Chapter 5

SCRIPTING LAYPERSONS' PROBLEM DESCRIPTIONS IN INTERNET-BASED COMMUNICATION WITH EXPERTS

Matthias Nückles, Anna Ertelt, Jörg Wittwer, and Alexander Renkl
Albert-Ludwigs-Universität, Freiburg

Abstract: In the information age, laypersons have to rely on experts in many domains and situations. Expert advice can be invaluable, for example, when new and complex software has to be learned, or an unexpected technical problem with the computer suddenly occurs. In order to communicate effectively with experts, laypersons should be able to provide the expert with a concise and comprehensive description of their problem. However, previous research on computer helpdesks has shown that laypersons' problem descriptions often suffer from a number of serious drawbacks. Their deficient and fragmentary knowledge makes it hard for them to formulate their queries in a way that would make it possible for the expert to understand their problem. Based on an analysis of these deficiencies, a problem formulation script was developed that supports laypersons in describing their problems with the computer. An experimental study showed that computer experts reconstructed the actual problem from the layperson's description best if the laypersons were prompted to describe successively (1) the aim of their interaction with the computer, (2) the steps they had so far undertaken, and (3) a hypothesis why they had failed to reach the aim. The script helped the laypersons to provide the expert with the relevant context information necessary to develop an adequate mental model of the layperson's problem.

1. INTRODUCTION

Expertise in using computers, so-called *computer literacy,* has gained the status of a cultural skill that is regarded almost as fundamental as the ability to read and to write (Süß, 2001; Wirth & Klieme, 2002). However, as hardware and software become ever more complex and powerful, acquiring expertise in the computer domain remains a daily challenge even for the experienced computer user (Kiesler, Zdaniuk, Lundmark, & Kraut, 2000).

Hence, reliance on expert advice can be invaluable, especially, when new and complex software has to be learned, or an unexpected technical problem with the computer suddenly occurs (Nückles & Stürz, 2006; Nückles, Wittwer, & Renkl, 2005). Internet-based helpdesks for hardware and software are a common and comfortable way to get expert advice. Such e-consulting services are maintained, for example, by large companies or university computing centers.

According to Alty and Coombs (1981) as well as Raskutti and Zukerman (1997), the users' description of their problem is the very starting point of every counseling and information seeking process. Therefore, the effectiveness of the advice the expert can give depends heavily on the user's ability to adequately present their query, that is, to provide the expert with a concise and comprehensive description of the problem at stake. Transcript analyses of face-to-face and asynchronous advisor-user interactions show, however, that users tend to be inappropriate in the presentation of their problems (Alty & Coombs, 1980, 1981; Coombs & Alty, 1980; Pollack, 1985). They often do not know what information they need to obtain in order to achieve their goals. Consequently, advisors must identify inappropriate queries and infer and respond to the goals behind them (Pollack, 1985). Only if the experts succeed in constructing a valid and coherent mental model of the problem from the client's description, can they provide instructions that help the user to understand and solve their problem.

Against this background, a scripting approach was developed to support laypersons in producing concise and comprehensive descriptions of their problems with the computer (Nückles & Ertelt, 2006). This approach is based on the idea that – despite their lack of domain specific knowledge – laypersons can draw on metacognitive knowledge from everyday problem-solving (Sinnott, 1989) that may help them generating better representations of their computer problems. Thus, the script approach presented in this chapter makes use of culturally shared knowledge about everyday problem-solving (Schank & Abelson, 1977) to support laypersons in their communication with experts in a domain-specific problem-solving context – a situation which is typically experienced as demanding and often also frustrating by many laypersons. The script consists of several prompts (Collins, Brown, & Newman, 1989; King, 1992) intended to induce the steps necessary for the composition of a concise and comprehensive problem description. Hence, in some respects, our problem formulation script (PFS) is comparable to King's guided strategic problem solving (GSPS) procedure (cf. King, this volume). However, whereas King intended to promote students' problem solving success by scaffolding their interaction when solving complex problems, our main intention was to help laypersons improving their description and presentation of computer problems to a computer expert.

