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A CELL IS A CELL IS A CELL -

LAY MEDICAL UNDERSTANDING AND ITS ROLE IN ONLINE HEALTH TUTORING

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Dedication

To my parents – Ursula and Dr. Heinrich Becker.

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So I thank you all… And here is my thesis:

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1 Introduction and Overview

In the course of a lifetime, people usually chose to or have to deal with several domains on which they concentrate their efforts, in which they build up and deepen skills and in which they enquire larger and larger amounts of knowledge. These domains, which can be professions as well as areas of private interest, thus become their areas of expertise. In the course of several years, the thorough occupation with a domain causes an expert-specific restructuring of knowledge in that domain; the resulting expert way of knowledge organization enhances and facilitates cognitive functioning in the field.

People do not, however, only dispose of knowledge in their areas of expertise. On the contrary, people generally know something also in a great many other areas. This lay type of knowledge is acquired through different sources; often, it is picked up unintentionally through the media or as a consequence of hearsay or personal experiences. Also, knowledge basics from school education are remembered to a certain degree throughout adult life. Lay knowledge has certain characteristics; thus, laypersons dispose of a wealth of assumptions and (so-called naïve) theories which are often erroneous. With regard to technical concepts of a domain, laypersons often have a divergent term understanding, which even holds for seemingly simple terms like stomach (see section 2.1).

In many situations in everyday life, laypersons are confronted with a situation in which they need the advice of an expert. Thus, an older citizen might need help with a newly bought computer, a tenant might be in a situation with her[1] landlord in which she would want to consult law counseling or a patient might need advice on an important medical decision. It is evident that experts and laypersons every so often need to communicate with each other; hereby, their communication is characterized by their systematically divergent knowledge backgrounds. As a consequence, expert-layperson communication is a conversational setting in which interlocutors approach a subject matter from very divergent perspectives; hereby, experts have the difficult task of ‚translating' some of their knowledge in a way that makes it understandable for their lay interlocutors. How and under which circumstances can successful knowledge communication be accomplished? These are questions which are addressed from a psycholinguistic perspective in the research project "Rezipientenorientierung in der netzgestützen Gesundheitsberatung" [Recipient orientation in net-based health counseling] that was granted to Prof. Dr. Rainer Bromme and Prof. Dr. Regina Jucks at the

[1] To enhance readability, I refrain from using the pronouns s/he, hers/his, etc., whenever referring to a singular person of either male or female gender. After flipping a coin in order to decide which gender to adhere to, I consistently use the female form throughout the dissertation. This does not mean, however, that the group of which the female person is a representative would consist only of women.

University of Muenster, Germany, within a Special Priority Program (SPP) funded by the German Research Foundation (cf. Bromme & Jucks, 2004). This dissertation is affiliated to the research project and the presented studies were conducted in its context.

It is, however, not only in everyday counseling contexts (so-called informal learning contexts) that experts and laypersons engage in conversation. Also in the formal educational settings of schools and universities, experts and laypersons communicate one-to-one in the setting of tutoring (see section 2.2).

In this dissertation, it will be argued that expert-layperson communication in these informal and formal settings can be regarded as structurally equivalent: For one thing, tutoring in formal settings can be conceived of as a special case of expert-layperson communication. For another thing, the counseling activity of the experts in the informal settings can also be called a tutoring activity in a broader sense of the term.

As a result of this parallelism, the two research strands of (i) tutoring research (which focuses on formal educational settings) and (ii) research on expert-layperson communication (which focuses on informal tutoring) can and will fruitfully be enriched by consideration of the respective other perspective. Thus, for instance, the results that are obtained in this dissertation on the tutoring behavior of experts in an informal counseling setting will be compared to results from formal settings, hereby enriching the body of research on tutoring.

In order to interpret the conversational behavior of the experts, several theoretical accounts will be applied (cf. section 2.3). By doing so, the impact of generic mechanisms from everyday human conversation on expert-layperson communication will be examined. While this endeavour can help shed more light on what shapes the tutoring behavior of experts in tutorial settings, it also refines the psycholinguistic accounts with regard to the specifics of expert-layperson communication.

The main focus of this dissertation is put on the impact of lay understanding (which is, as described above, often erroneous) on informal tutorial dialogue. Hereby, especially the ways in which experts respond to a *display* of such erroneous understanding will be of interest. In research on tutoring in formal settings, one of the tutorial moves that has been investigated is how tutors react to false understanding that their tutees utter spontaneously in conversation. This dissertation aims at investigating how tutors react to uttered lay false understanding in the informal learning context of email health counseling.

Email health counseling was chosen as applied research context for two reasons: Firstly, the option to consult experts via email is a service that is used more and more frequently by laypersons who seek advice on the Internet (see section 2.4). Also in for-

mal learning settings, computer-mediated tutorial interaction is a form of instruction with growing importance. Secondly, the medical domain is especially suitable, since laypersons hold assumptions and theories about medical issues from childhood. However, more research is needed to describe lay understanding for different medical fields. This research desideratum is addressed in study I (chapter 4) which explores lay knowledge for the topic of the metabolic syndrome.

Based on the results of study I, studies II (chapter 5) and III (chapter 6) will address the question of how medical experts react to a display of false understanding in a layperson's email. Hereby, study II investigates the impact of a display of false understanding on experts' assessment of lay knowledge. Study III, then, will focus on the impact on the actual communicational behavior of the experts. The results will be compared to research from formal, face-to-face tutorial settings. Hereby, the impact of the characteristics of computer-mediated expert-layperson communication will be considered.

As a consequence of the results of studies II and III, the last study presented in this dissertation will put a special focus on the conversational principle of politeness (cf. Brown and Levinson, 1987). As Person, Kreuz, Zwaan and Graesser (1995) point out, politeness plays a crucial role in formal tutorial settings, interfering with successful knowledge communication. Thus, for instance, tutors often disguise the correction of false understanding through politeness, even though direct error feedback is an important and useful tutoring strategy. Study IV (chapter 7) will address the question of whether a relation exists between the medical experts' demonstrated conversational behavior and an obeyance of the everyday conversational principle of politeness in email health counseling. For this aim, an instruction is developed and administered that aims at enabling the experts to ignore politeness in favor of a more effective knowledge communication.

In a nutshell, this dissertation aims at investigating the impact of false beliefs in lay email queries on experts' knowledge anticipation and answering behavior and at discussing it from a psycholinguistic perspective. On a theoretical level, the dissertation wants to make contributions to expert-layperson communication research and to tutoring research. Hereby, the question of how pragmatic principles from everyday conversation impact on expert-layperson conversation will be discussed. Last but not least, implications for future research shall be formulated that arise from the four studies presented in the dissertation.

2 Theoretical background

In the following, the theoretical foundations of the dissertation will be presented. Section 2.1 will start with providing some psychological research backgrounds on the specific characteristics of experts' and laypersons' knowledge, both with regard to knowledge in general as well as in the domain of medicine. Also, the impact of these characteristics on communication between experts and laypersons will be discussed. In section 2.2, research findings from tutoring research will be presented and a parallel will be drawn between expert-layperson communication and tutorial dialogue in formal instructional settings. Section 2.3., thereafter, will present the psycholinguistic foundations of this dissertation. Hereby, basic principles of human communication will be introduced. In section 2.4, the conversational setting of email health counseling will be depicted, which is the applied setting of this dissertation.

2.1 Experts and laypersons – a systematic knowledge divergence

2.1.1 Expert knowledge

Expert and expertise

Before turning to a description of what characterizes the knowledge of experts, the terms *expert* and *expertise* need to be given some attention, as in research on expertise several different definitions are taken as a basis.

Beyond the simplistic statement that the term expertise refers to an above-average performance of an individual in a certain area, Gruber (2001) differentiates between different definitions used in expertise research, and suggests a classification system using the following dichotomies:

- Explanation of expertise through dispositional constructs (e.g., intelligence) vs. through abundant practice and development of a structured knowledge base
- Focus on expert knowledge vs. on expert performance as central component of expertise
- Expertise as a general competence vs. as a domain-specific competence

This dissertation focuses on the domain of medicine. Based on Gruber's dichotomies, the following remarks shall be made about expertise in this domain: Medical experts have gone through several years of professional, academic formation in their domain, rather than distinguishing themselves by a special giftedness. As a consequence,

medical expertise is characterized by a structured, domain-specific knowledge base. The systematic knowledge formation of several years is a prerequisite for the experts in order to exert their domain-specific *expertise*, i.e. to successfully cope with complex tasks which are a characteristic of professions that require a long formation (cf. Bromme & Rambow, 2001). During expert knowledge formation, knowledge is restructured; this process has been described for different knowledge domains. In the following, this process will be delineated in more detail for the domain of medicine.

Expertise development in the domain of medicine

Henny Boshuizen and Henk Schmidt (Boshuizen & Schmidt, 1992; Schmidt & Boshuizen, 1992) describe the process of medical expertise development as follows: In the beginning of their formation, medical novices[2] acquire knowledge about the normal functioning of the human body (its anatomy, physiology and so forth), thus developing an extensive body of biomedical knowledge. As the formation continues (including contact with actual patients), knowledge restructures and is *encapsulated* (i.e. clustered together) under higher order, clinically relevant concepts. At last, medical knowledge is organized in so-called *illness scripts*. These illness scripts are "precompiled packages of diagnostic and clinical knowledge describing a general sequence of events that may be expected to occur when someone suffers from a particular disease" (Custers, Boshuizen & Schmidt, 1996, p. 385). They comprise several components of knowledge, such as patient factors and contextual factors which contribute to the development of an illness, the malfunctioning that occurs in an illness on a biomedical level, possible consequences of an illness and knowledge about the kind of action required to cure it (Boshuizen, 2003) and are activated as a whole.

Research findings on expert knowledge

What is characteristic of expert knowledge and thinking? Research on expertise has accumulated a substantial amount of evidence that points to the particularities of experts' cognitive organization and functioning (cf. Boshuizen, Bromme, & Gruber, 2004). The reorganization of knowledge during the process of expertise development leads to highly integrated and interconnected expert knowledge. Experts have a specific representation of their domain, in that they "organize their knowledge around deep principles of a domain" (Hmelo-Silver & Green Pfeffer, 2004, p. 128). In the sorting procedure reported in the much-noticed study of Chi, Feltovich and Glaser (1981), for instance, physics experts and novices sorted a number of physics problems into groups based on similarities of solution. While there were no differences in the number of

[2] In the following, the term *novices* will be used when referring to a group of people that are apprentices in a certain field and only recently started their formation.

categories produced by experts and novices, a qualitative analysis of the categories revealed that the novices grouped the problems mainly with regard to their 'surface structures' (p. 125), such as objects referred to in the problem or relations among these objects. Experts, on the contrary, grouped the problems with regard to physics principles that were required for their solution. The organization of expert knowledge around deep principles has been shown also for a variety of other expertise domains (e.g., Anderson & Leinhardt, 2002; Halpern & Wai, 2007).

The organization of expert knowledge influences all stages of expert information processing from perception and integration of new information to an efficient application of knowledge in cognitive activities. Experts can condense more information into one meaning unit – a so-called *chunk* – and store it in long-term memory (Anderson, 2000). As a consequence, knowledge is retrieved with less effort (Chase & Simon, 1973; cf. Kluwe, 1990). Also, experts recognize the relevant aspects of a situation faster, which enables them to more effective problem solving[3] (e.g., Larkin, McDermott, Simon & Simon, 1980). Anderson and Leinhardt (2002), for instance, compared geography experts (geography professors) and three different groups of geography novices; these were advanced novices (i.e. undergraduate geography students who participated in their first cartography class), novices (i.e. undergraduate geography students that had already had at least two cartography classes) and preservice social studies teachers without formal geographic education but who were supposed to teach geography at middle or high school or both in the future. Participants were given a map in which different cities were labeled and were asked to draw a line on the map to indicate the shortest distance between two cities as it would be on the surface of the earth. This task was repeated for several city pairs and with different maps (a map of the world and a map of North and South America). Experts were more successful in solving the task than novices and preservice teachers. An analysis of participants' talk-aloud protocols revealed that experts and advanced novices used their understanding of a map's representational system and of the relations among certain aspects of the map as well their knowledge of the surface of the earth to apply successful problem-solving strategies. Novices and preservice teachers, on the contrary, lacked an understanding of how maps are distorted as a result of projection and thus drew curved lines under application of misconceptions about why the lines should be curved or drew straight lines in the absence of any understanding of projection.

Also for the medical domain, several studies have illustrated how the structure of expert knowledge influences experts' information processing and reasoning. For instance, van de Wiel, Boshuizen, and Schmidt (2000) instructed participants of four

[3] Note that under certain circumstances, high knowledge interferes with effective problem solving (e.g., Adelson, 1984). However, such findings do underpin the influence of expertise on information processing.

medical expertise levels to study four case descriptions, to produce a diagnosis for each case and to explain the pathophysiology underlying the respective symptoms. The explanation protocols were then rewritten as semantic networks and the networks analyzed. Expert's diagnostic accuracy increased as a function of the level of expertise. Also, experts provided qualitatively better explanations in that they produced lines of reasoning that better matched canonical explanations. At the same time, their explanations were less extensive and less detailed. The authors also assessed the impact of time constraints on participants' explanations. While the quality of the experts' explanations was not affected by time constraints, they gave longer and more detailed explanations when they had had more time to read the case study. Results suggest that experts use high-level clinical concepts under time constraints to get to a correct diagnose in little time; when they spend more time on studying a case, however, intermediate concepts that are otherwise by-passed with links leading directly from one high-level concept to another also become activated.

As the above elaborations have shown, experts dispose of abundant knowledge structures that enable them to recall knowledge as well as store new information effectively. Taken together, we can say that experts approach their field of expertise from a specific (expert) perspective. In the next section, I will explore the perspective of laypersons, that is, people without a background of knowledge formation in a field. Thereafter, in section 2.1.3, the characteristics of expert-layperson communication as a conversational setting in which these two perspectives confront each other will be outlined.

2.1.2 Lay knowledge

Research findings on lay knowledge

With regard to a great variety of knowledge domains, people acquire knowledge in the course of everyday life. Therefore, rather than being blank slates, laypersons do dispose of some knowledge in most subject areas. Thus, for instance, medical laypersons have medically-related beliefs from childhood, and lay theories (so-called intuitive theories) on illnesses are developed early in life (Keil, Levin, Richman, & Gutheil, 1999). On a local, propositional level, lay knowledge can be described as containing both correct and erroneous beliefs (Chi, Siler, & Jeong, 2004).

These beliefs are often poorly connected (e.g., Jones & Read, 2005) and contradictory beliefs[4] are held simultaneously (Furnham, 1988). Apart from these single beliefs, laypersons also dispose of mental models that are erroneous but quite coherent; these are often called intuitive theories or naïve theories (Anderson & Lindsay, 1998; Rozenblit & Keil, 2002). Laypersons use these theories in order to predicate and explain the social and physical world. Also, the theories guide lay perception and information processing (Murphy, 2002). Intuitive theories are persistent and resistant to change (Dole & Sinatra, 1998).

In cognitive-psychological expertise research (cf. section 2.1.1 on expert knowledge) the characteristics of expert knowledge are compared with lay knowledge of persons who have only recently started their expert formation or with knowledge of persons who have gone through parts of their expertise formation (so-called intermediates). Thus, for instance, Jones and Read (2005) report that when asked to describe specific political conflicts, experts tied states, events and actions together in tight, extensive and complex networks, while laypersons' descriptions of the conflicts were much less interconnected. Hmelo-Silver and Green Pfeffer (2004), for instance, investigated expertise on aquatic systems and describe the organization of expert knowledge around deep principles of a domain and lay knowledge around superficial aspects: In their study, the laypersons' representations of an aquatic system mainly comprised the elements of a system - particularly those that were perceptually salient, while the processes in which these elements were engaged and their purpose within the system as a whole were less known (cf. Hmelo, Holton, & Kolodner, 2000).

While thus, expertise research has provided important insights into the unconnectedness and organization around surface characteristics of lay knowledge, concept research has described lay beliefs that are associated with certain concepts. Hereby, research studies have shown that lay concept definitions are often unclear and blurry, and that the representations of a concept differ considerably between different people

[4] As for 'belief', it is important to bear in mind that the term 'belief' actually contains both the notion of knowing a certain fact and the notion of being convinced of a certain fact. With regard to the terms knowledge and beliefs, several authors have pointed out a confusion in the use of these terms in educational-psychological literature (e.g., Pajares, 1992; Southerland, Sinatra, & Matthews, 2001); also, these constructs overlap (Murphy & Mason, 2006). Hereby, it is difficult to differentiate between the two constructs especially in those instances in which laypersons dispose of correct beliefs, because then, they dispose of correct knowledge and at the same time are convinced of that knowledge. Where laypersons are confronted with knowledge that contrasts with their own beliefs, however, the difference in the meaning of the terms is more evident. Thus, the term 'belief' stresses the subjectivity of the layperson's knowledge. For instance, Chinn and Samarapungavan (2001) point out that even if new and plausible information is understood and represented cognitively, the held beliefs are often retained and preferred. In order to be able to distinguish between lay beliefs that are more and those that are less resistant to change, Chi, Siler and Jeong (2004) provide the following distinction: Beliefs that are not difficult to correct per se (but are often not detected in instructional contexts) are called false beliefs, while beliefs that persist even when confronted with instruction and refutation are referred to as misconceptions.

(e.g., Murphy, 2002). Also, real life experiences and encounters have an effect on the ways in which concepts are represented (e.g., Barsalou, 1993).

Research on naïve theories, then, particularly focuses on students' intuitive theories in different domains of science (e.g., naïve physics, naïve biology; cf. Mähler & Ahrens, 2003; Wellman & Gelman, 1992). Studies in this area have shown that these theories constrain the acquisition of knowledge: Information that aims at teaching a scientific explanation to students is often integrated into the already-existing (erroneous) understanding, and consequently, the intended scientific understanding is not reached. As a consequence, conceptual change research has focused on the question of how naïve concepts can be changed to a scientific understanding of science phenomena (cf. Vosniadou, 2007). Hereby, the term conceptual change is used to describe a process in which existing naïve understanding is altered qualitatively (and not just enriched quantitatively). While conceptual change studies have mainly focused on naïve theories of children, also adult learners have been investigated (e.g., Slotta & Chi, 2006).

Lay knowledge in the domain of medicine

Also for the medical domain, the expertise domain in this dissertation, lay beliefs and theories have been investigated. For instance, Martin, Gordon and Lounsbury (1998) conducted a series of studies in which they presented vignettes with patient descriptions to the participants. In the vignettes, a person was described that suffered from symptoms consistent with a myocardial infarction. Participants were asked to rate the likelihood that the described symptoms were caused by a heart disease. The person in the vignette was either experiencing stressful life events or not. The authors found that when the patient in the vignette was female, the participants estimated the risk of a heart attack lower when the person was stressed. When the patient in the vignette was male, however, there was no such a stress-discounting effect. These results point to the naïve belief (held by both women and men) that women are especially likely to manifest stress in terms of physical symptoms.

In addition to providing insights into widely spread naïve beliefs and theories, research has shown that physicians and patients have a quite divergent understanding of commonly used medical concepts, including even simple terms such as *stomach* (Boyle, 1970). Thus, in 1945, Redlich was one of the first to recognize the importance of an empirical investigation of patients' knowledge of medical terminology, stating that it was less the terms *unknown* by the patient than those *understood divergently* by doctor and patient that caused a serious misunderstanding in doctor-patient communication. Since then, numerous studies in both Europe and the United States have addressed the topic, focusing on healthy lay individual populations (e.g., Anderson, Chad & Spink, 2005; Tring & Hayes-Allen, 1973) as well as on laypersons affected by a certain disease

(e.g., Lobb, Butow, Kenney & Tattersall, 1999; Samora, Saunders & Larson, 1961). Research has been done on different kinds of concepts, focusing on terms in common use in doctor-patient-communication (e.g., Thompson & Pledger, 1993) as well as on terms of particular interest in a specific context, as in cancer consultations (Chapman, Abraham, Jenkins & Fallowfield, 2003), genetic counseling (Chapple, Campion & May, 1997) or orthopedic consent forms (McCormack, Envoy, Mulcahy, & Walsh, 1997). Such research pieces demonstrate that laypersons have a rather vague or wrong understanding of what medical terms mean. In Gittelman, Mahabee-Gittens and Gonzales-del-Rey's study (2004), for example, 64 % of guardians of children defined an ear infection as a "red, swollen ear", while only 12% knew that an ear infection involved fluid within the middle/inner ear.

2.1.3 Systematic knowledge divergence and conversation

In the previous sections, the characteristics of systematic knowledge differences between experts and laypersons have been outlined. Hereby, expert knowledge was described as being highly integrated and interconnected. Therefore, when conversing about a certain issue within their domain, experts can easily retrieve a great amount of knowledge that is organized according to domain-inherent principles. Laypersons, on the contrary, dispose of domain knowledge that often consists of isolated bits of knowledge; they also hold wrong theories and beliefs.

What conversational implications do these knowledge characteristics have? When experts converse with experts, their knowledge organization enables them to exchange information efficiently. When layperson converse with laypersons, their lay type of knowledge organization generally does not hinder successful communication either. However, when experts and laypersons converse with each other, they enter conversation from very divergent perspectives (in that they have quantitatively and qualitatively very diverging knowledge prerequisites). Hereby, laypersons cannot anticipate the experts' perspective, because they have not gone through the formation which has shaped that perspective. Experts, on the other hand, also have difficulties in understanding or anticipating the layperson's perspective (cf. Jucks, 2001). Thus, as Bromme, Rambow and Nückles (2001) have shown, experts often have difficulties in estimating the knowledge of a lay population (cf. Rambow, 2000). Hayes and Bajzek (under review), in a recent study, presented their participants with lists with a total of 85 technical terms (like *Aurora Borealis* or *Cephalic*). The participants had to estimate the understanding of the terms in two lay populations (college freshmen and college graduates). The authors found that when the participants themselves were very familiar with the

terms (and were thus 'concept experts', so to say) they substantially overestimated the percentage of laypersons that would know this term.

In addition to the fact that experts have difficulties in estimating lay knowledge, laypersons also often overestimate their own knowledge and do not realize the incompleteness of their theories (Ahn & Kalish, 2000). In a study series conducted by Rozenblit and Keil (2002), laypersons initially overestimated their knowledge on complex phenomena (e.g., how a heart pumps blood). After having to explain or answer knowledge questions, however, their self-estimations dropped substantially. As other studies have shown, laypersons also tend to overestimate how well they have understood new information (Glenberg, Wilkinson, & Epstein, 1982).

Taking the above-described knowledge divergence and the difficulties that both experts and laypersons have in estimating lay knowledge into account, it becomes evident that in expert-layperson communication, successful knowledge communication is put at a considerable risk. Hereby, the experts have the difficult task of consulting their expert knowledge but transforming it in a way that is understandable for laypersons (Jucks, Schulte-Löbbert, & Bromme, 2007). In order to accomplish this adaptation, and to bridge the knowledge divergence, the expert needs to use all available information about her interlocutor's knowledge. One of these sources of information is those instances in the lay collocutors' diction where lay (erroneous) understanding becomes evident. To what extent do experts take this information into account when formulating an utterance for a lay interlocutor? This will be addressed in two of the presented studies (studies II and III), and will be discussed in more detail at later points of this dissertation.

The conversational situation of systematic knowledge divergence that has been described in this section holds for expert-knowledge communication in informal settings (e.g., medical laypersons consulting medical experts); however, it does also apply to the formal educational settings of schools and universities, where experts communicate with laypersons on a one-to-one basis in the setting of tutoring. Considerable research has been dedicated to this instructional method. In the next section, tutoring research will be introduced, with a focus on those research results in that field which are relevant in the current context.

2.2 Human tutoring

Pickering:
You should have heard the ooh's and ah's;
Ev'ry one wond'ring who she was.
Higgins:
You'd think they'd never seen a lady before…
Pickering:
[…] They thought she was ecstatic
And so damn'd aristocratic,
And they never knew
That you did it!

From *My Fair Lady*

In *My fair lady*, phonetics professor Higgins successfully refines the speech and manners of poor flower girl Eliza Doolittle into those of an upper-class lady. This outcome not only surprises his fellow linguist Pickering, but also illustrates the beneficial effects of tutoring, that is, of an interaction between a knowledgeable tutor and a less knowledgeable tutee in order for the tutee to learn about a subject matter . Not only in literature, though, but also in empirical Educational Psychology, human one-to-one tutoring has been demonstrated to be a very effective form of instruction (Bloom, 1984). In a meta-analysis of findings from 65 independent evaluations of tutoring programs, Cohen, Kulik and Kulik (1982) found that in far the majority of the studies, students that had participated in a tutoring program outperformed students taught in a conventional classroom setting in terms of achievement; they also developed a more positive attitude towards the respective subjects in which they were tutored. As Lepper and Chabay (1988) point out, tutoring also enhances the students' motivation and feeling of competence.

In school and university settings, tutoring is often done by so-called novice tutors, that is, by individuals that are highly knowledgeable about the content domain but have no formal education in instructional skills (Cohen et al., 1982; Fitz-Gibbon, 1977; cf. Chi, Siler, Jeong, Yamauchi, & Hausman, 2001; cf. Graesser & Person, 1994). However, notwithstanding the fact that tutors very often are not trained pedagogically, tutoring is, as described, rather effective. Therefore, it is not surprising that a substantial amount of research has been dedicated to studying the repertoire of different moves that tutors undertake while tutoring a single tutee as well as while fostering learning in peer tutee groups. Hereby, a variety of different domains have been investigated, like for instance programming (Merrill, Reiser, Merrill, & Landes, 1995) or reading (Cromley & Azevedo, 2005).

The research on tutorial moves was also driven forth by the fact that developers of intelligent tutoring systems were in need of promising tutoring moves that could be emulated by intelligent systems (cf., Chi et al. 2001; Cromley & Azevedo, 2005; McArthur, Stasz, Zmuidzinas, 1990; Shah, Evens, Michael, & Rovick, 2002; Van Lehn, Siler, Murray, Yamauchi, Baggett, 2003). Consequently, studies did not only scrutinize human tutors and their actions, but also used different versions of computer tutors to investigate the impact of different tutoring moves on learning outcomes. Corbett and Anderson (1991), for instance, compared four different versions of their intelligent tutor CMU Lisp tutor. This tutor is an instructional program that assists students in learning programming skills in the computer language Lisp. The four compared versions differed in the type of error feedback that they provided: In the *standard immediate feedback and correction* condition, the tutor immediately interrupted the student when an error was made, presented a feedback message, deleted the error, and asked the student to try again. In the *error flagging* condition, the tutor immediately flagged an error by displaying it in bold on the computer screen; students could choose when to go back and fix the error. Also, they could ask for a comment on the error. In the third condition, the *feedback on demand* condition, the Lisp tutor did not provide any comment on the student's activities unless the student asked the tutor to check over the code. The tutor then provided feedback on whether or not an error was found. Last, in the *no feedback* condition, the tutor did not provide any feedback to the students at all. Only after the student indicated that she had finished an exercise, the tutor reports whether or not the solution was correct. If not, the student was allowed to go back and try again. All participants worked through five tutoring lessons, with programming tests after the second and the fifth lesson. Results showed that there were hardly any differences in performance on the tests (and thus in learning gain) between the three groups that received feedback (standard immediate feedback and correction, error flagging, and feedback on demand). Students in the no feedback condition, however, performed consistently worse. The results suggest error feedback to be a useful tutoring strategy (cf. Corbett, Koedinger, & Hadley, 2001, who also stretch the importance of error feedback for tutoring). This is of high relevance in the current context, which focuses on the tutorial moves of medical experts especially with regard to the reaction to layperson's displayed erroneous thinking. Also, it is important to note that error correction is more effective if the tutees realize (metacognitively) that they made an error (Chi et al., 2001).

While such experimental comparisons of different tutoring techniques provide useful information on the efficiency of tutorial moves (for instance error feedback), mere descriptions of what human tutors do need to be considered with caution. According to

Chi et al. (2001), research studies that focus on the identification and analyses of tutors' moves take a *tutor-centered approach*, that is, they tacitly assume that it is the tutors' effectiveness which makes tutoring superior to other forms of learning:

> "By and large, research programs that study human tutoring take this tutor-centered approach in tacitly assuming that tutoring effectiveness derives from the tutors' skill. That is, it is *what the tutors say and when they say it* that causes tutoring to be more effective than unaided studying or classroom instruction. The conception is that tutors are agile at tailoring and microadapting their instruction to the students' understanding." (p. 474, original emphasis)

Such a conceptualization of the tutors' activities entails that tutors choose their tutorial moves according to what they deem best for their current tutee in a concrete situation, and adapt their behavior accordingly. A number of research studies, however, have found that tutoring is not as adaptive to the concrete tutee as one might think. Or, as Chi et al. (2004) put it, "the mere fact that tutors tend to dominate the tutoring sessions and undertake numerous tutoring moves does not necessarily lead to the conclusion that their tutoring tactics are skillfully executed. [...] In other words, are tutors in fact adaptive?" (p.364).

Paucity of adjustment in human tutoring

Putnam (1987) investigated six female mathematics tutors (in this case experienced teachers) in live and simulated tutoring sessions. In the live sessions, tutors and tutees were seated side by side at a table while they carried out two 20-minute tutoring sessions. Tutors were told to use any procedures or techniques that they thought to be appropriate for tutoring addition operations. In the simulated sessions, each teacher tutored six computer-simulated tutees consecutively in one 2.5-hour session. Hereby, tutors interacted with the simulated students in that they generated and presented addition problems and selected instructional moves from a predetermined set of moves. Both live and simulated tutoring sessions were recorded and analyzed.

In live tutoring, almost all tutee errors and incomplete responses were corrected by the tutor. In only 7 percent of the cases in which an error occurred, however, the tutors went into the cause for the tutee error, i.e., did they ask the tutees about their reasoning (as for instance "What were you thinking when you added that", p.27). In all other cases, the teachers did not make any move to determine the nature of the errors or incomplete responses more precisely. After 41 percent of tutee errors the tutors taught the tutee any content (i.e., a fact, procedure or response); in all other cases, they seemed to content themselves with having arrived at the correct response. As for error

correction in the simulated tutoring, the tutors had the option of choosing additional problems for the simulated student to work on before trying to correct the source of the error. However, only after two out of the many errors that the simulated students made, the teacher reacted with choosing another problem for the student to work on. In all other cases, after an error occurred, the teachers immediately reacted with instructional moves designed to correct the error. With regard to the sequence in which problems for the students were chosen, the results indicated that in both live and simulated tutoring, the tutors seemed to move through a systematic sequence of problems. Thus, while tutoring different students, the way of tutoring was rather consistent.

From the results, the author concludes that "rather than a thorough diagnosis of the students' misconceptions or faulty procedures providing the structure for the topics to be covered, a sequence of problem types – the curriculum script – appeared to be the primary determinant of the agenda for tutoring sessions" (p. 35). These results are further strengthened by the work of McArthur et al. (1990), whose expert algebra tutors asked only very general diagnostic questions (as for instance "Do you understand", p. 211) which did not refer to concrete errors made by the respective students.

As a consequence of these results, Putnam (1987) formulates the curriculum script model (see figure 2-1): Each tutor disposes of a so-called curriculum script (in this case one for addition) that resides in long-term memory; this script provides the overall structure (or the macrostructure) of the tutoring session. Upon this foundation, the concrete agenda (or the microstructure) of a session can vary according to student performance and the tutor's model of the student, the latter rather being – as the results suggest - a fuzzy impression built up during the tutorial session than a highly detailed representation of the student's correct and incorrect conceptions and procedural knowledge.

With the curriculum script model, Putnam (1987) provides an interesting account which considers several important components that influence tutors' actions and the tutorial process. Thus, as the illustration shows, the concrete agenda of a tutoring script is predetermined by the tutor's internal representation of an ordered set of problem types, by the tutor's overall goals for tutoring, as well as by a general representation of likely tutee misconceptions. These components embody the curriculum script, which determines the overall structure of a tutoring session. To these, another important aspect can be added which is suggested in by McArthur et al. (1990), and that is the pedagogical knowledge of the tutor, which also influences tutorial planning and thus, tutoring. The resulting agenda for a tutorial lesson is then only modified (and not determined) by the concrete tutee's performance.

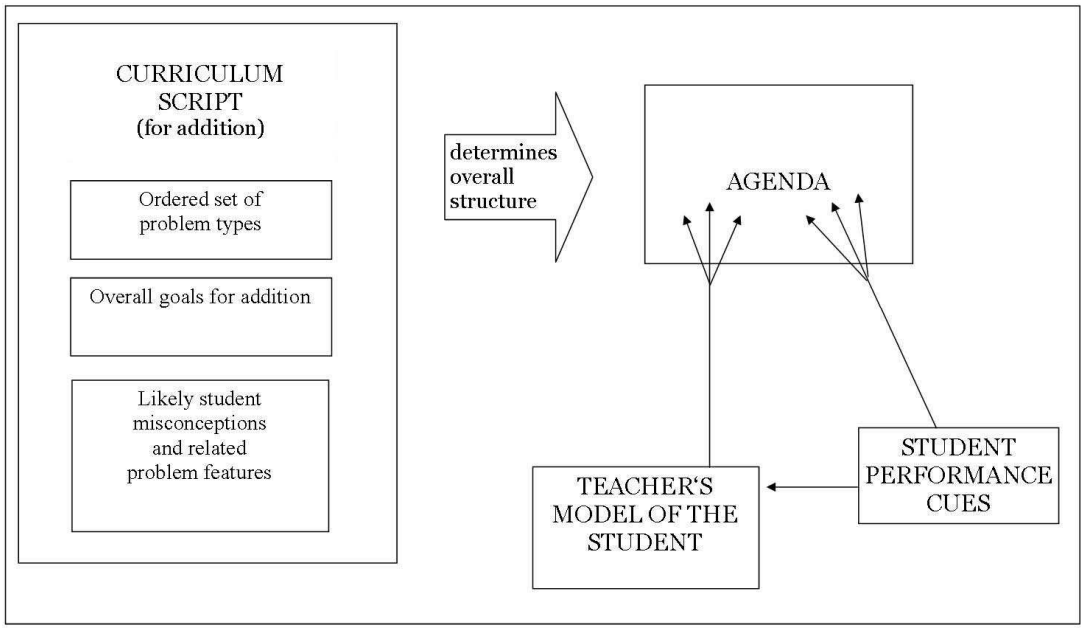

Figure 2-1. Curriculum script model (adapted from Putnam, 1987, p. 40)

Other and more recent studies have confirmed that tutoring is often not tailored to the tutee. In an analysis of protocols of tutoring interactions between a tutor and a college student on physics problems via telephone and computer, Chi (1996) puts the focus on the student's misconceptions and on how they are handled by the tutor during the tutorial process. In the protocols, the author found seven different tutee misconceptions. These were not necessarily displayed in written equations or utterances, and they were also not necessarily elicited by the tutor. Rather, they were deduced from instances of absence of what the student ought to say and by alternative actions that the student took. For instance, the tutee had the problem of confusing mass with weight; also, she did not realize that the F in '*F=ma*' was the sum of forces and not a single force. Out of the seven knowledge pieces, only three were learned in the sense that the tutee exhibited the correct application of the knowledge piece in relation to how she had used it before (e.g., while she initially confused mass and weight, she then used and applied the correct conceptions on various occasions).

The tutorial protocols were scrutinized with regard to which tutorial moves had caused learning and which had not. In terms of an adaptation to the tutee, three results should be pointed out in particular. Firstly, there were many occasions in which the tutor ignored the student's openly exhibited confusion: Out of the 41 tutorial actions coded for one of the problems, the tutee manifested confusion on six occasions. In five of these cases, the tutor ignored the confusion rather than clarifying it. Secondly, instead of diagnosing and addressing the tutee's misunderstanding, the tutor mostly

seemed to pursue his own plan respectively his own two subplans – which were identified as making the tutee (a) draw all forces on a diagram and (b) sum the forces – during the tutorial session. In contrast to the tutor's problems with diagnosing misunderstanding that the tutee had exhibited, he was quite competent at assessing those instances of knowledge problems that the tutor himself had represented as difficult for students. He then assessed whether the tutee had the knowledge also when the tutee had not exhibited any lack of knowledge or misunderstanding. Thirdly, the tutor gave several long-winded didactic explanations that were not tailored to (i.e., that did not address) the misunderstanding of the tutee.

While Chi (1996) concentrates on just one tutor/tutee dyad, Chi et al. (2004) analyze the tutoring process of eleven tutor/tutee pairs. In the one-to-one tutoring sessions, novice tutors and their tutees engaged face-to-face in a tutorial dialogue on passages of a textbook on the human circulatory system. The tutorial sessions were audiotaped and transcribed. Overall, there were 191 incidents where students self-initiatedly (i.e. not prompted by tutors' questions or scaffolding) exposed their knowledge deficits. Of these 191, only 91 were addressed by the tutors (in that they gave a content-related response). To investigate tutors' monitoring of and assumptions about the tutee's knowledge, every tutoring session was interrupted twice and the tutee was asked to draw and describe her view of the circulatory system. In addition, the tutors separately drew and described their perception of their tutee's understanding at that point. Analyses of these tutors' contributions showed that tutors overestimated the tutees' correct understanding. Furthermore, tutors did not acknowledge false beliefs that tutees held about issues not mentioned in the textbook.

Thus, Chi et al. (2004) assess tutors' representations of tutee knowledge by analyzing how tutors describe their tutee's knowledge during the interruptions of the tutorial dialogue. This description, however, does address the tutors' anticipation of the tutee's knowledge in general. It does not focus specifically on those tutee knowledge deficits that are *expressed* self-initiatedly *during* the tutoring session; the tutors' representation of these knowledge deficits is, as described above, assessed indirectly by analyzing to which degree these knowledge deficits are *addressed* immediately by the tutors. Hereby, not only the direct feedback about the incorrectness of the knowledge deficit was rated as addressing the knowledge deficit, but also a mere provision of the correct knowledge. From the fact that many of these incidents are not addressed, the authors conclude that the tutors have difficulties in *detecting* these displayed, unexpected knowledge deficits. From such an analysis of tutors' reactions to a tutee's uttering of knowledge deficits, however, the effects of uttered knowledge deficits on the tutors' knowledge representation are not measured directly and differentiatedly; this also

holds for the other studies described in this section that analyze the tutors' representation of their tutee's knowledge.

In study II of this dissertation, these effects will be measured more directly for the informal tutorial setting of email health counseling with the help of a knowledge anticipation questionnaire. Due to the fact that in this study, the participating expert tutors will be confronted with the same self-initiated tutee knowledge deficits, the questionnaire can measure the effects of the display of knowledge deficits on the tutors' knowledge anticipation separately for both beliefs-related and not-related issues (cf. chapter 5).

To sum up, we have seen that while tutoring is a very effective form of instruction, the presented tutoring studies have described that tutors often do not build up an elaborate mental representation of their tutee's knowledge. Also, they often ignore when a tutee voices confusion during the tutorial process. Frequently, they do not trace and correct tutee errors. The tutor's moves are often not tailored to the tutee; instead, tutors seem to follow a preconceived tutoring plan, which Putnam (1987) called 'curriculum script'. In addition to these results, it needs to be pointed out that tutors seem to be fairly convinced of their own tutoring efficiency (DeSmet, Van Keer, & Valcke, 2007).

However, if it is not a skillful adaptation to the tutee that makes tutoring so effective, what is it then? Some authors have argued that often in tutoring, in contrast to classroom instruction, active knowledge construction processes are triggered (e.g., Graesser & Person, 1994). Thus, as Chi et al. (2001) point out, tutors often tutor in a way that encourages students to self-correct their line of reasoning. Thus, a tutor would for instance ask *Now tell me how you got that answer* rather than directly stating that the answer was wrong and providing the correct answer; or, she would give hints that pave the way towards a self-generated answer rather than providing it. In one-to-one tutoring, there is more room for student activities that foster active knowledge construction, such as self-explaining, question asking, forming hypotheses and testing them, forming analogies, exploring different strategies etc.; these activities foster deep understanding and enhance learning (c.f., Chi, 1996; Chi, de Leeuw, Chiu, & Lavancher, 1994; Renkl, 1997). This constructive and more self-regulated learning on part of the student, however, requires a longer and more turn-taking interaction between tutor and tutee which is the case in most face-to-face tutoring settings. In many settings of *written online tutoring*, however, the interaction is restricted to very few turns. As a consequence, the adaptivity of the tutorial moves and contributions to the tutee are vitally important;

and errors have to be corrected instantly. Computer-mediated tutoring is a relevant phenomenon which needs to be focused on in educational science:

Written online tutoring
As a response to the fast rise of the importance of information and communication technology, the computer-mediated tutorial support (often via online devices) has also become increasingly important and popular in many educational settings, such as school classrooms (Kramarski & Ritkof, 2002), open and distance education (Zhang, Perris, & Yeung, 2005) and university seminars (Paechter, Schweizer, & Weidenmann, 2000). Thus, for instance, big lectures often have a tutor for student support and the students write an email to the tutor when they have a question about certain contents of the lecture. There are many advantages to online tutorial support; thus, online tutorial support might enhance a learner's motivation. Also, flexibility is gained as students can get support also outside of the time and space constraints put by classroom settings and set office hours. The forms in which tutors can support their tutees online are various; a common, asynchronous kind of one-to-one assistance being tutorial support via email (Hampel & Stickler, 2005).

In the previous sections, the characteristics of expert-layperson communication have been depicted (section 2.1). Also, tutoring research has been described (foregoing parts of this section 2.2). As already announced in the introduction of this dissertation, the two conversational settings of expert-layperson communication in informal settings and of tutorial dialogue in formal learning settings will be viewed as being in principal structurally equivalent. In the next section, some remarks shall be made on the reasons why these two conversational settings can be viewed as structurally equivalent. While thus, for the current purpose, the similarities between written tutoring and written expert-layperson communication will be emphasized, it certainly has to be kept in mind that there are also important differences (see Bromme & Rambow, 2001, who draw a distinction between expert-layperson communication and more "classic" instructional settings; cf. section 8.2).

2.2.1 Tutoring and expert-layperson communication

On the one hand, tutoring in formal educational settings is a communicational situation in which an expert who has gone through a long formation (as desecribed in section 2.1.1) converses with a layperson that is approaching dialogue from a naïve per-

spective (see section 2.1.2). As a result, we can say that tutorial dialogue *is* a form of expert-layperson communication.

