for the variance in all 4 cases simultaneously. These components have the same interpretation in all 4 cases, because their weights are equal and apply
to the same items. The results are presented in Table 6.3.

Table 6.3 SCA factor weights for all cases and factor loadings for the law case (between brackets) of the items used in the main test. Absolute weights lower than .15 and absolute loadings lower than .35 are left out.

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Item Wording</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Compliance</td>
<td>Objectivity</td>
<td>Easiness</td>
<td>Case Authority</td>
</tr>
<tr>
<td>3</td>
<td>I fully agree with the way the problem is solved</td>
<td>.34 (.88)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>This way of problem solving is tempting</td>
<td>.26 (.78)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I wouldn’t have any questions after this explanation</td>
<td>.23 (.68)</td>
<td>.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>More often problems should be solved this way</td>
<td>.24 (.84)</td>
<td>.16 (.53)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>I have full confidence in the way the problem is solved</td>
<td>.33 (.91)</td>
<td>.15</td>
<td></td>
<td>(.50)</td>
</tr>
<tr>
<td>9'</td>
<td>I wouldn’t have tolerated such a treatment if I had a similar problem</td>
<td>.33 (.73)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>The problem is solved reliably</td>
<td>.34 (.82)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13'</td>
<td>This conclusion is a bad one</td>
<td>.29 (.74)</td>
<td>.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>I would have solved the case in a similar way</td>
<td>.31 (.83)</td>
<td></td>
<td></td>
<td>(.57)</td>
</tr>
<tr>
<td>21</td>
<td>Inference and conclusion are trustworthy</td>
<td>.20 (.61)</td>
<td>.16 (.55)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>The problem is dealt with sympathetically</td>
<td>.24 (.56)</td>
<td></td>
<td></td>
<td>(.36)</td>
</tr>
<tr>
<td>1</td>
<td>The problem is solved in a rational way</td>
<td>.33 (.46)</td>
<td></td>
<td>.20</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>The conclusion is objective</td>
<td>.45 (.67)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16'</td>
<td>The problem is dealt with in an emotional way</td>
<td>.51 (.56)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>The problem is solved step by step</td>
<td>.26 (.57)</td>
<td>.19 (.51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>The problem is dealt with unbiasedly</td>
<td>.48 (.70)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>This case is easy</td>
<td>(.42)</td>
<td>.25</td>
<td>.48 (.55)</td>
<td>-.17</td>
</tr>
<tr>
<td>14</td>
<td>A child could have come to this conclusion</td>
<td>.69 (.86)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The solution of the problem involves a lot of thinking</td>
<td></td>
<td>-.32</td>
<td>(.51)</td>
<td>.32 (.60)</td>
</tr>
<tr>
<td>6</td>
<td>The problem is analyzed thoroughly</td>
<td>.18 (.60)</td>
<td></td>
<td>.19 (.42)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>The analysis shows great expertise</td>
<td>(.68)</td>
<td>-.21</td>
<td>.32 (.62)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>The problem is solved in a powerful way</td>
<td>(.49)</td>
<td>.18</td>
<td>.41 (.69)</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>The solution is authoritative</td>
<td></td>
<td></td>
<td>.60 (.73)</td>
<td></td>
</tr>
</tbody>
</table>

* reverse scoring is used on these items.
The SCA showed 4 factors: compliance, objectivity/rationality, easiness of the case, and authority. The compliance and authority factors were based on the interpersonal persuasiveness constructs. Items 2, 6, 10, 20, and 23 were used to measure authority. They constitute the fourth factor. The other items based upon interpersonal persuasiveness constructs constitute the first factor: compliance. Its items are on trustworthiness (Items 8, 11, and 21), liking (Items 9 and 22), similarity (Item 19), and consensus (Items 3, 4, 5, 7, and 13). Objectivity (Items 15, 16, and 18) and rationality (Items 1 and 17) make the second factor. Easiness of the case (Items 12 and 14) is the third factor. Table 6.4 gives an overview of the variance accounted for by the factors found.