Inasmuch as the problem formulation script is intended to support the layperson in representing the semantic aspects of a problem according to a prescribed sequence of steps, it can be classified as a *content-based* script (Weinberger, Fischer, & Mandl, 2003) or *content schema* (cf. Ertl, Kopp, & Mandl, this volume). Nevertheless, its primary objective is to facilitate the layperson's communication with the expert. The prompts used in the script are derived from empirical analyses of the deficiencies typical of laypersons' problem descriptions. The question of whether they can successfully compensate for these deficiencies was addressed by an experimental study. The major findings of this study will be reported in this chapter (for a complete account cf. Nückles & Ertelt, 2006).

2. UNFAVORABLE FEATURES OF LAYPERSONS' PROBLEM DESCRIPTIONS

Compared to expert users, laypersons may be in a more difficult situation when seeking advice. Their deficient and fragmentary knowledge makes it hard for them to formulate their queries in a way that would make it possible for the advisors to understand their problem (Allwood, 1986). Alty's and Coombs's (1981) classic analysis of advisory interactions shows that the query is usually presented in a single and brief utterance, which is rarely questioned by the advisor. Rather than providing the advisor with a detailed description concerning the aim of their interaction with the computer and the actions they have so far undertaken to accomplish this aim, lay users prefer to present a particular portion of their problem that often fails to convey its real nature. In order to be brief (cf. maxim of manner; Grice, 1975), a layperson typically fails to provide enough context when presenting their query (Clark & Carlson, 1981), thus making comprehension hard for the expert (e.g., "I don't understand why I haven't got any output; there aren't any error messages"; Alty & Coombs, 1981, p. 29). A layperson often fails to mention key concepts indispensable for comprehending the problem (e.g., which application program or which operation system is the user actually referring to?), or simply assumes that the helpdesk expert is able to see what they see on their screen (e.g., "I have clicked on that button, but nothing happened..."). The task of formulating their problem is cognitively very demanding because the layperson normally lacks the specialist knowledge necessary for generating an adequate representation of the problem. Besides the deficits of providing insufficient context information, it is another frequent drawback that, instead of giving a description of what has happened and what is observable, laypersons tend to present their opinion about the nature or possible solutions of the problem, which is often misleading (Alty & Coombs, 1981; Pollack, 1985).

In face-to-face communication, most of the above mentioned deficits concerning the laypersons' problem descriptions can be compensated by clarification questions the advisor asks in response to the user's initial query (Aaronson & Carroll, 1987). However, such grounding behavior (Clark & Brennan, 1991) can easily be realized in verbal communication, but is less feasible in asynchronous email communication where the opportunity to provide feedback is seriously limited. First, the costs of producing a message, for example, a clarification question, are higher compared with verbal communication, because every message has to be typed on the keyboard (Clark & Brennan, 1991). Second, nonverbal feedback is practically impossible because the communication partners can neither see nor hear one another (lack of visibility and audibility). Third, there is often no set sequentiality of a message and its reply, which makes comprehension harder.

Considering the deficiencies of lay users' problem descriptions on the one hand, and the constraints of asynchronous communication as set out by Clark and Brennan (1991) on the other hand, it is evident that the layperson's initial presentation of the problem is crucial with regard to the effectiveness and the potential success of the advice the expert will be able to offer. The more detailed and comprehensively the laypersons describe their problem, the easier it should be for the expert to correctly diagnose the "real" nature of the problem – and the more effectively the computer expert would be able to help the client. Hence, laypersons who consult a helpdesk expert should be supported in stating their problem as detailed and completely as possible right from the start of the advisory dialogue. The problem description should in particular represent the user's problem as closely as possible so that the expert can infer a complete and coherent mental model of the problem.