On the other hand, when experts converse with laypersons in a counseling situation, they do interact with the layperson with the aim of conveying knowledge to that layperson by means of one-to-one interaction. Even though this one-to-one interaction does not take place within the frame of an institutional, formal learning context, we can thus say that the expert *tutors* the layperson in a broader sense of the term.

By drawing this parallel[5] between tutoring and expert-layperson communication, the theoretical approaches and empirical results of the two research strands can be related to each other. Concretely, in this dissertation, the conversational behavior of medical experts will be investigated in the context of email health counseling (cf. studies II and III), the results will then be compared to the behavior of tutors as described in literature on formal tutoring. The results will be discussed from a psycholinguistic viewpoint. Hereby, also the implications for tutoring research will be discussed (see chapter 8).

While for an analysis of experts' conversational behavior it is important to take into account the *particularities* of conversational settings (e.g., the systematic knowledge divergence), it is, as will be shown, also necessary to consider the impact of generic mechanisms of human communication. Therefore, in the next section, two basic conversational principles will be introduced.

[5] Despite the described parallel, it needs to be pointed out that there are also differences between formal and informal tutoring who also exert a certain influence on the tutorial dialogue: In the counseling setting, the expert's task is to explain issues to the layperson; these are issues that the layperson had asked for and that are relevant to her in her current situation. Thus, the layperson is not so interested in gaining in-depth knowledge of the domain, but rather needs information in a rather limited area. In formal tutoring, however, the tutors need to convey important principles and broad basic knowledge from a knowledge domain to their tutees. For this aim, tutor and tutee need to dive deeper into the domain than in informal tutoring. Also, tutors in formal tutoring need to obey the restrictions of the curriculum in the respective educational setting, while the tutors in informal counseling can chose freely which contents they deem relevant and want to explain.

2.3 Pragmatic principles in conversation

In the 1970s, pragmatics emerged as a subfield of linguistics emerged that concentrated on speakers' utterances and intentions under consideration of the concrete linguistic and situational contexts (cf., Katz, 1977; Levinson, 1983). One of the basic ideas of this view on language is that interlocutors follow certain principles when communicating to each other. In line with this idea, two important principles that speakers follow when producing utterances will be depicted in the following: First, the *cooperative principle*, introduced by Herbert P. Grice in 1975 (section 2.3.1) will be described. This principle deals with the adaptation of a speaker's messages to her addressee. More recent accounts which also address this mechanism will be described in section 2.3.2. Section 2.3.3, then, will focus on the principle of *politeness*, concentrating on the politeness theory of Penelope Brown and Stephen Levinson (1987).

2.3.1 Cooperative Principle

In his seminal theory, Grice (1975) states that interlocutors follow a principle when they communicate that makes it possible for them to communicate effectively: The c*ooperative principle* (p.45, original emphasis):

> „We might then formulate a rough general principle which participants will be expected (ceteris paribus) to observe, namely: Make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged. One might label this the COOPERATIVE PRINCIPLE".

Grice formulated four conversational maxims[6] in order to describe how interlocutors produced and understood conversational outcomes in accordance with the cooperative principle. These maxims that specify the cooperative principle are:

- *Maxim of quantity:*
  - Make your contribution as informative as is required.
  - Do not make your contribution more informative than is required.
- *Maxim of quality:*
  - Do not say what you believe to be false.

[6] Strictly speaking, Grice (1975) distinguishes the Cooperative Principles into four *categories* (Quantity, Quality, Relation and Manner), listing specific *maxims* under each. As in scientific literature, however, his four categories are generally being referred to as maxims, I shall stick to that label as well.

    - Do not say that for which you lack adequate evidence.
- *Maxim of relation:*
    - Be relevant.
- *Maxim of manner:*
    - Be perspicuous, or specifically:
        1. Avoid obscurity.
        2. Avoid ambiguity.
        3. Be brief (avoid unnecessary prolixity).
        4. Be orderly.

According to Grice (1975), people generally adhere to these maxims; this makes communication efficient in the first place: By adhering to these conversational conventions, interlocutors become able to interpret one another's utterance, which means that they do not only to grasp the semantic meaning of the utterance, but also its so-called conversational implicature (Grice, 1975). This conversational implicature is the implication that a message contains that can only be deduced from the concrete linguistic and extra-linguistic context. Thus, for instance, when friend A has come to visit friend B in the countryside[7], and enters the house commenting that she has run out of petrol, friend B might tell her that "there is a garage round the corner". Hereby, rather than only informing about the fact that there is a garage round the corner, friend B's message implicates that the garage might be open and likely to sell petrol. By doing as he did, friend B has adhered to the conversational maxims: In the given context, his message was relevant, perspicuous and informative to the right degree.

In a nutshell, speakers, according to Grice, have a communicative intention when speaking, and design their utterances under consideration of the concrete situation and their concrete addressee.

Also more recent linguistic accounts have focused on the adaptation to the addressee. In the following, the communicational theory of Herbert H. Clark (e.g., 1992, 1996) will be introduced, which – based on the idea of a cooperation in dialogue as proposed by Grice – focuses specifically on the impact of knowledge, or more precisely of knowledge that each conversation partner has and assumes the interlocutor to have, on conversation. This makes this account especially relevant for the current context, since in conversation between experts and laypersons, the speech partners' knowledge is a crucial factor (see section 2.1.3). The account also describes the cognitive processes which underlie an adaptation to the knowledge of one's addressee.

[7] Example adapted from Grice (1975), p. 51.

Sharing common ground- Clark's theory of communication

In his communicational theory, Clark (1996) describes language use in conversation not only as an individual, but also as a social process. As such, communication is a *joint action* that requires coordination between the communicational partners on both a semantic as well as a linguistic level (e.g., with regard to the way that utterances are sequenced).

In order to be able to understand each other and to do this coordination, the interlocutors need a shared referential framework, a so-called *common ground*[8]. This common ground entails knowledge about „surroundings, activities, perceptions, emotions, plans, interests" (Clark 1996, p. 92) that the communicational partners believe they share. Hereby, the interlocutors only assume and do not know as a fact that the information is shared; „when [we] act 'on the basis of our common ground', we are in fact acting on our individual beliefs or assumptions about what is in our common ground" (Clark, 1996, p. 96, original emphasis).

As it is impossible to be exhaustively informed about the interlocutor's knowledge and exchange information on the knowledge of the respective other explicitly and continuously during conversation, speakers use heuristics to estimate common ground (and then adapt their messages accordingly). Hereby, relevant information is obtained from both c*ommunal common ground* as well as *personal common ground* (cf. Clark & Marshall, 1981).

Communal Common Ground. Speakers use information about the cultural communities that the interlocutor belongs to (e.g., nationality, religion, political convictions, profession, gender, or interests). Each person belongs to a multitude of cultural communities, whose members share a common ground in that they share a certain amount of "facts, beliefs and assumptions about objects, norms of behavior, conventions, procedures, skills and even ineffable experiences" (Clark 1996, p. 112). Knowledge about the cultural communities of the collocutor helps estimate the common ground by application of the so-called *community membership heuristic*.

Personal Common Ground. In conversation, interlocutors also share experiences; these can be used to estimate common ground with the help of two heuristics. When applying the *physical copresence heuristic*, interlocutors assume that what is perceived during

[8] In addition to the term *common ground*, a variety of other terms are used by researchers to label shared meaning in conversations of two or more individuals; this creates a certain conceptual confusion. In a literature review, Akkerman, Van den Bossche, Admiraal, Gijselaers, Segers, Simons and Kirschner (2007) analyzed the terminology used in 22 studies to bring some structure into the ways terms are being used and operationalized.

conversation (auditorily, olfactorily or visibly) is also perceived by the other(s) and that it therefore constitutes common ground. The *linguistic copresence heuristic*, on the other side, implies that terms and semantic content already mentioned in a conversation can be considered common ground.

Thus, as described, heuristics enable interlocutors to make assumptions about the knowledge of their collocutor. These assumptions are helpful in order for the interlocutors to make the necessary adaptations of their utterances to the communicational needs of their addressees. This adaptation is called *audience design* (Clark & Murphy, 1982): „We don't expect our utterances to be understandable by just anyone. They are intended for particular listeners with particular momentary thoughts and beliefs. Let us call this feature of utterances audience design" (p. 287, original emphasis; cf. *recipient design* in Sacks, Schegloff, & Jefferson, 1974)). By tailoring one's utterances to the addressee, lengthy and unnecessary explanations can be avoided, which increases communicational effectiveness. While both community membership and physical copresence heuristics can be used from the very beginning of a conversation, that is, from the first utterance made, the linguistic copresence plays a role only after the first communicational turn.

As the adaptation is based on heuristics, therefore on estimations and not on actual knowledge about what the interlocutor knows, speakers need some feedback on whether their utterances have been understood. Hereby, a process is central that Clark has called *grounding*: „The hypothesis is that people try to *ground* what they do together. To *ground a thing*, in my terminology, *is to establish it as part of common ground well enough for current purposes"* (Clark, 1996, p. 221, original emphasis). Grounding is based on two principles: When two (or more) individuals engage in communication, they will look for indications of whether their joint action is successful (*principle of joint closure*). While doing so, they will try to do this with the least joint effort possible (*principle of least collaborative effort*; cf. Clark & Wilkes-Gibbs, 1986).

As Clark and Schaefer (1989) point out, the grounding process entails two phases: in the *presentation phase*, the speaker sends a signal (i.e. an utterance) to the addressee and waits for feedback on its understandability for the addressee. In the ensuing *acceptance phase*, the addressee sends a feedback signal which contains information on whether the utterance has been understood or not. Thus, if an utterance has been understood, the speaker will find pieces of evidence in the addressee's feedback signal, for instance nodding, smiling, paraphrasing, frowning or utterances like „uh huh", „I see" or „yeah". The acceptance of an utterance does not need to be explicit, however; one can also implicitly accept an utterance by going on with the next relevant turn (Brennan, 1991).

In a nutshell, Clark describes that both communicational partners seek and provide evidence of their understanding; they want to get to the joint conviction of understanding each other.

Just like the Gricean account, Clark's view on communication is a collaborative one; the communicational partners use heuristics to build up a mental representation of the other's knowledge, which in turn is used to audience-design one's utterances. While this is an intriguing view on dialogue, there has been a substantial controversy on the cognitive processes that underlie adaptation in communication.

Audience design vs. automatic alignment

On the one hand, a substantial amount of empirical evidence shows that interlocutors take into account their addressees' perspective in utterance production and comprehension. Thus, for instance, New York City connoisseurs label city sights differently when talking to non-locals than when talking to New Yorkers (Isaacs & Clark, 1987) and medical experts give linguistically and contentually differing answers when answering the same question to a medical layperson vs. to a physician of a different expertise domain (Jucks, Bromme, & Runde, 2003). In a study by Fussell and Krauss (1992), participants adapted their messages to the estimated degree of recognizability for their collocutors[9]. In an experimental study of addressee's eye movements, Hanna, Tanenhaus and Trueswell (2003) found that addressees in a referential communication task were more likely to look at and spent more time looking at objects when they were part of common ground than when they were not. These and many other studies clearly demonstrate that interlocutors can and do take into account the perspective of the respective other in communication. Sometimes, as Hanna et al.'s (2003) work shows, they seem to be doing this very early in language processing (cf. Nadig & Sedivy, 2002).

On the other hand, however, empirical evidence has shown that often, the perspective of the interlocutor is left out in both utterance comprehension and production (e.g., Brown & Dell, 1987; Horton & Keysar, 1996; Keysar, Lin, & Barr, 2003). Thus, for instance, Horton and Keysar (1996) showed that participants adapted their utterances to whether their interlocutors also saw a series of aside objects that were presented in line with objects that had to be described. When put under time pressure, however, the effect disappeared. Jucks et al. (2003) described that when experts were provided with either a keyword list or an illustration in order to aid them in formulating their answer, experts' explanations were less oriented towards the addressee when experts were provided with the illustration; in other words, the illustration impinged on experts' expla-

[9] Also, research findings from studies that focus on adaptation on a lexical (word choice) level, that is, the so-called lexical entrainment, have been adduced as instances of adapation in communication (cf. section 2.4.3).

nations even though it did not constitute common ground (cf. the notion of *representational guidance* by Suthers and Hundhausen, 2002).

Various models were brought forth that try to account for the fact that the perspective of the other is sometimes taken into account and at other times neglected (cf. Barr & Keysar, 2006; Rossnagel, 2000). These positions are located on a continuum in which at one end, the specific interlocutor is always considered in utterance production and comprehension and at the other end, language processing is initially egocentric and based on mere accessibility and the partner is only taken into account in a second, non-mandatory step (cf. Schober, 2006).

An account closer to the latter than the first endpoint is the *interactive alignment model*, brought forth by Martin Pickering and Simon Garrod (Pickering & Garrod, 2004; Garrod & Pickering, 2004), which stretches the importance of priming processes as mechanism for adaptation in ordinary conversation. According to this account, interlocutors do not build up a mental model of the collocutor's mental state routinely; on the contrary, performing inferences about common ground is seen as an optional strategy that interlocutors employ only when resources allow and when a simpler mechanism is ineffective. This simpler mechanism, which normally causes adaptation in communication, is a "primitive and resource-free priming mechanism" (Pickering & Garrod, 200, p. 172), and is described as follows: In conversation, each interlocutor builds up a situation model, that is, a representation of the communicational setting that contains information about "space, time, causality, intentionality and currently relevant individuals" (Garrod & Pickering, 2004, p.8). In ordinary conversation, the situation models of the interlocutors overlap to a big extent; and hearing an utterance by interlocutor B will activate a particular aspect of interlocutor A's own situation model. As, according to the model, the same representations are used in comprehension and production, this will make it more likely that the person will use an utterance consistent with that aspect of the model, thereby causing alignment. The alignment in conversation takes place simultaneously and automatically on the various levels of conversation (i.e., with regard to the situation models as well as with regard to semantic representations etc.). Misalignment incidents are repaired by basic interactive repair processes, which also do not involve a modeling of the other's mind. Only when these fail, inferences processes are performed.

While thus, the emphasis of the Garrod and Pickering account is on priming, William Horton and Richard Gerrig (2005a, b) assume that interlocutors take into account each other's perspective and audience-design their messages whenever the relevant memory representations become accessible within the appropriate time course, that is, during ongoing speech production processes. Thus, information on the addressee is

processed parallely to other relevant information whenever accessible, not subsequently. The authors make a claim for the need to view the cognitive processes involved in audience design as part of general memory processes. In a similar vein, Hanna et al. (2003) suggest that it depends on the salience and constraints of other available information whether context information (which includes information about the addressee) has strong and immediate or weaker and delayed effects on language processing.

At the current point in the debate[10], no model that accounts for the obtained research findings has reached common sense status.

In sum, abundant empirical evidence has shown that interlocutors sometimes do take into account the other's knowledge in comprehension and production and at other times, comprehension and production are driven by mere accessibility. In the context of this dissertation, it is especially interesting to note that despite the lack of a definite model that could explain when adaptation takes place and when it does not, a variety of factors have been discussed which seem to condition if and how messages are adapted to a model of the other's knowledge (cf. Schober, 2004). Hereby, those factors which concern the characteristics of the conversational setting are especially relevant. Thus, Pickering and Garrod (2004) point out that their account was developed for "face-to-face spontaneous dyadic conversation between equals with short contributions" (p. 187) and assume that in conversational settings that deviate from this, the processes of alignment will be less automatic. This suggestion is relevant in the current context which focuses on email communication. Do experts consider their lay interlocutor's knowledge and adapt to it in the context of email health counseling? This will be addressed in studies II and III. The context of email health counseling will be described in more detail in section 2.4.

[10] In addition to the referenced studies, there are numerous other contributions to this debate, see e.g., Barr & Keysar, 2002, Gerrig, Brennan, & Ohaeri, 2000, Keysar & Horton, 1998, Metzing & Brennan, 2003, Polichak & Gerrig, 1998, as well as the open peer commentaries to Pickering & Garrod (2004; pp. 190-211), inter alia.

2.3.2 Politeness Principle

> "It's *very* provoking", Humpty Dumpty said after a long silence, looking away from Alice as he spoke, "to be called an egg - *very*!'"
> "I said you *looked* like an egg, Sir," Alice gently explained. "And some eggs are very pretty, you know", she added, hoping to turn her remark into a sort of a compliment.
> Lewis Carroll, *Through the Looking-Glass*

In the last section, issues regarding the adaptation of a conversant towards her interlocutor have been discussed, parting from the Gricean notion of a cooperative principle in conversation. Especially in those contexts in which there is a big knowledge divergence between the interlocutors, the cooperation in form of an adaptation to the (lay) collocutor is a necessary prerequisite for successful knowledge communication. However, the cooperative principle was not the only principle formulated for conversation. On the contrary, another important principle was – at least in early accounts – explicitly based on the observation that speakers often violate the Gricean maxims in order to achieve conversational goals other than efficient communication: Imagine, for instance, a godmother who travels from Cologne to the rather far away city of Leipzig in order to see her godson play in a trombone recital[11]. While the tones torment her ears during the recital, she is already trying to figure out what to say to her godson afterwards. Despite the fact that in line with the cooperative principle, "Your performance was horrendous" would be the most adequate message, the godmother is much more likely to utter "That was not perfect but quite nice", even though thereby massively violating the maxims of quality, quantity and manner.

The foregoing scenario depicts an example of how conversational goals can clash with the Gricean maxims. However, the godmother's utterance can be explained with another notion – the notion of *politeness*. In the following, I will introduce this conversational principle. Hereby, I will start with some commentaries on the linguistic term politeness. Thereafter, I shall introduce the widely received politeness theory by Penelope Brown and Stephen Levinson (1987). Also, I will specifically address politeness in expert-layperson communication and in human tutoring.

Linguistic politeness

Before turning to a description of accounts of politeness, some clarifying remarks need to be made with regard to the somewhat ambiguous meanings of the term *politeness*.

[11] Example adapted from the *Stanford Encyclopedia of Philosophy*, http://plato.stanford.edu/entries/implicature, retrieved on June 30, 2007.

On the one hand, there is an everyday use of the term polite, which, according to the *Oxford English Dictionary,* is defined as (a) courteous, behaving in a manner that is respectful or considerate of others; well-mannered, (b) cultured, cultivated; well-regulated, and (c) refined, elegant, scholarly[12]. This everyday understanding of politeness implies that polite behavior can be shown *by itself*, i.e. outside of concrete dyads and situations; or, in other words, certain forms of behavior can be labeled as polite behavior *per se*. With regard to the use of polite *language*, "we might give examples such as 'language which contains respectful forms of address like *sir* or *madam*', 'language that displays certain "polite" formulaic utterances like *please*, *thank you*, *excuse me* or *sorry*', or even 'elegantly expressed language'" (Watts, 2003, p. 1/2) in order to describe this per se polite behavior on a language level.

On the other hand, however, what should be labeled as polite in a pragmatic sense always depends on the concrete situation and linguistic context (cf., Terkourafi, 2001). Consequently, Watts (2003) distinguishes a *first-order (im)politeness* (i.e., a lay interpretation of the term politeness) from a *second-order (im)politeness* (i.e., politeness as understood in a sociolinguistic theory of politeness). In a similar vein, Brennan and Ohaeri (1999) contrast *true politeness* (which they define as giving a partner options) and *conventional politeness*, i.e. for instance merely adding words like please and thank you. In the following, this so-called true politeness will be the focus of interest.

Brown and Levinson's (1987) account of politeness

While earlier accounts of politeness had stretched the importance of rules and maxims to account for politeness in conversation (e.g., Lakoff, 1973; Leech, 1983), Penelope Brown and Stephen Levinson (1978[13]) focused on linguistic politeness from a new perspective, which emphasized – based on the notion of "face" as proposed by Goffman (1967) – the use of strategies for the consideration of politeness in conversation (cf. Terkourafi, 2001). In spite of the wealth of politeness accounts that have been brought forth since then (e.g., Blum-Kulka, 1987; Escandell-Vidal, 1996; Watts, 2003) and an ever-growing interest in the field of politeness, "Brown and Levinson's seminal treatment of politeness [...] has remained the most frequently cited publication on language and politeness. Indeed, [...] it has held its ground as the model that other writers turn to as the starting-point of their own research perspective" (Leech, 2005, p. 5). Also Person et al. (1995) point out the utility of the approach as a general framework.

Also in this dissertation, Brown and Levinson's account is taken as a basis for the consideration of politeness. This account is especially useful in the context of (formal as well as informal) expert-layperson communication due to its underlying notion of face,

[12] Retrieved from *Oxford English Dictionary Online*, http://dictionary.oed.com/, on July 1st, 2007.
[13] This work was published as a monograph in 1987 and is therefore cited as Brown & Levinson, 1987.

as will become clear later in this section. Prior to an application of the account to this setting, however, the account will be described in general.

Brown and Levinson (1987) start from the notion that in quite unrelated languages and cultures (South Indian Tamil, Mexican Tzeltal and US and British English), striking similarities in the ways in which utterances are constructed can be observed that diverge from a maximum of communicational efficiency (as would be expected according to the Gricean maxims). These convergences are due to another rational principle in communication, namely to politeness.

To illustrate their point, the authors introduce the notion of a Model Person. This Model Person is a fluent speaker of a natural language who has (as all competent adult members of a society do) the capacity to reason rationally on her communicative goals and on how to achieve those goals. Also, the Model Person has so-called *positive* and *negative face*. Brown and Levinson (1987)'s notion of face is derived from the Goffmanian one. In *Interaction Ritual*, Erving Goffman (1967) defines face as "the positive social value a person effectively claims for himself by the line others assume he has taken during a particular contact. Face is an image of self delineated in terms of approved social attributes – albeit an image that others share, as when a person makes a good showing for his profession or religion by making a good showing for himself." (p.5). Brown and Levinson (1987), then, describe face as a public self-image that every interlocutor wants to maintain, that can be either lost or enhanced and that needs to be constantly attended to in interaction. Hereby, face consists of two parts. On the one hand, there is *negative fac*e, that is, "the basic claim [...] to freedom of action and freedom from imposition" (Brown & Levinson, 1987, p. 61). On the other hand, *positive face* is described as "the positive self-image or 'personality' (crucially including the desire that this self-image be appreciated and approved of) claimed by interactants" (p. 61; original emphasis). These two aspects of face are basic wants of members of society, which every member knows the others to have and which in general the members are inclined to satisfy.

However, sometimes the communicative goals of two interlocutors might clash, if one of them – in order to pursue her goals with regard to the conversation – makes an utterance that somehow threatens the face of her interlocutor. Every speech act has the potential of threatening the other's face, thus to be an imposition to the addressee, or in other words a *face-threatening act (FTA)*. FTAs vary in the degree to which they are face-threatening, and can face-threaten negative or positive face (or both), as well as either the speaker's face or the addressee's face. Table 2-1 provides some of Brown and Levinson (1987)'s examples for each of these cases. In the following, however, I will focus on those instances in which a speaker performs a FTA that is face-threatening for

her addressee (marked in grey in table 2-1), since for the current context of expert-layperson communication, in which the experts' conversational behavior towards their lay interlocutors is investigated, these threats are the relevant ones.

Table 2-1. Examples to the four types of face-threatening acts

	Negative face threatened	**Positive face threatened**
Threats to speaker's face	Excuses, expressing thanks, acceptance of apology, acceptance of offers	Apologies, self-humiliation, confessions, admissions of guilt or responsibility, non-control of laughter or tears
Threats to addressee's face	Orders, advice, warnings, offers, compliments, expression of hatred or anger, complaints	Expressions of disapproval, criticism, complaints, accusations, insults, disagreements

To which degree is concrete speech act face-threatening, then? According to Brown and Levinson (1987), speakers calculate the weightiness of a FTA for their addressees with the following formula

$$W_x = D(S,H) + P(H,S) + R_x$$

in which:
W_x = weightiness of the FTA
D(S,H) = social distance between speaker and addressee
P(H,S) = power asymmetry between speaker and addressee
R_x = degree to which the FTA is rated an imposition in the respective culture.

The values of these sociological parameters are conceptualized as the speaker's assumptions about mutually shared values*:* "Thus these are not intended as *sociologists*' ratings of *actual* power, distance, etc., but only as an actor's assumptions of such ratings, assumed to be mutually assumed, at least within certain limits" (p. 75/76, original emphasis).

In a conversation, both interlocutors can perform speech acts that are potentially face-threatening to their communicational partner. Due to this mutual interdependency, a speaker will try to attenuate the weightiness of the FTA (or else avoid it altogether). Brown and Levinson (1987) formulate five types of linguistic strategies that speakers employ in order to minimize a face threat (see 1. through 5.; figure 2-2).

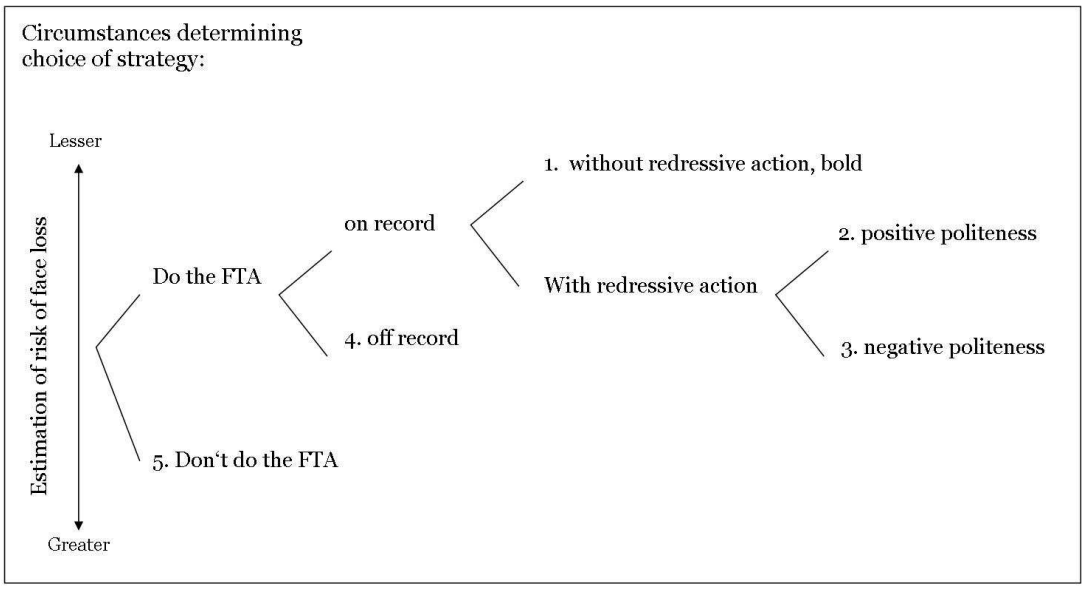

Figure 2-2. Strategies for doing FTAs (from Brown & Levinson, 1987, p.60)

The weightiness of the face-threatening act determines the degree of directness with which it is performed (the heavier the FTA, the more indirect the strategy). Hereby, the range goes from performing the FTA without any minimization effort (*without redressive action*[14]*, baldly*; strategy 1) to *not doing the FTA (*strategy 5*)* at all. If the speaker decides to realize the face-threatening act *off-record* (strategy 4), that means that the utterance can be interpreted in more than one way; therefore, the speaker cannot be held responsible for one particular content. Thus, for instance, if a girl says "Damn, I already had plans before mom asked me to water grandma's flowers", and her brother sighs and says "Oh no, you always ask me to water them for you", she could negate to have asked him this favor in the first place.

If a speaker, however, decides to do the FTA *on record*, striving to fulfill her communicational goal on the one hand while minimizing the FTA's face-threatening impact on the other hand, she can employ *positive politeness* (strategy 2; oriented towards the addressee's positive face) or *negative politeness* (strategy 3; oriented towards the addressee's negative face), depending on which aspect of face is potentially threatened by the FTA.

For both aspects of politeness, Brown and Levinson (1987) formulate a (non-exhaustive) set of substrategies with which the politeness aspect can be realized; concretely, these are 10 substrategies for negative and 15 for positive politeness. For the off-record realization of FTAs, 15 strategies are proposed. In the following, some exam-

[14] By redressive action, Brown and Levinson mean „action that 'gives face' to the addressee, that is, that attempts to counteract the potential face damage of the FTA by doing it in such a way, or with such modifications or additions, that indicate clearly that no such face threat is intended or desired" (p.69/70; original emphasis).

ples for each type of strategy will be given. Brown and Levinson (1987) provide numerous example sentences for each strategy; I will confine myself to one of their sentence examples each.

Negative politeness strategies. Negative politeness strategies are performed to minimize the imposition of the face-threatening act. Examples of the fifteen substrategies of negative politeness are:

- *Be conventionally indirect*
  Explanation: When using this strategy, the speaker uses phrases and sentences that are contextually unambiguous but have different literal meanings. Thus, the speaker expresses the desire to have conveyed the content indirectly.
  Example: "Can you post this letter for me?"
- *Be pessimistic*
  Explanation: The speaker may also express doubt that the conditions for the appropriateness of his speech act obtain.
  Example: "You don't have any manila envelopes, do you by any chance?"
- *Minimize the imposition, R_x*
  Explanation: When using this strategy, the speaker indicates that the intrinsic seriousness of the imposition is not great in itself.
  Example: "Could I have a taste of that cake?"
- *Apologize*
  Explanation: When applying this strategy, the speaker apologizes for doing an FTA, thus indicating his reluctance to impinge on the addressee's negative face.
  Example: "I'm sorry to bother you but…"
- *Impersonalize speaker and addressee*
  Explanation: With this strategy, the speaker phrases the FTA as if the agent was someone other than herself, and/or as if the addressee were someone other than the actual addressee.
  Example: "That letter must be typed immediately."
- *State the FTA as a general rule*
  Explanation: Hereby, the speaker states the FTA as an instance of some general social rule, regulation or obligation.
  Example: "We don't sit on tables, we sit on chairs, Johnny."

Positive politeness strategies. While negative politeness strategies are directly oriented towards the imposition itself, in positive politeness, the focus is widened to the appreciation of the other's positive face wants in general or to the expression of similarity between one's own and the other's wants. Examples of the fifteen substrategies of positive politeness are:

- *Exaggerate (interest, approval, sympathy with addressee)*
  Explanation: Hereby, the speaker exaggerates his interest, approval, sympathy with the help of prosodic features or by using certain words or particles.
  Example: “What a fantástic gárden you have!”
- *Use in-group identity markers*
  Explanation: Also, the speaker may use markers like address forms, dialect or slang to claim common ground with the addressee.
  Example:”Come here, buddy.”
- *Avoid disagreement*
  Explanation: When using this strategy, the speaker formulates his utterance so as to appear to agree with the addressee or as to hide her disagreement.
  Example: A: “What is she, small?” B: “Yes, yes, she’s small, smallish, um, not really small but certainly not very big.”
- *Presuppose / raise / assert common ground*
  Example: “Look, you know I’ve got this test coming up, well how about lending me your Encyclopaedia Britannica?”
- *Assert or presuppose the speaker’s knowledge of and concern for the addressee’s wants*
  Explanation: When using this strategy, the speaker asserts or implies knowledge of the addressee’s wants and her willingness to fit her own wants in with them.
  Example: “I know you love roses but the florist didn’t have any more, so I bought you geraniums instead.”
- *Be optimistic*
  Explanation: The speaker’s utterance contains the assumption that the hearer’s and the speaker’s interests are similar (and the FTA therefore little).
  Example: “Look, I’m sure you won’t mind if I borrow your typewriter.”
- *Include both speaker and addressee in the activity*
  Explanation: Speaker may use the inclusive ‘we’-form to appeal to the cooperation between speaker and addressee.
  Example: “Let’s stop for a bite.” (instead of: I want a bite, so let’s stop)

Off record strategies. When doing a face-threatening act off-record, the speaker hints at her intended message while the addressee is supposed to figure out the conversational implicature from the contextual cues of the utterance. The speakers can hereby proceed using for instance one of the following strategies:

- *Give hints*
  Explanation: The speaker says something that is not explicitly relevant in the situation, thereby inviting the addressee to search for an interpretation of the utterance which makes it relevant.
  Example: “It’s cold in here”. (meaning: “Close the window”)

- *Understate*
  Explanation: The speaker says less then is required in a situation and thus invites the addressee to think about why.
  Example: "What do you think of Harry?" "Nothing's wróng with him." (meaning: I don't think he's very good)
- *Overstate*
  Explanation: The speaker says more than is required in a situation and thus invites the addressee to think about why.
  Example: "I tried to call a húndred times, but there was never any answer".
- *Use metaphors*
  Example: "Harry's a real fish". (meaning: Harry is cold-blooded like a fish)
- *Use rhetorical questions*
  Example: "How was I to know…?" (meaning: I wasn't to know)
- *Be incomplete, use ellipsis*
  Explanation: By leaving the FTA half undone, the speaker can leave the implicature 'in the air' and for the addressee to figure out.
  Example: "Well, if one leaves one's tea on the wobbly table…."

Brown and Levinson's (1987) politeness account has been criticized on numerous grounds (for a comprehensive outline of criticisms, see Kasper, 1990; Eelen, 2001; Watts, 2003). Hereby, one major criticism concerns the claimed universality of the account. Concretely - even though Brown and Levinson's linguistic data had been collected from divergent languages and cultures –critiques have depicted a "Western" bias in the model's stress on individual face. Hereby, it was argued that - while apt within the Western cultures' ideal of autonomy – an explanation of politeness phenomena based on individualistic wants was inadequate for the more group-oriented Eastern cultures (cf., Mao, 1994, Matsumoto, 1989, Wierzbicka, 1991). And indeed, research on languages like Chinese, Japanese or Greek has shown that politeness phenomena in these languages can only be accounted for under consideration of the wants and obligations that an individual has relative to her position within (the social hierarchy of) a certain community. However, the 'individual vs. group orientation' does not need to be an either/or dichotomy. As Leech (2005) argues, a speaker is taking into account both individual and group values. For polite communication, then, the group values are more powerful in the East, while individual values are in the West. Consequently, Leech (2005) rightly remarks (p.6, original emphasis):

> "An absolute universalist position is clearly untenable: it is obvious, from studies over the past twenty years, that politeness manifests itself in different terms in different languages/cultures. On the other hand, a completely relativist position is equally untenable. If there were not a common pattern shared by different languages/cultures, it would be meaningless to apply a word like "politeness" or "face" to different cultures".

With regard to the impact of culture, then, we have to be aware that a speaker's politeness choices are not merely individual. On the contrary, they are constrained "by a *societal* rationality which has precast [...] the universe of possibilities into a range of concrete choices" (Terkourafi (2005), p. 249; original emphasis) that constitute the politeness norms and habits of that society.

As already mentioned, many empirical research studies on politeness in different conversational settings are conducted within the theoretical framework of Brown and Levinson's (1987) politeness account. In the following, some empirical research in this area will be depicted; hereby, the focus will be put on those studies that have produced results which are somewhat relevant in the current context of computer-mediated expert-layperson communication.

Research based on Brown and Levinson's (1987) politeness account

Research on politeness has mainly focused on the study of politeness in oral interaction (Duthler, 2006). Thus, for instance, Aronsson and Rundström (1989) analyzed the transcripts of 30 doctor-parent-child encounters in an allergy outpatient clinic. These authors characterize the setting of pediatric consultations as a setting potentially rich in face-threats: In this context, the doctors have institutional authority over the child and the non-expert parents. This potentially threats the parental authority, as doctors often need to discuss matters of child hygiene, pet keeping, food habits, smoking of the parents, among others, with the parents. Both child-directed and adult-directed recommendations were analyzed with regard to used politeness strategies. While the doctors gave their recommendations to the children in a quite direct fashion (*Before you go to the physiotherapist, you have to cut your fingernails*)[15], when addressing the parents, the doctors preferably used indirect, polite ways of communicating the advice (*That's daring, I'd say*). Only when doctors seemed to sense that these indirect moves were failing, their utterances became more direct in the course of the conversation.

[15] The baldness is frequently accompanied by playful elements, however, e.g. by calling the child "Mylord" or "Little Lady", or other jokes and playful uses of language.

Despite its main emphasis on spoken dialogue, politeness has also been analyzed in written communication. Hereby, many researchers apply linguistic research methods like genre analysis, corpus analysis and discourse analysis to natural text corpuses. Thus, for instance, Flowerdew and Dudley-Evans (2002) analyze 53 letters written by a co-editor of an international linguistics journal. In these letters, the editor sent out reviews and communicated his decision regarding the publication of a manuscript. With regard to face-saving strategies that were administered when conveying the decisions that the manuscript had been rejected or needed to be revised, the editor often mitigated the face-threat. Thus, for instance, he frequently apologized (*I am sorry that I have to bring you disappointing news*), used the modals 'could' and 'would' (*You could fairly easily remedy this*), or outlined options to the author (*If you would like to develop your research and write a more extensive paper, we would be happy to consider it for the journal*). As Flowerdew and Dudley-Evans (2002) point out, these instances of linguistic politeness serve the need to maintain a positive relationship but might clash with the comprehensibility of a message, leading to confusion on part of the manuscript's author(s).

While suchlike analyses of linguistic corpuses have been made for a variety of genres like for instance written requests in an institutional setting (Bremner, 2006), emails sent by learners of English to their teachers (Bretag, 2006) or work reports from subordinates to superiors (Rogers & Lee-Wong, 2003), also experimental studies have been conducted to address some of the issues raised by Brown and Levinson's account of politeness.

Thus, Brennan and Ohaeri (1999) compared the use of politeness devices in groups of three people each which had to recall and find a consensus on the plot of a movie clip they had just seen, either face-to-face, or mediated by a computer (using a chat tool). The authors argue that in the process of reaching consensus, face-needs are often threatened as different views clash. In the chat protocols respectively in the transcripts of the face-to-face discussions, the authors analyze the use of politeness for two politeness devices (i.e., hedges and questions), arguing that both are markers of provisionality of one's own opinion. These give information about the willingness of a speaker to let her opinion be modified. For instance, it is clear that *a bedtime story kind of thing* as a hedged utterance leaves room for different proposals on the same scene; so does the use of a question as for instance *"..., isn't it"*? As such, the speakers act politely, because they put some distance between themselves and their utterance, thus leaving room for their interlocutors to make a counterproposal. Results show that participants in the face-to-face and in the computer-mediated-communication groups performed equally well, with regard to the quantity and quality of recall of propositions from the

story, even though nearly twice as many words were used in the face-to-face condition. With regard to the provisionality markers, results showed that hedging was used much more in the face-to-face condition while questions were posed equally often in the two conditions. These findings are explained by the authors with the extra *costs* of hedging: For hedging, words or phrases have to be added, which requires more effort when typing than when speaking. The effort of posing questions, however, can be seen as more or less equal in both media. From their results, the authors conclude that social conventions play a role in computer-mediated communication; the characteristics of the medium influence the communicational contributions, however.

While Brennan and Ohaeri (1999) thus investigate synchronous communication settings, Duthler (2006) investigates two asynchronous communicational media (email vs. voicemail) with regard to message politeness. His student participants were instructed to request a meeting from a (fictitious) professor, to be scheduled either during or out of his office hours (variation of imposition) and using either voicemail or email (variation of communication medium). When composing an email, an author can plan, edit and revise her own message before sending it. Also, cognitive load during message construction is reduced because of the externally represented text draft. When leaving a voicemail message, however, the message can be planned beforehand but then has to be uttered without the possibility of revision. Also, cognitive load is higher due to the need for simultaneous concentration on the content and the performance of the message. As a consequence, Duthler hypothesizes that email messages should be more polite than voicemail messages, and that requests that are high in imposition should be formulated more politely than messages that are low in imposition. This should only hold for email messages however, as due to the time for composing, the email messenger is assumed to be more sensitive to the social context and have more chance to customize their message. Results show partial support for the supposed effects. For the asynchronous setting of email communication it can thus be concluded that it rather fosters the use of politeness.

In sum, politeness research within the theoretical framework of Brown and Levinson's (1987) politeness account has provided important insights with regard to politeness in different conversational settings. Thus, studies have documented ways in which face-threatening speech acts have been attenuated through the use of politeness. Also, it was shown that a polite way of formulation often impacts negatively on the clearness of a message and makes it less comprehensible to the addressee. Another important aspect which research has shown is that politeness is a relevant phenomenon also in written, computer-mediated communication. Hereby, politeness seems to be especially

relevant in asynchronous communication (concretely: email), Duthler (2006) ascribes this to the time for composing a message.

What implications do the so-far made elaborations on politeness have for formal and informal learning contexts in which experts and laypersons communicate with each other? The politeness account of Brown and Levinson (1987) has been introduced as an account that has proven a useful theoretical framework for the investigation of politeness, also in computer-mediated conversational settings. To recall to the mind: The core idea of this account is the notion that in dialogue, interlocutors try to maintain their 'face' as well as respect the face of their collocutor. However, speakers often have to do potentially face-threatening speech acts, like criticism or disagreement. In these instances, politeness is used in order to attenuate the face-threat of the speech act. The degree to which a speech act is a face-threat depends on the social distance and on the power distribution between the interlocutors, as well as on the culturally determined weightiness of the speech act.

Taking Brown and Levinson's account as a basis, Person et al. (1995) have described the impact of politeness in formal tutorial settings, providing evidence with examples from tutorial dialogues. In the following, starting with a description of Person et al's (1995) analysis, the role of politeness in formal and informal tutorial settings will be depicted.

Politeness in formal and informal tutorial settings

The tutorial dialogue has many features of normal conversation; on a range with normal conversation at one end and less interactive discourse (e.g., classroom teaching) at the other end, Person et al. (1995) locate tutorial dialogue somewhere in between these two poles – being more close to the normal conversation pole. This similarity calls for an investigation of the role of ordinary conversation principles in tutorial dialogue. Person et al. (1995) undertake this, providing an analysis of the one-to-one tutorial setting with regard to Brown and Levinson's three parameters distance, power and degree of imposition. Hereby, social distance and power asymmetry are high, because (at least in the settings analyzed by Person et al., 1995) the tutors and the tutees do not know each other and the tutor has control in the situation. As described above, the degree of imposition will vary with the amount of imposition contained in the speech act. Hereby, it needs to be pointed out that tutorial dialogue is a dialogue in which the tutor will need to do many potentially face-threatening acts; this will become clear in the following. From the analysis of the three parameters for tutorial dialogue, Person et al. (1995) conclude that politeness strategies play a substantial role in tutorial dialogue. In transcribed tutorial dialogues from two tutorial samples (college students being tutored on

research strategies and seventh grade students being tutored on algebra), Person et al. (1995) investigate politeness strategies in these contexts. Through close readings of the transcripts, numerous politeness strategies are identified and documented, and the authors analyze in what ways these strategies foster as well as hamper the tutorial process.