**Table 6.4** Percentage of variance accounted for by the SCA factors.

<table>
<thead>
<tr>
<th>Case</th>
<th>Total</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Compliance</td>
<td>Objectivity</td>
<td>Easiness</td>
<td>Authority</td>
</tr>
<tr>
<td>Dyslexia</td>
<td>59.9</td>
<td>40.9</td>
<td>8.6</td>
<td>7.1</td>
<td>25.3</td>
</tr>
<tr>
<td>Law</td>
<td>58.7</td>
<td>36.3</td>
<td>10.8</td>
<td>7.6</td>
<td>17.8</td>
</tr>
<tr>
<td>Cardiology</td>
<td>61.3</td>
<td>37.7</td>
<td>16.5</td>
<td>8.5</td>
<td>22.3</td>
</tr>
<tr>
<td>Train Ticket</td>
<td>64.9</td>
<td>43.1</td>
<td>18.6</td>
<td>7.2</td>
<td>26.8</td>
</tr>
</tbody>
</table>

A Mokken scale analyses reliability test (Molenaar, Debets, Sijtsma & Hemker, 1994) on the selected items per case supported the constructed factors. Reliabilities found were about .95 for compliance, .65 for objectivity/rationality, .75 for authority, and .40 for easiness of the case. In the dyslexia case reliabilities were a bit lower for objectivity/rationality and easiness of the case.

**6.3 Results**

All subjects finished their tasks in about one hour. One subject did not fill out a questionnaire completely and was left out of the analyses. No
differences could be explained by sex, age, or study. For examining the hypotheses, a 3 (condition) x 3 (need for cognition) repeated measurement MANOVA was performed on compliance, objectivity/rationality, easiness of the case, and authority SCA scores, taking the 4 cases as within factor. For the analysis, SCA factor scores were used. Scores mentioned in Figures 6.1 - 6.4 are standardised SCA factor scores. Results are reported below.

6.3.1 Compliance and authority

The SCA showed that compliance and authority were highly correlated; the scores on the 4 cases showed correlations between .51 and .66. An SCA can find constructs that correlate because several data sets (the scores on the 4 cases) are factorised simultaneously. Although compliance and authority are two separate constructs (this was confirmed in an analysis on the indicators of the compliance and the authority construct), they are related and therefore, they are discussed together.

Compliance and authority are both interpersonal persuasiveness factors. When these factors would be important for explaining persuasiveness of expert systems, their scores should be significantly higher in the expert system conditions. However, there was only a small within effect of the interaction between condition and case difference on compliance, $F(6,225) = 2.22, p < .05$ (see Figure 6.1). For the train ticket and law case the compliance scores were a bit higher in the production rule condition, but for the dyslexia and cardiology case the scores were lower in the production rule condition when compared with the expert system with natural language condition. The dyslexia and cardiology case were more technical and difficult to understand than the train ticket and law case. Maybe this caused negative feelings when production rules made the advice even more technical. However, as Figure 6.1 shows, the effect is very small. On authority there was no significant between or within effect from the conditions.

Contrary to the expectation that subjects with a low need for cognition would score higher for compliance and authority in the expert system conditions, they scored lower (see Figure 6.2). Apparently, subjects with a
low need for cognition assigned less authority to the expert systems than subjects with a high need for cognition. This goes especially for the expert systems with a production rule argumentation ($t(12) = 2.85, p < .01$).

The cases had a significant within effect on both factors ($p < .001$): compliance $F(3,225) = 28.96$; authority $F(3,225) = 5.51$. Scores on compliance and authority were much affected by the cases.

6.3.2 Objectivity/rationality

The objectivity/rationality factor seems to be an expert system persuasiveness factor. There was a significant between effect of the conditions on the scores, $F(2,75) = 6.01, p < .01$ (see Figure 6.3). Subjects thought the expert system to be more objective and rational, especially when production rules were used. There was a significant within effect of the case difference on the objectivity/rationality scores, $F(6,225) = 4.68, p < .01$, thus, case difference also influenced objectivity/rationality scores.