3. SUPPORTING A LAYPERSON IN PROVIDING PROBLEM DESCRIPTIONS

How could such a support method operate? It certainly cannot replace the domain-specific problem-solving competence, which the layperson does not possess. Laypersons typically seek advice from a computer expert in order to solve or get solved a concrete computer problem. However, in doing so, laypersons unlike novices usually do not intend to become a computer expert (cf. Patel et al., 1999, and Bromme, Rambow, & Nückles, 2001, for the distinction between the notions of novice and layperson). Hence, the aim cannot be to turn the layperson into a computer expert. However, problem-solving theory distinguishes between so-called *weak* problem-solving strategies, which are domain-independent and *strong* strategies, which are domain-specific (Jonassen, 2000). Typically, strong strategies are used by domain experts. Weak strategies, on the other hand, such as general heuristics like means-ends analysis, are usually part of the everyday problem-solving competences of laypersons (Arlin, 1989). A key element of means-ends analysis is, for example, the comparison between the desired target state and the actual knowledge state. This heuristic is particularly relevant for the formation of a problem representation. The problem solver tries to summarize the actual state of the problem (e.g., "How far have I already come, which are the barriers that prevent me from proceeding?") and formulates the desired goal state ("Where do I want to get to?"). Inasmuch as such a general, that is, domain-independent, heuristic for generating problem representations can be assumed to be part of the metacognitive knowledge of laypersons about everyday problem-solving (Arlin, 1989), it should be possible to support laypersons in applying this heuristic to their description of problems in the computer domain.

According to this rationale, the laypersons should specifically be supported in formulating the goal they want to reach through their interaction with the computer. They should further be encouraged to provide a detailed description of their actual problem state, including, for example, information about the software or the operating system they are working with, and the actions they have so far executed in order to reach the intended goal or solve the problem. Supporting laypersons this way should counteract their inclination to merely present a single portion of their problem as has been observed by Alty and Coombs (1981). Thus, helping laypersons to apply familiar heuristics from everyday problem-solving to the description of their computer problem, should result in more representative and comprehensive problem descriptions, which are easier to reconstruct for the computer expert. This approach might be successful precisely because it makes use of laypersons' preexisting metacognitive knowledge about representing problems. Helping the layperson to conceive of a difficult problem in terms of a familiar scheme might also facilitate learning of how to compose representations of problems in the computer domain.

4. THE PROBLEM FORMULATION SCRIPT

How could such a support method concretely look like? Inasmuch as laypersons can be assumed to possess the relevant metacognitive knowledge necessary for the composition of concise and comprehensive problem descriptions, it seems to be promising to *prompt* them how to proceed in formulating the problem. For this purpose, we provided laypersons with a problem formulation script that comprised several prompts. Each prompt was designed to trigger a different aspect of the problem description. In the context of our study, these prompts can be termed as *strategy activators* (Reigeluth & Stein, 1983) because they were intended to elicit specific problem solving activities that laypersons should in principle be capable of doing but which they do not spontaneously demonstrate, or demonstrate to an unsatisfactory degree (King, 1992; Pressley et al., 1992). We conducted an experimental study in which we tested two different versions of the problem formulation script. Both versions contained the same four prompts: First, the laypersons were asked to be as explicit and detailed as possible about their problem. Second, on a more concrete level, the laypersons were prompted to explain their goal they wanted to accomplish with the computer. Third, they were prompted to list their previous actions and to describe what they actually see on the computer screen. Fourth, they were also encouraged to speculate about a probable cause concerning their failure to accomplish the task. This last prompt was introduced to do justice to the users' inclination to present their inferences about the cause of the problem. However, because the contrast between this prompt and the previous ones made the difference between *inference* and *description* explicit, the tendency of mainly presenting inferences instead of observable facts and actions should lessen accordingly (cf. Figure 5-2).