On the whole, Person et al. (1995) deduce the use of 13 politeness strategies from their tutoring protocols (i.e., four positive politeness, five negative politeness and four off-record strategies; for a description of the strategies, see above in this section 2.3.2). For each of these strategies, the authors reflect on how the politeness conventions of normal conversation foster as well as hamper the tutoring process; this is depicted in table 2-2 (the strategies were described and can be reviewed on pp. 33 ff).

Table 2-2. The impact of politeness conventions on tutoring (adapted from Person et al., 1995)

Type of strategy	Benefits of strategy	Costs of strategy
Positive politeness		
Exaggerate.	Student is reinforced for mastering the material.	Feedback may be inappropriate for the response (e.g., ignoring minor errors in the response).
Avoid disagreement.	Student is not challenged or put in adversarial relationship with the tutor.	Tutors need to correct the student's knowledge deficits or develop student's reasoning skills.
Be optimistic.	Used by tutor to facilitate student's response.	Sets student up for failure if the student does not know the answer.
Presuppose common ground.	Time is not lost in a discussion of terms and principles already familiar to student.	Tutor's assumptions about student's knowledge may be false, leading to gaps in the student's knowledge.
Negative politeness		
Be conventionally indirect.	Student is not continually following tutor's commands.	Students may not understand what is expected from them.
Be pessimistic.	Reduces anxiety on part of student if probability of failure is high.	May cause student to believe that failure is expected or acceptable.
Minimize imposition.	Tutor's requests are made to seem less burdensome.	Tutor may inhibit student's learning by reducing the student's cognitive burden.
Apologize.	Used to clarify or restate ambiguous question.	May cause loss of tutor's credibility in the eyes of the student.
State FTA as a general rule.	Tutor does not need to provide rationale for the statement.	Obscures relation between student's act and general principle.
Off-record		
Give hints.	Tutor facilitates the student's answer.	Hints may be inappropriate, vague, or too specific.
Understate.	Softens the blow of critical feedback.	Feedback may be inappropriate for the response (e.g., minimizing errors when they are severe).
Use metaphors.	Facilitates the comprehension of complex topics.	Students may not understand or only partially understand the metaphor.
Use ellipsis.	Tutor assists student in constructing answer.	Tutor may obscure student's lack of understanding by providing too much information or doing the work for the student.

The types of situations in which politeness strategies are used are presented within a a 5-step tutorial frame. For the current purpose (in which the depiction of Person et al.'s (1995) account is restricted to those tutorial moves which are also possible in the email conversational context with its only one conversational turn), step 3 (tutor gives feedback on tutee's answer) und step 5 (tutor assesses student's understanding of the answer) are relevant. The ways in which – according to the authors – politeness is used in these situations will be described in more detail:

With regard to the *feedback that the tutees receive from their tutors*, it is important to point out that when tutees utter an error, tutors often do not give appropriate feedback nor correct the error. Concerning this matter, the authors assume (p. 174):

> "When a student commits an error in a tutoring session, the tutor has the responsibility to acknowledge and correct the error. Because, by definition, this is a face-threatening act, it seems likely that the politeness strategies will be employed to make the feedback less aversive".

To illustrate this point, the authors provide the following example (p. 175; original emphasis):

Tutor: … OK, now, what is it, just *FOIL*. OK, FOIL. It stands for "first, outside, inside, last." […] Do you see how that works?

Tutee: Here's the way I've done it [student mumbles solution to the problem from the book to himself].

Tutor: Right. Well, that's one way to do it, but they like this [the FOIL method]; this is really the way most people like to do it [elaborates on reasons].

In this example, the tutor lets the tutee's answer pass as an adequate alternative, despite its being wrong, and suggests the correct answer as just an alternative. The problem with this indirect kind of error correction is that the student may stick with his misconception. For the displayed tutorial sequence, the authors assign two politeness strategies: "state face-threatening act as a general rule" and "conventional indirectness".

With regard to the *assessment of the tutee's understanding*, the authors find in the protocols that tutors greatly rely on the tutee's self-assessment of their own understanding, using questions that trigger self-assessment like for instance "so you understand that, right?". The authors ascribe this to the fact that in normal conversation, interlocutors usually rely on the other's self-assessment of understanding, which is apt for everyday talk, but not for tutorial dialogue, where a tutee operates "on the frontier

of his or her knowledge, and self-assessments may be much less accurate" (p. 182) and the tutee is likely to try to hide knowledge deficits from the tutor. Thus, the authors conclude (p. 183):

> "Even when a concept or idea has been explicitly mentioned in a tutoring session, the tutor cannot be certain that the student both understands and remembers the information. This can be contrasted with normal conversation in which contributions by both participants are assumed to be in the common ground and completely understood [...]. Tutors, therefore, must be careful not to carry over this conversational assumption into tutoring sessions."

According to Person et al. (1995), tutors should be aware of these costs and benefits. Also, tutors and students should establish so-called ground-rules, that is, the tutee should be informed that the tutor will use negative feedback as well as violate other rules of normal conversation.

Finally, it is interesting to note that there were certain domain differences in the use of politeness strategies; these were used more heavily in the tutoring sessions on research methods than in the ones on algebra. This might be due to the fact that tutorial dialogue on research methods might resemble normal conversation even more, because in this domain, there are hardly any answers which can easily be evaluated by 'true or false', but answers can also be partly correct so there is more need for content negotiation between tutor and tutee than in tutoring sessions on algebra. Person et al. (1995) therefore call research methods an *open-world domain* and algebra a *close-world* domain. In this dissertation, the focus is put on medicine, which can also be perceived of as an open-world domain.

As has been described in the previous sections, Person et al. (1995) discuss the role of politeness for formal tutorial settings. However, due to the structural parallels of tutoring in formal and informal settings (see section 2.2.1), it is worthwhile to discuss the impact of politeness on dialogue also for *informal* tutorial settings. When experts and laypersons communicate in counseling settings, it is generally for the purpose of knowledge communication, as a layperson – needing some advice – resorts to an expert of the respective topic (Bromme & Rambow, 2001). However, the interpersonal dimension does exist and needs to be considered in this setting (cf. Jucks, Paechter, & Tatar, 2003). Thus, in expert-layperson communication, face-related and content-related issues and communicative goals exist side by side (Fetzer, 2000). In order to consider the role of politeness for expert-layperson counseling, it is a useful approach to analyze the setting with the help of Brown and Levinson's parameters (cf. p. 30): When a physician

is communicating with a medical layperson via email, what are the social distance, the power distribution and the weightiness of the speech acts likely to be?

Firstly, the social distance between expert and layperson is likely to be evaluated as high. Her expertise gives the expert a higher status; this status does not have to be negotiated during interaction but is predefined by the institutional frame in which doctor-patient communication takes place (Fetzer, 2000; Aronsson & Rundström, 1989). In addition, the social distance is even bigger (i) because expert and layperson communicate via email and (ii) they often do not know each other.

Secondly, with regard to the power distribution, there is a power asymmetry, as the patient depends from the doctor and her expertise[16][17].

Thirdly, with regard to the face-threatening value of a physician's speech acts, it is safe to say that doctor-patient communication is a communicational situation rich in face-threatening speech acts on part of the physician (cf. Aronsson & Rundström, 1989). For instance, the doctor often has to give medical advice that hazards the autonomy of the patient by requiring lifestyle changes. Thus, the patient might feel hazarded in her autonomy and also sense an implicit critique with regard to her current lifestyle. In addition, in email communication, the expert has time to compose her answer and might thus have more opportunity to realize a polite version of speech than if communicating synchronously (for instance via chat).

Taken together, we can hypothesize that politeness does very likely play a role also in informal learning settings. The question of whether and how the conversational principle of politeness impacts on how experts converse with laypersons in email health counseling will be addressed in study IV (cf. chapter 7).

[16] Depending on the concrete case, patient and doctor also negotiate contents and decisions, rather than the physician dictating them (cf., Runde, 2005). Also, the doctor depends on the patient to a certain degree (i.e., on her compliance, but also economically). However, on balance, the notion of power asymmetry still holds.

[17] Strictly speaking, Brown and Levinson explain P as a measure of power that the speaker has over the hearer. They also speak of power asymmetry, however. In the context of expert-layperson communication, as well as in tutoring (see next section), I will assume that the power that the expert (respectively the tutor) has over its interlocutor will also increase the weightiness of the face-threatening act (this is also proposed by Person et al., 1995).

2.4 Email health counseling

In the previous sections of this chapter 2, theoretical backgrounds have been described that are relevant in the applied research context of this dissertation, that is, in email health counseling. The remainder of this chapter is dedicated to providing more insights into this applied setting.

For this aim, I will start by describing online health counseling services, with email health counseling being one of them (section 2.4.1). Thereafter, special characteristics of email communication will be outlined in section 2.4.2. Last but not least, in section 2.4.3, research that has been conducted in this conversational setting will be described; these research pieces focus specifically on lexical alignment, that is, on the lexical adaptation of the expert to her lay interlocutor.

2.4.1 Health services on the Internet

In the last twenty years, the Internet has become firmly established in public as well as in private life (cf. Döring, 2003). The use of the Internet for information search on a variety of topics is large and growing; one very popular topic being health issues. Convenience (i.e., the option to search for information from home), anonymity and wealth of information are among the factors cited most frequently by Internet users as to why they look for health information on the Internet (Fox & Rainee, 2000). As Koc (2002) reports, every third Internet user also looks for health-related information. Other studies report even higher quotas. For instance, Fox (2006) reports data from the *Pew Internet & American Life Project* (conducted in August 2006). In this study, eighty percent of American Internet users reported to have searched for health information on the Internet on at least one of seventeen topics.

Baker, Wagner, Singer and Bundorf (2003) comment that there exists a „wide variation in estimates of Internet use for health, coupled with the fact that the highest estimates have been the most widely disseminated“ (p. 2401). Indeed, as shown, reported numbers vary substantially between studies. Therefore, absolute and definite figures cannot be reported here. However, it is safe to assume that the search for medical information on the Internet is a ubiquitous and evermore important societal phenomenon. This fact can be further illustrated with the help of the following anecdote reported by Cline & Haynes (2001): In 1997, the American National Library of Medicine (NLM) opened their database MEDLINE – which had only been accessible by physicians be-

fore – to the public[18]. As a result, the searches on the database increased from 7 million in 1997 to 120 million in 1998. The NLM and the US institutes of health reacted to this by creating MedlinePlus, which was specifically intended to serve the informational needs of consumers.

On the quality of health-related information on the Internet

Thus, an abundant amount of health-related information has become easily accessible on the Internet[19]; the *quality* of this information, however, is far from guaranteedly high (Eysenbach & Diepgen, 1999). Information can be obsolete or false, and often, commercial product information is presented in a way that makes the source of information seem official (Schürer-Maly, Koneczny, Butzlaff, & Vollmar, 2006). The problem is further exacerbated by the fact that most Internet users search for medical health information rather uncritically (cf. Stadtler, 2006).

An analysis[20] of the first five search hits of a Google search on "diabetes" (cf. footnote 18) shows how lay health information consumers are confronted with information from different backgrounds and with potentially varying quality (table 2-3). Hereby, the first hit leads to a site provided by the American Diabetes Association, and is specifically intended for lay use. The second hit leads to a site provided by a pharmaceutical company. The fact that this is a commercial site is, however, not apparent at first glance, which is on one side due to the neutrality of the URL (www.diabetes.com). On the other side, there is no obvious product placement or advertisement on the site. In the category 'Treating type 2 diabetes', however, a link labeled 'Click here for a type 2 diabetes treating option that can help' leads to a page that informs about a diabetes medicine of said pharmaceutical company.

The third hit leads to the 'diabetes' entry in Wikipedia. While in general, the quality of Wikipedia articles is deemed to be high and in many cases comparable to the quality of renowned encyclopedias (Giles, 2005), the information on Wikipedia can not be trusted unconditionally, as examples of false information that stayed for months on Wikipedia have shown[21]. Also, the numbers of edits and re-edits on popular Wikipedia sites are very high.[22]

The fourth hit is a link to the diabetes journal of the American Diabetes Association. The articles in this journal have titles like „Activation of Sphingosine kinase-1 Mediates

[18] Cf. http://www.nlm.nih.gov/about/nlmhistory.html (Retrieved March 2nd, 2007).
[19] As a means of illustration of the abundance of information: Typing the search command „diabetes" into google.com results in 82,700,000 hits (search undertaken March 13, 2007).
[20] Analysis procedure adapted from Schürer-Maly et. al, 2006.
[21] Cf. the following article in USA Today: http://www.usatoday.com/news/opinion/editorials/2005-11-29-wikipedia-edit_x.htm, retrieved on March 13, 2007.
[22] Cf. the following article in Zeit: http://www.zeit.de/online/2005/50/wikipedia?page=all, retrieved on March 13, 2007.

Inhibition of Vascular Smooth Muscle Cell Apoptosis by Hyperglycemia“ (You, Ren, Yan, & Sun, in press) and are intended for a scientific audience. While articles like these are of supposedly high scientific quality, they are not apt for laypersons.

The last, fifth hit leads to the ‘National Diabetes Information Clearinghouse’, an information dissemination website set up by the National Institute of Diabetes and Digestive and Kidney Diseases. The site is dedicated to patients, health care professionals and the general public and thus explicitly addressed at laypersons.

Table 2-3. Search results 1-5 of “diabetes” google search, March 13, 2007

	URL	Operator	Advertisement
1.	http://www.diabetes.org	American Diabetes Association	no
2.	http://www.diabetes.com	Glaxo Smith Kline	yes
3.	http://en.wikipedia.org/wiki/Diabetes	Wikipedia	no
4.	http://diabetes.diabetesjournals.org/	American Diabetes Association	no
5.	http://diabetes.niddk.nih.gov/	National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), NIH	no

As a consequence of the previous, various initiatives have been founded that aim at making high quality health information on the Internet easier to identify (cf. Charatan, 2002; Cline & Haynes, 2001) and quality criteria have been formulated by numerous authors and institutions (Adelhard & Obst, 1999).

For instance, since 1996, the non-profit Swiss Health on the Net Foundation (HON)[23] accredits web-sites according to eight ethical criteria (see table 2-4). Thus, when laypersons - looking for health information on the Internet - finds a site that is tagged with the HON seal, they know that these criteria are fulfilled. Also, users can download a free “plug in" service integrated in the navigator, which automatically indicates if the visited page is part of an HON-accredited site.

[23] See *www.healthonnet.org*

Table 2-4. The eight HONcode principles[24]

Authoritative	Indicate the qualifications of the author
Complementary	Information should support, not replace, the doctor-patient relationship.
Privacy	Respect the privacy and confidentiality of personal data submitted to the site by the visitor.
Attribution	Cite the source(s) of published information, date and medical health pages.
Justifiability	Site must back up claims relating to benefits and performance.
Transparency	Accessible presentation, identities of editor and webmaster, accurate email contact.
Financial disclosure	Identify funding sources.
Sponsorship	Clearly distinguish advertising from editorial content.

To provide another example, Brown (2002) describes the efforts of the World Health Organization (WHO) for a health-related Internet domain like for instance "**.**health"; such a domain could be used to signal to users that the respective sites meet certain criteria of accuracy and safety.

While thus, a lot of thought and research has been done on the *technical quality* of health-related Internet information, the *understandability* of this information to laypersons has been hardly investigated from a psychological perspective (cf. Jucks, et al., 2003). From the perspective of the layperson, however, it is just as important to obtain information that she can understand than obtain information that is correct. To provide understandable information is a great task for physicians, also in the net-based health counseling context which is the focus of this dissertation.

There are numerous possibilities for medical laypersons to obtain medical information from the Internet. Commercial Internet sites (e.g., *www.netdoctor.co.uk*) provide lay-oriented information on health-related issues, as well as clinics and medical institutions (e.g., *www.mayoclinic.com*; *www.health.nih.gov; http://medlineplus.gov*). Hereby, medical information is brought about in different forms. On the one hand, a layperson can consult and read informational texts displayed on web pages. Also, information can be obtained from lists of frequently-asked questions (FAQ's), mailing lists or newsletters.

Another source of information provided frequently, which is more adapted to the informational needs of the individual, is the possibility to consult a medical expert via email. Then, possibly with some delay, the individuals receive email answers; on some

[24] From: http://www.hon.ch/Global/pdf/ShortHONpresentationOct2006.pdf, retrieved on March 7, 2007.

sites, these answers are stored in publicly accessible archives so that other users con read them. This medical email counseling is the informational setting which is investigated in this dissertation. In the following, I will focus on email communication in more detail.

2.4.2 Characteristics of email health counseling

In "using language", Herb Clark (1996) makes a point for face-to-face conversation being the basic setting for language use from which all other conversational settings are but derivative. Therefore, the understanding of communication in different communicational settings needs to start from an understanding of conversation (cf., Schober, 2006). The characteristics of the respective specific conversational setting greatly influence communication. Clark and Brennan (1991) provide a framework with which different media of communication can be located on various dimensions (cf. Brennan & Lockridge, 2006). These dimensions describe the constraints[25] that different communication media put on establishing common ground in communication. These eight dimensions are:

- *Copresence*: In face-to-face conversation, the interlocutors share the same physical environment, they can usually see and hear what the respective other is doing and looking at. In other media, this is mostly not the case.
- *Visibility*: Also, in face-to-face communication, the interlocutors can see each other, while in many other media, they cannot.
- *Audibility*: When interlocutors communicate in a way that they can hear each other, they can take note of timing and intonation.
- *Cotemporality*: This dimension addresses whether interlocutor B receives a message at roughly the same time as it is produced by interlocutor A.
- *Simultaneity*: Also, in face-to-face communication, messages can be conveyed and received by both interlocutors simultaneously.
- *Sequentiality*: When talking face-to-face, interlocutor A's and B's turns usually do not get out of sequence.
- *Reviewability*: While speech fades quickly, in other communicational media, artifacts of conversation remain that can be reviewed later by either of the interlocutors or by a third party.

[25] Monk (2003) points out that the term 'constraints' may be a little distracting in the context of this taxonomy: While in everyday language, the term 'constraints' is used to describe something 'bad', here constraints are good in that they reduce ambiguity and thus foster the establishment of common ground.

- *Revisability*: Some media allow for revising one's utterances privately before sending them to the collocutor. Face-to-face communication, however, does not allow for this; rather, self-repairs must be done publicly.

The conversational setting that is the focus of this dissertation is a computer-mediated counseling scenario in which a layperson asks an expert for advice via email. Taking the dimensions proposed by Clark and Brennan (1991) as a starting point, it is possible to analyze this setting some more:

In email communication, the expert and the layperson do not share the same physical environment. Thus, when explaining, the expert cannot refer to objects that both interlocutors perceive[26] – for instance a model of an organ or an X-ray image; instead, she needs to find other ways to refer to objects. Expert and layperson cannot see nor hear each other either, so there is no possibility to add meaning to an utterance (beyond its content) through gesture, mimic or paraverbal features such as intonation. Also, the layperson cannot send a message parallely to the expert, for instance frown or make sounds that provide feedback on whether she is understanding what she is hearing or not. Therefore, it is harder to estimate whether one's messages are understandable to the interlocutor or not. As for sequentiality, in email communication utterances mostly form only a loose chain that is interrupted as interlocutors receive intermittent contributions uttered by others.

The characteristics described up to now of email communication make it more difficult to establish common ground than in face-to-face communication. It is harder for the expert to draw inferences about what the layperson already knows or doesn't know (because many feedback possibilities of face-to-face communication are missing; cf., Whittaker, 2003).

In our setting, this estimation is especially difficult given that mostly, communication consists only of one turn with one lay email query being followed by one expert answer. Thus, other than in multi-turn email interactions – the experts have to rely on the written query as *only* source of information on the sender's knowledge; they cannot elicit that knowledge during the course of a longer email dialogue. The email remains, however, visible and reviewable as an artifact of conversation, and the experts have time to think and plan their answer before sending it. Therefore, they might rely more heavily on their suppositions about the other than in face-to-face communication (cf., Fussell & Kraus, 1992).

[26] Unless it is an illustration that is provided online. In the already mentioned research program at the University of Muenster, one research question concerns the ways in which shared illustrations impact on netbased expert-layperson communication, e.g., Jucks, Bromme, & Runde, 2007.

In sum, there are several constraints put on communication in written, asynchronous net-based expert-layperson communication, which make it both difficult and vitally important for the expert to draw correct inferences about the layperson's knowledge from the email. Thus, experts are in great need of information on the layperson's knowledge. One type of information is the utterance of lay beliefs within the layperson's email text. To what degree do experts draw inferences from this information in order to assess the layperson's knowledge? To what extent does this information impact on the ways experts answer the lay query? These are two main research questions which will be addressed in this dissertation.

Up to this point, this section on email health counseling has focused on the applied setting of email health counseling by integrating it into the bigger context of health services on the Internet, as well as by applying characteristics of email communication to the setting. In the following, some empirical studies on online health counseling will be described which have been conducted within the research project on recipient orientation in net-based health counseling at the University of Muenster (see chapter 1). In these studies, the role of audience design and accessibility in the adaptation of the experts' answers to their lay addressee was analyzed, focusing specifically on the adaptation to the layperson's lexical choices; this uptake of word choices is called *lexical alignment* in linguistics. In order to make the description of the studies understandable, I will start with a short introduction on research on lexical alignment.

2.4.3 Lexical alignment in email health counseling

> The table was a large one, but the three were all crowded together at one corner of it: "No room! No room!" they cried out when they saw Alice coming. "There's *plenty* of room!" said Alice indignantly, and she sat down in a large arm-chair at one end of the table.
>
> Lewis Carroll, *Alice's Adventures in Wonderland*

In Lewis Carroll's *Alice's Adventures in Wonderland* (chapter VII), Alice joins the March Hare, the Hatter and a dormouse in the famous mad tea-party. The welcoming that Alice receives is quite rough; nonetheless, this excerpt is a good example of how quickly standardization of vocabulary takes place in communication. Imagine the three of them welcoming Alice by crying 'No seats! No seats!' instead, she would probably have replied, and rightly so, 'There are *plenty* of seats!'.

Lexical alignment in dialogue

Many research studies have shown that this mutual adaptation of word choices - called *linguistic entrainment* (Garrod & Anderson, 1987), *lexical entrainment* (Brennan & Clark, 1996) or *lexical alignment* (Garrod & Pickering, 2004)[27] - emerges rapidly in face-to-face communication (e.g., Krauss & Weinheimer, 1964, 1966; Carroll, 1980; Brennan & Clark, 1996) as well as in computer-mediated communication (Garrod & Anderson, 1987)[28]. For instance, in the well-known study conducted by Simon Garrod and Anthony Anderson (1987), participants cooperated in a computer maze game. In their analysis of the dialogue transcripts, the authors found that between dyads, very different ways were used to describe positions in the maze, but that within a dyad, very similar forms of description were used, both on a linguistic as well as on a conceptual level.

In a similar fashion, Brennan and Clark (1996) found evidence of lexical alignment between interlocutors. In their experimental series, pairs of participants cooperated in a matching task. In this task, two sets of 12 cards each were used, with each card depicting an object (e.g., a shoe). The two card sets differed as to whether the depicted objects were the only ones of their class (e.g., a penny loafer; card set 1) or whether there were more than one object of a class in the same set (e.g., a penny loafer, a sneaker and a high heel; card set 2). The participants ran through three kinds of trials. Hereby, they first used card set 1 (trials A) in which, as described, each object was unique in its category. Second, card set 2 was used, which in addition to the cards of card set 1 included pictures of other objects of the same categories (trials B). Last, in the C trials, the original card set A was used again. The authors analyzed the transcripts of the audiotaped experimental sessions with regard to how objects were referenced. They found that while in the trials A, the objects were referenced with their basic-level category names, in the trials B the interlocutors switched to more specific labels. Most interestingly, they maintained these labels in the trials C, albeit these being overly informative in the context of trials C, where only one object from each category was presented on a card. However, these more specific labels were only used when in trials C, participants cooperated with the same partner than in trials A and B; when a new partner was presented in trials C the dyads used the more basic level descriptions.

As the abovedescribed as well as numerous other studies (e.g., Bortfeld & Brennan, 1997; Krauss & Weinheimer, 1964, 1966; Carroll, 1980) demonstrate the occurrence of

[27] As from this point, I shall stick with the term *lexical alignment*.

[28] In the study of language coordination in dialogue, researchers frequently use the so-called referential communication task paradigm. In this paradigm, participants are engaged in tasks that require them to refer to a certain set of objects repeatedly. Mostly, participants cooperate in dyads, and the two people are assigned roles, usually those of a *matcher* and a *director*. Hereby, the director gives instructions which are followed by the matcher. For a review on the history of the referential communication task paradigm, I suggest (with Schober, 2006) Yule (1997).

lexical adaptation in dialogue, this phenomenon can be called undisputed. However, keeping in mind the different accounts for adaptation in dialogue that were presented in section 2.3.1, it does not come as a surprise that there are various different explanations for why it occurs; these accounts make different assumptions about the (specific) role of the addressee for lexical adaptation.

On the one hand, lexical entrainment has been conceptualized as an addressee-oriented activity: Interlocutor B uses certain expressions to label objects, *because her collocutor, interlocutor A, has used them.* According to this view, lexical entrainment can be conceived of as a product of a cooperation process in which interlocutors take each other into account. According to Clark and Marshall (1981), people keep so-called *reference diaries* for their specific conversational partners, enabling them to adapt their choice of words according to whom they talk. Brennan and Clark (1996) assume that lexical entrainment occurs as interlocutors build up so-called *conceptual pacts* with each other, i.e. mutual conceptual and terminological agreements which are built up in the process of grounding (cf. section 2.3.1) in dialogue. Conceptual pacts are established in the course of conversation with a concrete collocutor: „When people refer to an object in conversation, we have proposed, they establish a conceptual pact, a temporary agreement about how they and their addressees are to conceptualize that object." (Brennan & Clark, 1996, p. 1491). The authors interpret their abovedescribed results as consequences of an establishing of conceptual pacts in conversation. In a study on language comprehension, Metzing and Brennan (2003) use eye-tracking data to demonstrate that hearers connect word use to a certain speaker and hence, also expect conceptual pacts not to be broken: In a referential communication task (cf. footnote 52), the authors varied whether the same or a new director referred to objects that a prior director had already named before. Also, it was varied if new referents or same referents were used for labeling. Whenever the old director used new referents to refer to the objects, there were partner-specific interferences in that the addressees were slower to look at the object than when the new expression was uttered by the new speaker. The results can be interpreted as partner-specific effects on word comprehension in dialogue. Thus, some results point towards the role of the partner for lexical adaptation in dialogue.

On the other hand, however, a reasonable point was also made for standardization in word use being the result of a non-adaptive, egocentric activity that is based on word accessibility in memory. Experiments on priming have shown that memory processes impact greatly on the choice of referents for ambivalent objects (Sloman, Harrison & Malt, 2002) and on the syntax of subsequent sentences (Branigan, Pickering, & Cleland, 2000). Pickering and Garrod (2004) argue that interlocutors achieve aligned situational models, consisting of multiple level information, by a primitive and re-

source-free priming mechanism (cf. section 2.3.1); one of these levels is the lexical level. According to Barr and Keysar (2002), lexical alignment is due to the *use of linguistic precedents*. These precedents become established when an object is named for the first time, and thus, a connection between encodings and encoded objects is built. The precedents influence, once established, speech processes due to their high *availability*. In an eye-tracking experimental series, the authors found that previous mentioning of referents facilitated their identification – independently of whether precedents represented shared knowledge or not.

In sum, it is important to note that lexical alignment is an ubiquitous phenomenon in everyday conversation. Hereby, different theoretical accounts try to explain the phenomenon with either an adaptation of word choices under consideration of the addressee or with mere word accessibility. This reflects the differing positions on the mechanisms of adaptation in dialogue which have been outlined in section 2.3.1.

One of the research aims of the research program at the University of Muenster (cf. introductory section of this dissertation) was to investigate lexical entrainment in the context of online health counseling. Does lexical alignment also occur in this written, asynchronous, computer-mediated communication between experts and laypersons? The research findings also helped to shed more light on the aforesketched debate on the mechanism underlying lexical alignment. In the following, I will give a rough outline of a selection of the project's studies on the matter.

Lexical alignment in email expert-layperson communication

As described, lexical alignment has been amply documented for oral conversation; hereby, most of the relevant research findings were gathered in an experimental setting and transcripts of the dialogues analyzed with regard to conversational phenomena. In the written online health counseling setting, however, the emails remain as artifacts of conversation, and thus, constitute evidence of natural communication outside the experimental setting: Many health sites provide a service for users that allows the review of old email dialogues that other users have had with the medical experts of the site; these email dialogues are stored in topic-specific archives. Thus, before sending her own question to the medical doctor, the lay user may first check whether or not another user had asked that same question before.

In a field analysis of 120 question-answer sets from seven health archives, Jucks & Bromme (2007) exploratorily investigated the occurrence of lexical entrainment in this written expert-layperson communication. For this aim, they investigated the medical terminology used in laypersons' queries and found that laypersons did use a substantial

amount of medical technical terminology: At least one medical term was used in 84% of all investigated lay queries. The question-answer sets investigated by Jucks and Bromme (2007) were chosen under consideration of several quality and representativeness-related criteria. The authors analyzed how many of the medical terms that the laypersons had used in their emails were also used by the medical experts; they found a highly significant correlation between laypersons' and experts' use of medical terms. Hereby, a substantial amount of terminology that the patients had proposed was entrained by the expert (34 %). The entrainment, however, was not restricted to medical terms; also educated terms of the German language (mostly terms "borrowed" from Latin and Greek) were entrained by the experts.

As such, this field study of natural communication in the online health counseling suggested strongly that linguistic alignment also plays a role in this setting. Such a non-experimental approach cannot, however, substitute experimental evidence. Therefore, an experimental investigation of lexical alignment was undertaken by Bromme, Jucks and Wagner (2005). In a simulated online health counseling scenario, they asked participants to answer fictitious lay email queries. Each participant answered two queries, one on the topic of diabetes, one on thyroid problems. Lexical alignment was investigated with the following paradigm: Each lay query was formulated in two versions, which only differed in whether several terms were encoded in a more medical technical or in a more everyday-language way. For instance, the patient would speak of her *blood sugar level* in diabetes query version A, while in version B, she would speak of her *blood glucose concentration*. In German, many medical concepts can be phrased either in a more everyday language term or in a specialist term of Greek or Latin origin; for instance, one could say *Pankreas* for pancreas or else use the more colloquial German "translation" *Bauchspeicheldrüse* (literally: gland of ventral saliva). In the German language, these everyday medical terms are more common than in English. Apart from the lexical variations, the queries were identical. Each participant answered one query in the technical, the other one in the everyday version. Analyses of the experts' answers showed that experts entrained to the encoding that the layperson had brought into the email conversation: In answers to everyday-versions of a query, experts used more everyday encodings of the concepts than when answering the technical versions. When the layperson had 'suggested' technical wording, the experts also used more technical wording than when the layperson had suggested everyday terming.

Following the same paradigm, the participants in the study of Jucks, Becker and Bromme (in press) each answered one patient query on diabetes. The aim of this study was to investigate whether lexical alignment in experts' answer emails was restricted to an alignment to the interlocutors' word suggestions or if also wording from other sources would be entrained. For this purpose, a second variation was added to the lexi-

cal variation (i.e., the everyday vs. technical terming) in the queries: The experts were provided with an illustration (a concept map) which depicted the issues the layperson had asked for; the experts were told that this illustration was given to them in order to assist then in formulating their answer to the layperson, and that the layperson did not dispose of the illustration. Parallely to the two versions of the query, two versions of the illustration existed; in these, the same words that were varied in the query were varied in the illustration. Thus, illustration version A contained the terms in an everyday encoding and version B in a technical encoding. The resulting research design had four conditions: the four combinations of everyday and technical wording of illustration and query. Again, in the experts' answers, the everyday and technical encodings of the manipulated terms were counted. The results showed that both query and illustration impacted on the experts' lexical choices. Hereby, in the conditions where experts were confronted with technical language from one source (illustration or query) and everyday language from the other source, it did not make a difference for entrainment whether the everyday language (respectively the technical terminology) was suggested by the illustration or by the patient.

The results of Jucks et al. (in press) suggest that the found lexical alignment in the email counseling scenario cannot – at least not exclusively – be interpreted as a result of adaptation. On the contrary, the fact that the encodings of the illustration, even though not available to the addressee, impacted on word choices, makes a point for the impact of word accessibility on language processing (cf. Jucks et al., 2007, who also show how under certain conditions, experts are influenced by salient information that has nothing to do with the addressee, leading to expert answers that are less oriented towards the lay addressee).

The described studies on lexical alignment in email health counseling are relevant in the current context of the dissertation for several reasons:

First, these studies have documented that experts pick up technical terminology that is introduced into the conversation by their lay interlocutor. This adaptation seems to be, as the results of Jucks et al. (in press) suggest, due rather to an automatic priming mechanism than to conscious adaptation, which might cause problems in expert-layperson communication: The investigated terms that experts aligned to were technical terms, that is, words depicting concepts from the medical field (be it in a more technical or in a more everyday encoded version). Hereby, we have to remember that technical terminology has a different role in communication for experts and laypersons: A domain's technical terminology reflects the quality of experts' knowledge representations, enabling efficient communication between experts by condensing a great package of knowledge in one term. Furthermore, technical language forms the basis of experts'

categorical perception (Bromme & Rambow, 2001). Laypersons, on the contrary, often only have vague or wrong ideas about what a medical term means, and consequently, physicians and patients have a quite divergent understanding also of commonly used medical terms (cf. section 2.1.3). Nonetheless, when conversing with a doctor, medical laypersons tend to using medical terminology. Thus, if experts entrain on medical terminology suggested by laypersons in a rather unreflected manner, the different underlying understandings of the terms hazard successful knowledge communication.

While the drawn conclusions on lexical entrainment seem quite compelling, it has to be kept in mind what Jucks and Bromme (2007) state about the observed lexical entrainment in written net-based health counseling (p. 275):

> Nevertheless, we cannot say for sure that patients do *not* possess medical knowledge about the terms they use in their inquiries. We assume that patients will vary in terms of their medical knowledge about terms, and also that medical terms will vary in terms of their complexity. Further research [...] is needed to cast light on experts' and patients' understanding of common terms and enable us to draw clear conclusions on the practical implications of the phenomenon studied here."

This research desideratum is addressed in study I, in which lay understanding of common illness terms is investigated for issues broadly related to the metabolic syndrome.

Second, the studies on lexical alignment illustrate an example of how conversational mechanisms from everyday conversation are also applied by experts when conversing with laypersons.

In chapter 2, the theoretical backgrounds of the dissertation have been delineated. In the upcoming chapter 3, I will deduce the research questions which emerge from the theoretical background and which will be addressed in this dissertation.

3 Emerging research questions

In the process of expertise formation, expert knowledge is not only quantitatively increasing, but also qualitatively reorganized, leading to the highly interconnected and integrated expert knowledge. Lay knowledge, on the contrary, is characterized by naïve beliefs and theories, and while lay representations comprise correct beliefs and assumptions, they also consist of erroneous beliefs and lacks of knowledge. Lay representations of domain-related concepts are affected by real life personal experiences as well as by naïve presumptions; therefore they diverge largely between laypersons and are unclear and blurry (cf. section 2.1). For different topics within the field of medicine, research studies have shown that experts and laypersons have a crucially divergent understanding of important medical terms. However, as Jucks and Bromme (2007) point out, further research is needed to cast more light on experts' and laypersons understanding of common medical terms. Therefore, in **Study I**, lay medical knowledge will be investigated for illness terms related to the broad thematic field of the metabolic syndrome, within which expert-layperson communication processes are studied in this dissertation. The study will provide a description of lay beliefs related to the terms.

When experts converse with laypersons, both enter conversation from very divergent perspectives. Hereby, the experts have the difficult task of transforming their knowledge in a way that makes their explanations understandable for their lay collocutor (cf. section 2.1). In this dissertation, the focus is put on the expert-layperson conversational setting of email health counseling. Especially in this context, it is difficult for the expert to draw inferences about the knowledge of the layperson, due to the limited feedback possibilities of the setting. Since the conversation usually does only consist of one conversational turn, however, it is vitally important for the expert to estimate the layperson's knowledge in order to be able to adapt their utterances (see section 2.4). In online health counseling, the written lay query is the only source of information for the experts in order to estimate the layperson's knowledge. Hereby, one type of information is provided by those instances in which the layperson utters false understanding in her email. How does this display of false understanding impact on experts' assessment of lay knowledge? Research from tutoring in formal learning contexts has shown that in face-to-face conversation, experts have difficulties in acknowledging erroneous knowledge that is uttered spontaneously by the tutee. In addition, they do not build up a detailed representation of their lay collocutor's understanding but only a rather fuzzy impression (cf. section 2.2). Also, they tend to overestimate their lay tutee's knowledge. **Study II** will help shed some light on the open empirical question of if and

how a display of erroneous knowledge will affect knowledge assessment in the conversational context of email health counseling.

As already mentioned, due to the divergent perspectives of experts and laypersons, experts cannot communicate with laypersons from their own angle, but have to tailor their utterances to a lay level of understanding in order for them to be comprehensible. As studies from face-to-face tutoring research have shown, one important feature of adaptation is the correction of the tutee's false understanding. However, tutors frequently ignore when a tutee utters false beliefs; also, their tutoring is generally not adapted to their individual tutees but rather done in stereotypic ways (cf. section 2.2). What impact does a display of false understanding on part of the laypersons have on the ways experts tutor in email health counseling, then? **Study III** will provide some answers to this research question.

In addition to the purpose of knowledge communication, there is an additional dimension to expert-layperson communication, namely the interpersonal dimension, which needs to be resolved in every conversation. Expert-layperson communication is potentially rich in face-threatening speech acts. Consequently, when experts communicate with laypersons in tutorial dialogue, they might try to attenuate the impact of their speech acts by phrasing their utterances in a polite way. As Person et al. (1995) show for formal tutorial settings, tutors in these settings frequently avoid direct error feedback and prefer indirect ways of error correction. By proceeding like this, error feedback is made less aversive; however, such politeness strategies are often detrimental to pedagogical goals and to the effectiveness of knowledge communication.

In **study IV**, the question will be addressed of whether politeness is also relevant for the experts' conversational behavior in the informal tutorial setting of email health counseling. For this aim, medical experts will be provided with metapragmatic information about the characteristics of the conversational setting.

4 Study I: Not quite blank slates – a questionnaire survey of lay medical beliefs

4.1 Introduction

People acquire a great amount of medical knowledge in the course of everyday life. Hereby, a variety of sources offers bits and pieces of medical information, like television, magazines, the Internet, or family and friends. Consequently, from childhood, laypersons hold a variety of medicine-related beliefs, which are often erroneous.

As has been outlined in section 2.1.2, a number of research studies have investigated the beliefs that laypersons hold with regard to frequently used medical concepts, for instance concepts from orthopedics or from genetic counseling. These studies show that laypersons often have a rather vague or erroneous understanding of the terms. In conversations between experts and laypersons, however, the divergent understanding often remains unnoticed, as experts have difficulties in diagnosing false beliefs held by their lay interlocutors (see section 2.1.3).

In this dissertation, the metabolic syndrome was chosen as thematic field in which to study communication processes between experts and laypersons. This rather broad thematic field was chosen because it entails a variety of key concepts which are common in everyday lay medical talk, such as 'diabetes', 'arteriosclerosis' or 'stroke'. Study I[29], to-be-presented in this chapter, provides a description of beliefs that laypersons hold with regard to these concepts. Thus, the research aims of Study 1 are

- *to describe central beliefs that laypersons hold about concepts related to the metabolic syndrome*
  as well as
- *to describe the disparity of knowledge within the lay sample.*

The topics related to the metabolic syndrome are of societal relevance (as will be outlined in section 4.2.2). Nonetheless, at least in Germany, knowledge about these terms does not form a part of high school biology education curricula. Thus, correct and congruent knowledge representations of these concepts in laypersons cannot be taken for granted. In contrast to experts, who build up systematic, highly interconnected expert knowledge in the course of their expertise formation (cf. section 2.1.1), laypersons gain knowledge – as mentioned above – through a variety of sources and personal ex-

[29] A paper which presents the data described in study I has been published in Becker, Bromme, and Jucks (2008).

periences. As a result, when investigating beliefs that laypersons have with regard to medical concepts related to the metabolic syndrome, it is expected that

- *a considerable disparity should be found within the lay sample*
  and that
- *lay knowledge with regard to these concepts will comprise correct as well as erroneous beliefs, and also lacks of knowledge, just like in other lay domains (cf. section 2.1.2)*

As pointed out in section 2.1.3, not only experts have difficulties in estimating lay knowledge; also laypersons frequently have difficulties in estimating their own knowledge. In Study I, the layperson's estimation of their own understanding with regard to the investigated beliefs was assessed exploratorily by asking the laypersons to rate their own confidence with regard to these beliefs.

As lay participants, college students enrolled in courses other than natural sciences were chosen, who are a highly relevant population with regard to the metabolic syndrome, because college students are young and prevention of the metabolic syndrome – as will be elaborated below – needs to start at an early age.

4.2 Method

4.2.1 Participants

The sample consisted of a total of 100 students enrolled in an undergraduate course at the University of Muenster (WWU). They were approached in lectures and on campus and asked to participate in the study. The students participated voluntarily and were compensated with € 7. In order to obtain a representative sample of WWU students enrolled in courses other than natural sciences, the ratio of participants from each faculty to all participants reflected the ratio of the students enrolled in that faculty to all students of the university, resulting in a majority of humanities students (see table 4-1 for the number of participants from the different faculties and for the resulting percentages[30]).

[30] The number of students refers for each faculty refers to those students whose main course ('Hauptfach') is allocated to that faculty, winter semester 2004/2005. This statistic was retrieved from the homepage of the University of Muenster (WWU) on the 18th of May, 2005.

Table 4-1. WWU student statistics and distribution of participants on faculties

Faculties	**Number of students**	**%**	**Number of participants**
Interdisciplinary courses	544	1.90	2
Faculties of Theology	1278	4.46	5
Faculty of Law	4365	15.25	15
Faculty of Economics	4756	16.61	16
Faculty of Philosophy	13866	48.44	48
Faculty of Mathematics and Natural Sciences without Physics, Chemistry, Pharmacy and Biology	3611	12.61	13
Music Department of the WWU	207	0.72	1
Total	28627	28.73	100

In order to prevent insufficient language skills to account for participant performance, proficiency in German was essential for participation. Therefore, the data sets of two participants were excluded, because they stated that they had started speaking German later than early childhood[31]. Thus, the data from 98 medical laypersons (61 female) was used in the analysis. Participants were on average in their third year of university (M = 4.84, SD = 3.12 semesters) and their ages ranged between 19 and 38 (M = 22.84, SD = 2.80).