Low need for cognition did not increase the effect of the conditions. However, need for cognition seemed to influence the evaluation. Figure 6.3 suggests that subjects with a high need for cognition expected objective and
rational advice when an expert system was mentioned as message source; subjects with a low need for cognition increased their expectations of objectivity and rationality when production rules were shown as well. The difference between high and low need for cognition was significant in the expert system with natural language condition ($t(19) = 2.17, p < .05$).
6.3.3 Easiness of the cases

As expected, there was a significant within effect of case difference on easiness of the case, $F(3,225) = 36.70, p < .01$, but there was no interaction with other factors. The train ticket case was judged to be easier than the other cases. More interesting, however, was the between effect of
the experimental conditions on easiness of the case, \( F(2,75) = 6.74, p < .01 \). As shown in Figure 6.4, cases were judged to be easier in the expert system with production rules condition. Especially subjects with a high need for cognition thought cases to be easier in the production rule condition.

![easiness of case scores](image)

**Figure 6.4** Collapsed scores on easiness of the case.

### 6.3.4 Computer experience

In a 2 (computer experience) x 3 (condition) repeated measurement MANOVA, computer experience did not have an effect on compliance, objectivity/rationality, case easiness, or authority. Thus, computer experience did not affect user attitudes towards expert system advice.

### 6.4 Conclusions and discussion

Given the same advice, subjects thought an expert system to be more objective and rational than a human adviser, especially when the expert system advice was given in a production rule format. Thus, \( H_1 \) and \( H_2 \) hold for the objectivity and rationality construct. Objectivity and rationality seem to be persuasive cues (beliefs) that can make users accept advice of expert
systems without examining it. Experimental conditions did not seriously affect scores on other, interpersonal, persuasiveness factors (compliance and authority); only on compliance there was a small within effect of condition by case. Thus, $H_1$ and $H_2$ were not supported for compliance and authority, which indicates that these factors are relatively unimportant persuasive expert system cues. The experimental conditions did have an effect on easiness of the cases. Surprisingly enough, subjects found cases to be easier when the advice of the expert system was given in a production rule style. Thus, a case was thought to be less difficult when the advice was more difficult to understand.

The experiment shows that studying an expert system merely as a persuasive message source can give an interesting new view on expert system use. The fact that people are told that information comes from an expert system is enough to influence their evaluation of the information. This might explain why users of expert systems sometimes neglect the incompetence of the expert system. It is very likely that actual interaction with an expert system will strengthen this persuasive effect. However, more research has to be done to examine this hypothesis.

The effect of need for cognition was different than expected: $H_3$ was not supported. It was hypothesised that subjects with a low need for cognition would favour the expert system advice more than subjects with a high need for cognition. However, the effects of need for cognition on the authority and compliance scores indicate that people with a low need for cognition do not like expert systems. A significant correlation between computer experience and need for cognition supports this interpretation. This does not mean that these people will disagree with the expert system. According to Todd and Benbasat (1992, 1994a, 1994b), reduction of cognitive effort is a reason to accept expert system advice. Most likely, people with a low need for cognition want to reduce cognitive effort and, therefore, accept advice of an expert system, even when they do not like it.

The cases were thought to be easier in the production rule condition, especially by subjects with a high need for cognition. It seems like these subjects put an effort in trying to understand the production rules and, unfortunately, neglect the difficulties of the cases involved. This implies that
expert system use can decrease attention paid towards problems. This would make need for cognition an interesting but difficult factor when studying the attitudes towards expert systems. People with a low need for cognition may be uncritical towards expert system advice because they want to reduce cognitive effort. People with a high need for cognition may be uncritical because they pay too much attention to the argumentation of the expert system and forget to think about the case. Personal concern and responsibility, two other factors that influence a user's motivation to examine the advice (Petty & Cacioppo, 1986a, 1986b), will probably affect judgements on expert system advice in a similar way. This makes these factors interesting aspects for further research on attitudes of expert system users.