It should be noted that this approach to support laypersons' problem descriptions by means of a problem formulation script is similar to the way *process worksheets* are used in recent computer-based instructional approaches to guide instruction (cf. van Meeriënboer, 1997). Like the problem formulation script suggested here, process worksheets provide a description of the phases one should go through when solving a problem as well as hints or rules of thumb that may help to successfully complete each phase. However, process worksheets are typically employed to help novice students adopt "strong" domain-specific problem solving strategies (cf. Nadolski, Kirschner, van Meeriënboer, & Hummel, 2001). The script approach suggested here, however, encourages laypersons to apply a weak and domain-independent strategy, which they are familiar with, to their description of problems in the computer domain.

The two versions of the script differed in the *sequencing* of the prompts offered to the layperson (Kollar et al., in press). In the *non-sequenced version*, the prompts were listed in the header of the email form sheet and the layperson was encouraged to start by carefully reading through all prompts and to bear each in mind while composing the problem description. The *sequenced version*, in contrast, required the laypersons to respond to each prompt separately in succession (except for the first prompt which referred to the general *style* of how to write the description rather than to a particular semantic aspect of it). We introduced this experimental distinction regarding the sequencing of the prompts because we wondered whether asking the laypersons to keep the prompts in working memory during text production might demand too much of them. Consider that laypersons are typically not used to describing their computer problems according to the schema outlined above – although they may in principle be capable of doing so. Thus, as the non-sequenced prompting version required the laypersons to keep the prompts in working memory during text production, this additional demand might impair the quality of the descriptions. The sequenced version, in contrast, encouraged the layperson to proceed in a step-by-step fashion and each prompt could be dealt with individually. Hence, only one prompt at a time had to be kept in working memory and no decision was required from the layperson concerning the linearization of the text (cf. Levelt, 1989), that is, the sequence by which the prompts were processed.

5. TESTING THE PROBLEM FORMULATION SCRIPT EXPERIMENTALLY

5.1 Research questions

In our experiment study (cf. Nückles & Ertelt, 2006), we addressed the basic question whether a problem formulation script as outlined above would effectively support laypersons' composition of problem descriptions in the computer domain. In concrete terms, we expected that the script should counteract laypersons' tendency to be too brief ("maxim of manner"; Grice, 1975) and to describe merely a particular portion of the problem (Alty & Coombs, 1981). Consequently, laypersons following the script should produce more extensive problem descriptions compared with laypersons having no script available (*extensiveness prediction*). While *extensiveness* is primarily a quantitative aspect of problem descriptions, it is of course important to show that the script also improves the quality of the descriptions. The previous theoretical discussion suggests that *representativeness* is a central qualitative aspect of problem descriptions. It can be defined as the extent to which a layperson's description reflects her or his actual problem state. Thus, we predicted that prompting the laypersons to report their goal, the actions previously accomplished, as well as what they see on the screen, should particularly improve the representativeness of the problem descriptions compared with a control condition without any prompts available (*representativeness prediction*). Consequently, more extensive and more representative problem descriptions should make it easier for computer experts to reconstruct the layperson's problem from the written description (*quality-of-reconstruction prediction*). This prediction concerning the *quality of reconstruction* is crucial because counseling a layperson in asynchronous communication settings usually implies that the advisor is blind to the client's actual situation and has to reconstruct the client's problem from the client's email.

Beyond the basic question regarding the effectiveness of a problem formulation script, we asked on a more specific level whether the *sequencing* of the prompts would make a difference. In particular, we expected that the *sequenced* prompting version should be more advantageous than the *non-sequenced* version (*sequencing prediction*) because in the sequenced prompting condition the laypersons were encouraged to work off each prompt individually. Accordingly, formulating a problem description should be less demanding because only one prompt at a time had to be kept in working memory and no decision was required concerning the linearization of the text.