4.2.2 Materials

Selection of the topic

The term *metabolic syndrome* comprises several risk factors of metabolic origin, which researchers associate with an elevated risk for cardiovascular diseases (CVD) and Type 2 diabetes. While there are several definitions of the metabolic syndrome, the National Cholesterol Education Program Adult Treatment Panel III (ATP III, 2001) offered a modus of diagnosis that simplified former WHO criteria (Alberti & Zimmet, 1998). Ac-

[31] Both students belonged to the faculty of Philosophy.

cording to the ATP III definition, diagnosing the metabolic syndrome requires the concomitance of three of the following clinical measures: elevated waist circumference, elevated triglycerides, reduced HDL cholesterol, elevated blood pressure and elevated glucose. The risk potentials of these factors exponentiate, i.e. they increase the risk of CVD, Type 2 diabetes and the manifestations of not-yet existing other factors by more than the sum of their individual risks (Grundy, 2006).

Epidemiological studies have shown a high prevalence of the metabolic syndrome with a quota of ≥ 20% in U.S. adults older than 20 and of ≥40% in U.S. adults older than 60 (Ford, Giles, & Dietz, 2002). Also in other continents, high numbers have been reported (e.g., Isomaa et al., 2001; Gu et al., 2005). However, the metabolic syndrome is not a constellation of symptoms affecting only the elderly, but can also be found in children and adolescents (Molnar, 2004).

Although multiple factors contribute to the pathogenesis of the metabolic syndrome, including genetic predisposition, a sedentary lifestyle plays a prominent role in the process (Ford, Kohl, Mokdad, & Ajani, 2005). Thus, lifestyle modification is not only the primary therapy for the metabolic syndrome, but also plays a major role in its prevention, which needs to start at an early age in order to decrease the risks of developing one or more of the metabolic syndrome's constituting factors.

Hereby, in the main, two components of lifestyle modification exert a favorable influence on the metabolic syndrome's cardiovascular disease risk factors, thus leading to weight reduction and an amelioration of lipid profiles, blood pressure and glucose levels: For one thing, a substantial body of evidence points to the beneficial effects of leisure time physical activity and to the harms of physical inactivity (sedentary behavior) (e.g., Gustat, Srinivasan, Elkasabany & Berenson, 2002). For the other thing, the effectiveness of a healthy diet in risk reduction is assumed (e.g., Park et al., 2003; with regard to the combined impact of diet and physical activity on preventing and treating the metabolic syndrome, see Robinson & Graham, 2004).

As the descriptions show, the topic metabolic syndrome (MetS) comprises a variety of different symptoms and consequences, and thus entails a variety of medical concepts that are part of lay everyday talk, like for instance diabetes, obesity and heart infarction. Coming next, the construction of a medical questionnaire will be described that was designed in order to investigate lay beliefs with regard to these topics: The MetS Questionnaire.

Development of the MetS Questionnaire

A questionnaire was constructed in order to assess lay knowledge in the domain of the metabolic syndrome. In the following, the construction of the questionnaire is described.

Selection of concepts. The terms listed in table 4-2 were selected which – after an extensive study of the medical literature (e.g., Greten, 2002; Hien & Böhm, 2001) – were deemed as highly relevant in the context of MetS. For these terms, items were constructed.

Table 4-2. Disorder concepts and their English translations

Disorder concepts
Diabetes (diabetes)
Fettleibigkeit (adiposity)
Hoher Blutdruck (hypertension / high blood pressure)
Erhöhter Cholesterinspiegel (high blood cholesterol)
Arterienverkalkung (arteriosclerosis)
Schlaganfall (stroke)
Herzinfarkt (cardiac infarction / infarction of the heart)

Item format. The item format of true/false questions, combined with the option to respond “unsure”, was chosen for the study after having considered the pros and cons of various item formats (which are discussed controversially; cf., Bortz & Döring, 2002; Ebel, 1978). For multiple choice formats, for instance, it is rather difficult and should be undertaken empirically to create adequate alternatives which seem equally plausible to the uninformed. Also, by suggesting alternatives, sensitivity is created for the possibility of one’s own beliefs being inadequate. Semi-structured formats, in turn, are criticized for their lack of objectivity. In the end, the above-mentioned format was chosen and, by adding the option 'don’t know', the most serious disadvantage of forced-choice item formats, i.e. the obligation to select an answer, was removed. By choosing 'don’t know', the laypersons were able to indicate their lack of knowledge. As an additional feature, whenever answering “true” or “false”, participants rated the confidence about their answer on a 7-point Likert scale, ranging from “very unsure” to “very sure”. By a comparison of these ratings for correct and incorrect answers, the feel that laypersons

have for the correctness of their own knowledge was investigated exploratorily. For an item example, see figure 4-1.

Hardening of the arteries can cause renal damages.	**TRUE** O **FALSE** O O---------O---------O---------O---------O---------O---------O very unsure halfway sure very sure
	Don't know O

Figure 4-1. Example of item format (English translations)

Creation of an item pool. Because the scope of the present study was to obtain a fairly broad picture of lay knowledge, several pieces of information were selected which – after consultation of the medical literature (e.g., Greten, 2002; Hien & Böhm, 2001) – were regarded as relevant for a layperson to know about the respective concept. Also, information distributed by official health organizations, patient information brochures from health insurance companies, and medical books written for a lay readership were consulted (see table 4-3 for examples). To provide an example of a piece of information that was regarded as relevant to know: With regard to hypertension, it is relevant for laypersons to know that some disorders are related, for instance that individuals with hypertension are more likely to suffer from arteriosclerosis than individuals without.

Items were formulated in consideration of formal criteria to make statements lexically and syntactically as understandable as possible. By proceeding as described, an item pool of 127 items on disorders was constructed[32].

[32] For the purpose of material construction for a different study, participants were also presented with items on other concepts than on disorder concepts related to the metabolic syndrome. For the current purpose, however, analyses focus on the metabolic syndrome.

Table 4-3. Examples of sources of medical information

Sources of information	**Examples**
Medical literature	Faller, A. (1999). *Der Körper des Menschen [The human body]* (13th ed.). Stuttgart: Thieme
	Hien, P. & Böhm, B. (2001). *Diabeteshandbuch [Handbook of diabetes].* Berlin: Springer
	Greten, H. (2002). *Innere Medizin [Internal medicine]* (11th ed.). Stuttgart: Thieme
Information distributed by official health organizations	*www.gbe-bund.de* (Federal Health Monitoring)
	www.adipositas-gesellschaft.de (German Adiposity Society)
	www.deutsche-gefaessliga.de (German League against vascular diseases)
	www.schlaganfall-hilfe.de (German Stroke Foundation)
Patient information brochures	Techniker Krankenkasse (2002). *Diabetes mellitus*.
Medical books written for lay readership	Schmeisl, G.W. (2002) *Schulungsbuch für Diabetiker [Training guide for diabetics]* (4th ed.). München: Urban & Fischer
	Rümelin, A. (2003). *Kursbuch Arthrose [Arthrosis guidelines]*. München: Südwest
	Mathes, P. (2003). *Ratgeber Herzinfarkt [Cardiac infarction guide]* (4th ed.). Darmstadt: Steinkopff
	Vaitl, D. (2004). *Ratgeber Bluthochdruck [Hypertension guide]*. Göttingen: Hogrefe.

Preliminary expert questionnaire analyses. In one individual (60 minutes, n=1) and one dyadic interview session (100 minutes, n=2), the item pool was presented to 3 medical experts, who were asked to answer the questionnaire. Afterwards, they were shown the true and false labeling of the items and were asked to indicate whether the items were (i) correctly labeled as true or false and (ii) formulated unambiguously from a medical point of view. Also, further comments were encouraged. After having made

notes for themselves, the experts discussed the items with the interviewer (i.e., with me). As a consequence of the interviews, 13 disorder items were deleted from the item pool. To provide an example: One item had initially been phrased "Liposuction is a therapy in adiposity treatment" which was tagged as false in the list. However, as one expert pointed out correctly, this item was formulated in a way that it could *not* unambiguously be tagged as false, because some obese patients consult and undergo cosmetic surgery (liposuction) in order to deal with their weight problems. Liposuction, however, is surely not an *advisable* primary therapy for the treatment of adiposity. As a consequence, in order to be unequivocally taggable as false, the item was reformulated into "Liposuction is a state-of-the-art treatment in adiposity therapy".

In order to base item selection and validation on an even bigger sample of experts, an additional questionnaire study with n=33 medical experts was conducted. Advanced medical students were recruited in lectures and on the WWU Medical Campus and were paid 10 Euros for their contribution to the study. Participants filled in a version of the questionnaire which consisted of the remaining items.

Because proficiency in German was essential for participation, three experts had to be excluded, as they had started to speak German later than early childhood. The remaining 30 medical students were in their fifth year of university medical training with M = 5.3, SD = 1.32 semester *after* First State Examination[33]. They were between 24 and 33 years old (M = 25.13, SD = 2.01). Sixty-seven percent of the sample was female; the first language of 26 students was German, while the others spoke German since early childhood.

Items were deleted that were not answered with either "true" or "false" by at least 70% of the expert sample, because it was deemed likely that those items were formulated ambiguously. Consequently, an additional 15 illness items were deleted from the pool.

Final questionnaire. The final questionnaire consisted of 90 items (for item distribution on the different concepts see table 4-4) [34]. At the end of the questionnaire, several demographic variables were assessed.

[33] Medical schools in Germany are organized into a non-clinical and a clinical part, with the former requiring four semesters (i.e., two years) of study.

[34] Item numbers for each of the concepts are not distributed equally (i) due the described item selection processes that lead to a reduction of the itempool, and (ii) due to the interplay of factual constraints of the respective topics and the item format (for instance, to formulate an item on the manifestation of diabetes, one would have to differentiate between different types of diabetes with different manifestation processes. Of more basic interest, however, is the assessment of whether laypersons knew *that there were* different types of diabetes at all. Since an item on the manifestation of diabetes would automatically indicate that there were different types and thus prohibit the assessment, it was not administered).

Table 4-4. Number of items per concept

Concepts	Number of items
Diabetes	16
Adiposity	9
Hypertension	12
High blood cholesterol	6
Arteriosclerosis	17
Stroke	12
Cardiac infarction	18
∑	**90**

4.2.3 Procedure

The study was conducted in group sessions in group rooms of the WWU. Participants were asked to work by themselves without flipping back pages in the questionnaire and could take as much time as they needed. The average participation time was 40 minutes.

4.3 Data Analyses and Results

In order to investigate the lay participants' beliefs with regard to each concept, percentage scores for correct, incorrect and 'don't know' responses were calculated. In the following, the knowledge of the lay sample will be described with regard to the investigated beliefs. In order to provide a comprehensible overview of lay knowledge on the concepts, knowledge on each concept will be described only with regard to an exemplary subset of the investigated beliefs. The results for all 90 items, however, can be consulted in table 4-5 (p.70) which provides the percentages of correct responses, false responses, and ‚don't know' responses for all items.

Diabetes. One interesting result concerning diabetes beliefs was that 70% were ignorant about the connection between diabetes and arteriosclerosis, including 37% of 'don't know'-answers. While about three quarters of the sample detected correctly that alertness was no frequent symptom of diabetes, its most common symptom, that is,

frequent urination, was acknowledged by less than half of the laypersons as important symptom. While about half of the participants knew that in diabetes, sugar can't enter the cells sufficiently, more than half erroneously assumed that diabetes was characterized by the fact that sugar cannot diffuse in the blood.

Adiposity. By far the majority of the laypersons (89%) affirmed that adiposity was something other than just overweight and that nutrition was not the only factor determining adiposity. Most also knew about the link between adiposity and arteriosclerosis. A false adiposity belief held by a considerable amount of laypersons was that liposuction was a state-of-the-art treatment in adiposity therapy (39%).

Hypertension. Two thirds of the lay sample knew that it is often difficult to make out a concrete cause for why a patient suffers from hypertension, while almost one third falsely believed that such a cause could be detected. Eighty-six percent knew that heredity played a role in the genesis of hypertension. Less than half knew that hypertension can cause dizziness (44% thinking that it couldn't and 9 percent 'don't know'). As for the sequelae of hypertension, 32% thought that hypertensive individuals were as likely as anybody else to suffer from arteriosclerosis (and 13% didn't know). Thirty percent falsely assumed that medication could usually be discontinued when the hypertension has declined.

High blood cholesterol. About half of the sample knew that heredity and high blood cholesterol were linked in some way, and that high blood cholesterol promotes arteriosclerosis. While 61% knew that high blood cholesterol does not cause acute ailments, 39% falsely assumed fatigue to be a symptom of high blood cholesterol. By far the majority of the participants knew that treatment included a low cholesterol diet and medication.

Arteriosclerosis. Laypersons had some correct, but also some erroneous ideas about what actually happens in the arteries in arteriosclerosis. While 41% knew that blood platelets accumulate on the walls of the arteries, 47% denied the correct fact that fat also does. More than half of the lay sample knew that arteries do not contract when sclerotic and do not soften, but rather get less elastic, while almost all laypersons have denied the true fact that arteries also get brittle. While almost 70% knew that arteriosclerosis can not be cured completely, more than half erroneously assumed that there was medication that could free arteries from the sediments. Almost 30% erroneously assumed that the risk of arteriosclerosis was not hereditary.

Stroke. While almost all of the laypersons knew that a stroke affects the brain, eleven percent falsely assumed that a stroke is caused when overexcited cells produce too much electricity (26% 'don't know'). Twelve percent falsely denied the fact that a stroke is caused by artery obstruction (plus 9% who didn't know). More than one third of the sample thought that a stroke announces itself through chest pains (which often precede a cardiac infarction), while also more than one third denied the true fact that stroke typically announces itself through speech problems. One third of the sample lacked knowledge on the link between diabetes and stroke. Almost all of the laypersons knew that a stroke is very likely to cause permanent damages.

Heart infarction. While 72% of the participants knew that cardiac infarction was caused by artery obstruction, almost 70% falsely assumed that malfunctioning of the heart valves caused the infarction. While more than 80% of the participants knew that the oxygen supply of the heart was affected by an infarction, only 47% knew that cardiac muscle tissue dies in an infarction. Almost 30% of the participants thought that damage caused by an infarction was usually non-permanent. Almost 70% of the participants thought that a heart infarction was preceded by loss of sensation and numbness (plus 6% didn't know), and almost half thought that it is followed typically by paralysis phenomena (plus 8% 'don't know'); both applies to stroke rather than infarction. Twenty-eight percent denied the fact that diabetes was a predisposing factor for a heart infarction (26% 'don't know).

Table 4-5. Percentages of responses to questionnaire items

	Correct response	% correct response	% false response	% don't know
Diabetes				
There are several different types of diabetes.	True	88	5	7
Hereditary factors play a major role in the development of diabetes.	True	85	12	3
An increased alertness is a frequent symptom of diabetes.	False	77	10	13
Hereditary factors play only a minor role in the development of diabetes.	False	65	27	8
Pregnant women have a reduced risk of acquiring diabetes.	False	64	5	30
Eye disorders can be consequences of diabetes.	True	60	25	15
For some diabetics it is not advisable to take insulin.	True	60	30	10
Diabetics may only eat special sweets for diabetics.	False	59	41	0
With diabetes, sugar cannot enter the cells sufficiently.	True	57	32	11
Poor appetite is a frequent symptom of diabetes.	False	54	24	22
With Diabetes, too much sugar enters the cells.	False	53	32	15
Pregnant women have an increased risk of acquiring diabetes.	True	51	34	15
Frequent urination is a frequent symptom of diabetes.	True	47	35	18
Diabetes patients must have insulin shots.	False	34	66	0
Arteriosclerosis is one of the sequelae of diabetes.	True	30	34	37
With Diabetes, sugar cannot diffuse in the blood.	False	29	52	19

	Correct response	% correct response	% false response	% don't know
Adiposity				
Adipose individuals have an elevated risk of suffering heart infarction.	True	99	0	1
Adiposity is not only caused by nutrition, other factors contribute as well.	False	98	0	2
An excessively fatty, high-caloric diet is the only factor that determines adiposity.	False	97	2	1
The terms 'overweight' and 'adiposity' are synonyms.	False	89	9	2
Cessation of breathing while sleeping is a possible consequence of adiposity.	True	88	11	1
Adipose individuals have the same risk than non-adipose individuals of suffering a stroke.	False	76	20	4
Adipose individuals are more likely to suffer from arteriosclerosis.	True	68	15	16
Liposuction is a state-of-the-art treatment in adiposity therapy.	False	59	39	2
Adiposity can be treated surgically.	True	50	46	4
Hypertension				
Hypertension is associated with heredity.	True	86	8	6
For the most part, a concrete single reason of why a patient suffers from hypertension can be determined.	False	67	31	2
Pregnant woman are less likely to suffer from hypertension.	False	65	6	29

	Correct response	% correct response	% false response	% don't know
After medication has lowered hypertension, the medication can usually be discontinued.	False	62	29	9
People with hypertension are as likely to suffer from arteriosclerosis as those with normal hypertension.	False	53	32	15
Pregnant women are as likely to suffer from hypertension as non-pregnant women.	False	50	21	29
Individuals with hypertension are less likely to suffer from arteriosclerosis.	False	49	25	27
Hypertension can cause dizziness.	True	47	44	9
Hypertension can be caused by disorders of the thyroid gland.	True	45	28	28
Hypertension can cause renal damage.	True	37	37	27
Hypertension can lead to eye disorders.	True	36	47	17
Hypertension can be caused by cerebral tumors.	True	18	50	32
High blood cholesterol				
A low cholesterol diet can supplement therapy for high blood cholesterol.	True	95	1	4
High blood cholesterol can be treated with medication.	True	85	10	5
High blood cholesterol does not cause acute ailments.	True	61	29	10
High blood cholesterol is not associated with hereditary factors.	False	55	31	14
High blood cholesterol promotes arteriosclerosis.	True	53	13	34

	Correct response	% correct response	% false response	% don't know
Fatigue is a frequent symptom of high blood cholesterol.	False	42	39	19
Arteriosclerosis				
Arteriosclerosis increases the risk of suffering a stroke.	True	83	7	10
Leg pains are a symptom of arteriosclerosis.	True	70	16	13
With arteriosclerosis, arteries become softer.	False	69	5	26
Arteriosclerosis can be cured completely.	False	67	14	18
With arteriosclerosis, arteries contract.	False	59	29	12
With arteriosclerosis, arteries become less elastic.	True	58	20	21
As a result of arteriosclerosis, blood pressure is likely to decline.	False	53	16	31
As a result of arteriosclerosis, blood pressure is likely to increase.	True	51	18	31
High blood pressure and arteriosclerosis are not linked with each other.	False	50	36	14
In arteriosclerosis, a sustainer can be inserted into the artery in order to stabilize it.	True	50	24	27
The risk of suffering from arteriosclerosis is not hereditary.	False	48	29	24
Arteriosclerosis can cause renal damage.	True	45	28	28
With arteriosclerosis, blood platelets accumulate on the arterial walls.	True	41	31	29
With arteriosclerosis, fat accumulates on the arterial walls.	True	36	47	17

	Correct response	% correct response	% false response	% don't know
Individuals with high blood pressure are more likely to suffer from arteriosclerosis.	True	29	49	22
Medication can remove completely sediments from the arteries.	False	26	51	24
With arteriosclerosis, arteries become brittle.	True	25	49	27
Stroke				
A stroke affects the brain.	True	98	2	0
If a patient survives a stroke, there are usually no permanent consequences.	False	98	2	0
Permanent speech defects are possible consequences of a stroke.	True	96	3	1
A stroke is often followed by memory dysfunction.	True	87	11	2
There are different types of strokes.	True	82	11	7
A stroke is caused by artery obstruction.	True	79	12	9
The nutrient supply to the brain is not affected by a stroke.	False	78	16	6
A stroke is characterized by a sudden dysfunction of the heart.	False	65	28	7
A stroke is caused when overexcited cells produce too much electricity.	False	63	11	26
A stroke is preceded frequently by chest pains.	False	58	34	8
A stroke is preceded frequently by speech problems.	True	58	38	4

	Correct response	% correct response	% false response	% don't know
Diabetics are more likely to suffer a stroke.	True	32	37	32
Heart infarction				
Smoking is a minor risk factor with respect to a heart infarction.	False	96	3	1
When suffering a heart infarction, pain may radiate into the arms.	True	86	5	9
The oxygen supply to the heart is not affected by a heart infarction.	False	81	15	4
Hereditary factors play a role in the risk of suffering a heart infarction.	True	79	19	2
After a heart infarction, anticoagulants are administered.	True	78	7	15
A heart infarction is caused by cerebral deregulation of the heart.	False	77	10	13
A heart infarction is often preceded by shortness of breath.	True	74	17	9
A heart infarction is caused by arterial obstruction.	True	72	15	12
Damage caused by a heart infarction is not usually permanent.	False	62	29	9
After a heart infarction has occurred, parts of the cardiac muscle tissue can die.	True	58	29	13
A heart infarction must be treated surgically.	False	57	40	3
With a heart infarction, cardiac muscle tissue dies.	True	47	34	19
Diabetes is a predisposing factor for a heart infarction.	True	47	28	26
A heart infarction is typically followed by some degree of paralysis.	False	44	48	8

	Correct response	% correct response	% false response	% don't know
When suffering a heart infarction, pain may radiate into the stomach.	True	27	54	19
A heart infarction is caused by malfunction of one or more heart valves.	False	25	68	7
A heart infarction is usually preceded by loss of sensation and numbness.	False	25	69	6
A heart infarction can manifest itself through nausea and vomiting.	True	22	58	19

Note. These English items are translations of the original German ones. A thematical list of the German items can be found in appendix A1.
Due to rounding, percentages sometimes may seem not to add up to exactly 100. For each concept, items are presented sorted in declining order of the percentage of correct responses. However, in the administered questionnaire, all items were presented in a randomized order.

In sum, while there are numerous correct beliefs held by the participants with regard to each of the investigated concepts, also false beliefs for each concept are widely spread. Hereby, are some knowledge areas more problematic for laypersons than others? An additional, exploratory analysis was conducted in order to explore the structure of the laypersons' knowledge, that is, to explore which aspects of illness knowledge were more and which less problematic for laypersons. For this aim, the item statements were allocated to the following four categories[35] [36]:

- *Enabling conditions of an illness* (27 items)
  Items on patient and contextual factors that contribute to the development of an illness.
  Item example: *Hereditary factors play a major role in the development of diabetes.* (True)
- *Pathophysiological processes* (18 items)
  Items about the malfunctioning that occurs in an illness.
  Item example: *With diabetes, too much sugar enters the cells.* (False)
- *Consequences of an illness* (27 items)
  Items on probable short-term and long-term consequences of an illness.
  Item example: *Permanent speech defects are possible consequences of a stroke.* (True)
- *Procedures* (12 items)
  Items on treatment procedures and medication.
  Item example: *Liposuction is a state-of-the-art treatment in adiposity therapy.* (False)

The allocation of items to the four knowledge aspects was subjected to an independent coding; intercoder agreement was 95.83 %. Because of the explorative character of this analysis, ($p < .05$) is defined as significant and ($p < .10$) as a trend. With Cohen (1988), the effect sizes will be interpreted as follows: $\eta_p^2 < .06$ as small effect, η_p^2 between .06 and .13 as medium effect and >.13 as large effect; d<.5 as small effect, d between .5 and .8 as medium effect and >.8 as large effect.

For all attribute classes, a mean knowledge score was calculated for each layperson, by dividing the sum of correctly answered items by the sum of all items in the respective component. To determine whether the students' knowledge differed systematically between the different knowledge components, a repeated-measures ANOVA with knowledge components as within-subject factor was conducted, and this factor turned out to be highly significant, $F(3, 95) = 8.16$, $p < .001$, $\eta_p^2 = .21$, large effect.

[35] The categories were chosen following the components of the illness script proposed by Boshuizen and colleagues (e.g., Boshuizen,2003), cf. section 2.1.1.
[36] Hereby, six of the 90 items were excluded, because they did not match the knowledge components.

Post-hoc comparisons of means were performed with t-tests[37] and indicated that lay knowledge fell into three groups. Hereby, the lay participants knew most about the enabling conditions (M = .63, SD = .15), followed by treatment procedures (M = .60, SD = .14). Knowledge scores on illness consequences (M = .57, SD = .14) and on pathophysiological processes (M = .56, SD = .16) were lowest and did not differ statistically from each other (see table 4-6).

Thus, participants knew least about the bodily processes that occur in an illness and about the consequences of an illness. They knew more about treatment and medication, and most about the enabling conditions. Even though this distinction into three groups is supported partly only by trends, and the effect sizes of the t-tests are rather small, the distinction provides a first exploratory indication of lay knowledge structure.

Table 4-6. Post hoc-comparisons of knowledge aspects

Comparisons	***t*(97)**	***p***	***d***
Enabling conditions - Procedures	2.14	< .05	.24
Enabling conditions - Consequences	4.59	< .001	.46
Enabling conditions - Processes	4.21	< .001	.45
Procedures - Consequences	1.82	< .10	.21
Procedures - Processes	1.86	< .10	.22
Consequences - Processes	.26	*ns*	.02

There is a substantial amount of disparity in the lay sample concerning conceptual knowledge on the assessed terms. Laypersons gave a maximum of 61 and a minimum of zero 'don't know'- answers (M = 12.75; SD = 14.01). With regard to correct responses, a minimum of 28 correct responses and a maximum of 81 correct responses were given out of the 90 items (M = 54.76, SD = 9.71). The laypersons gave M = 23.29 incorrect responses on average (i.e. the incorrect choice of 'true' or 'false; Min = 4, Max = 45, SD = 8.38).

As already mentioned, also the confidence ratings that the participants gave for each of their 'true' and 'false' answers were analyzed. Table 4-7 shows the means and standard deviations for all confidence ratings, for confidence ratings of only correct responses and of confidence ratings for incorrect responses. Also, the minimums and maximums of the participants' mean confidence ratings are reported.

[37] Since the t tests can be considered as *protected* t tests, there was no correction for inflation of Type I error rate.

Table 4-7. Means and standard deviations of different confidence ratings

	M	***SD***	***Min of mean confidence***	***Max of mean confidence***
All confidence ratings	4.23	.75	2.24	6.06
Confidence ratings of correct answers	4.45	.78	2.17	6.17
Confidence ratings of incorrect answers	3.82	.73	2.23	5.94

As the table shows, there is a substantial variation between the participants as to how confident they were about their answers, with a rather wide range of mean confidences for all confidence ratings in general, as well as for confidence ratings of correct and of incorrect answers. A t-test performed to compare mean confidence ratings of correct and incorrect answers revealed that the participants were more confident with regard to their correct than with regard to their incorrect answers, $t(97) = 13.85$, $p<.001$, $d = .84$, large effect.

4.4 Discussion

'Diabetes', 'stroke' and 'hypertension' are terms that are frequently used in lay everyday medical talk, as well as the other four illness concepts for which lay understanding was investigated in Study I. For each of these terms, a number of aspects were selected which are important for laypersons to know (as inspections of the medical literature, of patient information brochures and of information on official health organizations' Internet sites had shown). In order to assess the beliefs that laypersons hold with regard to these illness concepts, a questionnaire was developed and answered by a student lay sample. On the basis of the participants' answers to the questionnaire items, the main research aim of the study was to describe widespread lay beliefs; the beliefs were outlined separately for each concept in a descriptive analysis. The results of this analysis show that laypersons are no 'blank slates' – while there are certainly many pieces of information that are not known to the laypersons; laypersons also have numerous correct or erroneous medical beliefs. Thus, for instance, many participants assumed a malfunctioning of the heart valves to be responsible for cardiac infarction. Or,

to provide a second example, the study showed that many laypersons seemed to get the symptoms of cardiac infarction and stroke mixed up.

In addition to a description of frequent lay beliefs for each term separately, an exploratory analysis aimed at investigating across terms whether laypersons were more knowledgeable with regard to some aspects of knowledge than with regard to others. This analysis revealed that participants were most knowledgeable about the conditions that contribute to the manifestation of an illness, followed by knowledge about how illnesses are treated. Least was known about the micro-processes and consequences of illnesses. As described in section 2.1.3, results from cognitive research on lay knowledge have described that lay knowledge comprises the superficial aspects of knowledge, for instance the perceptually salient elements. The results partly support these findings, in that the laypersons were least knowledgeable about the (perceptually not salient) micro-processes of an illness. The fact that the participants also showed comparatively little knowledge about the consequences of an illness is somewhat more surprising. However, these results are only indications based on a first exploratory analysis. Future research will need to shed more light on knowledge structures of laypersons.

The lay sample showed a big disparity with regard to how much they knew and how many false beliefs they held. Also, the laypersons differed considerably in how confident they were about their answers. While the mean confidence rating was only slightly higher than the middle of the 7-point scale, the laypersons showed some sense of whether their answers were right or not, because the confidence ratings were significantly higher in those cases in which the participants had given a correct answer than in those that they had given an incorrect answer. Taken together, the laypersons were not very efficient at estimating their own knowledge, which is in line with the results on the estimation of laypersons of their own knowledge as presented in section 2.1.3.

Results of studies that describe concrete lay medical beliefs like the ones obtained in this study point towards problematic aspects of lay understanding. Thus, the study contributes to the body of research that is devoted to shed more light on lay understanding of common medical terms and through this adds to the existing literature (see section 2.1.2) by complementing it with results for concepts related to the topic 'metabolic syndrome'. Thus, the results of study I are also of practical value, because an awareness of lay knowledge can help physicians to provide explanations which are appropriate to a lay level of understanding. Thus, in addition to being a prerequisite for the other studies that are described in this dissertation, the results of study I are of practical relevance to physicians.

Study I provides results for a sample of lay college students enrolled in courses other than natural sciences and thus for a population of laypersons that is (a) highly relevant

in terms of prevention and (b) likely to be more educated than the general population. As a consequence, the results cannot be extrapolated to laypersons in general, but they give sufficient evidence to assume that false beliefs should be as widespread (if not more) in other lay populations than the student one as well.

With regard to expert-layperson communication, the results show that also in the domain of interest in this dissertation (i.e., issues within the broad field of the metabolic syndrome), a medical expert cannot take for granted that her lay interlocutor has a sufficient understanding of concepts that are part of the conversation. This becomes even clearer when one considers the great disparity that was found in Study I, and it applies to terms that are introduced by the expert into the conversation as well as to terms that are introduced by the layperson herself. Studies II through IV of this dissertation will investigate how experts react when an erroneous understanding on part of the layperson is displayed in a layperson's utterance for the conversational context of email health counseling.

5 Study II: The impact of a display of lay beliefs on medical experts' anticipation of lay knowledge

5.1 Introduction

When experts communicate with laypersons in email counseling settings, the interlocutors cannot hear nor see each other, and thus cannot give feedback through gesture, mimic or paraverbal features on whether they have understood the other's utterance. As a consequence, it is more difficult for the expert to draw inferences about her lay interlocutor's knowledge; at the same time, it is vitally important to draw those inferences: As communication usually only consists of one turn (one lay email query being followed by one expert answer), the expert cannot elicit the layperson's knowledge in a stepwise manner during the course of a longer conversation, but has to rely on the written query text as only source of information (see section 2.4.2).

One type of information on the lay interlocutor's knowledge that stems directly from the email query text is those instances in which the layperson utters false beliefs in her email. As the results of Study I showed, medical laypersons hold a variety of false beliefs with regard to important concepts in the field 'metabolic syndrome'. In Study II, to-be-described next, the impact of this type of information on experts' assessment of their lay interlocutor's knowledge was investigated. Consequently, the following research question was formulated:

How does a display of false beliefs in the lay query impact on the experts' assessment of the lay query author's knowledge?

Study II introduces a paradigm that allows for the comparison of experts' knowledge anticipation for cases in which the lay nature of the email author's understanding of medical concepts is evident in the email to a different degree. In this paradigm, the medical experts are provided with a lay email query, in which a (fictitious) layperson-upon describing her[38] situation – uses several medical concepts as for instance 'arteriosclerosis' (from the broad field of the metabolic syndrome, diabetes was chosen as main topic of the query). The query is realized in 3 versions; in the first version, the layperson utters a false belief for each of these concepts (FB query version). As described, these false beliefs do not only inform on the layperson's *concrete* misunderstanding,

[38] The gender of the email author was irrelevant for this study in that it was not deducible from the email text. When referring to the fictitious lay email author, however, I will stick with the female form.

but also point to the fact that there is a *general* deficiency to lay term understanding. In the second version, a correct belief is uttered by the layperson for each concept (CB query version). Obviously, if a correct belief is uttered, the expert is not made aware of the lay concept misunderstandings (rather on the contrary, i.e. it rather obscures the lay nature of concept knowledge). In the third version, there are no beliefs displayed alongside the concepts (NB query version; for a detailed description of the query versions, see 5.2.2). After reading the query, the experts rate the layperson's knowledge in a questionnaire. Due to the manipulation of beliefs in the query versions, the impact of a display of false beliefs on the experts' knowledge assessment can be estimated by comparing the assessment in the false-beliefs condition with the ones in the two other conditions.

In section 2.2, I have proposed a structural parallel between expert-layperson communication in formal and informal learning settings. Research studies on face-to-face tutorial dialogue in formal learning settings have shown that the tutors in these settings have difficulties in acknowledging a tutee's erroneous knowledge: The tutors do not build up an elaborate representation of the tutee's knowledge and rather tend to overestimate correct understanding; this holds especially for so-called *open-world domains* like for instance medicine, that is, domains in which errors do not consist in giving the wrong answer to a yes-or-no problem, or to a simple question, but in a more complex misunderstanding on part of the tutee.

Tutors do, however, not only have difficulties in acknowledging erroneous tutee understanding in general, but also with regard to erroneous knowledge that is uttered explicitly by the tutee during the tutorial session: In the study by Chi et al. (2004), for instance, the authors analyzed how tutors reacted when tutees uttered erroneous knowledge in a tutorial session. Frequently, these errors were not addressed at all (meaning that neither a feedback about the incorrectness of the knowledge deficit nor the correct knowledge was provided). These results were interpreted as a failure to detect the knowledge deficits (cf. section 2.2).

Taking this interpretation as a basis, one might assume that just as in face-to-face formal tutorial settings, the experts in email health counseling might not acknowledge the erroneous knowledge that is uttered by the layperson, resulting in the following hypothesis:

- *Disregard hypothesis:*
  The display of false beliefs does not impact on the experts' estimation of lay knowledge. With regard to the three versions of the email query that are realized

in Study II, this would result in *no differences between experts' knowledge ratings in the three conditions.*

It needs to be considered, however, that inferences supposedly do play a bigger role in email communication than in face-to-face communication (cf. section 2.3.1). As already mentioned above, the characteristics (constraints sensu Clark and Brennan, 1991) of online communication make it harder to establish common ground in email than in face-to-face communication (cf. section 2.4.2). Considering the lacking feedback possibilities and the fact of usually only a singular conversational turn, and given that the email is visible and reviewable, it is plausible to assume that the conversational scenario of online health counseling calls for a more thorough consideration of the lay interlocutor's conversational contribution. As a consequence, the experts might build up a more thorough and detailed representation of the layperson's knowledge. Hereby, the display of false beliefs in the email query contains two types of information: Thus, it does not only inform on the layperson's concrete false beliefs, but it also hints to the fact of the characteristic deficiency of lay understanding (that is, the fact that laypersons frequently hold erroneous beliefs. Which of these two informational values will be taken into account by the experts?

In order to translate the preceding considerations into hypotheses, I shall coin the term *beliefs-related prior knowledge* in order to refer to knowledge that relates directly to those knowledge pieces about which beliefs were displayed, and the term *topic prior knowledge* in order to refer to knowledge that refers to the topic of the query but is not related to the displayed beliefs. Thereby resulting, based on the afore-sketched considerations concerning the characteristics of email counseling, the following two hypotheses can be formulated:

- *Specific impact hypothesis:*
  The display of beliefs impacts on the experts' beliefs-related prior knowledge assessment. As a consequence, the lay email author will be estimated as less knowledgeable about these knowledge pieces when the email contains false beliefs than when it does contain no beliefs or correct beliefs. The layperson should be estimated as more knowledgeable about the knowledge pieces, however, when the email contains correct beliefs than when it does not contain these or when it contains false beliefs. With regard to topic prior knowledge, no differences in knowledge estimation of the lay authors of the three different email versions are expected.

- *Generalizative impact hypothesis:*
  The display of beliefs impacts on the experts' assessment in a generalizative way, that is, with regard to both beliefs-related prior knowledge and topic prior knowledge. As a consequence, the knowledge ratings will not only differ with regard to the beliefs-related prior knowledge, but also with regard to topic prior knowledge. Concretely, if this was the case, the lay email author will be estimated as less knowledgeable about knowledge pieces of the thematic field (both related to the beliefs and not) when the email contains false beliefs than when it does contain no or correct beliefs. The layperson will be estimated as more knowledgeable about the knowledge pieces of the thematic field, however, when the email contains correct beliefs than when it does not contain these (or when it contains false) beliefs.

The three delineated alternative outcomes (*disregard of display of beliefs* / *specific impact of display of beliefs* / *topic-general impact of display of beliefs*) are depicted graphically in table 5-1 and are investigated in the present Study II.

Table 5-1. Alternative outcomes of Study II

Disregard of display of beliefs			
	FB	CB	NB
False beliefs in email (FB)		=/ =	= / =
Correct beliefs in email (CB)			= / =
Specific impact of display of beliefs			
	FB	CB	NB
False beliefs in email (FB)		</ =	< / =
Correct beliefs in email (CB)			> / =
Generalizative impact of display of beliefs			
	FB	CB	NB
False beliefs in email (FB)		</ <	< / <
Correct beliefs in email (CB)			> / >

Note. This table is to be read following the lines from left to right. The black symbols refer to the hypothesized specific impact, the grey ones to the hypothesized overall impact. The first line of the specific impact hypothesis (FB condition), for instance, says that according to this hypothesis, the experts' ratings should be lower for those knowledge pieces about which beliefs are uttered in the FB than in the CB and in the NB condition. For the overall impact, however, no differences are expected.

In addition to answering the knowledge assessment questionnaire in which the medical experts rated the layperson's knowledge with regard to concrete knowledge issues, the medical experts were also asked to give a holistic assessment of the layperson's diabetes knowledge. Thus, the impact of the inserted lay beliefs on an overall impression was investigated.

5.2 Method

5.2.1 Participants

Advanced medical students (n=75) from a German university were asked at the end of lectures to participate in our study. In order to assess their knowledge in the domain of diabetes, the experts completed a 15-item diabetes knowledge questionnaire (see section 5.2.2). Three participants answered less than 10 items correctly and were excluded from the analyses.

Fifty-four per cent of the remaining participants were female. The mean age was 24.2 years (SD=2.73). The students were in their fourth year of university medical training[39] (*M* = 3.17, *SD* = .80 semesters *after* First State Examination). Participants were rewarded for participation with candy and by having a one-in-five chance of winning € 5 in a raffle.

5.2.2 Materials

Diabetes questionnaire

In addition to choosing medical students at the end of their university training in order to ensure that the participants would be medical experts, a test was developed to test the participants' knowledge specifically for the specific thematic field of the query, that is, diabetes. After a thorough consultation of the medical literature (e.g., Böhm, Palitzsch, Rosak, & Spinas, 2001; Hien & Böhm, 2001; Scherbaum, 2002; Greten, 2002), a 15-item questionnaire was constructed in order to test the participants' diabetes knowledge. The data of those participants that had answered less then ten items correctly were excluded from the study.

The questionnaire is displayed in table 5-2. For the original, German version of the questionnaire, see appendix B1.

[39] Medical schools in Germany are organized into a non-clinical and a clinical part, with the former requiring four semesters (i.e., two years) of study and concluding with the First State Examination.

Table 5-2. Diabetes questionnaire (English translation)

	True	False	Don't know
In diabetes, glucose absorption into the cells is increased.	□	□	□
Lack of appetite is a frequent symptom of diabetes.	□	□	□
An insulin overdose is a cause of hypoglycaemia.*	□	□	□
Polydipsia is a symptom of diabetes.*	□	□	□
The early detection test of diabetes-caused renal damages is called macroalbuminuria test.	□	□	□
The $HBA1_c$ level is a measure of the blood glucose levels of the last three months.*	□	□	□
A clinically manifest diabetes starts at fasting blood sugar levels of 20 mmol/l.	□	□	□
Diabetes type 2 is characterized by an absolute lack of insulin.	□	□	□
Retinopathy is one of the complications of diabetes.*	□	□	□
Most type 2 diabetics are overweight.*	□	□	□
Insulin is released in constant quantities.	□	□	□
Insulin causes sugar to dissolve in the blood.	□	□	□
Arteriosclerosis is one of the complications of diabetes.*	□	□	□
Some type 2 diabetics have an elevated insulin secretion.*	□	□	□
Adiposity starts at a BMI of 25.	□	□	□

Note. Correct items are marked with a *

Patient email query

As already pointed out in the introduction, a query was constructed in which a layperson described how a physician had recently confronted her with the diagnosis 'diabetes', about which certain aspects had remained unclear to her. The topic type 2 diabetes was chosen because, though relevant for a considerable number of people, the general

public's knowledge about it is not as widespread as to rule out further informational needs. In order to ensure that the medical expert would engage in explaining subject-matters to the patient (instead of just giving a simple yes-or-no answer or some empathetic or advisory commentary), the query closed with questions that needed some explanations of medical relations (for instance an explanation of the effects of increased insulin production on receptor desensitization). This was especially relevant in order to be able to investigate the answering behavior of the medical experts. This is undertaken in study III, which uses the same query (versions) as study II.

The query was constructed in three versions, displaying either various false beliefs (condition FB) or correct beliefs (condition CB) related to central concepts in the query, or which did not contain these beliefs (condition NB). For instance, the fictitious lay-person stated that "my mother also suffers from diabetes, I guess *therefore I had a higher risk myself*" (CB) vs. "my mother also suffers from diabetes, *that's quite a coincidence*" (FB) vs. "my mother also suffers from diabetes" (NB), thus exhibiting (or not) her understanding of the role of heredity in diabetes. The patient query in version FB is displayed in figure 5-1, in which the two parts (i) patient describes her situation and (ii) patient poses questions (i.e. the final part of the query, starting with 'I know what I am supposed to do, but my questions to you are:') are marked with arrows.