1. See also Chapter 5.
Appendix

Law case wordings used in the expert system with natural language argumentation (the original text was in Dutch).

**Tenancy case**

About four years ago, Karel Biegman (age 27) moved in with his mother again, after having lived on his own for 13 months. Mrs. Biegman, a widow, rents her house from the rental company 'Sun house,' but Karel pays the rent. Mrs. Biegman is disabled and rather old; soon she will move to a Senior Citizens' Home. Karel would like to be the new tenant of his mother's house but the rental company does not agree. Karel thinks he has a right to stay and looks for advice. Therefore, at City Hall, Karel consults the expert system 'Tenant Advice.' After Karel has answered some questions on the case, the computer concludes:

As a non-tenant you want to claim tenancy rights, thus you want to plead for joint tenancy (section 1623 Civil Law).

To claim joint tenancy according to section 1623 Civil Law you should have established a long-term household with the current tenant. A parent and child cannot set up a long-term household together, because, for the law, a child is thought to live with its parents only temporary (DeWit vs Koning, 1972). Usually, a child leaves home when he or she is grown up. However, there is the possibility that, after living on your own, you move in with your parents again. In such a case, it is possible to set up a long-term household together; that is when you really share the housekeeping and you plan to live with your parents permanently (Eleveld vs DeHaan, 1981). Unfortunately, the period of 13 months you have lived on your own is too short to claim joint tenancy after moving in with your mother again.

A bit depressed Karel goes home. He cannot believe that the period he has lived on his own influences his tenancy rights. Two months later the rental company orders Karel to leave the house.

In the human adviser condition, the last two sentences of the first paragraph read:

"Therefore, at City Hall, Karel consults Mr. Stienstra for advice. After Karel has answered some questions on the case, Mr. Stienstra concludes:"
In the expert system with production rules condition the case material reads:

**Tenancy case**

About four years ago, Karel Biegman (age 27) moved in with his mother again, after having lived on his own for 13 months. Mrs. Biegman, a widow, rents her house from the rental company 'Sun house,' but Karel pays the rent. Mrs. Biegman is disabled and rather old; soon she will move to a Senior Citizens’ Home. Karel would like to be the new tenant of his mother's house but the rental company does not agree. Karel thinks he has a right to stay and looks for advice. Therefore, at City Hall, Karel consults the expert system 'Tenant Advice.' After Karel has answered some questions on the case, the computer concludes:

**GOAL joint_tenancy [section 1623 Civil Law]**  
{Comment: a non-tenant wants to claim tenancy rights}

**RULE long-term-household_parent_child**

IF child_living_with_parent = TRUE  
THEN long-term_household := FALSE  
{Source: DeWit vs Koning (1972). A parent and child cannot set up a long-term household together, because, for the law, a child is thought to live with its parents only temporary. Usually, a child leaves home when he or she is grown up.}

**INFFERENCE**

child_living_with_parent = TRUE  
THUS long-term_household = FALSE

**RULE exception_long-term-household_parent_child**

IF child_has_lived_on_its_own = TRUE  
AND period_child_living_on_its_own > 2 {year}  
AND parent_child_share_housekeeping = TRUE  
AND intention_living_together_permanently = TRUE  
THEN long-term_household := TRUE  
{Source: Eleved vs DeHaan, 1981}

**INFFERENCE**

period_child_living_on_its_own < 2  
THUS long-term_household = FALSE

**RULE joint_tenancy**

IF long-term_household = TRUE  
THEN joint_tenancy := TRUE  
ELSE joint_tenancy := FALSE

**INFFERENCE**

long-term_household = FALSE  
THUS joint_tenancy := TRUE

**CONCLUSION:** you cannot claim joint tenancy

A bit depressed Karel goes home. He cannot believe that the period he has lived on his own influences his tenancy rights. Two months later the rental company orders Karel to leave the house.