5.2 Participants and research design

Laypersons were recruited among undergraduate students of psychology. Experts were recruited among advanced students of computer science. The participants' expertise status as experts or laypersons was ascertained by a questionnaire that included self-ratings of computer expertise and estimations regarding the frequency of computer software usage. In order to test the effectiveness of our scripting approach, a one-factorial between-subjects design was used with "prompting version" as the independent variable: For the task of writing problem descriptions laypersons received either a) no prompts (*non-prompting condition*), b) prompts *without* a specified sequence (*non-sequenced prompting condition*), or c) prompts *with* a specified sequence (*sequenced prompting condition*). Dependent variables included the *extensiveness* of the problem descriptions as measured by the number of words, their *representativeness* in respect to the layperson's actual problem state, and the *quality of reconstruction*, that is, the extent to which the experts were able to reconstruct the layperson's actual problem from the description of it.

5.3 Materials and procedure

The laypersons worked individually on a personal computer equipped with the application software required for solving several experimental tasks. These tasks covered problems one typically encounters when using common desktop software such as Microsoft Word, Microsoft PowerPoint, Adobe Acrobat Reader and graphics software such as Adobe Photoshop (for an example, see Figure 5-1). The tasks were selected in a preexperiment in which the difficulty for laypersons of a large number of tasks was determined. Only tasks were selected which could not be solved by any of the participants of the preexperiment.

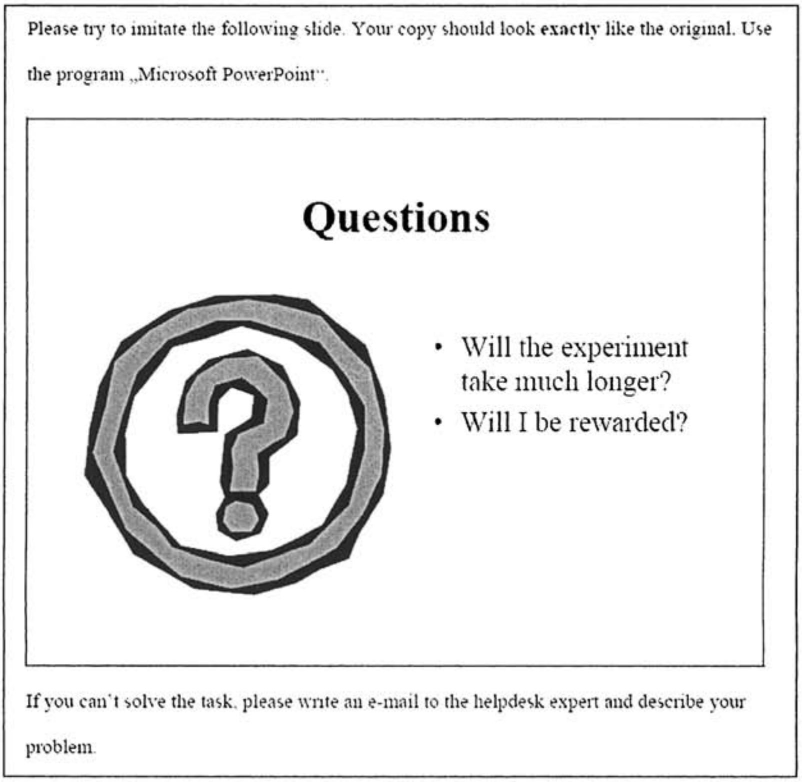

Figure 5-1. Example task of the experiment.

In the experiment, the laypersons tried to solve each of the six tasks one after the other. The maximum time to be spent on a task was 5 minutes. When the time was up, the experimenter asked the participants to prepare an email for the helpdesk and describe their problem so that a computer expert who is unknowledgeable of the participant's problem situation would be able to give advice. Participants were given 10 minutes to finish their problem description email before the next task had to be tackled. For each problem description, a separate email form sheet in Microsoft Outlook format had been prepared. In the non-prompting condition, the text fields of the Microsoft Outlook form sheets were blank.