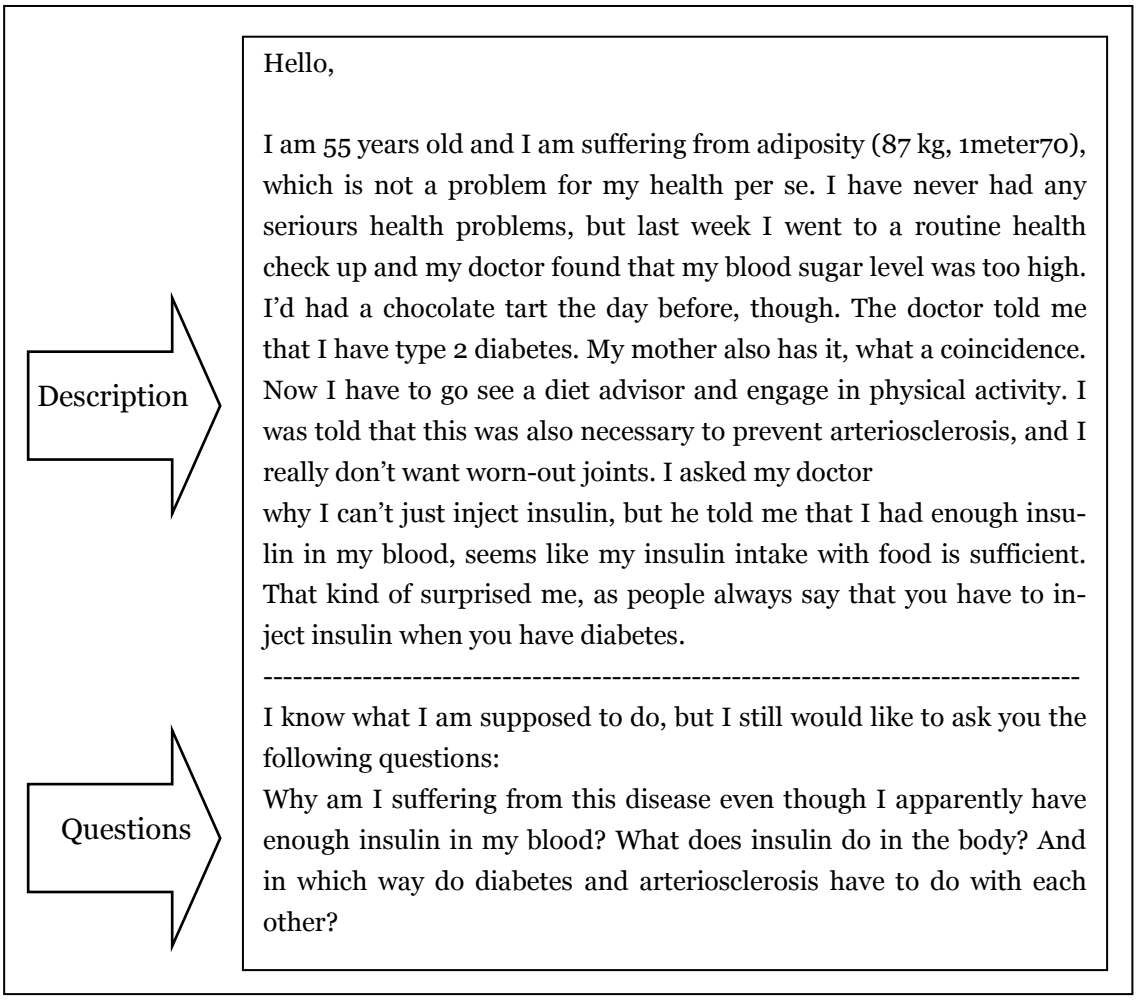

Figure 5-1. (Fictitious) lay query (English translation)

Apart from the addition of beliefs in the FB and CB queries, there were no further differences between the three query versions. As can be seen in figure 5-1, the beliefs in the FB and CB versions were only inserted into that part of the query in which the patient described her own situation. The questions at the end of the query were identical in all three conditions. Table 5-3 provides an overview of the manipulations of this study. To read all three versions of the query, see appendices B2 for the German and B3 for the English versions.

Table 5-3. Manipulation of Study II (English translation)

CB	FB	NB
I am 55 years old and I am suffering from adiposity (87 kg, 1meter 70), *and I am aware that that is a health risk.*	I am 55 years old and I am suffering from adiposity (87 kg, 1meter 70), *which is not a problem for my health per se.*	I am 55 years old and I am suffering from adiposity (87 kg, 1meter 70).
I have never had any serious health problems, but last week I went to a routine health check up and my doctor found that my blood sugar level was too high. *This was surely not only due to the chocolate tart that I'd had the day before.*	I have never had any serious health problems, but last week I went to a routine health check up and my doctor found that my blood sugar level was too high. *I'd had a chocolate tart the day before, though.*	I have never had any serious health problems, but last week I went to a routine health check up and my doctor found that my blood sugar level was too high.
The doctor told me that I have type 2 diabetes. My mother also has it, w*hich probably made me more vulnerable for it.*	The doctor told me that I have type 2 diabetes. My mother also has it, *what a coincidence.*	The doctor told me that I have type 2 diabetes. My mother also has it.
I was told that this was also necessary to prevent arteriosclerosis, *and I really don't want jammed arteries.*	I was told that this was also necessary to prevent arteriosclerosis, *and I really don't want worn-out joints*	I was told that this was also necessary to prevent arteriosclerosis.
I asked my doctor why I can't just inject insulin, but he told me that I had enough insulin in my blood, *seems like I produce enough insulin.*	I asked my doctor why I can't just inject insulin, but he told me that I had enough insulin in my blood, *seems like my insulin intake with food is sufficient.*	I asked my doctor why I can't just inject insulin, but he told me that I had enough insulin in my blood.

Note. For the purpose of demonstration, the concepts with regard to which beliefs are displayed in the query are underlined, the corresponding beliefs are written in italics.

Knowledge assessment questionnaire

In order to investigate the experts' assessment of the lay author's knowledge, a knowledge assessment questionnaire was constructed which consisted of 20 specific knowledge items (e.g. *How much does the patient that wrote the inquiry know about the symptoms of diabetes?*). All items had to be answered using a 7-point Likert scale with verbally anchored points ranging from 'very little' to 'very much'. Figure 5-2 shows the item format of the knowledge assessment questionnaire.

How much does the patient that wrote the inquiry know about…

	Very little	Little	Rather little	Medium	Rather much	Much	Very much
… the role of heredity in diabetes?	O	O	O	O	O	O	O

Figure 5-2. Example of item of the knowledge questionnaire

With the help of the 20 specific knowledge items, the experts' knowledge anticipation could be assessed for different facets of diabetes knowledge. In the introductory section of this chapter, I explained how the beliefs that are inserted into the lay emails might impact on the experts' assessment of the laypersons knowledge not only on a local level (i.e. with regard to that very beliefs), but also on a broader level. This 'broader level' can be further differentiated. Thus, due to the inserted beliefs, the layperson might be assessed as less (or more) knowledgeable about (i) issues related to the manipulation of false vs. correct vs. no beliefs, but also with regard to (ii) other issues mentioned in the query; (iii) issues related to the layperson's questions at the end of the query; and (iv) other aspects of diabetes that were not subject of the query. Thus, (i) focuses on the assessment of beliefs-related prior knowledge, while (ii) through (iv) focus on aspects of topic-prior knowledge. These knowledge facets are assessed by 5 items each in the questionnaire. In the following, I will explain these facets as well as provide the corresponding items. In the original questionnaire, however, the items were presented in a randomized order. The original German questionnaire as well as its English version can be viewed in appendices B4 and B5.

- *Issues related to the manipulation of false vs. correct vs. no beliefs.*
  These items treated the facts about which the patient had uttered beliefs in the CB and FB queries. For instance, the patient had said that it was a coincidence that her mother was also suffering from diabetes. In the related item of the knowledge assessment questionnaire, the experts had to rate how much they thought the patient knew about the role of heredity in diabetes. The five items that belong to this category are:

How much does the patient that wrote the inquiry know about…
… the sequelae that adiposity can have?
… the functioning of blood sugar regulation?
… the role of heredity in diabetes?
… the processes that happen in arteriosclerosis?
… how insulin is produced?

- *Issues mentioned in the query.*
  An additional group of items treated other pieces of knowledge that were related to the issues that the patient talked about in her query, but that were not manipulated in the beliefs. For instance, the patient addressed dietary aspects. In the related item of the knowledge questionnaire, then, the experts rated how much they thought the patient knew about how diabetes can be influenced nutritionally. The five items that belong to this category are:

How much does the patient that wrote the inquiry know about…
… what kind of illness diabetes is?
… how diabetes can be influenced nutritionally?
… the treatment options of diabetes?
… what adiposity is?
… the relations between adiposity and arteriosclerosis?

- *Issues related to the layperson's questions at the end of the query.*
  Five items treated those issues about which the patient had asked the questions at the end of the query (cf. figure 5-1), these are:

How much does the patient that wrote the inquiry know about…
… which different types of diabetes exist?
… what distinguishes the different types of diabetes?
… which factors influence the development of diabetes type 2?
… which function insulin serves in the body?
… the relation of diabetes and arteriosclerosis?

- *Other aspects of diabetes knowledge not part of the query.*
  In order to assess how the manipulation impacted on the experts' knowledge assessment of aspects that were not directly related to the query, the following five

items were used that treated diabetes-related issues that were not mentioned in the lay query:

How much does the patient that wrote the inquiry know about...
... the symptoms of diabetes?
... critical blood sugar levels?
... at what age levels the different types of diabetes are likely to appear?
... the possible role of diabetes in pregnancy?
... which different types of diabetes medication exist?

Holistic knowledge assessment item

In addition to rating the layperson's knowledge for concrete knowledge pieces within the topic of diabetes, the medical experts also gave a holistic assessment of the layperson's knowledge on diabetes, using the same 7-point Likert scale with verbally anchored points ranging from 'very little' to 'very much'. 'For the item format, see figure 5-3.

In your opinion, how much does the patient know about diabetes?

Very little	Little	Rather little	Medium	Rather much	Much	Very much
O	O	O	O	O	O	O

Figure 5-3. Holistic assessment item format in Study II (English translation)

5.2.3 Design and Procedure

The participants were assigned randomly to the experimental conditions resulting in a number of 24 participants in each of the three conditions FB, CB and NB. In the introductory part of the questionnaire, participants were told that they had to read a health-related email query and answer some questions about it. Thus, participants did not know that they were going to be asked to assess the knowledge of the email author. Then, each participant read one of the three query versions (between-design with *display of beliefs* as independent factor) and afterwards filled in the knowledge assessment questionnaire. The participants were told not to flip back to the query while answering the assessment items. Last, the participants filled in the diabetes test and answered some demographic questions. For a schematic overview of the experimental

procedure, see figure 5-4. The study was conducted in seminar rooms of the medical campus; the average participation time was 30 minutes.

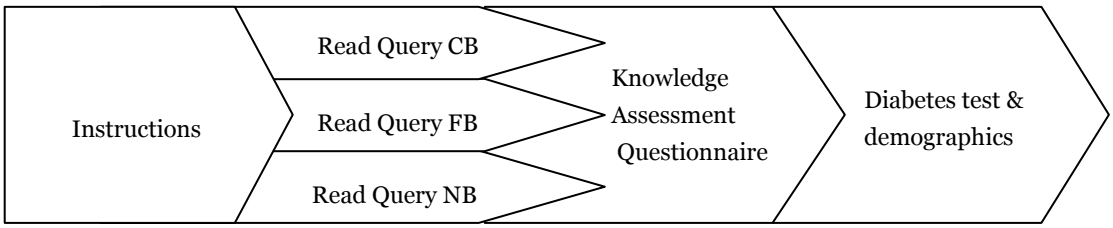

Figure 5-4. Experimental procedure of Study II.

5.3 Results

In the following, all significances are reported two-tailed unless specified otherwise; hereby, ($p < .05$) is defined as significant and ($p < .10$) as a trend. With the aim of being able to draw (however tentative) conclusions from finding no statistically significant differences between the experimental conditions, an alpha-level of >.25 was taken as a basis for interpretation. This procedure indirectly minimizes the beta-error by enlarging the alpha-error (cf., Bortz, 1993). With Cohen (1988), the effect sizes will be interpreted as follows: $\eta_p^2 < .06$ as small effect, η_p^2 between .06 and .13 as medium effect and >.13 as large effect; $d<.5$ as small effect, d between .5 and .8 as medium effect and $d >.8$ as large effect.

For the specific knowledge assessment, a mean score was calculated for each of the four item aspects (cf. description of knowledge assessment questionnaire in section 5.2.2). The multivariate analysis revealed a significant effect of display of beliefs, $F(8, 134) = 3.34$, $p = .002$, $\eta_p^2 = .17$ (large effect). Univariate analyses revealed a significant difference between the assessment of the lay author in the three query versions only for the items on issues related to the manipulation of false vs. correct vs. no beliefs ($F(2,69) = 10.00$, $p = < .001$, $\eta_p^2 = .23$ (large effect). For all other groups of items, there were no differences between the ratings to the three query versions, all $F(2, 69) < 1.70$, $p > .19$.

For the items on issues related to the manipulation of beliefs, post-hoc comparisons of means were performed with t-tests[40] and showed that the experts' ratings on these issues were significantly higher in the CB condition than in the NB ($t(46) = 2.67$, $p = .01$, $d = .78$; medium effect) and in the FB condition ($t(46) = 4.09$, $p < .001$, $d = 1.19$; large effect). Also, there is a trend for the ratings in the NB condition to be higher than in the

[40] Since the t tests can be considered as *protected* t tests, there was no correction for inflation of Type I error rate.

FB condition, $t(46) = 1.84$, $p = .072$, $d = .53$ (medium effect). Descriptive statistics for the four mean score variables are displayed in table 5-2.

Table 5-2. Means (and standard deviations) of the knowledge assessments

Knowledge assessment mean scores	**Experimental condition**		
	CB query version *M (SD)*	FB query version *M (SD)*	NB query version *M (SD)*
Issues related to the manipulation of beliefs	2.65 (.91)	1.76 (.56)	2.06 (.58)
Other issues mentioned in the query	2.93 (.71)	2.65 (.70)	2.62 (.55)
Issues related to the layperson's questions at the end of the query	2.17 (.75)	1.97 (.65)	1.95 (.65)
Other aspects of diabetes that were not subject of the query	1.84 (.54)	1.76 (.48)	1.75 (.58)

To sum up, medical experts who read one of the three query versions rate the knowledge of the email author differently between the versions only with regard to those aspects that relate to the manipulated beliefs. For these, the layperson is rated most knowledgeable when the email displays correct beliefs, less when there are no beliefs and least when there are false beliefs. With regard to knowledge that concerns other contents of the query, the concrete questions at the end of the query or additional diabetes knowledge that was not topic of the query, there are no differences between the experts' knowledge assessment in the three conditions. Thus, the findings confirm the specific-impact hypothesis, while both the topic-general impact hypothesis and the disregard hypothesis need to be refuted. In figure 5-5, the findings are displayed graphically.

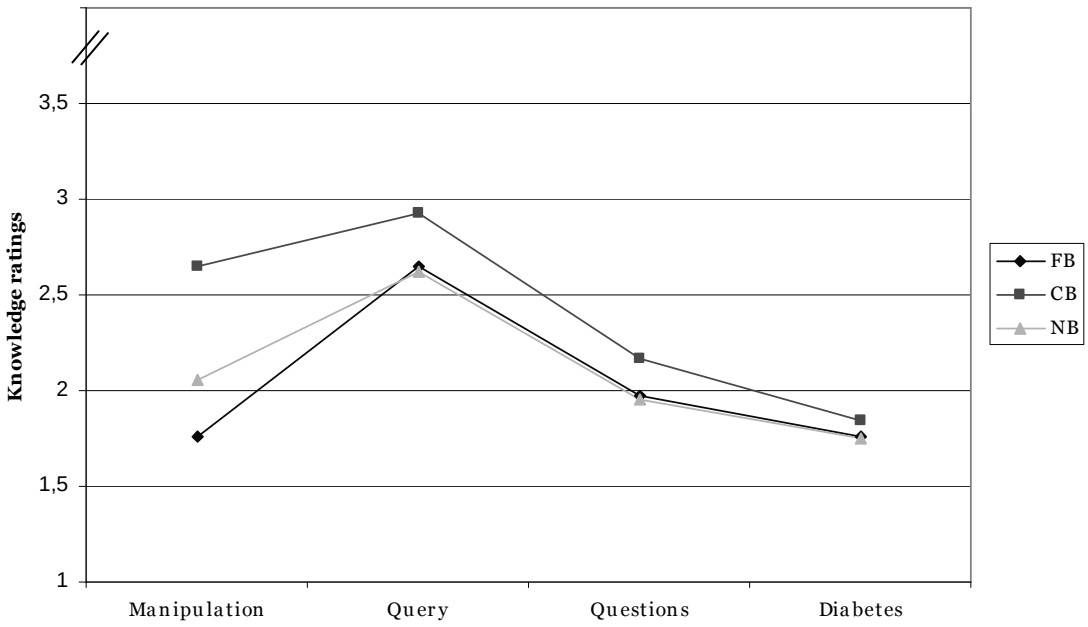

Figure 5-5. Specific knowledge assessment.

With regard to the holistic knowledge item, a univariate analysis revealed a significant difference between the conditions, $F(2,68) = 5.48$, $p < .01$, $\eta_p^2 = .14$ (large effect). Post-hoc comparisons of means were performed with t-tests[41] and showed that the overall rating was significantly higher in the CB condition ($M = 3.17$, $SD = 1.13$) than in the NB ($M = 2.52$, $SD = .90$; $t(45) = 2.16$, $p<.05$, $d = .64$; medium effect) and in the FB condition ($M = 2.21$, $SD = 1.02$; $t(46) = 3.08$, $p = .003$, $d = .89$; large effect). The assessment in the NB and in the FB condition did not differ significantly from each other, $t(45) = 1.12$, $p > .25$. Thus, those experts that had read the correct-beliefs email rated the knowledge of the lay author globally higher than experts that had read the no-beliefs version or the false-beliefs version of the query. The estimations of the experts in the latter two conditions, however, did not differ from each other.

5.4 Discussion

In section 2.2, two ways are described in which the tutors' mental representation of their tutee's knowledge is investigated in tutoring research: Thus, on the one hand, tutors describe what correct and erroneous knowledge they assume their tutees to have. Comparisons between these descriptions and tutees' descriptions of their own knowl-

[41] Since the t tests can be considered as *protected* t tests, there was no correction for inflation of Type I error rate.

edge show that the tutors often do not acknowledge erroneous knowledge held by the tutees, while correct tutee understanding is overestimated. On the other hand, the tutors' conversational behavior in instances in which the tutee utters erroneous knowledge during the tutorial session is analyzed. From the addressing (or not-addressing) of the tutees errors, inferences about the tutors' mental representation of the uttered errors are drawn. This is an indirect way of analysis, which contains the presumption that when tutors acknowledge an error, they also address it.

In study II, presented in this chapter, however, experts' knowledge representations of uttered laypersons' errors were investigated more directly for the informal tutorial setting of email health counseling: Medical experts read an email query and afterwards assessed the knowledge of the layperson that had written the email. In the query, the layperson uttered either several false or several correct beliefs, or did not utter these beliefs. The medical experts had to rate both beliefs-related prior knowledge and topic-prior knowledge, i.e. knowledge that was not related directly to the manipulated beliefs, but to the topic of the lay query. Hereby, a generalization of effects of the display of beliefs to other aspects of topic-prior knowledge in the form of higher or lower ratings on the layperson's knowledge was investigated for three aspects: For issues that the layperson mentions in the query, for issues asked by the layperson at the end of the query, and for issues that are not mentioned in the query but only related to the topic of the query. Thus, the study aimed at investigating how uttered errors impact on the experts' representation of lay knowledge differentiatedly for different aspects of knowledge.

The results of the knowledge assessment questionnaire showed that the inserted beliefs impacted only on the experts' assessment of the layperson's beliefs-related knowledge. After reading the query into which false beliefs had been inserted, the experts rated the layperson's knowledge on these issues lower than when no beliefs or correct beliefs were inserted. When correct beliefs were inserted, the experts rated the knowledge highest, higher than when no or false beliefs had been inserted. However, no generalization to other aspects of knowledge was found.

Before filling in the knowledge assessment questionnaire, the experts answered a general item in which they had to rate how much they thought the layperson knew about the topic of diabetes. With regard to this holistic assessment, only correct beliefs impacted on the assessment. The lay author was rated more knowledgeable when correct beliefs were displayed in the email than when false or no beliefs were displayed, while ratings for the latter two types of queries did not differ from each other. This result shows that a display of beliefs does have some influence also on the overall impression of the layperson's knowledge; however, this observation is restricted to the display of correct beliefs. While false beliefs in lay queries serve as information on the lay inter-

locutor's knowledge on issues that are closely related to these beliefs, they do not serve as hints on the lay nature of the interlocutor's concept understanding in general: The tendency to rate the lay knowledge lower in the false-belief condition and higher in the correct-beliefs condition does not generalize to other aspects of lay knowledge. Thus, with regard to an overarching impression of the layperson's knowledge, the results of the holistic knowledge assessment item point towards an impact of a display of correct beliefs but not of false beliefs on the assessment. Future research will need to clarify the impact of a display of beliefs on a more holistic knowledge impression further.

In a nutshell, with regard to the specific knowledge assessment of the experts, the results point towards a local influence of the display of false beliefs on the experts' knowledge assessment. Presumably, hereby, the characteristics of online communication play a central role: When conversational contributions are processed more thoroughly in written asynchronous communication, erroneous knowledge can be detected and represented more easily. These results correspond to the notion by Pickering and Garrod (2004; cf. section 2.3.1), who point out that in conversational settings that deviate from face-to-face conversation, communication processes are likely to be less automatic. Thus, experts might make more inferences on the layperson's knowledge and thus detect knowledge deficits more easily than in face-to-face contexts.

With the help of the paradigm used in this study, the impact of a display of erroneous knowledge on the experts' knowledge assessment could be measured directly and differentiatedly. Also for tutoring research which focuses on face-to-face tutoring, also here new ways need to be found that allow for a more direct assessment of the tutors' representation of tutee knowledge. For this aim, a paradigm would need to be constructed in which several tutor participants of a study are confronted with the same errors. Possibly, these errors could be uttered by a confederate tutee, in a tutorial session that would be controlled to a certain degree but also be as ecologically valid as possible. After the tutorial session, the tutors could rate the tutee's knowledge with regard to different knowledge aspects, both related and unrelated to the uttered errors.

The foregoing study investigated medical experts' assessment of lay email author's knowledge. In the upcoming Study III, the focus will shift from experts' anticipation to their *communicative behavior* in email health counseling. Tutoring research has shown that novice tutors often tutor in a rather standardized way, not responding to the specific needs of their respective tutees. How and to what extent do medical experts in email health counseling adapt to their specific lay interlocutors and to uttered lay errors? Again using the paradigm of display of beliefs, this question will be addressed in Chapter 6.

6 Study III: The impact of a display of lay beliefs on medical experts' answers to lay queries

6.1 Introduction

When a layperson turns to an expert with a problem for which she seeks advice or with issues for which she would like to receive more information, both expert and layperson are confronted with a conversational partner with a knowledge background that is very divergent from their own (cf. section 2.1). As a consequence, when experts have to explain issues from their domain of expertise to laypersons, they cannot explain them from their own angle, but have to transform, so-to-say translate their expert knowledge in order to produce explanations that are apt to the understanding of their lay interlocutors. Hereby, different conversational settings put different constraints on accomplishing this audience design. Thus, in face-to-face conversation, interlocutors can adapt and re-adapt their messages to the collocutor's understanding: In the process of grounding (sensu Clark, see section 2.3), meaning is negotiated during a several-turn conversation, and lacks of understanding can become apparent in the course of the conversation through verbal and non-verbal feedback. The conversational context of written, asynchronous, online health counseling, however, does not allow for such a step-wise adaptation (see section 2.4): Because the email counseling interaction usually only consists of one turn (i.e., one email query is followed by one answer), there are no feedback possibilities and no course of several interactional turns. As a consequence, an initial adaptation of the expert's conversational contribution does play an even bigger role; it is vitally important that the expert adapts her reply to the layperson as much as possible. One aspect of adaptation hereby is the addressing of false understanding. Results from formal tutoring research have shown that the correction of errors is central for learning and knowledge acquisition; in addition, it is also beneficial for learning when tutees are aware of the fact that they had made an error and that their assumptions had been wrong (cf. section 2.2). In study III, to-be-described in this chapter, the experts' adaptation to uttered lay errors in email health counseling will be investigated.

In study II, I have introduced the paradigm of display of beliefs. In this paradigm, the fact of the existence of an alternative and often erroneous lay understanding is made apparent in a lay email to a different degree. Concretely, medical experts are presented with an email query of a (fictitious) layperson in which that layperson describes her medical situation. In the three versions that were constructed of the query, either false, correct, or no beliefs were inserted into the query (see section 5.2.2).

In study III, the same paradigm will be used in order to explore how a display of false lay understanding in the query impacts on experts' adaptation to the lay addressee. Concretely, in this study, the following research question will be addressed:

How does a display of false beliefs in the lay query impact on the experts' email answers?

As will be described in the following, I hereby distinguish between two different ways of adaptation to the layperson. As a result, the research question can be specified as follows:

How does a display of false beliefs in the lay query impact on the experts' email answers (a) with regard to the adaptation of the emails to the lay understanding of their interlocutors and (b) with regard to an addressing of the layperson's false beliefs?

In order to address this question, medical experts were asked to read one of the three lay query versions and answer it. Due to the manipulation of beliefs in the query versions, the impact of a display of false beliefs on the experts' answering behavior can be estimated by comparing the answers in the false-beliefs condition with the ones in the two other conditions. Hereby, the answers will be analyzed (i) with regard to their audience design to a low level of understanding and (ii) with regard to whether issues that need to be explained by the expert and that are related to the inserted beliefs are addressed more frequently in the false-beliefs condition.

As has been delineated in section 2.2, studies from tutoring research have described that tutors often do not adapt their tutorial behavior to their tutees. Thus, the tutors frequently do not correct errors that are uttered by the lay tutee. Also, they do not tailor their tutoring moves to their individual lay interlocutors, but rather tutor in a standardized way. As Putnam (1987) proposes, tutors follow a so-called curriculum script when tutoring; this curriculum script contains an internal representation of an ordered set of tutorial moves. While the tutors and tutees in Putnam's (1987) study were engaged in tutorial dialogues on the "close-world domain" of addition operations, also for tutoring sessions that deal with more "open" topics, little adaptation on part of the tutors has been reported. Thus, based on analyses of tutoring protocols on the human circulatory system, Chi et al. (2004) state that the tutors' "explanations must have been delivered very much in the spirit of knowledge displays and knowledge telling" (p. 385).

In section 2.2, a structural parallel between tutorial dialogue in formal learning settings and expert-layperson communication in informal learning settings has been proposed. Due to this analogy, it could be reasoned that experts in the online health counseling setting might also show only poor adaptation to their individual lay email interlocutor. While these experts are unlikely to dispose of a curriculum script, since they are not trained pedagogically and the counseling setting is not a formal learning setting, they are even more likely to present their knowledge to the layperson in a knowledge-telling kind of way, without a proper adaptation of their explanations to the individual lay interlocutor. Based on the foregoing considerations, the following hypothesis can be formulated:

- *Knowledge telling hypothesis:*
  The display of beliefs does not impact on the experts' email answers. With regard to the three versions of the email query, this will result in *no differences between experts' answers in the three conditions with regard to the different measures of adaptation.*

While this hypothesis seems quite compelling, the non-addressing of errors and the knowledge telling in formal face-to-face tutoring is, however, frequently explained with a *failure of detection* of erroneous lay knowledge (see sections 2.2 and 5.1). In the context of tutoring in email health counseling, however, erroneous knowledge seems to be detected and represented more easily, as the research results of study II have shown: When the layperson had uttered false beliefs in her email, the experts were more likely to rate her knowledge on issues that were related to these beliefs as lower than when correct or no beliefs were contained in the query. Thus, the false beliefs were processed quite specifically in the written, net-based counseling scenario.

Based on these results of study II, one could also argue that possibly, the characteristics of the setting - for instance the fact that the lay email is visible and reviewable while the expert composes her answer - do not only facilitate the mental representation of the layperson's knowledge but also facilitate an adaptation to the individual lay email author. Hereby, two levels of adaptation can be distinguished; these differ in how extensive the adaptation is.

On the one hand, the adaptation could be restricted to a "repair" of the displayed false beliefs in the FB version of the lay query: Thus, in the false beliefs condition, the layperson's erroneous beliefs that are inserted into the query could function as a sort of warning signal, that is, since the expert has processed these beliefs, she might also address them (other than in tutorial dialogue, where spontaneously uttered false tutee's beliefs are often not addressed, but supposedly also often not detected, either). Apart

from this error repair, the experts might still stick to a knowledge telling kind of answering behavior, as described above for the tutors in formal tutorial settings; this would result in no further adaptations of the answers.

The outlined considerations can be translated into the following hypothesis:

- *False beliefs correction - hypothesis:*
  The manipulation of the display of beliefs in study III will impact on medical experts' answers to their lay interlocutor in such a way that they are more likely to address issues related to these beliefs in the false beliefs condition than in the other two conditions. Since in study II, the layperson in the no beliefs condition was rated less knowledgeable than in the correct beliefs condition, the issues will also be addressed more when the layperson had not uttered any beliefs related to these issues than when she had uttered correct beliefs. Beyond that, there will be no further adaptations on part of the experts to their lay addressee.

On the other hand, however, the characteristics of the email counseling setting could also have a more extensive effect on the experts' answering behavior. Hereby, it needs to be taken into account that the false beliefs that are inserted into the queries are quite fundamental to an understanding of the issues about which the layperson had asked. Now taking into account that (a) these beliefs are visible while the expert is composing her answer, and (b) an adaptation is vitally important (as described above), and (c) the expert has – other than in face-to-face dialogue - time to compose (and revise) her answer, the displayed false beliefs might also trigger further supportive actions on part of the experts in that they would produce answers that might be more apt for a low level of lay understanding. This would result in adaptations that go further than mere error repair. As a consequence, the following, third hypothesis can be formulated:

- *Comprehensive adaptation - hypothesis:*
  The medical experts will address issues that are related to the manipulated beliefs more frequently when answering queries that contain false beliefs, and least frequently when the layperson has uttered correct beliefs (same assumption than in the error correction hypothesis).
  In addition, the display of beliefs will impact on the experts' answers in such a way that the answers will show adaptations to a low understanding in the false beliefs condition. Thus, indicators of audience design to a low level of understanding will show higher values in this than in the other two conditions, between which no differences are expected.

The three outlined, concurring hypotheses are investigated in Study III, described in this chapter.

6.2 Method

6.2.1 Participants

The sample consisted of 88 medical students from a German university. Participants were recruited in lectures and on the university's Medical Campus and were paid € 6 for their contribution to the study. In order to assess their knowledge in the domain of diabetes, the experts completed the same 15-item diabetes knowledge questionnaire that was administered in study II (see section 6.2.2). Two participants answered less than 10 items correctly and were therefore excluded from the analyses. Because proficiency in German was essential for participation, the data of another participant had to be excluded who did not speak German for at least 15 years. Due to technical problems, the data sets of two participants were lost.

The remaining 83 medical students were in their fifth year of university medical training (M = 5.38, SD = 2.19 semester after First State Examination); the mean age was M = 26.10 years (SD = 3.35). Sixty-four percent of the sample was female; the first language of 65 students was German, while the others spoke German since childhood respectively at least for 15 years. They answered an average of 12.38 out of the 15 diabetes items correctly (*SD* = 1.14). In terms of counseling experience, 86% said that they at least sometimes explained medical contents to medical laypersons.

The participants were also asked to answer a short questionnaire on their computer use, their Internet use and their text-processing software use (for more details, see section 5.2.2). Herein, the participants stated that they used computers with a mean of 13.89 hours a week (*SD* = 15.56). This included an average of 2.85 hours of using text-processing software (*SD* = 3.59) per week and 8.44 hours (*SD* = 7.76) on the Internet. All experts stated that they used the Internet, with 85% (N=71) having Internet access at home. Seventy-six experts stated that they used email. The percentage of family and friends that use the Internet was estimated with a mean of 82.83 % (*SD* = 19.17).

Preliminary analyses revealed no significant differences between the three experimental conditions with regard to domain knowledge (as manifested in the diabetes knowledge test), years of medical training, age, computer use, Internet use, text-processing software use, counseling experience and percentage of family and friends that use the Internet (all $F(2,80) < 1.60$, *ns.*). Also, there were no differences with regard to gender, the Internet services the participant used and if they had Internet access at home (all $\chi^2(2) < 2.78$, *ns.*). Therefore, these variables were not considered further.

6.2.2 Materials

Diabetes questionnaire

The same diabetes questionnaire as in study II was administered to the participants (for a detailed description of the questionnaire, see section 5.2.2.). With this questionnaire, it was ensured that the participants' knowledge level was sufficiently high with regard to the thematic field of diabetes. Thus, the data of those participants that had answered less then ten items correctly were excluded from the study. The questionnaire items can be viewed in their English translation in table 5-2 (p. 96). For the original German questionnaire, see appendix B1.

Patient email query

The same patient query versions than in study II were used. In the query, a medical layperson describes how she has recently been confronted by her physician with the diagnosis 'Type II diabetes' and names some issues that she still has not understood, asking the online doctor for explanations. Hereby, the layperson uttered either various false beliefs (version FB) or various correct beliefs (condition CB) related to central concepts in the query, or did not utter these beliefs (condition NB). For a more detailed description of the query, see section 5.2.2.

Computer, Internet, & text processing software use questionnaire

The research aim of the current study III was to investigate the impact of a display of lay medical beliefs on medical experts' communicative behavior in the conversational setting of email health counseling. This display is not the only possible influence on the communicative behavior, however. On the contrary, experts are also influenced in how they communicate via email by their experiences with the medium. Thus, it was important to ensure that the experimental groups did not differ with regard to their experiences concerning computer use, use of the Internet and of text processing software. In order to measure these experiences, a short questionnaire was constructed[42]. The questionnaire is displayed in table 6-1. For the original German version, see appendix C1.

[42] The questionnaire consists of a sample of items that have also been used in other research studies from the research project on recipient orientation in net-based health counseling (cf. chapter 1), e.g., Bromme, Jucks, & Wagner, 2005.

Table 6-1. Computer, Internet, & text processing software use questionnaire (English translation)

How frequently do you use a computer?					____ hours per week	
How frequently do you use the Internet?					____ hours per week	
How frequently do you work with text processing software?					____ hours per week	
Do you have internet access at home?					□ YES	□ NO
Which Internet services do you use?						
World Wide Web (WWW) □	Email □	Chat □	Telnet □	FTP □	Others □	None □
How many of your friends and acquaintances use the Internet (including email) on a regular basis?					____ %	

Holistic knowledge assessment item

After answering the email query, the experts' were asked how much they thought the layperson knew about the topic of diabetes when composing their query (for the item format, see figure 6-1).

In your opinion, how much did the patient know about diabetes when composing the query?						
Very little	Little	Rather little	Medium	Rather much	Much	Very much
O	O	O	O	O	O	O

Figure 6-1. Holistic assessment item format in Study III (English translation)

This overall item was administered to the participants in order to compare exploratorily whether a holistic assessment of lay knowledge after answering a query would produce different results than doing the assessment after only reading a query. Studies II and III from this dissertation had been conducted as separate studies on purpose, in order to avoid an influence of the answering activity on the assessment. For future research, however, it is important to gain some knowledge on whether such a confounding is likely or not.

6.2.3 Design and Procedure

Using a 1x3 design with the *display of beliefs* as independent factor, participants were assigned randomly to the experimental conditions (between-subject design; see table 6-2).

Table 6-2. Experimental conditions and number of participants of Study III

	N
False beliefs displayed (FB)	28
Correct beliefs displayed (CB)	29
No beliefs displayed (NB)	26

The experiment was conducted online using an Internet browser. The experimental environment was programmed in HTML, data were stored with the database program FileMaker. The experimental environment consisted of eight web pages that could only be viewed in a predetermined sequence (for a screenshot of the experimental environment, see figure 6-2, which depicts the query page of the environment).

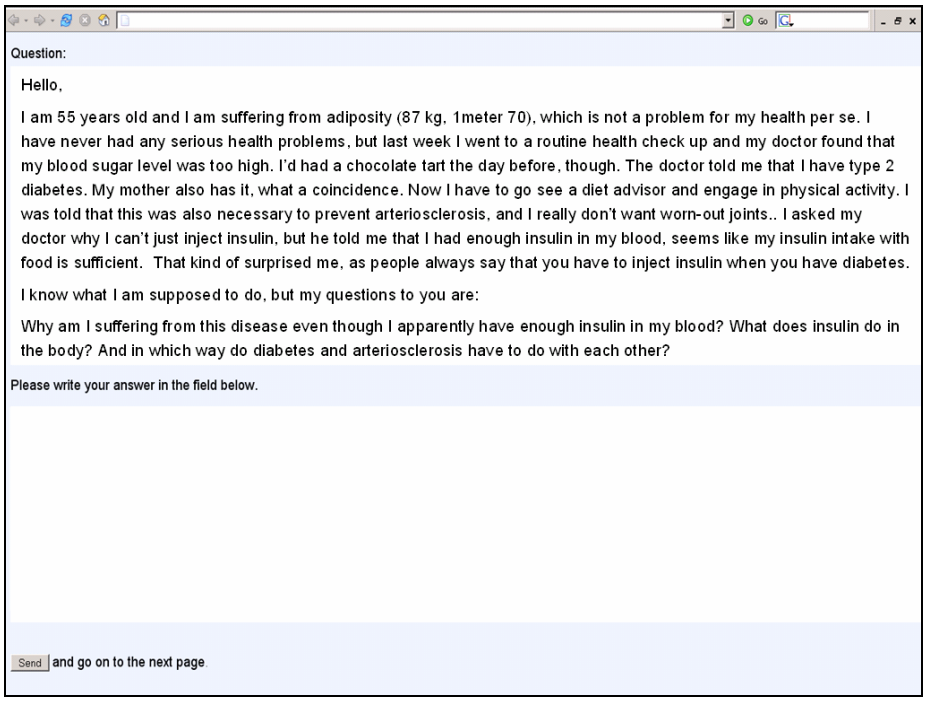

Figure 6-2. Screenshot (FB version of patient query; English translation)

After a brief introduction to the task, participants answered the computer, Internet, & text processing software use questionnaire before they proceeded to answering the patient's query. On the query web page, the participants – as figure 6-2 shows – typed their answers into a text field that was located below the query text. Once they had completed and sent off their answer to the query, they were no longer able to review or edit it. After answering the query, the experts answered the holistic knowledge assessment item; the experiment ended with the domain-specific knowledge test and some demographic questions. The medical experts participated in computer rooms of the Medical Campus, the average participation time was 35 min. For a schematic overview of the experimental procedure, see figure 6-3.

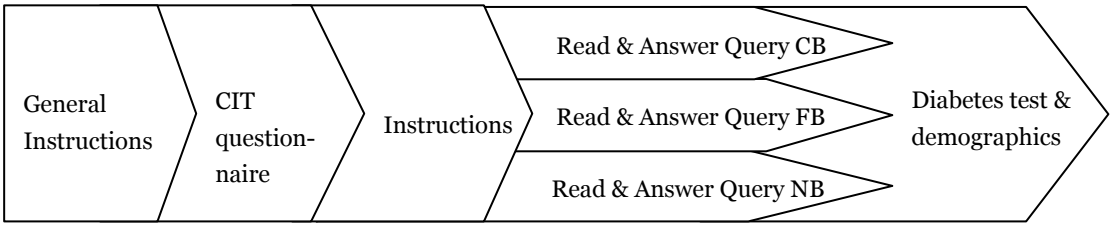

Figure 6-3. Experimental procedure of Study III.

6.2.4 Quantitative data analysis

Intercoder agreement

A group of trained coders analyzed the text corpus. Intercoder agreement was assessed by providing two coders with the same randomly selected subset of the text corpus (10 answers) for analyses. The similarity of their codings on this subset was determined by assessing reliability. For quasi-interval data, the intra-class coefficient ($ICC_{2\text{-way, unjust}}$) is reported (cf., Shrout & Fleiss, 1979; Wirtz, 2006). For categorical data, kappa (κ) statistics reported. Hereby, it needs to be considered that κ is drastically lowered by an imbalance in the cross table's marginal totals. Since for some of the dependent variables, cross tables of intercoder concordance have quite asymmetrically distributed marginal totals, the informational value provided by the κ coefficients was enriched with reports of the percentage of agreement of the respective variables. Reliability statistics are reported below, in line with the description of the respective dependent variable.

Dependent measures

The experts' answers were analyzed with regard to content-related as well as linguistic variables, to-be-described next. These variables were analyzed in order to measure the experts' adaptation to the lay email author with regard to the addressing of false beliefs and with regard to the adaptation of the answer to a low level of understanding.

As for their contents, the answer emails of the experts were submitted to a content analysis: What did the experts explain in order to answer the layperson's questions posed at the end of the query (i.e., in the *questions*-part of the query, see figure 5-1, p. 90)? In order to handle the explanation task successfully, that is, to answer the questions at the end of the query, the experts had to explain certain issues and processes related to type 2 diabetes. With the help of a medical expert and medical textbooks (e.g., Böhm, Palitzsch, Rosak, & Spinas, 2001; Hien & Böhm, 2001; Scherbaum, 2002; Greten, 2002), fifteen different aspects which are essential for a comprehensive explanation of these processes were identified. Hereby, five of these issues are related to the beliefs that are inserted into the queries in the FB and CB conditions. The other ten aspects do not relate to these beliefs. The two types of aspects were analyzed separately, as will be depicted in the following.

Elaboration of issues related to manipulation. Thus, the first content-related analysis was dedicated specifically to those parts of the explanations that were related to the experimental manipulation of the study. The five issues about which the layperson had uttered beliefs in the FB and CB versions of the query were issues which the expert needed to elaborate on in order to answer the layperson's questions properly. For instance, the layperson had asked why she was suffering from diabetes. A comprehensive expert answer would also address the fact that the layperson had a higher risk of developing diabetes due to the diabetes of her mother. With regard to the role of heredity in diabetes, a belief had been uttered by the layperson in the FB and CB conditions (stating that her mother's diabetes had probably made her more vulnerable for developing the disease vs. rating her mother's diabetes as a coincidence).

Thus, by analyzing whether the five issues that were related to the manipulation were elaborated on in the experts' answers, it was possible to look at how the experts deal with the laypersons false beliefs, or in other words, whether the issues are elaborated on more frequently (thus addressing the false beliefs) in the FB condition than in the other conditions.

For a listing of all five issues related to the manipulation, see table 6-3. For each of the five issues, the experts were given a point when they had elaborated on the issue.

Raters agreed on the coding of the manipulation-related issues with an unweighted Cohen's kappa of .88 (with a percentage agreement of 96%).

Table 6-3. Elaboration of issues related to manipulation (English translation)

In the email query, the layperson…	**Issues related to manipulation**
.. does (version CB) vs. does not (version FB) recognize adiposity as a health risk.	*Adiposity as health risk* When elaborating on this aspect, the expert explains that adiposity is a predisposing factor for a variety of illnesses.
… does not (CB) vs. does (FB) think that the elevated blood sugar level could have been caused by a chocolate tart the day before.	*Relation of nutrition and blood sugar level* Hereby, the expert elaborates on how food uptake and short-term as well as long-term elevations of blood sugar levels are related to each other.
… does (CB) vs. does not (FB) recognize the diabetes of her mother as a predisposing factor for herself to develop diabetes.	*Role of hereditary factors in diabetes* The expert elaborates on the fact that diabetes type II has a genetic component.
… associates the term 'arteriosclerosis' with hardening of the arteries (CB) vs. with worn-out joints (FB).	*Characteristics of arteriosclerosis* When elaborating on this aspect, the expert explains the bodily characteristics of arteriosclerosis.
… thinks that insulin is produced in the body (CB) vs. taken up via nutrition (FB).	*Insulin production* Hereby, the experts elaborates on the fact that the body produces insulin.

Extensiveness of expert explanation. In the second content-related analysis, the experts' answers were analyzed with regard to the ten different aspects which (in addition to the five issues related to the manipulation) are essential for a comprehensive explanation. For example, answers could address the fact that glucose absorption into the cells is inhibited in adult onset diabetes, or could point out the role of adiposity as a predisposing factor for diabetes. In table 6-4, all ten issues are outlined.

For these ten issues, the number of issues that the experts elaborated on in the answers was assessed, thus obtaining a measure of the extensiveness of the experts' answers. For each of the ten issues, the experts were given a point when they had elaborated on the issue. Raters agreed on the coding of the manipulation-related issues with an unweighted Cohen's kappa of .93 (with a percentage agreement of 96.88%).

Table 6-4. Aspects of comprehensive explanation

Insulin production intact The expert explains that most of the time, the production of insulin is still working in type II diabetes.
Type I vs. type II diabetes A differentiation is made between the different types of diabetes, mentioning that there is also diabetes type I that has different characteristics from type II diabetes.
Role of age The expert explains that diabetes type II is developed mostly by elderly people.
Process of receptor desensitization The expert explains how a progressing receptor desensitization takes place in type II diabetes.
Insulin resistence of cells and tissues In the answer, it is explained that ultimately, there is an insulin resistance of cells and receptors in type II diabetes.
Function of insulin The expert explains the functioning of insulin in the body.
Reduced effectiveness of insulin The expert explains that the functioning of insulin is impeded in diabetes type II, so that the insulin's effectiveness is reduced.
Disturbed glucose uptake into cells The expert explains that the glucose metabolism is obstructed in type II diabetes.
Arteriosclerosis as one of the sequelae of diabetes Arteriosclerosis is named as one of the sequelae of diabetes.
Other consequences of diabetes The expert elaborates on other consequences of diabetes.

In addition to the described content-related analyses, further characteristics of the experts' answers were assessed in order to determine the degree of adaptation of the email answer to a lay level of understanding. These characteristics were based on variables that have been used in other psycholinguistic studies on audience design; in addition, variables from instructional psychology were included (for a similar procedure, see e.g. Bromme, Jucks, & Wagner, 2005; Jucks, Bromme, & Runde, 2003; Runde, 2005). It can be assumed that these characteristics are relevant to recipients' text understanding.

Number of words. The length of the provided answers was assessed by counting the total number of words used in the answers with the help of a text processing software.

Use of difficult medical technical language (MTL) terms. In German, many medical concepts can be named in different ways: In a technical term with a Greek or Latin origin or in a non-technical German translation term, which is commonly used by laypeople. This is significant in the current research context, because the use of non-technical (or technical) language signals whether a lay perspective was used (or not). Use of MTL terms was assessed by counting all words which are listed in the German reference book for medical terms, and which are not listed in the general German dictionary. This approach excludes non-technical language concepts (like *stomach*). Each word was counted only once even if it occurred more often within one answer. The interrater reliability for identifying MTL terms was high with an intraclass coefficient of .86, $p < .001$.

Use of examples. The number of times that experts provided one or more examples to illustrate their explanations was counted, such as naming neuropathy as an example of a complication of diabetes. The raters agreed in counting how many times examples were given with an intraclass coefficient of 1.00.

6.2.5 Qualitative data analysis

The answers from the FB condition were submitted to an additional qualitative analysis. This analysis transcends the formal addressed-yes-or-no coding in that it takes a closer look at *how* false beliefs were addressed.

6.3 Results

6.3.1 Results of quantitative analysis

In the following, all significances are reported two-tailed unless specified otherwise; hereby, ($p < .05$) is defined as significant and ($p < .10$) as a trend. With the aim of being able to draw (however tentative) conclusions from finding no statistically significant differences between the experimental conditions, an alpha-level of >.25 was taken as a basis for interpretation. This procedure indirectly minimizes the beta-error by enlarging the alpha-error (cf., Bortz, 1993).

With Cohen (1988), the effect sizes will be interpreted as follows: $\eta_p^2 < .06$ as small effect, η_p^2 between .06 and .13 as medium effect and >.13 as large effect; d<.5 as small effect, d between .5 and .8 as medium effect and >.8 as large effect.

Descriptive statistics of the dependent variables are reported in table 6-5.

Table 6-5. Means (and Standard Deviations) of the dependent variables

	Experimental conditions		
Dependent measures	CB query version	FB query version	NB query version
Elaboration of issues related to beliefs	1.10 (1.01)	1.82 (1.16)	1.00 (.80)
Extensiveness of expert explanation	3.66 (1.63)	3.96 (1.75)	4.00 (1.33)
Number of words	157.48 (94.48)	167.25 (96.17)	143.00 (75.46)
MTL terms	7.00 (3.64)	7.50 (4.70)	7.50 (4.43)
Examples	.28 (.53)	.36 (.62)	.50 (.81)

Elaboration of issues related to manipulation

A sum score was calculated for the number of manipulation-related issues that were addressed in each answer. A univariate ANOVA revealed a significant main effect for *display of beliefs*: $F(2, 80) = 5.48$, $p < .01$, $\eta_p^2 = .12$ (medium effect). Post-hoc comparisons of means[43] indicated that tutors explained significantly more of these issues in the FB condition than in the CB condition ($t(55) = 2.50$, $p = .02$, $d = .66$; medium effect) and in the NB condition ($t(52) = 3.01$, $p = .004$, $d = .82$; large effect), while the latter conditions did not differ from each other, $t(53) = .42$, $p > .25$. Thus, the experts were more likely to elaborate on the contents for which beliefs were formulated when they answered a query that contained false beliefs on these issues than when it contained correct or no related beliefs. Nonetheless, it is important to note that they only addressed 1.82 out of the five aspects on average (36%) in the FB condition. In table 6-6, the number of answers in which issues were elaborated are displayed separately for the

[43] Since the t tests can be considered as *protected* t tests, there was no correction for inflation of Type I error rate.

three experimental conditions. As the table demonstrates, all five displayed false beliefs are addressed by a considerable number of experts (at least by 14 % of the experts).

Table 6-6. Frequencies of elaborations on issues related to beliefs

	Experimental conditions			
Issues related to beliefs	CB (n=29)	FB (n=28)	NB (n=26)	Σ
Adiposity as health risk	6	17	8	31
Relation of nutrition and blood sugar level	5	5	2	12
Role of hereditary factors in diabetes	4	5	2	11
Characteristics of arteriosclerosis	2	8	5	15
Insulin production	15	16	9	40

Extensiveness of expert explanation

A sum score was calculated for the number of arguments that experts used to answer the layperson's questions (out of the list of ten arguments, see 6.2.4). A univariate analysis did not reveal differences with regard to how many of these issues were addressed in the three conditions, $F(2,80) = .40$, *ns.*, $p > .25$.

The results of the content-related analyses are depicted graphically in figure 6-4.

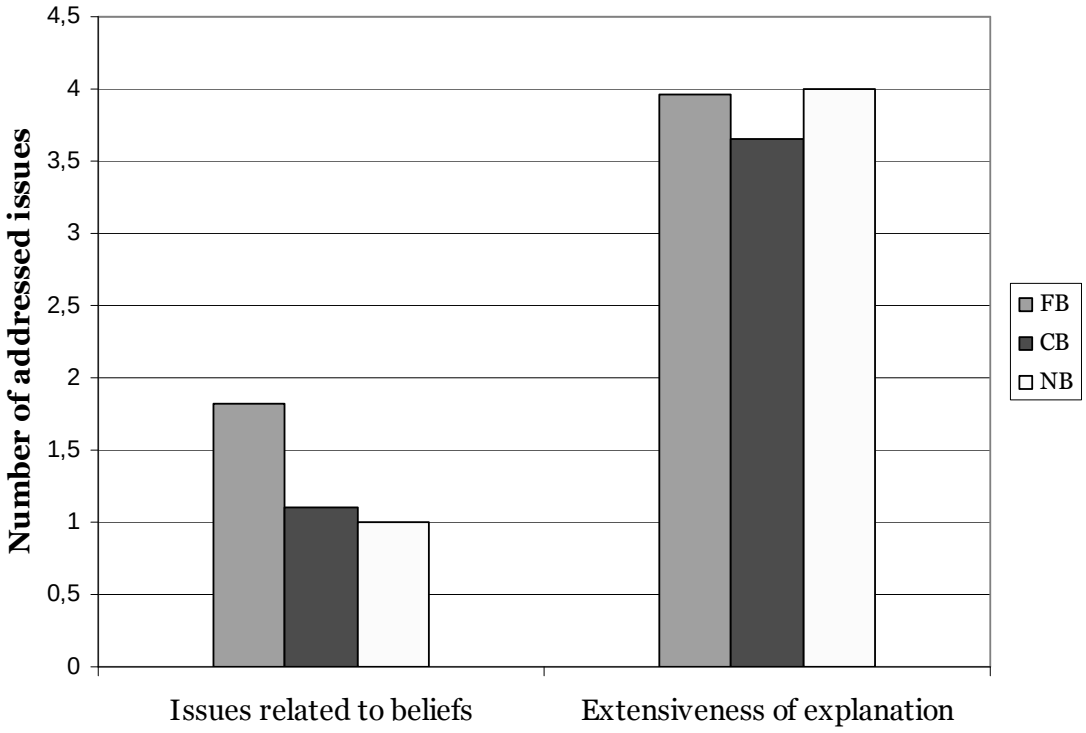

Figure 6-4. Content-related analyses.

Number of words

The lengths of experts' answers varied considerably, ranging from a minimum of 37 to a maximum of 409 words, $M = 156.24$, $SD = 89.03$. In order to illustrate the disparity of the answer within the sample, the shortest and the longest answer are displayed in figure 6-5. For the German original answers, see appendix C2.

A univariate ANOVA did not reveal any significant differences in length between the conditions, $F(2, 80) = .50$, *ns*, $p > .25$.

Answer expert no. 75:
In order for the cells to be able to take up glucose, insulin is needed. In addition, the cells have receptors; these are occupied by fat in adipose individuals. As a consequence, glucose cannot be taken up by the cells with the help of insulin. In diabetes, substances settle in the blood vessels, resulting in a higher risk of arteriosclerosis, heart infarction or stroke.

Answer expert no. 5:
Hello,
your physician is right with what he has explained to you! You do have enough insulin. However, solely insulin is not sufficient in order to transport sugar which is taken up with each meal, from the blood to the cells in the human body. The sugar needs to enter the cells, because it is vitally important for each cell of the body – thus, for us. You take up sugar (as well as other nutrients, of course, but let's leave that out for now), it enters the bloodstream and also gets to the pancreas. At this point (when the sugar has reached the pancreas), the pancreas starts to release insulin, also into the bloodstream. Our goal is: Sugar into the cell! But how can it enter the cell? This is not so simple, but it works with insulin, of which you have a sufficient amount. The cells are equipped with certain receptors, to which the insulin binds. In this way, the cell is provided with a signal to provide transport molecules that can take up the sugar into the cell. This can be illustrated with the following comparison:
Imagine that the insulin was something like a messenger who knocks on a door (our receptor) and tells the cell to open another, specific door (our transport molecule) for the sugar. Only then it can enter the cells. Now, in your case, the insulin is not the problem, but the number of "doors" which the insulin approaches in order to tell the cell: Please open door for sugar! You dispose of the same among of doors as someone without diabetes type 2, but you need to sustain a much bigger body mass and that with the same number of "doors" for insulin. As a consequence, the cells take up much less sugar than those of a person that has normal weight and that is healthy. If you can reduce your weight, the same number of "doors" need to sustain less mass, and the sugar can be taken up once more into the cells adequately. What does this have to do with arteriosclerosis?
Because the sugar is in your blood and the whole amount of sugar that you eat is not taken up into the cell anymore, a part of it remains in the blood. The more sugar is in the bloodstream, the higher the probability that small sugar micro crystals form in the bloodstream and stick to the walls of the blood vessels. This process can, at some point, lead to a slow obstruction of the blood vessel.

Figure 6-5. Shortest (expert no. 75) and longest (expert no. 5) expert answer (English translation)

Use of MTL terms

Technical medical terms were identified with the help of a medical and a general German reference book. The expert participants used a minimum of 1 and a maximum of 22 technical terms in their answers. With regard to the technicality of language in the tutors' answers, there was no significant effect for display of beliefs, $F(2, 80) = .129$, ns, $p > .25$.

Use of examples
The experts provided a minimum of zero and a maximum of three examples in their answers. They did, however, not use more examples in any of the conditions than in any other, $F(2, 80)=0.810$, *ns,* $p > .25$.

The results of the analyses, taken together, provide partial support for the false beliefs correction hypothesis: While the experts addressed issues that related to the manipulated beliefs more frequently when answering the false-beliefs query, there were no further adaptations to a low level of understanding. It has to be taken into account, however, that contrary to the assumptions, the answers to queries that contained correct or no beliefs did not differ from each other with regard to the manipulation-related issues, but just contained less elaboration on these issues than the answers to the false beliefs. The two other concurring hypothesis (i.e., the *comprehensive adaptation hypothesis* and the *knowledge telling hypothesis*, see chapter 6.1), need to be rejected.

Holistic knowledge assessment item
With regard to the holistic knowledge assessment item, there was a significant difference between the conditions, $F(2,80) = 3.39$, $p < .05$. Post-hoc comparisons of means were performed with t-tests and showed that the rating was significantly higher in the CB condition ($M = 3.28$, $SD = 1.16$) than in the NB ($M = 2.69$, $SD = 1.29$; $t(53) = 1.77$, $p<.10$, $d = .48$; small effect) and in the FB condition ($M = 2.54$, $SD = .92$; $t(55) = 2.66$, $p = .10$, $d = .71$; medium effect). The assessment in the NB and in the FB condition did not differ significantly from each other, $t(52) = .52$, $p > .25$.

6.3.2 Results of qualitative analysis

In the FB version of the query, the layperson utters several false beliefs throughout her email text. The experts that answer this version of the email (FB condition of the experimental design) have to deal with these uttered false beliefs. In the quantitative analyses, instances were counted in which experts addressed issues that were related to the false beliefs, thus providing the layperson with proper knowledge and correcting the beliefs. While conducting the quantitative analyses, it became evident that there were differences with regard to the *directness* with which the experts addressed the false beliefs. As a consequence, the answers from the FB condition were submitted to an additional qualitative analysis. Hereby, through a close reading of those parts of the answers that elaborated on beliefs-related issues, several manners in which the experts addressed the beliefs were identified, to-be-described in the following.

References to lay belief

Some of the experts made a reference to the false belief of the layperson when elaborating on a belief-related issue. These references were made in different ways:

- *Explicit reference to query.*
  One way in which the experts referred to a false lay belief when correcting it was by explicit reference to the query. Hereby, the attention of the layperson is drawn to their own contribution and possibly to the false belief that it contains. Expert no. 17, for instance, explains:

  > *[…] In your query, you mention arteriosclerosis, which you are supposed to prevent through weight reduction. Arteriosclerosis does not have to do with the joints (the wearout of joints is called arthrosis). Arteriosclerosis is an illness that involves the arteries that lead away from the heart. […]*

  In this excerpt, the expert points towards the part of the lay query in which the layperson had used the term 'arteriosclerosis' (giving it a wrong definition). Thus, without directly mentioning it, the answer hints to the fact that the layperson had been wrong in her definition of arteriosclerosis.

- *Entrainment of the layperson's phrase formulation.*
  In the query, the layperson's false beliefs are uttered using certain phrases. For instance, with regard to the fact that her insulin level seemed sufficiently high, the layperson commented: "seems like my insulin intake with food is sufficient". When correcting this belief, some experts made a reference to the query by entraining the belief phrase. For instance, expert no. 23 explained in her answer:

  > *[…] Insulin is a hormone, so there is no insulin intake with food; your body produces this hormone. […]*

  Hereby, the erroneous phrase *insulin intake with food* is entrained from the query. This is another way of hinting to a lay error in the query without directly mentioning it.

- *Use of markers.*
  Sometimes, when elaborating on an issue that relates to a false belief, the experts used certain adverbs or phrases which implicate that what they are going to say next is in some way contradictory to something that has been said in earlier conversation, so in this case in the lay query (as the earlier conversation does only consist of the layperson's contribution). For instance, expert no. 14 writes:

> *[…] By the way, insulin is a hormone which accelerates the glucose metabolism. It is produced in the pancreas. […]*

The use of the phrase *by the way* can be (but does not have to be, cf. below) interpreted as a reference to the false belief of the layperson that insulin was taken in with food.

By phrasing their explanations in one of the just-described ways, the medical experts just hinted to the lay query when elaborating on beliefs-related issues. From all instances in which false beliefs were addressed, these references were made in 29.4% of the cases. Hereby, a further differentiation can be made: In 19.6% of the cases, the experts negated the erroneous knowledge and provided correct knowledge. In 9.8%, they just did one or the other.

Mere knowledge provision

The qualitative analysis revealed that in most instances, the false beliefs were addressed only in an indirect fashion, namely by providing the correct knowledge (70.6% of all instances in which beliefs were addressed). Thus, for instance, expert no. 68 explains to the lay query author:

> *[…] Thus, more sugar remains in the blood. It is built into the walls of the arteries, and over the years, a constriction of the arteries emerges. They get less elastic. This is called arteriosclerosis […]*

Thus, this answer provides an explication of the term arteriosclerosis without any reference to the layperson's confusion of arteriosclerosis and arthrosis in her email.

Taking together the examination of the instances in which tutors addressed issues about which the tutees had voiced false beliefs, the qualitative analysis can be summed up as follows: Most of the time, the false beliefs are addressed in a very indirect manner, that is, the experts only provide the correct knowledge, without further reference to the lay email text. A more direct way was chosen with considerably less frequency, hereby the experts' answers contained references to the email query and to the false beliefs uttered in that query.

It needs to be pointed out that only one of the experts, and only once, provided the layperson with (metacognitive) *feedback on the fact that she had uttered a false belief*: With regard to the layperson's confusion of arteriosclerosis and arthrosis, expert no. 6 wrote:

> *[…] Arteriosclerosis is an illness of the arteries, not of the joints. What you probably meant was arthrosis. […]*

Hereby, from the phrase *what you probably meant was*, the layperson is provided with the information that he had been wrong with something in her email.

6.4 Discussion

In study II of this dissertation, medical experts assessed the knowledge of a fictitious lay email interlocutor in a questionnaire. The results showed that when false beliefs were displayed in the layperson's query, the experts rated the layperson's knowledge on issues related to these beliefs lower than when no or correct beliefs were displayed (cf. chapter 5). Against the background of the structural parallels between expert-layperson communication in informal counseling settings and tutor-tutee-communication in more formal learning settings, the results were compared to studies from tutoring research in which tutors' mental representations of uttered tutee errors had been investigated: Hereby, experts in the email counseling setting seemed to detect and represent uttered lay errors more easily than tutors in formal face-to-face tutorial dialogues. These results were explained with the characteristics of the conversational setting of email health counseling, which tend to make communication less 'automatic' and thus foster experts' inferences on the layperson's knowledge (cf. chapter 5.4).

Tutors in face-to-face tutoring however do not only have problems in representing their tutee's knowledge, they also do not adapt their explanations to their individual tutee interlocutors. Thus, studies in tutoring research have described that tutors frequently do not correct a tutee's errors, and tutor rather in a standardized way, without adapting very much to their individual tutee collocutor (see introduction of this chapter).

Consequently, the question arises of whether experts in email health counseling do not only have less difficulties in representing uttered erroneous knowledge than in face-to-face tutoring (as demonstrated in study II), but do also adapt more to their individual lay interlocutors.

In order to address this question, the same paradigm than in study II was used in study III: Medical experts were asked to answer one version of a lay email query. Following the same paradigm than study II, the email versions were identical other than the fact that the first version contained some false beliefs related to central concepts of the query, the second one contained a number of correct beliefs, while in the third version, no such beliefs were uttered by the layperson. Through this experimental manipu-

lation, the nature of a lay kind of conceptual understanding (i.e., the fact that laypersons often hold false beliefs) was apparent to a different degree in the query versions (or, in other words, only the false-belief version contained a hint to it). Thus, the answers produced by the experts provide evidence of how the experts adapt to such knowledge display in the context of online health counseling. Hereby, the notion of adaptation was differentiated. On the one hand, the experts' answers were analyzed for an addressing of the knowledge deficits in the false-beliefs condition. On the other hand, the answers were analyzed for further adaptations to a conversational partner with a low level of understanding.

The analyses of the experts' answers in the three conditions provided the following results: A content analysis in which the experts' answers were analyzed for an elaboration of contents related to the manipulated beliefs showed that the experts were more likely to elaborate on these issues when answering a query in which false beliefs had been uttered. However, they did not cover all beliefs, but only two out of five false beliefs were addressed on average.

With regard to features that condition whether an explanation is likely to be understood by someone with a low, lay knowledge background, the analyses did not provide any evidence of further adaptations to the display of beliefs. Thus, on a content level, the experts did not provide more extensive explanations in the false-beliefs condition. Also, the answers did not differ in length, in the use of medical technical terminology, nor in the use of examples.

Even though the results need to be interpreted with a certain caution, because an inferential statistical test cannot *directly* affirm a null hypothesis, they make a strong point for assuming that apart from locally addressing (and thus 'repairing') the beliefs in the false-beliefs condition, the experts did not adapt their answers any further to a display of a low level of understanding.

Thus, in light of the results, the experts' answering behavior can be described in terms of a local error correction. Hereby, the false beliefs in the query function as a sort of "red traffic light": If the beliefs are false, more elaboration is dedicated to them; the experts 'repair' them. More precisely, however, they do only address 36 percent of them. For a proper answer to the query, nonetheless, they would have to address all of the beliefs. By way of example: In the false-beliefs version of the query, it is quite obvious that the layperson confuses the concepts of arthrosis and arteriosclerosis. At the end of the query, then, the layperson asks for an explanation of the relations between diabetes and arteriosclerosis. If the expert now explains these relations, she first needs to clarify the meaning of the word arteriosclerosis to the layperson, because if the latter continues to think about arteriosclerosis as worn-out joints, she cannot understand the explanations of the expert or else will understand them in the wrong way.

In a supplementary qualitative analysis, the answers that were given to the false-beliefs query were scrutinized for the ways in which false beliefs were addressed by the experts. The results of this analysis showed that the experts addressed the beliefs mostly in a rather indirect fashion. Thus, only in one third of the times that a belief was addressed, did the experts provide a reference to the false belief in the query. These references were given by entrainment of the layperson's phrase formulation, through the use of certain marker words or through explicit mentioning of the query. In the rest of the cases, however, the addressing was limited to that the experts provided the correct knowledge, without any reference to the related false belief. Only one expert made a remark that informed the layperson on a metacognitive level about the fact that she had held a false belief. As tutoring research has shown, however, it is very important that the layperson is informed about the fact that she had held a false belief, because without this explicit information, laypersons likely integrate the experts' explanations into their knowledge without noticing the contradictions between their own knowledge and the new knowledge. However, to 'translate' the more indirect references that the experts make to the query (and to the false beliefs contained in it) into this metacognitive information, is supposedly a too demanding task for the laypersons. For instance, when the experts entrain the layperson's phrase formulation when negating the false belief, the layperson still has to recognize the formulation as her own false belief that she had uttered. Above all in the context of written health counseling, where there is only one chance to correct a false belief, a more direct way of addressing is absolutely necessary.

In sum, considering the outcomes of both studies II and III, it needs to be pointed out that *even though* in net-based health counseling, experts process uttered errors more than in face-to-face tutorial dialogue, they – just like in face-to-face tutoring - frequently do not address these errors and if they address them, than in a rather indirect way. Apart from that, they do not adapt their answers linguistically or with regard to the contents to the individual tutee. Such an experts' conversational behavior is detrimental to the layperson's understanding, as (i) the layperson needs to be made aware of the fact that she had held a false belief, as well as being provided with the correct knowledge and as (ii) the expert should react to the display of false beliefs with further supportive actions in order to help the layperson understand the explanations. While in tutoring research, one reason that is provided for the fact that tutors often do not address the tutee's uttered errors is that they do not recognize them, the results of studies II and III suggest that there needs to be an additional reason for why the medical experts do show that little and only local adaptation to their email lay collocutor.

Why do the experts not correct the errors and adapt their explanations in other ways as a consequence of the display of errors, if these errors are recognized? One suggestion for an answer to this question comes from tutoring research itself, and that is the notion by Person et al. (1995), who pointed out the impact of ordinary conversational principles on tutorial dialogue. One of these principles is the linguistic principle of politeness, according to which conversational partners try to save their interlocutor's so-called face when conversing with them. Based on analyses of protocols of tutorial dialogues in formal learning settings, Person et al. (1995) describe different ways in which tutors try to attenuate the impositions on their tutees by means of a polite way of conducting their tutorial moves: Thus, for instance, tutors often do not give appropriate feedback on errors; for instance by merely providing the correct knowledge or by letting a tutee's erroneous answer pass as an adequate alternative. As will be shown, the characteristics of doctor-patient email communication call for a use of politeness in this conversational setting. In study IV of this dissertation (described in the upcoming chapter 7), the question will be addressed of whether an abidance of the conversational principle of politeness is also a relevant factor for explaining the conversational behavior of the medical experts that was shown in study III.

Apart from the results that were central to the research questions of Study III and that have been the focus of the discussion up to now, there was also the additional research question of whether an overall assessment item would be answered differently right after the experts answered the lay query than it was answered in Study II (in which there is no query answering). Hereby, the pattern of results for this item in study II is difficult to interpret (cf. 5.4). However, the fact that the pattern is identical in studies II and III suggests that the act of answering the query does not impact on the subsequent answering of an overall knowledge item. For studies within the same paradigm (see section 5.1 and 6.1), it is thus plausible to consider conducting experiments on experts' knowledge assessment and on their answering behavior within the same experiment. This aspect will be further discussed in chapter 8.

7 Study IV: Politeness in email health counseling

7.1 Introduction

When interlocutors communicate in a conversational setting, they often adapt their utterances to their conversational partner. According to Grice (1975), hereby, a speaker follows certain maxims that help create an utterance that is understandable, meaning that in a concrete situation, and for a concrete addressee, their utterances have the right degree of informativity, are formulated as clear as possible, avoiding prolixity and obscurity. As a result, these conversational contributions allow for efficient communication.

However, this cooperative principle (cf. section 2.3.1) is not the only principle that interlocutors follow when producing an utterance; on the contrary, the Gricean maxims are frequently violated in utterance production. In order to account for this phenomenon, another important conversational principle was formulated: The principle of politeness. Following the widely received politeness account proposed by Brown and Levinson (1987, cf. section 2.3.2), this principle can be described as follows: Every person has a public-self image, the so-called 'face', that she wants to maintain. This face consists on the one side of the want of freedom of action and freedom from imposition (so-called negative face), and on the other side of the want to be appreciated and approved of (so-called positive face). These two aspects of face are basic wants which every conversational partner has and knows the other one to have and which in general the conversational partners are inclined to satisfy. However, speakers often have to do speech acts that potentially threaten their interlocutor's face, like for instance disapproval, criticism, and disagreement. In these instances, politeness is used in order to attenuate the face-threat of the speech act.

According to Brown and Levinson's (1987) account, the degree to which a speech act is a face-threat depends on the social distance and on the power distribution between the interlocutors, as well as on the culturally determined weightiness of the speech act. From the constellation of these factors, the weightiness of a face-threatening utterance results; the heavier the face-threat, the more the communicator will use politeness in order to cushion its blow. Hereby, speakers use numerous politeness strategies (for a detailed description, see section 2.3.2).

While thus, as described, instances of politeness serve the need of an interlocutor to maintain a positive relationship with her conversational partner by acknowledging their face, a polite way of formulation often impacts negatively on the clearness and comprehensibility of a message. This is pointed out by Person et al. (1995), who deline-

ate the ways in which politeness strategies are commonly employed by tutors in one-to-one tutorial interactions: Tutors frequently have to do face-threatening acts; thus, for instance, they have to correct a tutee's errors and point them out to the tutee. While this is important to foster effective learning, negative feedback on errors has a face-threatening potential in that it might challenge the self-image of the tutee. This potential face-threat is often faced by tutors with formulating the speech act in a polite way: Thus, when tutees utter an error, tutors often do not give appropriate feedback nor correct the error. Instead, they often just provide correct knowledge without correcting or mentioning the errors, or else they let the tutee's answer pass as an adequate alternative, despite its being wrong, and suggest the correct answer just as an alternative (cf. section 2.3.2).

The conversational behavior of the medical experts in study III of this dissertation (cf. chapter 6) resembles this: In study III, the medical experts were confronted with one version of a lay query, into which either false beliefs, no beliefs or correct beliefs had been inserted. When confronted with the layperson's false beliefs, the experts addressed these beliefs, elaborating more on beliefs-related issues than those who responded to the other two query versions. However, less than half of the tutee's uttered errors were addressed, and the addressing was done in a rather indirect way, by just providing the correct information or by hinting rather vaguely at the query text instead of pointing out explicitly that the layperson had uttered an error. The errors that the layperson utters are central issues with regard to what the layperson wants to know about. However, apart from the described (partwise) correcting of the errors, the experts did not adapt their answers any further to a low level of understanding, for instance they did not provide examples nor did they explain more relevant contents.

Taken together, the medical experts in study III show conversational behavior that is similar to what Person et al. (1995) describe a polite disguise of tutoring actions for tutors in formal, face-to-face tutorial settings. Thus, taking into account that a non-detection of the errors is an explanation which in email counseling accounts even less for the experts' behavior than in face-to-face tutoring (cf. chapter 5), politeness seems a relevant variable to be considered for the explanation of the experts' conversational behavior in study III.

As a result of the up-to-now described considerations, the following research question can be formulated for study IV:

Is there a relationship between the conversational behavior of medical experts in email health counseling and politeness aspects?

This research question will be addressed in study IV with the help of the following paradigm: Medical experts will have to answer a lay email query. This lay query will contain the same false beliefs than those that were displayed in the FB version of the email query from studies II and III (cf. chapter 5 and 6). Before answering the query, the experts will be instruction with one of two instruction versions. Hereby, one of these two instructions (which will henceforth be called *metapragmatic instruction*) will aim at making the experts aware of the tutorial character of the counseling setting (while in the other condition, the experts will be instructed with a control instruction). This paradigm is based on the following considerations: The email health counseling setting is an informal learning setting, and the medical experts are not trained pedagogically; consequently, it is plausible to assume that they do not conceive of the counseling setting as an instructional, tutorial setting. Thus, conversational mechanisms that interlocutors abide by in everyday conversations should impact on the expert-layperson dialogue in the counseling setting even more than in the tutorial setting (in which they have an impact, as Person et al. (1995) have pointed out). One of these principles that interlocutors follow is the politeness principle.

In addition, according to the parameters formulated by Brown and Levinson (1987) in their politeness theory, email health counseling is a conversational setting that calls for an attenuation of speech acts with the help of politeness (cf. section 2.3): Thus, doctor-patient communication is a communicational situation rich in face-threatening speech acts on part of the physician (cf. Aronsson & Rundström, 1989). The medical experts frequently have to elaborate on issues which are unpleasant to the patient, making the patient feel hazarded in her autonomy or making her sense an implicit critique in the physician's utterance. Also, the social distance between medical expert and layperson is likely to be evaluated as high. Her expertise gives the physician a higher status; this status does not have to be negotiated during interaction but is predefined by the institutional frame in which doctor-patient communication takes place (Fetzer, 2000; Aronsson & Rundström, 1989). Also, they frequently do not know each other. Furthermore, with regard to the power distribution, there is a power asymmetry, as the patient depends from the doctor and her expertise. In addition to these parameters, which make the use of politeness likely in health counseling, it becomes even more likely when taking into account that in email communication, the expert has time to compose her answer and might thus have more opportunity to realize a polite version of speech than if communicating synchronously, for instance via chat (cf. Duthler's (2006) study, described in section 2.3.2, who showed that in comparison to oral speech, the use of politeness is even fostered in email communication).

Taken together, we can hypothesize that experts in informal learning settings follow the conversational principle of politeness when formulating their utterances. If this was the case, their utterances in this setting would be shaped by politeness. In the following, the characteristics of the conversational utterances that were analyzed in study III will be scrutinized from this perspective. Hereby, I will also reason on concrete politeness strategies (as formulated by Brown and Levinson, 1987, as described in section 2.3.2) that might underlie the ways in which the experts answer the lay email.

On the one hand, the experts in study III might follow the politeness strategy "avoid disagreement" when answering the lay email query (which is described by Person et al., 1995, for formal tutors), which would account for the fact that they addressed the layperson's uttered errors only to some extent, and if, then in rather indirect ways. With regard to the fact that the tutors do not adapt their answers more to the displayed false and low understanding, this might be based on the politeness strategy "presuppose common ground" (also described by Person et al., 1995, for formal tutors): In everyday conversation, it is 'impolite' not to acknowledge the addresse's knowledge and conversational wants. Thus, it would be impolite to provide lengthy explanations, explain a lot of different contents, avoid certain terms in favor of simpler terms, and use many examples in order to illustrate one's point, because it makes the interlocutor feel "taught". The abidance of this politeness strategy would explain why the experts do not adapt their answers more to the layperson.

Against this background, the reasoning of study IV works as such: If politeness is indeed relevant for explaining how experts answered the lay email in study III, an instruction that aims at informing the experts about the necessities of the conversational setting should result in 'less polite', and thus, instructionally more apt expert explanations. This approach is inspired by the plea of Person et al. (1995) who suggest that tutors need to be provided with an awareness of the costs and benefits of polite conversational behavior for the effectiveness of tutoring. In the metapragmatic instruction, provided in study IV, the medical experts are informed about the tutorial character of the counseling setting, that is, the importance of directness for knowledge communication and the fact that this directness does also entail speech acts which might be unpleasant for the patient. The experts are also told that through this directness, a better understanding on part of the patient can be achieved, and that this is also in the interest of the patient who wrote the query. Thus, without labeling it in such abstract terms, the experts are encouraged to 'teach', i.e., to ignore the conversational principle of politeness in favor a more effective knowledge communication.

An impact of the metapragmatic instruction in the described way would make a strong point for the impact of politeness on the experts' conversational behavior.

In study IV, the answers obtained from those experts instructed with the metapragmatic instruction will be compared to the answers from experts instructed with a *control instruction* (see section 7.2.2, for a detailed description of the instructions).

As research on politeness points out, the degree to which a speech act is attenuated through politeness depends on the speaker's evaluation of the imposition of the speech act (cf., section 2.3.2). The metapragmatic instruction aims at reducing the amount of imposition that the experts assume with regard to their explanations. If the experts had attenuated their utterances through politeness before and thus, through the instruction, 'obtain the permission' to behave teacherlike, they should produce utterances that are less attenuated through politeness and therefore address the layperson's uttered errors more and in a more direct way, as well as support the layperson's understanding by an ('impolite' but comprehension fostering) adaptation of their answers.

Against this background, the following hypothesis can be formulated:

- *Politeness hypothesis:*
  The metapragmatic instruction will impact on the experts' answers in such a way that they will show less polite, but instructionally more valid counseling behavior than in the control instruction condition. Concretely, false beliefs that are uttered in a layperson's email will be addressed more frequently and more directly. Also, the answers should be longer, should contain more explanations of contents, more examples and less medical technical language.

The politeness hypothesis will be investigated in study IV.

7.2 Method

7.2.1 Participants

Eighty-five medical students from a German university participated in the experiment. They were recruited in lectures and on the university's Medical Campus and were compensated with € 6 for their participation. The same 15-item diabetes knowledge questionnaire than in studies II and III was administered to the experts in order to test their knowledge in the domain of diabetes. Two participants answered less than 10 items correctly and were therefore excluded from the analyses. Proficiency in German was essential for participation in the study, and the proficiency criterion was to speak German for at least 15 years. In study IV, no participant spoke less than 15 years of Ger-

man. However, six participants had to be excluded who were not at the end, but only in the middle of their university medical training and who had participated by mistake. Finally, due to technical problems, the data sets of two participants had to be excluded.

The remaining 70 medical students were in their fifth year of university medical training (M = 4.27, SD = 1.74 semester *after* First State Examination); the mean age was M = 24.91 years (SD = 3.03). Of the seventy participants, 49 were female. Sixty experts spoke German as their first language, while the other ten spoke German since childhood respectively at least for 15 years. They answered an average of 12.74 out of the 15 diabetes items correctly (SD = 1.36). In terms of counseling experience, 87.14% said that they at least sometimes explained medical contents to medical laypersons.

The participants used computers with a mean of 13.27 (SD = 7.85) hours a week (for a description of the questionnaire on computer, Internet and text-processing software use, see section 6.2.2). This included an average of 3.43 hours of using text-processing software (SD = 3.91) per week and 9.63 hours (SD = 7.32) on the Internet. All experts used the Internet, with 95.71% (N=61) having Internet access at home. Sixty of the seventy experts stated that they used email.

Preliminary analyses revealed no significant differences between the experimental conditions with regard to domain knowledge (as manifested in the diabetes knowledge questionnaire), years of medical training, age, computer use, Internet use, text-processing software use, and counseling experience (all $t(68) < 1.31$, *ns.*). Also, there were no differences with regard to gender, the Internet services the participant used and if they had Internet access at home (all $\chi^2(1) < 1.87$, *ns.*). Therefore, these variables were not considered further.

7.2.2 Materials

Instruction versions

As already pointed out in the introductory section of this chapter, the experimental manipulation of study IV consisted in providing the medical experts with one of two instruction versions at the beginning of the experiment. In the following, the two instruction versions will be described in more detail.

Both instruction versions consisted of a part that was identical in the two conditions, and a part in which the manipulation was realized. With regard to the latter, the aim of the manipulation was to provide a neutral instruction in one of the conditions (*control instruction condition*). In the other condition, however, the instruction contained metapragmatic information about the conversational setting of email health communication: The physicians were told that in order to promote the layperson's understand-

ing of medical issues, it was important for them to communicate knowledge as directly and clearly as possible. They were also told that when patients write an email query they do so *because* they want to understand medical issues better, and that these patients should not be ashamed of their little knowledge. And that experts in this setting – in order to communicate knowledge as effectively as possible – have to take the risk of patients feeling ashamed of their little knowledge and not avoid being clear just to avoid making the patient feel unpleasant (*metapragmatic instruction condition*).

The instruction was given directly before the experts had to answer the lay query. Thus, the metapragmatic instruction aimed at fostering the experts' awareness of the 'learning setting'-like character of the counseling situation. The instruction aimed at supporting the experts in formulating answers that were 'less polite but more instructional' (cf. section 7.1).

When constructing the instruction versions, it was taken into account that scrutinized closely, the metapragmatic instruction contains the information that (i) the expert should accept the patient's eventual uneasiness for the sake of effective knowledge communication and that (ii) patients know little. In order to be able to trace eventual effects of the metapragmatic instruction back to the first of these two aspects (i.e., the one related to politeness), the information that patients generally do not dispose of much pre-knowledge and that experts therefore have to formulate their information in an understandable way, was inserted into both instruction conditions and thus did not constitute part of the manipulation.

In figure 7-1, the parts of the instruction that were identical in both conditions are displayed. The three asterisks mark the part of the instructions in which the manipulation was realized.

Dear participants of the study,

In public and in private life, the Internet is getting more and more important and also health-related Internet pages are visited by an increasing number of people. Hereby, more and more frequently, medical laypersons also use the possibility provided by different health services to send an email to a medical expert and obtain an answer.
Patients mostly lack the prior knowledge that is needed to evaluate and understand medical issues. As a consequence, the physicians need to formulate the information that they give in a way that the patients are able to understand it.

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* * *

In our study, this type of email conversation is emulated. On the next page, you will find a typical query from the Internet. Please answer the patient's query in your function as health expert.

Click "continue" to get to the inquiry.

Figure 7-1. Identical parts of instruction versions (English translation)

The text that was inserted into the instruction versions at that part where the asterisks are is displayed in table 7-1. For the original German versions of the instructions, see appendix D1.

Table 7-1. Experimental manipulation (English translation)

Control instruction condition	**Metapragmatic instruction condition**
Within the wide range of health service offers, the direct email contact with a physician is a very frequently used service, alongside other services such as dictionaries for special diseases and symptoms or newsletters. The queries are sent directly via an e-mail form. With some delay, the medical layperson then receives the physician's answer.	Hereby, it does not help when the physician avoids everything that could be unpleasant for the patient. For instance, a patient does not need to be ashamed for not knowing everything. Patients who use the "Ask the doctor"- option on the Internet do want to get a better idea of medical issues. The physician needs to take the risk that his utterances might make the patient feel exposed in his lack of knowledge and needs to clearly tell what he thinks to be important. Only by this means, he can accomplish a better understanding on part of the patient.