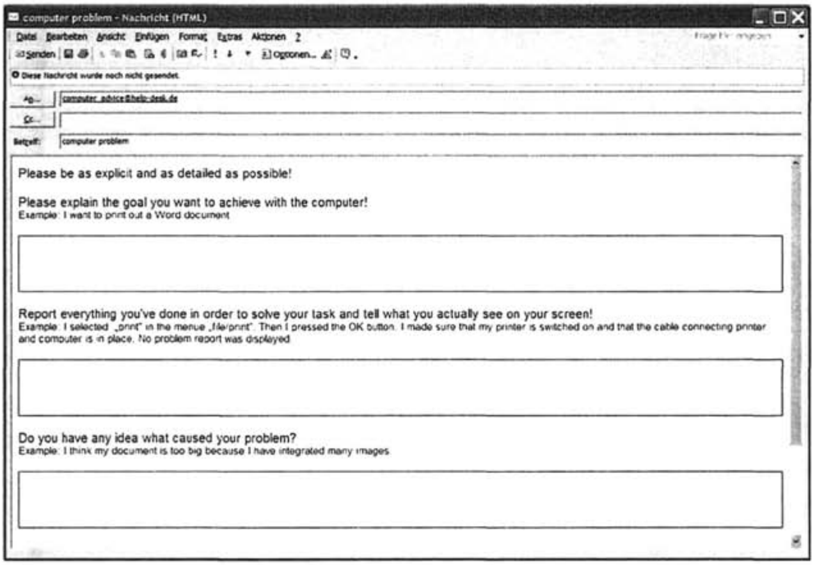

Figure 5-2. Screenshot of the sequenced prompting version.

In the non-sequenced prompting condition, the four problem description prompts were presented in the upper part of the text field. The meaning of each prompt was illustrated by an example except for the general prompt, which emphasized explicitness and detailedness. The prompts were accompanied by an introductory sentence, which asked the participants to carefully read the four prompts and to use them in formulating their problem description. The same four prompts and the accompanying sentence were also used in the sequenced prompting condition. However, the difference was that the sequenced version encouraged the participants to process the promptings separately and one after another. This was accomplished by providing a textbox, directly below each prompt, in which the participants could write their answer. Of course, there was no textbox for the explicitness/detailedness prompt because it referred to the *manner* of writing and not to a specific semantic feature of the problem description such as goal state or actions. Figure 5-2 presents a screenshot of the form sheet used in the sequenced prompting condition.

In the second part of the experiment, the laypersons' problem descriptions were given to computer experts who were ignorant to the tasks the laypersons had tried to solve. Each expert received the problem descriptions of one layperson only because every layperson had treated the same set of computer tasks. This assured that the set of problem descriptions an expert had to evaluate referred to different computer tasks. Thus, the problem descriptions did not overlap or complement each other, which might have considerably facilitated the reconstruction of the underlying task. The prompts in the corresponding experimental conditions were removed from the email form sheets the laypersons had used for delivering their descriptions. Hence, merely the text that the layperson had produced was available to the experts. This was done in order to make the descriptions produced in the prompting conditions comparable to those in the non-prompting condition. The experts were asked to reconstruct the layperson's specific problem from each of the problem descriptions at hand. The instructions told them to write down in complete sentences what they thought the layperson's problem would be and to be as explicit and elaborate as possible in doing so.

Coding. Two blind and independent raters determined the degree to which a layperson's problem description matched the corresponding "objective" reference description on a 5-point rating scale. The quality of the experts' reconstructions was determined in a similar way. The interrater reliability for both rating scales was very good.

6. MAIN FINDINGS

6.1 Test of the extensiveness prediction

The extensiveness of each individual problem description was determined by counting the number of words. To test the *extensiveness prediction*, an a priori contrast was calculated, which compared the mean of the two prompting conditions with the non-prompting condition. The test of this contrast was highly significant and yielded a large effect. Evidently, supplying laypersons with a script how to proceed in describing the problem in fact led them to produce more extensive problem descriptions than laypersons who had no script available.