Patient email query

A slightly modified version of the false-beliefs query version (FB version) from studies II and III was used, which did, however, contain the same false beliefs than in studies II and III. The query is displayed in figure 7-2. For the original, German version of the query, see appendix D2.

Diabetes questionnaire

The same diabetes questionnaire than in study II and III was administered to the participants (for a detailed description of the questionnaire, see section 5.2.2.). With this questionnaire, it was ensured that the participants' knowledge level was sufficiently high specifically with regard to the thematic field of diabetes. The questionnaire items can be viewed in their English translation in table 5-2 (p. 96). For the original German questionnaire, see appendix B1.

Hello,

I am 55 years old and I am suffering from adiposity (87 kg, 1meter70), which is not a problem for my health per se. I have never had any seriours health problems, but now I went to a routine health check up and my doctor found that my blood sugar level was too high. I'd had a chocolate tart the day before, though. The doctor told me that I have type 2 diabetes. My mother also has it, what a coincidence. Now I have to go see a diet advisor, engage in physical activity and lose weight. I find that hard, because my job leaves me hardly any time.

I was told that physical activity and weight loss are also necessary to prevent arteriosclerosis, and I really don't want worn-out joints. I asked my doctor why I can't just inject insulin, but he told me that I had enough insulin in my blood, seems like my insulin intake with food is sufficient.

I know what I am supposed to do, but I still would like to ask you the following questions: Why am I suffering from this disease even though I apparently have enough insulin in my blood? And in which way do diabetes and arteriosclerosis have to do with each other?

Figure 7-2. (Fictitious) lay query (English translation)

Computer, Internet, & text processing software use questionnaire

The experts in this study also had to answer questions about their computer experience. This was done with the help of a slightly shortened version of the computer, internet, & text processing software use questionnaire from Study III (cf. section 6.2.2).

Table 7-2. Computer, Internet, & text processing software use questionnaire (English translation)

How frequently do you use a computer?					____ hours per week	
How frequently do you use the Internet?					____ hours per week	
How frequently do you work with text processing software?					____ hours per week	
Do you have internet access at home?					□ YES	□ NO
Which Internet services do you use?						
World Wide Web (WWW) □	Email □	Chat □	Telnet □	FTP □	Others □	None □

As experts are also influenced in how they communicate via email by their experiences with the medium, the questionnaire helps ensure that the experimental groups do not differ with regard to their experiences concerning computer use, use of the Internet and of text processing software. The questionnaire is displayed in table 7-2. For the original German version, see appendix D3.

7.2.3 Design and Procedure

The experiment was conducted online using an Internet browser. With the help of an online survey tool, the experimental environment was created, the study run and the data stored. The experimental environment consisted of nine web pages that could only be viewed in a predetermined sequence (for a screenshot of the experimental environment, see figure 7-3, which depicts the instruction page of the environment). On the query web page, the participants typed their answers into a text field that was located below the query text.

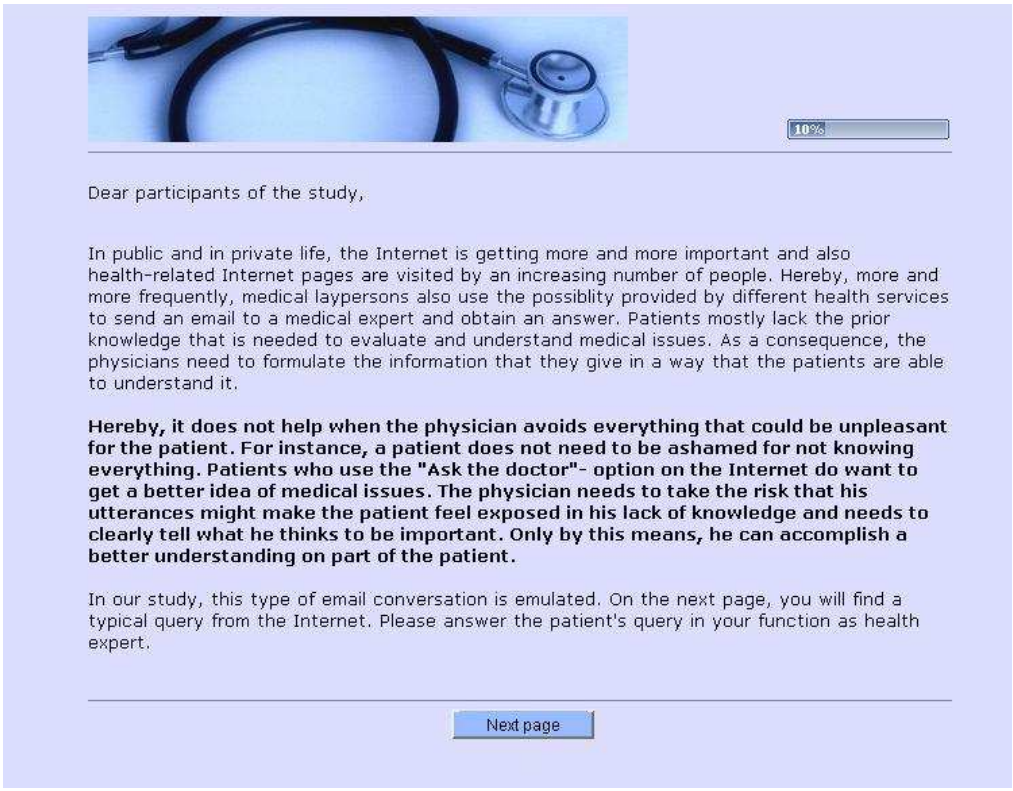

Figure 7-3. Screenshot from the experimental environment (English translation; metapragmatic instruction condition)

Using a 1x2 design with the *type of instruction* as independent factor, participants were assigned randomly to one of the two experimental conditions (between-subject design; see table 7-3).

Table 7-3. Experimental conditions and number of participants

	N
Control instruction (CI)	35
Metapragmatic instruction (MI)	35

First, the participants were thanked for their participation in the study and told to read the instructions on the following page attentively and carefully. After reading the instructions, the participants answered the patient's query. Once they had completed and sent off their answer to the query, they were no longer able to review or edit it. After answering the query, the experts answered the diabetes knowledge test and the

questionnaire on computer, Internet and text-processing software use. The experiment ended with the demographic questions. The medical experts participated in computer rooms of the Medical Campus; the average participation time was 40 min. For a schematic overview of the experimental procedure, see figure 7-4.

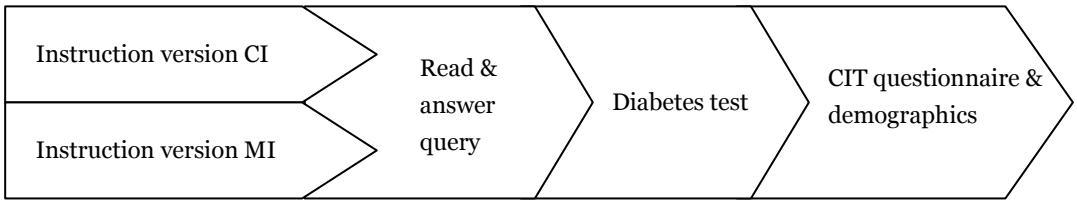

Figure 7-4. Experimental procedure of Study IV.

7.2.4 Data analyses

Intercoder agreement

Group of trained coders analyzed the text corpus. Intercoder agreement was assessed by providing two coders with the same randomly selected subset of the text corpus (10 answers) for analyses. The similarity of their codings on this subset was determined by assessing reliability. For quasi-interval data, the intra-class coefficient ($ICC_{2\text{-way, unjust}}$) is reported (cf., Shrout & Fleiss, 1979; Wirtz, 2006). For categorical data, kappa (κ) statistics reported. Hereby, it needs to be considered that κ is drastically lowered by an imbalance in the cross table's marginal totals. Since for some of the dependent variables, cross tables of intercoder concordance have quite asymmetrically distributed marginal totals, the informational value provided by the κ coefficients was enriched with reports of the percentage of agreement of the respective variables. Reliability statistics are reported below, in line with the description of the respective dependent variable.

Dependent measures

The answer emails of the medical experts were analyzed with regard to two aspects:

Firstly, the analyses were concerned with how the experts responded to the displayed erroneous understanding of the layperson. Hereby, the analysis of the ways in which the lay false beliefs from the query were addressed consisted of two parts: In a first part, those instances were counted in which a false belief was addressed (focus on quantity of addressing). In a second part, the directness with which this addressing was done was analyzed (focus on quality of addressing). Also, commentaries of the experts suited to reduce the layperson's embarrassment with regard to her little understanding were analyzed.

Secondly, the adaptation of the emails to a low level of understanding by means of various characteristics that foster understanding, was analyzed. For this aim, the same variables than study III were used.

The two aspects of analyses will be introduced in the following consecutively.

Addressing of false beliefs – quantity analysis. The answer emails of the experts were submitted to the same content analysis than in study III. Hereby, the answers were analyzed for contents which are essential for a comprehensive answer of the lay query (see section 6.2.4 for a more detailed description). Five of the relevant fifteen contents were issues related to the false beliefs that are displayed in the lay query (the other ten aspects were not related to the beliefs and will be described below, see 'extensiveness of expert explanation'). For instance, in the email query the layperson described it as a coincidence that her mother was suffering from diabetes as well. Thus, the analysis would look at whether or not the expert would elaborate on the role of heredity in her answer. For a listing of all five issues, see table 6-3, p. 110. For each of the five issues, the experts were given a point when they elaborated on the issue in their answer. Raters agreed on the coding of the manipulation-related issues with an unweighted Cohen's kappa of .79 (with a percentage agreement of 92%).

Addressing of false beliefs – quality analysis. In addition to analyzing the addressing of the layperson's uttered false beliefs, an analysis was undertaken which aimed at assessing the impact of the instruction on the directness with which the experts addressed false beliefs. For this purpose, the instances in which the experts addressed the false-beliefs-related issues were analyzed with regard to the manners of addressing that had been identified in the qualitative analysis of Study III (see section 6.3.2). In that analysis, three ways of error addressing had been identified:

- *Mere knowledge provision*
  The way of addressing that was chosen by most experts of study III was a very indirect one, that is, the experts merely provided the correct knowledge without further reference to the lay email query text.
- *Reference to lay belief*
  A more direct way was chosen with considerably less frequency by study III's experts: Hereby, the experts' answers contained references to the email query, respectively to the false beliefs uttered in the query. These references were made in different ways, which can be reviewed in more detail in section 6.3.2. In short, the experts made references by means of entrainment of the layperson's phrase formulation, use of markers or explicit reference to the lay query. By phrasing their

explanations in one of these ways, the medical experts hinted to the displayed erroneous understanding in the lay query when explaining on the beliefs-related issues.

- *Metacognitive feedback.*
  Only one of the experts from study III had, in one occasion, made it explicitly clear to the layperson that she had been wrong and had held a false belief by making a related meta-cognitive feedback commentary.

The instances in which false beliefs are addressed in the experts' answers in study IV were allocated to one of these three ways of addressing (*mere knowledge provision*, *reference to lay belief* or *metacognitive feedback*). Raters agreed on the assorting of the instances to one of the ways of addressing with an unweighted Cohen's kappa of .87 (with a percentage agreement of 93%).

Embarassment reduction comments. In the metapragmatic instruction, the experts were told that they had to communicate medical knowledge as clearly as possible, despite the possibility that the lay email author might feel ashamed of knowing rather little. This instruction, thus, contained the information that patients sometimes feel rather ashamed of their little knowledge. When conducting the above-described content analysis of the experts' answers, it became apparent that the experts used reassuring comments apt to reduce a possible uneasiness and embarrassment of the patient with regard to her deficient understanding. Thus, these commentaries might be called a 'redressive action' in Brown and Levinson's (1987) terms, because giving these commentaries is an action that attempts to counteract a potential face-damage of a speec act by clearly indicating that no face-threat is intended or desired (cf., section 2.3.2).

An analysis was conducted that measured the degree to which these comments were used in the answers. Five types of comments were found in the answers; all answers were then analyzed with regard to these types of comments (depicted in table 7-4). In each answer, it was checked for each type of comment whether it was made; for each comment made, a point was given.

Raters agreed on the coding of the embarrassment reduction comments with an unweighted Cohen's kappa of .85 (with a percentage agreement of 98%).

As already remarked, the experts' answers were also analyzed with regard to the adaptation of the emails to a layperson's low level of understanding. For this aim, the answers were submitted to analyses with regard to variables that foster understanding of explanations. This analysis used the same variables from psycholinguistics as well as instructional psychology than study III. The variables are described in short in the following, for a more detailed description see section 6.2.4.

Table 7-4. Types of embarrassment reduction comments

The expert praises/reinforces the layperson for informing herself. *Example: 'It is good that you are interested in your illness and that you want to know more about it.'*
The layperson's questions are labeled as valid questions. *Example: 'You are asking valid questions, because… '*
The expert points out her task (i.e., inform, not expose). *Example: 'I will gladly try to answer all your questions.'*
The expert emphasizes the existing knowledge of the layperson. *Example: 'As you have already pointed out correctly, …'*
The expert labels knowledge contents as difficult to understand. *Example: 'These things are often not easy to understand…'*

Number of words. The length of the answers was assessed by counting the total number of words with the help of a text processing software.

Extensiveness of expert explanation. In the content analysis (see above), the experts' answers were analyzed with regard to which contents the experts explained in order to answer the layperson's questions posed at the end of the query. In order to handle the explanation task successfully, that is, to answer the questions at the end of the query, the experts had to explain certain issues and processes related to type 2 diabetes. Ten different aspects which (in addition to the five issues related to the false beliefs) were essential for a comprehensive explanation of the relevant issues and processes (and thus a comprehensive answer to the patient questions) were identified. In table 6-4 (p. 111), all ten issues are outlined.

For these ten issues, the number that was treated in the answers was assessed, thus obtaining a measure of the extensiveness of the experts' answers. Raters agreed on the coding of the manipulation-related issues with an unweighted Cohen's kappa of .67 (with a percentage agreement of 84%).

Use of difficult medical technical language (MTL) terms. In German, many medical concepts can be named in different kinds of ways: In a technical term with a Greek or Latin origin or in a (non-technical) German translation term, which is commonly used by laypeople. This is significant in the current research context, because thus, the use of (non)technical language signals whether a lay perspective was used. Use of MTL terms was assessed by counting all words which are listed in the German reference book for

medical terms, and which are not listed in the general German dictionary. This approach excludes non-technical language concepts (like *stomach*). Each word was counted only once even if it occurred more often within one single text unit. The inter-rater reliability for identifying MTL terms was high with an intraclass coefficient of .96, $p < .001$.

Use of examples. The number of times that experts provided one or more examples to illustrate their point were counted, such as naming neuropathy as an example of a complication of diabetes. The raters agreed in counting how many times examples were given with an intraclass coefficient of .92, $p < .001$.

7.3 Results

In the following, all significances are reported two-tailed unless specified otherwise; hereby, ($p < .05$) is defined as significant and ($p < .10$) as a trend. With the aim of being able to draw (however tentative) conclusions from finding no statistically significant differences between the experimental conditions, an alpha-level of >.25 was taken as a basis for interpretation. This procedure indirectly minimizes the beta-error by enlarging the alpha-error (cf., Bortz, 1993).

With Cohen (1988), the effect sizes will be interpreted as follows: $\eta_p^2 < .06$ as small effect, η_p^2 between .06 and .13 as medium effect and $\eta_p^2 > .13$ as large effect; d <.5 as small effect, d between .5 and .8 as medium effect, and d >.8 as large effect.

Addressing of false beliefs – quantitative analysis

A sum score was calculated for the number of issues related to the false beliefs from the query that were addressed by an expert; this sum score was compared for the answers in the control instruction condition ($M = 1.91$, $SD = 1.25$) and in the metapragmatic instruction condition ($M = 1.94$, $SD = 1.41$). A t-test for independent samples did not reveal any differences between the two conditions, $t(68) = -.09$, $p > .25$. This result stands in contrast to the politeness hypothesis, which had predicted the addressing of false beliefs to be more frequent in the metapragmatic instruction condition. The results are displayed graphically in figure 7-5, alongside the results of the analysis of the extensiveness of the experts' answers, see below.

In table 7-5, the number of answers in which an issue was elaborated is displayed separately for the two experimental conditions. As the table demonstrates, all five displayed false beliefs are addressed by a considerable number of experts (at least by 17 % of the experts).

Table 7-5. Frequencies of elaborations on false-beliefs related issues

	Experimental conditions		
Issues related to beliefs	CI (n=35)	MI (n=35)	∑
Adiposity as health risk	18	16	34
Relation of nutrition and blood sugar level	4	8	12
Role of hereditary factors in diabetes	15	13	18
Characteristics of arteriosclerosis	9	11	20
Insulin production	21	20	41

Addressing of false beliefs – qualitative analysis

The addressing of false beliefs analysis as just described was followed by a qualitative analysis of the identified instances in which issues related to the layperson's false beliefs were elaborated upon in the experts' answers. Hereby, the instances in which false beliefs were addressed were allocated to one of three ways of addressing. Thus, the addressing was done using metacognitive feedback, reference to lay query/belief or mere knowledge provision.

Only six of the 70 experts made a metacognitive feedback commentary, informing the layperson that she had held a false belief. Four of these commentaries were made by experts who had read the control instruction, two by experts who had read the metapragmatic instruction. Due to the rarity of this type of addressing of false beliefs (4% of all addressings), no statistical testing for differences was done for this variable. It is just to be stated that metacognitive feedback commentaries were made very scarcely in both experimental conditions.

With the help of the allocation of the rest of the addressings to either the 'mere knowledge provision'- way (38% of addressings) or the 'reference to lay belief'-way (58% of addressings), the impact of the metapragmatic instruction on the directness with which the lay false beliefs were addressed was investigated as follows: For both ways, a sum score was calculated for the amount of times that a false belief had been addressed in the 'reference' way. The resulting sum variable was then divided by the total number of addressings in one of the two ways and multiplicated by 100; by proceeding this way, a percentage variable resulted that reflected the proportion of the 'reference' way of addressing on all times that a false belief was addressed. Thus, a dif-

ference between the experimental conditions on this variable indicates that the experts in one condition chose this way of addressing instead of mere knowledge provision more frequently. The difference between the two conditions was tested with a t-test for independent samples, which did not reveal a significant difference, $t(58) = 1.12$, $p > .25$. Thus, there is no indication of differences with regard to the way in which experts addressed errors after reading the metapragmatic instruction or the control instruction. This result stands in contrast to the politeness hypothesis, which had predicted the addressing of false beliefs to be more direct in the metapragmatic instruction condition.

In sum, with regard to the first aspect of analysis of the experts' answers, i.e., the impact of the metapragmatic instruction on the ways that experts responded to the displayed erroneous understanding of the layperson, the results do not support the politeness hypothesis: The addressing of the displayed false beliefs was neither more frequent nor more direct when the experts had read the metapragmatic instruction than when they had read the control instruction.

Embarassment reduction comments

A sum score was calculated for the number of comments that the experts made in order to reduce the patient's potential uneasiness about being little knowledgeable. The experts gave between a minimum of zero and a maximum of two embarrassment reduction comments. A t-test for independent samples revealed a significant difference between the two experimental conditions, $t(68) = -2.01$, $p<.05$, $d = .49$; small to medium effect). Descriptive statistics are displayed in table 7-6.

Table 7-6. Means and standard deviations for the embarrassment reduction comments.

	M	***SD***
Control instruction	.11	.32
Metapragmatic instruction	.34	.59

Thus, after reading the metapragmatic instruction, the experts were more likely to make comments that could reduce an embarrassment about one's own little knowledge for the patient than after reading the control instruction. Since the comment analysis was integrated into the analyses as a result of the observation of this type of comments in the answers (see section 7.2.4), it is not directly relatable to the politeness hypothesis, but rather constitutes an additional analysis.

Number of words

The lengths of experts' answers varied considerably, ranging from a minimum of 57 to a maximum of 643 words. A t-test for independent samples indicated a tendency for a difference between the two conditions, $t(68) = -1.76$, $p = .084$, $d = .42$, small effect; for descriptive statistics see table 7-7.

Table 7-7. Means and standard deviations for number of words.

	M	***SD***
Control instruction	233.26	144.58
Metapragmatic instruction	293.69	143.27

Thus, the experts that were instructed with the metapragmatic instruction wrote longer answers than the experts that were instructed with the control instruction. This result is in line with the politeness hypothesis.

Extensiveness of expert explanation

A sum score was calculated for the number of issues that experts elaborated on in order to answer the layperson's questions (out of the list of ten arguments). Hereby, a minimum of one issue and a maximum of eight issues were elaborated on by the experts. A t-test for independent samples revealed a significant difference between the two experimental conditions, $t(68)=-2.05$, $p<.05$, $d = .49$, small to medium effect; for descriptive statistics, see table 7-8.

Table 7-8. Means and standard deviations for extensiveness of expert explanation.

	M	***SD***
Control instruction	4.03	1.32
Metapragmatic instruction	4.80	1.80

Thus, when instructed with the metapragmatic instruction, the experts explained more relevant contents to the layperson than when instructed with the control instruction, which is in line with the politeness hypothesis.

The results of the content-related analyses (i.e., both the number of explained issues that related to the false beliefs and the number of other explained issues) are depicted graphically in figure 7-5.

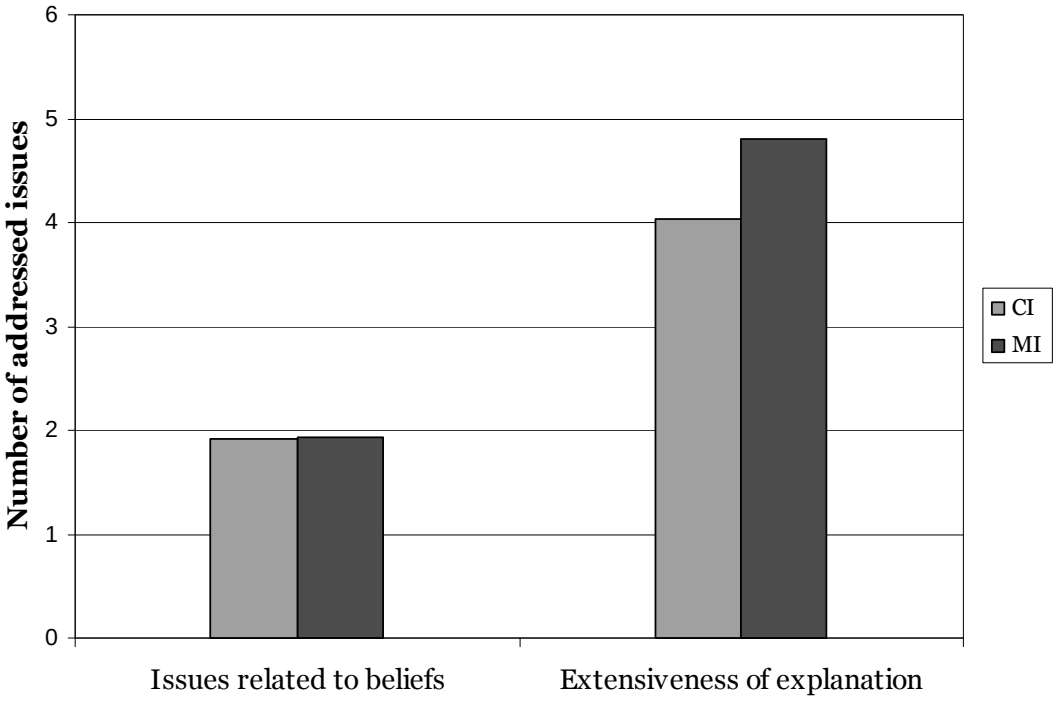

Figure 7-5. Content-related analyses

Use of MTL terms

Technical medical terms were identified with the help of a medical and a general German reference book. The experts used a minimum of two and a maximum of 25 technical terms in their answers. With regard to the technicality of language in the tutors' answers, there were no significant differences between the answers in the control instruction condition (M = 9.80, SD = 4.82) and in the metapragmatic instruction condition (M = 10.70, SD = 4.17), $t(68)$ =.82., p >.25. This is a surprising result, because according to the politeness hypothesis, the medical experts in the metapragmatic instruction condition were expected to use less MTL terms than in the control instruction condition.

Use of examples

The experts provided a minimum of zero and a maximum of seven examples in their answers. A t-test for independent samples indicated a tendency for a difference between the two conditions, $t(68) = -1.67$, $p < .10$, $d = .40$, small effect; for descriptive statistics see table 7-9.

Table 7-9. Means and standard deviations for number of provided examples.

	M	***SD***
Control instruction	.89	.96
Metapragmatic instruction	1.40	1.54

Thus, the experts that had read the metapragmatic instruction used more examples in their explanations than those who had read the control instruction. With regard to the politeness hypothesis, this result goes in line with the hypothesis.

In sum, with regard to the second aspect of analysis of the experts' answers, i.e., the impact of the metapragmatic instruction on the adaptation of the experts' answers to a low level of understanding, the results do mostly support the politeness hypothesis: Apart from the use of MTL terms, all investigated understanding-fostering variables differed between the two experimental conditions in that the answers in the metapragmatic instruction condition were more designed for low understanding: The experts that had read the metapragmatic instruction wrote longer answers, explained more relevant contents, and used more examples than the experts that had read the control instruction.

7.4 Discussion

In email health counseling, medical laypersons turn to physicians online, asking for information and explanations on medical issues that are relevant to them and that they want to understand better. In this conversational scenario of informal learning, both interlocutors are faced with a speech partner with a very divergent knowledge background. Hereby, the expert has the difficult task of adapting her explanations as good as possible to the individual lay interlocutor (cf., section 2.1.3). In study III, this adaptation of experts' answers was investigated, focusing specifically on the adaptation to a displayed low level of understanding. Concretely, this displayed low understanding consisted in several false beliefs that the layperson had uttered in her email in one of the research conditions (while in the other two research conditions, no such false beliefs respectively correct beliefs had been uttered; cf., chapter 6). As study II has shown, medical experts do process the display of such false beliefs in lay email queries quite specifically (cf., chapter 5). The false beliefs displayed in the query were central to the topic about which the layperson wanted to know more about.

An adaptation of the experts' answers to such displayed erroneous understanding of central issues can consist in an addressing and correction of the displayed erroneous knowledge. Furthermore, however, experts can also adapt by providing an answer that is as understandable as possible for a layperson with such (displayed) erroneous knowledge. These facets of adaptation are addressed in study III. As the results show, the experts adapt locally by correcting the false beliefs; albeit in a rather indirect (and thus inadequate) fashion. Apart from these local corrections, no further adaptations to the experts' answers were found.

Considering these results from studies II and III, the following research question arises: If the layperson's false beliefs are processed by the experts, why do they show only such insufficient adaptation? In the current chapter, a study (study IV) was presented that tried to answer this question by considering the conversational principle of politeness as a relevant factor for explaining the described conversational behavior of the medical experts: According to the politeness theory by Brown and Levinson (1987), a speaker tries to formulate an utterance that might be unpleasant for the interlocutor in a way that saves the interlocutor's 'face'. Thus, for instance, they often do not correct errors directly, but only in more indirect ways. In the introductory section of this chapter, the idea was formulated that conversational moves that are instructionally advantageous in order to foster the understanding of interlocutors with little knowledge are often those moves which are impolite in a linguistic sense. Thus, for instance, it is a potential face-threat to an interlocutor to get one's utterances marked as errors. Therefore, in order not to be impolite, speakers might only provide the correct information and not correct the error, thus attenuating the potential face-threat of the speech act. Or, to provide another example, it might be instructionally relevant to provide longer explanations; in everyday conversation, however, this speech act contains a potential face threat, because the interlocutor might feel "taught".

As has been delineated in section 7.1, it is very plausible to assume that also in the conversational setting of email health counseling, the medical experts are likely to be influenced in their tutorial behavior by the conversational principle of politeness. This hypothesis is based on the one hand on the fact that according to the characteristics of conversational settings formulated by Brown and Levinson (1987), the conversational setting of email health counseling is a setting that triggers the use of polite conversation. Also, polite behavior becomes very plausible when taking into account the notions by Person et al. (1995), who have described how tutors use politeness in formal tutorial settings. For the informal learning setting of email health counseling, it was assumed that the medical tutors should also use politeness and that they might use politeness even more, because the tutorial character (and thus the necessity for efficient instruc-

tional behavior) is even less obvious than in tutoring; expert-layperson counseling resembles more everyday conversation than tutorial dialogue.

As a consequence of the foregoing considerations, study IV aimed at investigating the relationship between the conversational principle of politeness and email health counseling. For this aim, medical experts were instructed with (i) a control instruction or (ii) a metapragmatic instruction that provided information about the necessities of the conversational setting (i.e., the fact that the physician needed to give the relevant information as clearly as possible, even if this meant that a patient might feel exposed in her lack of knowledge, and that patients do not need to be ashamed for not knowing everything). The experts then answered a patient email query into which several false beliefs had been inserted.

An analysis of the experts' answers that focused on how the experts responded to the displayed erroneous understanding of the layperson showed that the experts addressed the errors rather little and in an inadequate fashion in both research conditions, between which no differences were found. Thus, the experts addressed less than half of the five false beliefs from the query. In addition, a qualitative analysis of the instances in which errors were addressed showed that metacognitive feedback commentaries (i.e., telling the layperson that she had been wrong about a certain issue) were hardly given; on the contrary, errors were addressed only in a rather indirect fashion. Also in this analysis, there were no differences between those answers that were provided by experts that had read the control instruction and those that were provided by experts that had read the metapragmatic instruction.

However, an additional analysis of comments apt to reduce a possible uneasiness and embarrassment of the patient with regard to her little knowledge showed that the experts that were instructed with the metapragmatic instruction gave more reassuring comments than those instructed with the control instruction.

The experts' answers were also analyzed with regard to the audience-design of the answers, that is, the adaptation of the emails to a low level of understanding. For this aim, various characteristics that foster the understanding of explanations on part of interlocutors with little knowledge were examined. These analyses showed for most of these variables that those experts who had been instructed with the metapragmatic instruction gave answers that were more apt to a low lay level of understanding than the experts which had been instructed with the control instruction. Thus, in the metapragmatic instruction condition, the experts wrote longer answers than in the control condition; also, they explained more relevant issues and used more examples. Only with regard to the use of medical technical language, no differences were found between the conditions.

In light of these results, it can be stated that the metapragmatic instruction impacts on the experts' answers in that these are formulated in an instructionally more apt way with regard to a variety of characteristics. In section 7.1, it was reasoned that the metapragmatic instruction aimed at making the tutors aware of the costs and benefits of polite conversational behavior, and that hence, the information provided by the instruction should result in 'less polite' behavior, thus indirectly making a strong point for the relationship between politeness and the tutorial behavior of the medical experts. The results of study IV strongly point to the existence of such a relationship, given that the fact that the politeness-related instruction impacts so clearly on the experts' answers.

At this point, one could argue that since the frequency and directness of error correction was not affected by the metapragmatic instruction, the deficient error correction on part of the experts could have nothing to do with politeness aspects. This is not very likely however, since the analysis of the embarrassment instruction has shown that also with regard to error correction, experts are sensitive to aspects of face-threat and politeness. Hereby, the instruction impacted in such a way that the experts used more comments when instructed with the metapragmatic instruction.

In sum, the politeness hypothesis that was formulated in section 7.1 and that assumed that the experts would show less polite, but more instructionally valid counseling behavior in the metapragmatic instruction condition can be largely confirmed. As a consequence, study IV makes a strong point for the relationship between the conversational behavior of the medical experts in email health counseling and politeness, thus confirming the research question posed in section 7.1.

While these conclusions seem quite compelling, future research studies will have to investigate the impact of politeness on (informal as well as formal) expert-layperson communication further. Hereby, for the context of email health counseling, other paradigms than the one used in study IV (i.e., two instruction versions) will need to be used; these paradigms might allow for a more direct investigation of the relation between politeness and the experts' conversational behavior than the investigation that was undertaken in study IV. In addition, further research needs to find out whether a less subtle metapragmatic instruction than the one used in study IV can impact on the error correction of the experts. In study IV, a very subtle intervention was realized, with the metapragmatic instruction differing only in a few sentences from the control instruction. In study IV, the experts seem to be sensible to metapragmatic information about the conversational setting, which the analysis of the embarrassment reduction com-

ments has shown; they are, however, not able to translate the provided information into a more direct and more frequent error addressing. An instruction which points more directly to the necessity of an addressing of false beliefs when answering a lay query might provide different results and should thus be tested.

Further implications of the research results from study IV as well as from studies I through III presented in this dissertation will be discussed in more detail in the general discussions and conclusion section of this dissertation, coming up in the next chapter.

8 General discussion and conclusions for future research

The conversational setting that is investigated in this dissertation is the communication of medical experts and laypersons via email. Laypersons are frequently confronted with situations in which they need to consult an expert in order to obtain explanations on issues that interest them or affect them in a current situation. More and more, this consultation is done via email.

In expert-layperson communication, both expert and layperson are confronted with an interlocutor with a very divergent knowledge background; hereby, the experts dispose of an extensive and efficiently structured knowledge base, while the laypersons – albeit disposing of some knowledge – often hold erroneous assumptions and theories. As a consequence, experts have to communicate in a certain way in order to make their utterances understandable to their lay interlocutor. Concretely, hereby, the experts have to adapt to the low level of lay knowledge. For this aim, the experts need to 'translate' their knowledge, as well as support the understanding of the layperson 'didactically', for instance by providing examples.

The ways in which medical experts communicate with laypersons were analyzed in this dissertation under consideration of the following question: What role do conversational principles from everyday conversation play in the specific conversational context of email expert-layperson communication (with its high knowledge divergence, as described above)? On the one hand, in everyday conversation, speakers often adapt to their addressee's needs by taking into account the other's specific knowledge background when formulating an utterance. At other times, however, the knowledge of the interlocutor is disregarded. On the other hand, in everyday conversation, a speaker takes into account the interlocutor's need to be appreciated and not humiliated by her conversational partner. What impact do these principles have on the communicational behavior of the medical experts in email health counseling? To address this question was one of the main aims of this dissertation.

With regard to the experts' communicational behavior, the dissertation focused specifically on how experts reacted to a display of erroneous understanding in the lay email. Tutoring research has shown that both an addressing of errors as well as a feedback on the fact that an error has been made are important for the tutee's learning. Also the conversational setting of this dissertation can be described as a type of informal tutoring. In order to support this claim, a parallel was drawn between expert-layperson counseling and tutorial dialogue in formal learning settings (like for instance universities) which pointed out the structural similarities of the two settings. As a consequence of this parallel, the research results of this dissertation can also enrich tutoring research.

In the following, the results from the studies that are presented in this dissertation will be discussed from different theoretical as well as research-oriented perspectives. For this aim, the remainder of this chapter on general discussion and conclusions for future research is divided into five sections. First, the key empirical results from studies I through IV will be summarized (section 8.1). Hereby, the outline will be confined to those results that are most relevant in the context of the subsequent discussion sections. A discussion of all research results can be found in the discussion sections of chapters 4 through 7. For the sake of the presentation of the key results, section 8.1 will also describe the characteristics and aims of the respective studies in short. For a more detailed depiction, see the method sections of chapter 4 through 7.

After the summary of the main results, the discussion part will begin with a discussion of the results against the background of tutoring research (section 8.2). Thereupon, section 8.3 will discuss the results from a psycholinguistic vantage point, reflecting on the role of communication principles from everyday conversation in online health counseling. From these more theoretically oriented sections the focus will then shift towards a more application-oriented perspective. Thus, section 8.4 will discuss the role of metapragmatic instruction for the facilitation of expert-layperson communication. In section 8.5, then, the chapter concludes with an outlook on directions for future research.

8.1 Summary of main results

The aim of the first of the studies presented in this dissertation (i.e., study I), was to lay the foundations of the three ensuing studies II through IV in that lay understanding for important concepts from the field of the metabolic syndrome was investigated, which had been chosen as broad thematic field for the empirical research presented in this dissertation. Hereby, concretely, beliefs were assessed that laypersons had with regard to frequently used medical concepts from the thematic field of the metabolic syndrome. For an assessment of the beliefs, a questionnaire was administered which measured the prevalence of correct and erroneous beliefs in the lay sample. The results of study I confirm research from medical literature which demonstrates that laypersons frequently hold erroneous beliefs with regard to common medical concepts. In addition, a high disparity of knowledge was found in the relatively homogenous sample (cf. section 4.3).

Parting from these findings from study I, different versions of a lay email query were constructed. In the query, a fictitious patient described her medical situation and asked for explanations of certain medical issues in order to understand her situation better.

In one of the query versions, the characteristic deficiency of lay understanding was made apparent in that the layperson uttered several false beliefs in her email. From the two other versions of the query, one version did not contain such beliefs, while in the other version, correct beliefs were uttered by the layperson. Apart from this variation in the display of beliefs, the query versions did not differ from each other (cf. section 5.2).

In study II, the three described query versions were used to investigate whether a display of erroneous lay understanding as described above impacted on the mental representation that the expert had of the lay query author's knowledge. The experts read one of the query versions. Thereafter, they rated the knowledge of the lay email author with regard to several knowledge pieces. As such, a differentiated knowledge assessment was done in that the experts had to rate the amount of the layperson's knowledge on both beliefs-related prior knowledge as well as on other topic-related knowledge that was not related to the displayed beliefs. By proceeding like this, the impact of the beliefs display on the experts' knowledge assessment on a local level could be separated from a more generalizative impact.

The results of study II showed that the experts processed the displayed beliefs quite specifically: In the false-beliefs condition, beliefs-related prior knowledge was rated lower than in the other conditions, in the correct-beliefs condition, it was rated higher. For the other (not beliefs-related) topic knowledge, there were no differences in experts' knowledge assessment between the conditions. Thus, the results confirm the specific impact hypothesis which, against the background of the special characteristics of email health counseling, had predicted a specific, but no generalizative impact of the display on the assessment (cf. chapter 5.3). This overruled the concurring generalizative impact hypothesis, which had predicted that experts would assume a less knowledgeable lay email author in the false-belief condition also with regard to other issues than the beliefs-related ones. Also, the second concurring hypothesis, the disregard hypothesis, was overruled which – drawing on research results from formal tutoring research - had argued that the experts would have difficulties in acknowledging the erroneous knowledge and had thus predicted no differences between the assessments in the three conditions.

While thus, study II focused on the impact of a display of erroneous beliefs on the experts' knowledge assessment, study III used the same query versions in order to investigate the experts' answers to the query. Hereby, the focus laid both on an addressing of false beliefs in the false-beliefs condition as well as on the adaptation of the answers to a low level of understanding. The experts were presented with one of the query versions that they read and answered (cf. section 6.2).

As the results of study III show, the experts explained more issues that were beliefs-related contents in the false-belief condition than in the other conditions. With regard to the audience design of the queries, however, no differences were found between the conditions. The results provided some support in favor of the false-beliefs correction hypothesis, which had drawn on the results of study II as well as on the special characteristics of the conversational setting of email health counseling. At the same time, due to the obtained results, the two concurring hypotheses were overruled: The comprehensive adaptation hypothesis, on the one side, had assumed that experts would not only do a correction of false beliefs but would also do a more comprehensive adaptation of their answers to a low level of understanding. This however, was not found as there were no differences in the content-related and linguistic indicators which had been used for measuring the audience design of the experts' answers. Thus, the answers did not differ between the three conditions in length, in the amount of explained issues, of use of examples and of use of difficult terms. On the other side, the knowledge telling hypothesis had predicted – drawing on research results from formal tutoring research, that the experts would overlook the display of beliefs in the query and just tell their knowledge in all three conditions without adapting it to their lay addressee. Thus, this hypothesis did not predict any differences between the experimental conditions. The hypothesis needed to be refuted because with regard to the beliefs-related issues that were mentioned in the answers, differences between the three experimental conditions were found, as described above (cf. section 6.3).

In addition to the described analyses, also an exploratory, qualitative analysis was undertaken in study III which scrutinized the instances in which experts addressed a false belief in the answers given in the false-beliefs condition. The results of this analysis pointed out that the experts chose rather indirect ways to address the layperson's errors; thus, they merely provided the correct knowledge or made some kind of reference to the lay query.

Such indirect ways of addressing uttered erroneous knowledge had also been reported for formal expert-layperson tutorial dialogue by Person et al. (1995), who had ascribed this to the impact of politeness on the tutors' answers. As the informal tutorial setting of email counseling is also a conversational setting that triggers the experts' use of politeness (cf. section 2.3.2), the research aim of study IV was to test whether politeness could provide an (at least partial) explanation for the conversational behavior of the medical experts in study III. For this aim, an instruction was introduced and tested which aimed at fostering instructional (and thus less polite) communication on part of the experts. For this aim, in the so-called metapragmatic instruction, the experts were informed about the importance of direct communication in the setting and were en-

couraged to leave out potential feelings of uneasiness on part of the patient in favor of effective knowledge communication (cf. section 7.2). As formulated in the politeness hypothesis, the metapragmatic instruction was supposed to impact on the experts' answers in such a way that they would show less polite, but instructionally more valid counseling behavior when instructed with the metapragmatic instruction than when instructed with the control instruction. Thus, for instance, it was expected that the experts would address uttered false beliefs more directly and more frequently and that experts would write longer answers and provide more explanations. The experts were instructed with one of the two instructions (metapragmatic instruction or control instruction) and then answered a lay query which displayed false beliefs.

The results of study IV show partial support for the politeness hypothesis in that the metapragmatic instruction indeed lead to experts' answers that were less polite and more apt for a low level of understanding with regard to several of the investigated variables. Thus, the experts in the metapragmatic instruction condition wrote longer answers, explained more relevant issues and used more examples than in the control condition. With regard to the directness and frequency of false belief addressing, however, no differences were found between the two conditions (cf. section 7.3).

8.2 Discussion of results against the background of tutoring research

In this dissertation, the two conversational settings of expert-layperson communication and of tutorial dialogue have been introduced as structurally parallel conversational settings. For this aim, the structural similarities of the two settings were described (cf. section 2.2.1) and two points were made: First, it was stated that tutorial dialogue is a form of expert-layperson communication due to the fact that tutors are subject-matter experts who converse with their lay tutees who approach dialogue from a naïve perspective on the subject-matter. Second, the conversational activities of the counseling experts can be called tutoring, even if this one-to-one tutorial interaction does not take place within the frame of an institutional learning context.