To examine the sequencing prediction, that is, sequenced prompting results in more extensive descriptions than non-sequenced prompting, another planned contrast was calculated. The analysis showed that the descriptions in the sequenced prompting condition were indeed significantly more extensive than the descriptions in the non-sequenced prompting condition. Nevertheless, the non-sequenced version compared with the non-prompting version substantially raised the extensiveness of laypersons' descriptions as well. Thus, both prompting versions effectively influenced the extensiveness of the laypersons' problem descriptions. The sequenced prompting version, however, which required the laypersons to elaborate on each prompt separately one after the other turned out to be the most successful method.

6.2 Test of the representativeness prediction

To test whether the availability of prompts improved the representativeness of the problem descriptions (*representativeness prediction*), another a priori contrast was computed, which compared the mean of the two prompting versions with the non-prompting version. This contrast was also significant and yielded a large effect, thus showing that the provision of prompts in fact helped the laypersons to produce problem representations that were substantially more representative of the underlying problem than the descriptions of laypersons in the non-prompting version.

Analogous to the previous analysis of the extensiveness scores, the second contrast test showed that the problem descriptions in the sequenced prompting condition were clearly more representative than the descriptions in the non-sequenced prompting condition. However, at the same time, the non-sequenced prompting condition did not significantly differ from the non-prompting condition. Hence, providing laypersons with a script that told them how to proceed in describing their computer problem did not per se enhance the representativeness of the descriptions. Only when the laypersons were encouraged to process the prompts in a prescribed sequence could the prompts unfold their potential to effectively support the layperson's text production.

6.3 Test of the quality-of-reconstruction prediction

Finally, we tested whether the descriptions produced in the prompting conditions facilitated the task for computer experts – ignorant to the computer problems – to reconstruct the layperson's actual computer problem from the mere description of the problem. The planned comparison of the two prompting versions with the non-prompting version clearly confirmed our prediction: Prompted problem descriptions facilitated the reconstruction of the problem compared with non-prompted descriptions. Consistent with the previous results, the effect on the quality of reconstruction was mainly due to the sequenced prompting version. Accordingly, the sequenced prompting condition clearly differed from the non-prompting condition, but there was no significant difference between the non-sequenced prompting condition and the non-prompting condition. All in all, these results underscore the conclusion that simply offering laypersons a script without prescribing the sequence when to process the individual prompts was not sufficient to improve the quality of their problem descriptions. Instead, the prompts had to be processed by the layperson one after the other in order to improve the quality of the descriptions and their comprehensibility for experts who had no direct access to the problem that was described.

7. DISCUSSION

The experimental study provided clear evidence that the problem formulation script effectively supported laypersons in how to describe their problems with the computer. Both the extensiveness and the representativeness prediction were confirmed. Accordingly, the prompted problem descriptions were significantly more extensive and they represented the underlying problem much better compared with descriptions that had not been prompted. Consequently, in line with the quality-of-reconstruction prediction, it was considerably easier for computer experts to reconstruct the problem from the layperson's written description. Evidently, the promptings helped to remedy typical deficiencies of laypersons' problem descriptions. First of all, they counteracted laypersons' tendency to be too brief when presenting the helpdesk a problem (cf. Alty & Coombs, 1981). Second, laypersons' descriptions were substantially more representative; thus, the tendency to report only a particular portion of the problem was lessened (cf. Alty & Coombs, 1981). Third, experts who were completely blind to the layperson's problems were much more successful in developing a mental model of the problem from the laypersons' descriptions. Hence, the script apparently supported the laypersons in writing descriptions that were less misleading (cf. Pollack, 1985), less incomplete (e.g., lack of key concepts) and less egocentric with regard to the way they were formulated. It is noteworthy that in the non-prompting version, the match between the reference description of a problem and an expert's reconstruction (i.e., the quality of reconstruction) was 42% on average whereas in the sequenced prompting condition it was raised to almost 68%.

Nevertheless, it has to be emphasized that the prompts were mainly effective when presented in a sequenced version. Although the non-sequenced prompting version raised the extensiveness of the laypersons' problem descriptions, it had practically no effect on the representativeness of the descriptions and, even more importantly, on the experts' ability to reconstruct the problem. Consequently, just asking laypersons to report the goal they want to reach, to tell the actions undertaken so far and their idea of the reason for their failure, did not affect the quality of their text production unless they were encouraged to answer each prompt separately one after another. Asking the laypersons to work off each prompt individually and consecutively evidently facilitated the task to produce representations of problems in a domain where the participants had only a very low level of experience.

It may be speculated that the way the sequenced problem formulation script supported laypersons in describing computer problems is comparable to the way process worksheets guide students' problem-solving activities in computer-based learning environments (cf. Nadolski et al., 2001; van Merriënboer, 1997). Accordingly, it is possible that the sequenced version of the problem formulation script reduced the cognitive load induced by the demand to keep the prompts in working memory during text production (Sweller, van Merriënboer, & Paas, 1998). However, it has to be acknowledged that we did not measure cognitive load in this experimental study. Thus, future research is needed in order to identify the exact cognitive mechanisms that mediated the effectiveness of the sequenced version of the problem formulation script.

What are the broader practical and theoretical implications of this research? Guiding laypersons' problem descriptions by a problem formulation script has proved to be a successful approach to support asynchronous communication between computer experts and laypersons. Interestingly, the research by Alty and Coombs (1981) suggests that the script approach presented here might also be useful to support face-to-face counseling. In most of the conversations they analysed, a stage where the advisor tried to clarify the user's query was lacking (Alty & Coombs, 1981). Thus, given that in face-to-face settings advisors tend to abstain from questioning the clients' presentation of their problem, it seems to be crucial that the clients present their problem as adequately and comprehensively as possible. In order to support the clients' problem descriptions in face-to-face communication, a problem formulation script could be used by the advisor to initiate the advisory dialogue with the client. Accordingly, the promptings could serve expert and client as a *collaboration script* that supports the *presentation* phase of advice-giving dialogues (Alty & Coombs, 1981). On the other hand, inasmuch as the advisors consciously use the prompts to initiate and control the dialogue with the client, they may be stimulated to monitor more carefully their own understanding of the client's problem. Hence, scripting communication between computer experts and laypersons that way may not only support the *presentation* phase but also the *clarification* phase of the advisory dialogue.

Another implication of the script approach presented here refers to the theoretical distinction between effects *with* the script and effects *of* the script (Salomon, 1993). In the present experiment, our main intention was to investigate the effects *with* the script, particularly, whether the availability of the problem formulation script in the email form sheet would facilitate the task of writing more representative and more comprehensive problem descriptions. However, it might be further interesting to investigate the effects *of* the script, for example, whether its availability and continued application triggers the internalization of the script and thereby – on the long run – improves laypersons' ability to generate problem representations in the computer domain (cf. the chapters by King, this volume, and Rummel & Spada, this volume). Hence, experimental settings would be interesting where laypersons' ability to create problem representations is assessed after the promptings have been faded out (cf. Collins et al., 1989). Last but not least, future research should also explore the generalizability of the problem formulation script. While the script presented in this chapter might easily apply to slightly different technical domains, such as electronic devices, supporting laypersons in communication with experts in other knowledge domains seems to be of equal importance. As there is, for example, a growing reliance on health-related information in the Internet, laypersons in this domain could also benefit from improved problem descriptions that allow experts to give more effective and individualized medical advice (see Runde, Bromme, & Jucks, this volume). Future research is needed to investigate this promising avenue to supporting laypersons communication with experts. In conclusion, one can say that laypersons should by no means act as a passive recipient in communication with experts. Rather, it has been our intention to show that despite their lack of domain specific knowledge laypersons can actively contribute to reaching their goal of getting adequate and satisfactory expert advice.

AUTHOR NOTE

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