As a result of this parallelism, the applied research paradigms as well as the obtained results from this dissertation can also enrich tutoring research. Thus, for instance, with regard to the tutors' estimation of their lay tutee's knowledge, the reasoning behind the research methodology that was used in study II of this dissertation could fruitfully be transferred to tutoring research: Studies from tutoring research (as described in chapter 2.2) had deduced from the observed tutors' conversational behavior whether tutors had detected uttered tutee errors. This is a rather indirect way of assessment, however. In study II, a more direct methodology was used in order to assess the medical experts'

knowledge assessment via a questionnaire. As suggested in chapter 5.4, also for tutoring research with its focus on face-to-face conversation, a paradigm could be found in order to separate the impact of uttered tutee errors on (i) the representation of tutee errors and on (ii) the reaction to tutee errors. Thus, for instance, several tutor participants of a study could be confronted with the same errors which could be uttered by a confederate tutee in a tutorial session. After the tutorial session, the tutors could rate the tutee's knowledge with regard to different knowledge aspects, both related and unrelated to the uttered errors (cf. Chapter 5.4).

When taking together the research results from study II and III, it becomes evident that even though in the investigated setting of online health counseling, the uttered errors were processed quite specifically, they were only addressed rather little and infrequently by the medical experts. In study IV then, evidence for the supposition that the experts did not only not react to the errors because they did not detect them, but also due to considerations of politeness was gathered. If the tutors' representation of tutee errors would be investigated more directly in tutoring research, results would possibly show that a failure of detection of the errors would be less frequent than thought up to now, but that the tutors are also 'holding back' an addressing of the errors due to an abidance of the conversational principle of politeness: While Person et al. (1995) have already pointed out the impact of politeness on tutorial dialogue, this notion needs further and also experimental research.

While thus, a general point is made for a greater consideration of politeness on tutorial dialogue, it has to be kept in mind that the specific characteristics of the conversational settings impact greatly on tutorial dialogue. Thus, for instance, as pointed out in section 2.4.2, the characteristics of online health counseling have a somewhat facilitating effect on the medical experts' assessment of their interlocutor's knowledge. Hereby, the lack of feedback possibilities and the fact that there is usually a single conversational turn make an initial assessment of the tutee's knowledge more important; at the same time, the fact that the email is visible and reviewable makes it is easier to detect a tutee's uttered erroneous knowledge than in face-to-face communication where utterances are ephemeral. Research studies on face-to-face tutoring should describe tutoring in different conversational settings under consideration of the characteristics, influences, possibilities and limits of the respective tutorial settings.

In addition to the already discussed points, one important remark needs to be made: The counseling tutors that were focused on in this dissertation showed tutorial behavior that was not very optimal with regard to ensuring successful knowledge communication, which applies specifically to studies III and IV, in which the tutors answered lay

queries. Thus, the tutorial behavior is not pedagogically adequate; this goes in line with the notion of Chi et al. (2001) who had pointed out that tutors' effectiveness should not just tacitly be assumed (cf. section 2.2) and that as a consequence, it was not a good research approach for tutoring research to simply describe the tutors' behavior and assume that this was what caused the efficiency of tutoring. On the contrary, the communicational behavior of tutors needs not only to be described and observed (for tutorial settings with different characteristics, see above), but also analyzed critically with regard to which tutorial moves are detrimental and which are beneficial to the tutoring aims. Hereby, also experimental studies can be helpful as for instance the study of Corbett and Anderson (1991; cf. section 2.2) which experimentally showed the usefulness of error feedback as tutorial move with the help of a computer tutor.

8.3 On the role of pragmatic principles in online health counseling

In the previous section 8.2, reflections were made about the impact of politeness on tutorial dialogue; behind these considerations stands the more general idea of conversational principles from ordinary conversation being influential also in specific conversational situations. In the following, the impact of the conversational principles that have been introduced in section 2.3 of this dissertation will be discussed for the applied setting of email health counseling. When experts communicate with laypersons in email health counseling, this conversational situation diverges from everyday conversation. As human beings, however, experts are very experienced in everyday conversation. Also, they are not trained with regard to instructional dialogue. As a consequence, it can be deemed quite likely that the pragmatic principles that shape human everyday conversation also play a role in expert-layperson communication.

One important conversational principle that has been described is that speakers in a conversation try to design their conversational contributions in a way that makes them understandable to their addressee and thus enables efficient communication (cf. section 2.3.1). This notion is contained in the Gricean account of the cooperative principle. Based on this notion, the communicational theory proposed by Herbert Clark focuses on the adaptation of a speaker to the supposed knowledge background of the addressee. Hereby, the account describes cognitive processes which underlie the adaptation of the conversational contributions. According to the account, speakers use certain heuristics in order to estimate the shared knowledge background with the interlocutor. Then, the utterances are adapted to the supposed needs of the addressee.

While ample research supports this notion of adaptation, there has also been a substantial amount of empirical evidence of instances in which speakers do not consider

their addressees but leave out the perspective of the interlocutor on utterance production (cf. 2.3.1). Rather, the utterance production takes place from an egocentric perspective, and is influenced by the accessibility of terms and contents rather than by the understandability of these terms and contents on part of the addressee. Recent psycholinguistic accounts try to reconcile these diverging empirical results by assuming that both adaptation and accessibility impact on the speech production process (for a more detailed depiction of the accounts, see section 2.3.1). Hereby, the question of when and under which circumstances the perspective of the respective other is taken into account in utterance production is not yet sufficiently clarified.

While the just described accounts are concerned with the impact of adaptation and accessibility in utterance production, and thus with under which circumstances utterances are adapted to the knowledge of the interlocutor, another important principle in conversation focuses on the adaptation of a speaker not to the knowledge of her addressee, but to the wants of the conversational partner with regard to not being bothered and to be appreciated and approved of. As depicted in the politeness account described by Brown and Levinson (1987), speakers often have to do speech acts (e.g., disapproval, criticism) that potentially threaten their interlocutor's 'face'; in these instances, politeness is used in order to attenuate the face-threat of the speech act. The degree to which a speech act is a face-threat depends on the social distance and on the power distribution between the interlocutors, as well as on the culturally determined weightiness of the speech act (cf. section 2.3.2).

In the research project at the University of Muenster (cf. chapter 1), the impact of adaptation and accessibility has been shown for the informal tutorial setting of email health counseling. Thus, for instance, Jucks, Bromme, and Runde (2003) have shown that medical experts gave linguistically and semantically differing answers when answering the same question to a medical layperson vs. to a physician of a different expertise domain. This shows that experts in this setting do adapt to their addressees. However, also accessibility plays a role in the setting. Thus, Jucks, Becker, and Bromme (in press) have shown that experts adapt to the word choices of their addressees, but also adapt to words proposed by an illustration. The fact that the encodings of the illustration, even though not available to the addressee, impacted on word choices, makes a point for the impact of mere word accessibility on the experts' utterance production.

While this dissertation does not focus primarily on the differentiation of the role of adaptation and accessibility for the setting, the results from studies II and III point towards the role of both adaptation and automatization in net-based health counseling: While the experts show adaptation of their explanations in that they address and correct some of the layperson's erroneous knowledge in the false beliefs condition, the ex-

planations in general are uttered rather in a standardized way, as no further adaptations were found. This might be due to a rather automatized telling of knowledge that is driven mainly by accessibility. Future research will need to shed further light on the role of adaptation and accessibility in net-based counseling.

In addition to adaptation and accessibility, also the conversational principle of politeness plays a role in email health counseling. After an analysis of the role of politeness for netbased health counseling (cf. section 2.3.2) pointed towards the impact of politeness also in this informal tutorial setting, the results of study IV suggest that experts are sensitive to the role of face-threat in the expert-layperson email dialogue (cf. chapter 7).

For the described principles, it needs to be considered that while in everyday conversation, these mechanisms are in general beneficial to an effective knowledge communication, they can impact negatively on expert-layperson communication. Thus, the adaptation of one's conversational contributions is more difficult in expert-layperson communication (both for experts and laypersons), due to the systematic knowledge divergence between the interlocutors in this setting. Thus, laypersons cannot anticipate the experts' perspective because they have not gone through the formation which has shaped that perspective. Experts, on the other hand, also have difficulties in anticipating the layperson's perspective. Since in everyday conversation, the knowledge assessments of one's interlocutors are usually successful, the experts might overestimate the quality of their knowledge assessment also in the expert-layperson setting and thus try to adapt but not adapt their contributions well to their addressee. In sum, the adaptation according to an estimated knowledge is often not a useful strategy for effective expert-layperson communication.

Also the mechanism of producing utterances according to accessibility, which is usually effective and economic in everyday conversation, might be problematic in expert-layperson communication. For instance, the experiment of Jucks, Becker and Bromme (in press; see above) has shown that the experts' lexical alignment to the word choices of the layperson seems to be due rather to an automatic process of accessibility than to adaptation to the needs of the layperson. However, as also the results from study I show, laypersons often hold false beliefs with regard to technical terms of a domain. If the expert now uses the same terms (which for her have a different meaning), expert-layperson communication is hazarded, because experts and laypersons use the same terms to label different things, thus the risk of (also unnoticed) miscommunication is high.

Last, also the use of politeness is potentially detrimental to expert-layperson communication: While serving the experts' need to maintain a positive relationship with

their lay interlocutors by acknowledging their face, a polite way of formulation often impacts negatively on clearness and comprehensibility of a message. As the results from study IV suggest, the experts try to avoid instructionally more valid conversational behavior in order not to threaten their lay interlocutors' face (cf. chapter 7). As expert-layperson communication is an informal learning setting, however, experts should behave 'teacher-like' in a certain sense (e.g., by giving explanations and using examples) in order to make their utterances as understandable as possible for their lay interlocutors.

While a consideration of the above-discussed principles of ordinary conversation for the context of email health counseling can help understand the experts' communicational behavior in this applied setting better, the considerations that have been made up to now in this section 8.3 do also call for expansions of the psycholinguistic accounts themselves. Thus, Herb Clark describes the cognitive processes that underlie the adaptation of an interlocutor to the supposed knowledge of her addressee. While the account contains important notions on how an adaptation to an interlocutor is accomplished, it does not elaborate on the notion that two communication goals of a speaker consist side by side in a conversation, that is, effective communication on the one side, and maintaining a positive relationship with the addressee on the other side. For the latter, speaker often attenuate their utterances by means of politeness, thus reducing the face-threatening value of an utterance. In order to be able to interpret the communicational behavior of a speaker, both goals need to be considered. As a consequence, Clark's account should acknowledge politeness as a conversational principle. Depending on the face-threatening value of a concrete speech act, one or the other goal of communication will have a greater impact on utterance production.

While Clark's theory should be expanded with regard to politeness, the politeness account does not need to be expanded with regard to the goal of efficient communication, because it was formulated as a response to the notion of cooperation, stating that when an utterance is face-threatening, it is often attenuated by means of politeness. If the utterance does not contain a face-threat, however, it is likely to be communicated in a more direct and efficient way. Thus, the account does already explicitly include the cooperative principle.

8.4 Metapragmatic instruction and its potential for fostering formal and informal tutoring

In their analysis based on tutoring protocols from different tutorial settings, Person et al. (1995) describe the impact of everyday conversational mechanisms on tutorial dialogue. As a consequence of their considerations, Person et al. (1995) draw the following conclusions: In order to foster tutorial dialogue, tutors and tutees need to be made aware of the conversational conventions of the tutorial interaction, this entails that the 'normal' rules of conversation may be violated.

As described in section 7.1, an instruction that provided information on such necessities of communication in expert-layperson tutorial interaction was developed and used in study IV of this dissertation. This so-called metapragmatic instruction aimed at making the experts aware of the tutorial character of the email counseling setting. When experts were provided with this information in the instruction, they produced instructionally more valid answers with regard to an audience design to a low level of understanding. Also, they reinforced the laypersons in that there question asking was good and important. While these results strongly indicated the role of politeness for the counseling setting (to investigate this role was the aim of study IV), they showed that the conversational behavior of the experts can be favorably influenced by means of a metapragmatic instruction. Hereby, it needs to be pointed out that the instruction of study IV was rather subtle (in that it only differed from the control instruction in only a few sentences).

In sum, the results provide evidence for the minimal intervention of only a few metapragmatic sentences in the instruction causing a sensitivization of the experts for both adaptation and face-related aspects. This evidence points towards the role of metapragmatic information as a means of helping experts to leave aside the conversational principle of politeness in favor of a more direct and effective knowledge communication. However, future research will need to address the question of how the impact of conversational principles can be altered by metapragmatic instruction, and hereby differentiate between diverse formal and informal tutorial settings. If successful, such a metapragmatic instruction could constitute a less costly and resource-consuming way of fostering expert-layperson communication than for instance the use of software tools who are also a promising intervention for fostering effective expert-layperson communication (see, for instance the Concept Revision Tool (CRT), which helps experts revise their own answer with regard to technical concepts that they used, thus fostering a better audience design of the answers; cf. Jucks, Schulte-Löbbert, & Bromme, 2007).

Tutoring research has shown tutoring in formal settings to be a very effective way of instruction compared to other forms of instruction. Hereby, tutoring is effective even though the instructional moves of the tutors are often suboptimal. It seems very likely that the medical laypersons in the informal tutorial context of email health counseling also benefit from experts' explanations, even though the experts' explanations are not optimal either (as studies III and IV of this dissertation have shown). Thus, it is a worthwhile effort to work on ways to foster email health counseling. This becomes even clearer when comparing email health counseling to other ways in which laypersons can obtain medical information on the Internet. As described in section 2.4, for these less personalized sources of information like web pages or medical journals the technical quality of information is often not very transparent for the layperson. And even if the quality is high, the information is often not apt for laypersons. In light of these considerations, it becomes evident that email health counseling is an important way of lay information-seeking and that it is thus a worthwhile endeavor to foster its efficiency.

8.5 Further research questions

In the preceding section of this general conclusion chapter, the empirical results of the dissertation's research studies were discussed from various viewpoints. Hereby, several directions for future research were outlined, both with regard to the expansion of theoretical accounts and with regard to future empirical research questions. In this last section of the chapter, these suggestions for further research will be complemented with some additional directions.

Examination of transferability of results to other populations

In order to discuss the transferability of the obtained research results to other populations than the investigated ones, a distinction needs to be made between study I which was conducted with a lay sample and studies II through IV which were conducted with each one expert sample.

In study I, the relatively narrow lay population of students enrolled in other course than the natural sciences were chosen in order to investigate lay beliefs in the thematic field of the metabolic syndrome. Thus, the population that was chosen was likely to be more educated than the general population. It is especially interesting to note that also in such a population, there are many widespread false beliefs as well as a high disparity of knowledge within the sample and it is likely that these outcomes will be even stronger in other lay populations. Future research studies, thus, should choose other lay populations in order to investigate lay knowledge both on the topic of the metabolic

syndrome as well as on other topics. This is important for two reasons: First, these studies should be conducted in order to provide further support for the claim of study I that medical laypersons often hold erroneous beliefs; second, because it is of practical relevance for practitioners to know lay knowledge for as many topics and as many different lay populations as possible, since this is helpful for their dialogues with their patients.

In studies II through IV, medical studies at the end of their academic formation were chosen as medical expert participants. This choice of a relatively homogenous sample had the advantage of avoiding a high disparity of the sample which could have obscured the effects of the experimental manipulation of the respective studies. Such effects for instance could have been caused by a high disparity with regard to years since academic formation was finished, patient contact or the chosen specialty within the medical domain. Despite these advantages, future studies should also investigate the impact of a display of lay erroneous understanding on experts' assessment and adaptation also with other samples of medical experts, for instance with practitioners in general or specifically with physicians who do health counseling on the Internet.

Future research within the paradigm of display of beliefs

In studies II and III, the impact of a display of lay erroneous understanding on the knowledge assessment and answering behavior of medical experts in email health counseling was investigated. For this aim, a research paradigm was developed and introduced which allowed for the comparison of experts' knowledge anticipations for cases in which the lay nature of the email author's understanding of medical concepts was evident in the email to a different degree. In this paradigm, the medical experts are provided with a lay email query that was realized in three different versions; in the first version, the layperson uttered several false beliefs. These false beliefs do not only inform on the layperson's *concrete* misunderstanding, but also point to the fact that there is a *general* deficiency to lay term understanding. In the second version, correct beliefs are uttered by the layperson; obviously, if a correct belief is uttered, the expert is not made aware of the fact that laypersons often have false beliefs; on the contrary, it rather obscures the nature of lay knowledge). In the third version, there are no specific beliefs displayed in the query (cf. section 5.2.2).

There are many thinkable and relevant further research questions which could promisingly be addressed with the paradigm. Thus, for instance, it would be a fruitful endeavor to analyze the impact of a belief display on the conversational mechanism of lexical alignment in email counseling. As Jucks, Becker, and Bromme (in press) have shown, experts align to lexical suggestions from previous conversation. This alignment

seems to be a rather automatic mechanism of conversation, as the experts align to the suggested wording no matter whether it has been introduced into conversation by their lay addressee or by a not-shared illustration. It would constitute an interesting research question to investigate the impact of a display of lay false beliefs in the query on lexical alignment to the addressee's word choice in the lay query. Do experts entrain to the technical terminology of the patient even if it is evident in the query that the patient does not have a correct understanding of the term? Or does the display interrupt this stable conversational pattern of lexical alignment which has already been shown for the conversational setting of email health counseling in a variety of research studies? The experts' alignment and other answering behavior could then be compared to the correct-beliefs and no beliefs display conditions. These and other research questions could well be addressed with the paradigm of display of beliefs.

When thinking about future research that could be conducted using the paradigm, one remark needs to be made: In this dissertation, the paradigm was used in two different studies: In study II, the experts' knowledge assessment was investigated, while study III investigated the experts' answering behavior. Hereby, the aspects of knowledge assessment and answering were investigated purposely in two separate studies with two separate expert samples in order to avoid an influence of the answering activity on the assessment. In study III, however, in which the same query versions than in study II were used, the holistic knowledge assessment item from study II was administered exploratorily to the experts. The pattern of results on this item in study III was the same than in study II. From this, we can tentatively conclude that the act of answering the lay query might not impact on the experts' assessment of how much the layperson knew when answering the query. However, this impression needs to be supported through future research, which also needs to investigate whether a more specific and differentiated knowledge assessment is influenced by a prior answering of the query or not.

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Appendix

Appendix A1. German questionnaire items in thematic order

Diabetes **[Diabetes]**
Es gibt Untergruppen von Diabetes.
Erbliche Faktoren spielen für die Entstehung von Diabetes eine große Rolle.
Ein häufiges Symptom von Diabetes ist gesteigerte Wachheit.
Für die Entstehung von Diabetes spielen erbliche Faktoren nur eine geringe Rolle.
Schwangere erkranken seltener an Diabetes.
Eine Folgeerkrankung von Diabetes sind Augenerkrankungen.
Manche Diabetiker sollten kein Insulin erhalten.
Diabetiker dürfen als Süßigkeiten nur Diabetiker-Süßigkeiten essen.
Bei Diabetes gelangt zu wenig Zucker in die Zellen.
Ein häufiges Symptom von Diabetes ist Appetitlosigkeit.
Bei Diabetes gelangt zuviel Zucker in die Zellen.
Schwangere haben ein erhöhtes Diabetesrisiko.
Ein häufiges Symptom von Diabetes ist häufiges Wasserlassen.
Wenn man an Diabetes erkrankt ist, muss man Insulin spritzen.
Eine Folgeerkrankung von Diabetes ist Arterienverkalkung.
Bei Diabetes kann der Zucker sich nicht im Blut auflösen.
Fettleibigkeit **[Adiposity]**
Fettleibige haben ein erhöhtes Herzinfarktrisiko.
Neben der Ernährung hängt die Entstehung der Fettleibigkeit auch von anderen Faktoren ab.
Zu fette und kalorienreiche Ernährung ist der einzige Faktor, der Fettleibigkeit bedingt.
Die Begriffe Fettleibigkeit und Übergewicht sind synonym zu gebrauchen.
Eine mögliche Folge von Fettleibigkeit sind Atemaussetzer im Schlaf.
Fettleibige haben ein genauso hohes Schlaganfallrisiko wie Nicht-Fettleibige.
Bei Fettleibigen verkalken die Adern schneller.
Zur Behandlung von Fettleibigkeit ist Fettabsaugung eine Therapie der Wahl.
Fettleibigkeit kann chirurgisch behandelt werden.

Bluthochdruck [*Hypertension*]

Bluthochdruck ist auch Veranlagungssache.
Warum ein Patient an Bluthochdruck leidet, lässt sich meist an einer Ursache festmachen.
Schwangere bekommen nicht so schnell Bluthochdruck.
Wenn der Blutdruck medikamentös gesenkt wurde, können die blutdrucksenkenden Medikamente in der Regel wieder abgesetzt werden.
Bei Personen mit Bluthochdruck verkalken die Gefäße genauso schnell wie bei Personen mit normalem Blutdruck.
Schwangere bekommen genauso schnell Bluthochdruck wie Nicht-Schwangere.
Bei Personen mit Bluthochdruck verkalken die Gefäße langsamer.
Hoher Blutdruck kann Schwindel hervorrufen.
Bluthochdruck entsteht auch als Folge von Schilddrüsenerkrankungen.
Eine Folgeerkrankung von Bluthochdruck sind Nierenschäden.
Eine Folgeerkrankung von Bluthochdruck sind Augenerkrankungen.
Bluthochdruck entsteht auch als Folge eines Hirntumors.

Erhöhter Cholesterinspiegel [High blood cholesterol]

Eine cholesterinarme Diät kann die Therapie des hohen Cholesterinspiegels unterstützen.
Ein erhöhter Cholesterinspiegel kann mit Medikamenten behandelt werden.
Ein erhöhter Cholesterinspiegel verursacht akut keine Beschwerden.
Ob man einen erhöhten Cholesterinspiegel hat, ist von erblichen Faktoren unabhängig.
Ein erhöhter Cholesterinspiegel begünstigt Arterienverkalkung.
Ein erhöhter Cholesterinspiegel macht sich durch Müdigkeit bemerkbar.

Arterienverkalkung [Arteriosclerosis]

Wenn man an Arterienverkalkung leidet, bekommt man eher einen Schlaganfall.
Ein Symptom von Arterienverkalkung sind Beinschmerzen.
Bei einer Arterienverkalkung sind die Adern aufgeweicht.
Arterienverkalkung kann völlig geheilt werden.
Bei einer Arterienverkalkung ziehen sich die Adern zusammen.
Bei einer Arterienverkalkung sind die Adern weniger elastisch.

Wenn man an Arterienverkalkung leidet, sinkt häufig der Blutdruck.
Wenn man an Arterienverkalkung leidet, steigt häufig der Blutdruck.
Bluthochdruck und Arterienverkalkung sind voneinander unabhängig.
Bei Arterienverkalkung kann zur Stabilisierung der Arterie eine Stütze in die Arterie eingebracht werden.
Das Risiko, an Arterienverkalkung zu erkranken, wird nicht vererbt.
Arterienverkalkung kann die Niere schädigen.
Bei einer Arterienverkalkung lagern sich Blutplättchen an der Arterienwand ab.
Bei einer Arterienverkalkung lagert sich Fett an der Adernwand ab.
Bei Personen mit hohem Blutdruck verkalken die Gefäße schneller.
Mit medikamentöser Behandlung können Arterien vom Kalk befreit werden.
Bei einer Arterienverkalkung sind die Adern brüchig.

Schlaganfall **[Stroke]**

Bei einem Schlaganfall ist das Gehirn betroffen.
Ein Schlaganfall hat, wenn er überlebt wird, meist keine dauerhaften Folgen.
Eine mögliche Folge eines Schlaganfalls ist eine bleibende Sprachstörung.
Nach einem Schlaganfall macht oft das Gedächtnis Probleme.
Es gibt verschiedene Typen von Schlaganfall.
Ein Schlaganfall entsteht durch die Verstopfung von Adern.
Trotz Schlaganfalls bleibt die Nährstoffversorgung des Gehirns in der Regel erhalten.
Ein Schlaganfall ist gekennzeichnet durch einen plötzlichen Funktionsverlust des Herzens.
Ein Schlaganfall entsteht, wenn übererregte Zellen zuviel Elektrizität produzieren.
Ein Schlaganfall kündigt sich häufig durch Brustschmerzen an.
Ein Schlaganfall kündigt sich häufig durch Sprachprobleme an.
Diabetiker bekommen eher einen Schlaganfall.

Herzinfarkt **[Heart infarction]**

Rauchen ist als Risikofaktor für Herzinfarkt von untergeordneter Bedeutung.
Bei einem Herzinfarkt kann der Schmerz in die Arme ausstrahlen.
Die Sauerstoffversorgung des Herzens ist bei einem Herzinfarkt nicht beeinträchtigt.

Das Risiko einen Herzinfarkt zu bekommen kann vererbt werden.
Nach einem Herzinfarkt werden Medikamente zur Blutverdünnung gegeben.
Ein Herzinfarkt entsteht durch Fehlsteuerung des Herzens aus dem Hirn.
Ein Herzinfarkt kündigt sich häufig durch Atemnot an.
Ein Herzinfarkt entsteht über den Verschluss einer Arterie.
Durch einen Herzinfarkt entstandene Schäden bilden sich nach einiger Zeit wieder zurück.
Nach einem Herzinfarkt können Teile des Herzmuskels absterben.
Ein Herzinfarkt muss operativ behandelt werden.
Bei einem Herzinfarkt stirbt Herzmuskelgewebe ab.
Diabetes ist ein Risikofaktor für einen Herzinfarkt.
Häufige Folgen eines Herzinfarktes sind Lähmungserscheinungen.
Bei einem Herzinfarkt kann der Schmerz in den Magen ausstrahlen.
Ursache eines Herzinfarktes ist das Versagen einer oder mehrerer Herzklappen.
Ein Herzinfarkt kündigt sich durch Gefühllosigkeit und Taubheit an.
Ein Herzinfarkt kann sich durch Übelkeit und Erbrechen ankündigen.

Appendix B1. German version of diabetes questionnaire

Zum Abschluss der Untersuchung wollen wir Ihnen noch einige medizinische Wissensfragen zu dem oben angesprochenen Themenbereich stellen. Bei den folgenden Fragen geht es um **Ihr** Wissen. Alle von Ihnen gemachten Angaben werden selbstverständlich anonym ausgewertet, so dass kein Rückschluss auf Ihre Person möglich ist.

	Stimmt	**Stimmt nicht**	**Weiß nicht**
Bei Diabetes wird vermehrt Glukose in die Zellen absorbiert.	□	□	□
Ein häufiges Symptom von Diabetes ist Appetitlosigkeit..	□	□	□
Eine Überdosis Insulin ist eine Ursache von Hypoglykämie.	□	□	□
Polydipsie ist ein Symptom von Diabetes.	□	□	□
Der Test auf Früherkennung von diabetesbedingten Nierenschäden heißt Makroalbuminurie-Test.	□	□	□
Der HBA_{1c}-Wert gibt Aufschluss über die Blutzuckereinstellung der letzten drei Monate.	□	□	□
Von einem klinisch manifesten Diabetes spricht man ab Nüchtern-Blutzuckerwerten von 20 mmol/l.	□	□	□
Diabetes Typ II ist durch absoluten Insulinmangel gekennzeichnet.	□	□	□
Eine Spätkomplikation von Diabetes ist Retinopathie.	□	□	□
Die meisten Typ II Diabetiker sind übergewichtig.	□	□	□
Insulin wird in konstanten Mengen ausgeschüttet.	□	□	□
Insulin sorgt dafür, dass Zucker sich im Blut auflöst.	□	□	□
Eine Spätkomplikation von Diabetes ist Arteriosklerose.	□	□	□

Bei einigen Diabetikern vom Typ II ist die Insulinsekretion erhöht.	□	□	□
Ab einem BMI von 25 spricht man von Adipositas.	□	□	□

Appendix B2. German query versions

CB version of query

Guten Tag,

ich bin 55 Jahre alt und bin fettleibig (87 kg bei 1,70 m), und ich weiß, dass Fettleibigkeit wirklich schlecht für die Gesundheit ist. Ich hatte noch nie ernsthafte gesundheitliche Probleme, aber vor einer Woche stellte mein Hausarzt bei einer Routineuntersuchung einen erhöhten Blutzuckerspiegel fest, da war wohl nicht nur die Schokoladentorte am Tag zuvor schuld. Er hat gesagt ich hätte Diabetes Typ 2. Diabetes hat meine Mutter übrigens auch, wahrscheinlich war ich deshalb auch mehr gefährdet. Jetzt soll ich mich mit einer Diätassistentin treffen und mich viel bewegen. Das sei auch nötig, um einer Arteriosklerose vorzubeugen, und verstopfte Adern will ich auch wirklich nicht haben. Ich habe meinen Arzt gefragt, warum ich nicht einfach Insulin spritzen kann. Aber er hat gesagt, ich hätte genug Insulin im Blut, scheinbar produziere ich also genug. Dabei sagt man doch immer, dass man bei Diabetes Insulin spritzen soll, das hat mich schon gewundert.

Ich weiß zwar, was ich zu tun habe, aber habe noch folgende Fragen an Sie:

Wieso habe ich diese Krankheit, wenn ich doch genug Insulin im Blut habe? Wofür ist Insulin eigentlich gut? Und auf welche Weise hat Diabetes etwas mit Arteriosklerose zu tun?

FB version of query

Guten Tag,

ich bin 55 Jahre alt und bin fettleibig (87 kg bei 1,70 m), aber Fettleibigkeit ist ja an sich nicht schlecht für die Gesundheit. Ich hatte noch nie ernsthafte gesundheitliche Probleme, aber vor einer Woche stellte mein Hausarzt bei einer Routineuntersuchung einen erhöhten Blutzuckerspiegel fest, ich hatte aber auch am Tag zuvor Schokoladentorte gegessen. Er hat gesagt ich hätte Diabetes Typ 2. Diabetes hat meine Mutter übrigens auch, das ist schon ein Zufall. Jetzt soll ich mich mit einer Diätassistentin treffen und mich viel bewegen. Das sei auch nötig, um einer Arteriosklerose vorzubeugen, und verschlissene Gelenke will ich auch wirklich nicht haben. Ich habe meinen Arzt gefragt, warum ich nicht einfach Insulin spritzen kann. Aber er hat gesagt, ich hätte genug Insulin im Blut, scheinbar nehme ich also genug Insulin mit der Nahrung auf. Dabei sagt man doch immer, dass man bei Diabetes Insulin spritzen soll, das hat mich schon gewundert.

Ich weiß zwar, was ich zu tun habe, aber habe noch folgende Fragen an Sie:
Wieso habe ich diese Krankheit, wenn ich doch genug Insulin im Blut habe? Wofür ist Insulin eigentlich gut? Und auf welche Weise hat Diabetes etwas mit Arteriosklerose zu tun?

NB version of query
Guten Tag,
ich bin 55 Jahre alt und bin fettleibig (87 kg bei 1,70 m). Ich hatte noch nie ernsthafte gesundheitliche Probleme, aber vor einer Woche stellte mein Hausarzt bei einer Routineuntersuchung einen erhöhten Blutzuckerspiegel fest. Er hat gesagt ich hätte Diabetes Typ 2. Diabetes hat meine Muter übrigens auch. Jetzt soll ich mich mit einer Diätassistentin treffen und mich viel bewegen. Das sei auch nötig, um einer Arteriosklerose vorzubeugen. Ich habe meinen Arzt gefragt, warum ich nicht einfach Insulin spritzen kann. Aber er hat gesagt, ich hätte genug Insulin im Blut. Dabei sagt man doch immer, dass man bei Diabetes Insulin spritzen soll, das hat mich schon gewundert.
Ich weiß zwar, was ich zu tun habe, aber habe noch folgende Fragen an Sie:
Wieso habe ich diese Krankheit, wenn ich doch genug Insulin im Blut habe? Wofür ist Insulin eigentlich gut? Und auf welche Weise hat Diabetes etwas mit Arteriosklerose zu tun?

Appendix B3. English query versions

CB version of query

Hello,

I am 55 years old and I am suffering from adiposity (87 kg, 1meter 70), and I am aware that that is a health risk. I have never had any serious health problems, but last week I went to a routine health check up and my doctor found that my blood sugar level was too high. This was surely not only due to the chocolate tart that I'd had the day before. The doctor told me that I have type 2 diabetes. My mother also has it, which probably made me more vulnerable for it. Now I have to go see a diet advisor and engage in physical activity. I was told that this was also necessary to prevent arteriosclerosis, and I really don't want jammed arteries. I asked my doctor why I can't just inject insulin, but he told me that I had enough insulin in my blood, seems like I produce enough insulin. That kind of surprised me, as people always say that you have to inject insulin when you have diabetes.

I know what I am supposed to do, but my questions to you are:

Why am I suffering from this disease even though I apparently have enough insulin in my blood? What does insulin do in the body? And in which way do diabetes and arteriosclerosis have to do with each other?

FB version of query

Hello,

I am 55 years old and I am suffering from adiposity (87 kg, 1meter 70), which is not a problem for my health per se. I have never had any serious health problems, but last week I went to a routine health check up and my doctor found that my blood sugar level was too high. I'd had a chocolate tart the day before, though. The doctor told me that I have type 2 diabetes. My mother also has it, what a coincidence. Now I have to go see a diet advisor and engage in physical activity. I was told that this was also necessary to prevent arteriosclerosis, and I really don't want worn-out joints.. I asked my doctor why I can't just inject insulin, but he told me that I had enough insulin in my blood, seems like my insulin intake with food is sufficient. That kind of surprised me, as people always say that you have to inject insulin when you have diabetes.

I know what I am supposed to do, but my questions to you are:

Why am I suffering from this disease even though I apparently have enough insulin in my blood? What does insulin do in the body? And in which way do diabetes and arteriosclerosis have to do with each other?

NB version of query

Hello,

I am 55 years old and I am suffering from adiposity (87 kg, 1 meter 70). I have never had any serious health problems, but last week I went to a routine health check up and my doctor found that my blood sugar level was too high. The doctor told me that I have type 2 diabetes. My mother also has it. Now I have to go see a diet advisor and engage in physical activity. I was told that this was also necessary to prevent arteriosclerosis. I asked my doctor why I can't just inject insulin, but he told me that I had enough insulin in my blood. That kind of surprised me, as people always say that you have to inject insulin when you have diabetes.

I know what I am supposed to do, but my questions to you are:

Why am I suffering from this disease even though I apparently have enough insulin in my blood? What does insulin do in the body? And in which way do diabetes and arteriosclerosis have to do with each other?

Appendix B4. German version of knowledge assessment questionnaire

Wie viel weiß der Patient, der diese Anfrage verschickt hat, darüber…	Sehr wenig	Wenig	Eher wenig	mittel	Eher viel	Viel	Sehr viel
…was unter Fettleibigkeit zu verstehen ist?	O	O	O	O	O	O	O
… welche verschiedenen Arten von Insulinpräparaten es gibt?	O	O	O	O	O	O	O
… welche Vorgänge bei Arterienverkalkung ablaufen?	O	O	O	O	O	O	O
…welche unterschiedlichen Typen von Diabetes es gibt?	O	O	O	O	O	O	O
…welche Blutzuckergrenzwerte gelten?	O	O	O	O	O	O	O
…welche Faktoren die Entstehung von Diabetes Typ 2 beeinflussen?	O	O	O	O	O	O	O
… welche Funktion Insulin im Körper hat?	O	O	O	O	O	O	O
… welche Rolle erbliche Faktoren bei Diabetes spielen?	O	O	O	O	O	O	O
… wie die Blutzuckerregulation funktioniert?	O	O	O	O	O	O	O
… wie Insulin produziert wird?	O	O	O	O	O	O	O
… welche Folgen Fettleibigkeit haben kann?	O	O	O	O	O	O	O
… wie der Zusammenhang zwischen Diabetes und Arterienverkalkung beschaffen ist?	O	O	O	O	O	O	O
… was Diabetes für eine Erkrankung ist?	O	O	O	O	O	O	O
…wie Diabetes über die Ernährung beeinflusst werden kann?	O	O	O	O	O	O	O

… wodurch sich die Diabetes-Typen unterscheiden?	o	o	o	o	o	o	o
… wie Diabeteserkrankungen therapiert werden?	o	o	o	o	o	o	o
… wie der Zusammenhang zwischen Fettleibigkeit und Arterienverkalkung beschaffen ist?	o	o	o	o	o	o	o
… welche Symptome Diabetes hat?	o	o	o	o	o	o	o
… in welchem Lebensalter die verschiedenen Typen von Diabetes vermehrt auftreten?	o	o	o	o	o	o	o
… welche Rolle Diabetes in der Schwangerschaft spielen kann?	o	o	o	o	o	o	o

Appendix B5. English version of knowledge assessment questionnaire

How much does the patient that wrote the inquiry know about…

	Very little	Little	Rather little	Medium	Rather much	Much	Very much
…what adiposity ist?	O	O	O	O	O	O	O
… which different types of diabetes medication exist?	O	O	O	O	O	O	O
… the processes that happen in arteriosclerosis?	O	O	O	O	O	O	O
…which different types of diabetes exist?	O	O	O	O	O	O	O
…critical blood sugar levels?	O	O	O	O	O	O	O
…which factors influence the development of diabetes type 2?	O	O	O	O	O	O	O
… which function insulin serves in the body?	O	O	O	O	O	O	O
… the role of heredity in diabetes?	O	O	O	O	O	O	O
… the functioning of blood sugar regulation?	O	O	O	O	O	O	O
… how insulin is produced?	O	O	O	O	O	O	O
… the sequelae that adiposity can have?	O	O	O	O	O	O	O
… the relation of diabetes and arteriosclerosis?	O	O	O	O	O	O	O
… what kind of illness diabetes is?	O	O	O	O	O	O	O
…how diabetes can be influenced nutriutionally?	O	O	O	O	O	O	O
… what distinguishes the different types of diabetes?	O	O	O	O	O	O	O

… the treatment options of diabetes?	o	o	o	o	o	o	o
… the relations between adiposity and arteriosclerosis?	o	o	o	o	o	o	o
… the symptoms of diabetes?	o	o	o	o	o	o	o
…at what age levels the different types of diabetes are likely to appear?	o	o	o	o	o	o	o
… the possible role of diabetes in pregnancy?	o	o	o	o	o	o	o

Appendix C1. German version of computer, Internet, & text processing software use questionnaire

Wie häufig nutzen Sie einen Computer?					____ Stunden pro Woche	
Wie häufig nutzen Sie das Internet?					____ Stunden pro Woche	
Wie häufig arbeiten Sie mit einem Textverarbeitungsprogramm?					____ Stunden pro Woche	
Haben Sie einen Internetzugang zu Hause?					□ JA	□ NEIN
Welche Internetdienstleistungen nutzen Sie?						
World Wide Web (WWW) □	Email □	Chat □	Telnet □	FTP □	Sonstige □	Keine □
Wie viel Prozent Ihrer Freunde und Bekannten nutzen das Internet (inkl. Email) regelmäßig?					____ %	

Appendix C2. German version of email answers of expert no. 75 and expert no. 5 (spellchecked)

Answer from expert no. 75
Man braucht Insulin, um Zucker in die Zellen aufzunehmen. Zusätzlich gibt es Rezeptoren an den Zellen, diese sind von Fett bei fettleibigen Pat. besetzt, deshalb kann kein Zucker mittels Insulin aufgenommen werden. Bei Diabetes kommt es zu einer Ablagerung von Stoffen in den Gefäßen, so hat man ein erhöhtes Risiko Arteriosklerose zu bekommen und an z. B. einem Herzinfarkt oder einem Schlaganfall zu erkranken.

Answer from expert no. 5
Guten Tag,

Ihr behandelnder Arzt hat mit dem, was er ihnen erklärt hat vollkommen recht! Insulin haben sie genug. Doch insulin allein genügt nicht, um im menschlichen Körper den Zucker, den wir ja mit einer Mahlzeit zu uns nehmen, aus dem Blut in die Körperzelle zu transportieren. Der Zucker muss in die Zelle, weil er lebensnotwendig für jede einzelne Zelle unseres Körpers ist - also auch für uns. Sie nehmen also Zucker auf (natürlich auch noch andere Nährstoffe, aber die lassen wir jetzt mal beiseite), er gelangt in die Blutbahn und so auch zu ihrer Bauchspeicheldrüse. Zu diesem Zeitpunkt (Zucker ist an der Bauchspeicheldrüse angelangt) fängt diese jetzt an das Insulin auszuschütten, auch in die Blutbahn. Unser Ziel ist ja: Zucker in die Zelle! Aber wie kommt es in die Zelle? Einfach so geht das nicht, aber mit Insulin, von dem auch sie genug haben. Die Zellen sind mit bestimmten Rezeptoren ausgestattet, an die das Insulin bindet. So wird der Zelle das Signal gegeben, Transportmoleküle bereitzustellen, die den Zucker aus dem Blut in die Zelle aufnehmen können. Hier nun, zur Vereinfachung ein Vergleich:
Stellen sie sich vor das Insulin ist so was wie ein Bote, der an die Tür (unser Rezeptor) klopft und der Zelle sagt, sie solle eine andere, spezielle Tür (unser Transportmolekül) für den Zucker aufmachen. Erst dann kann er auch in die Zellen gelangen. Bei ihnen ist nun nicht das Insulin das Problem, sondern, die Anzahl der "Türen" an die das Insulin tritt um der Zelle zu sagen: Bitte Tür für Zucker aufmachen! Sie haben zwar die gleiche Anzahl Türen, wie jemand ohne Diabetes Typ 2, aber sie haben eine viel größere Körpermasse zu versorgen und das bei gleich gebliebener Anzahl an "Türen" für Insulin. So nehmen Ihre Zellen viel weniger Zucker auf, als z.B. die eines Normalgewichtigen und Gesunden. Können sie ihr Gewicht reduzieren, so müssen die gleichgebliebene Anzahl von "Türen auch wieder" weniger mMasse versorgen, und der Zucker kann wieder adäquat in die zellen aufgenommen werden. Was hat das jetzt mit Arteriosklerose zu tun?

Dadurch, dass sich der Zucker ja nun in ihrem Blut befindet und auch nicht mehr der komplette Zucker, den sie essen, in die Zelle gelangt, verbleibt ein Teil im Blut. Je meht Zucker sich nun in der Blutbahn befindet um so mehr steigt auch die Wahrscheinlichkeit, dass sich kleine Mikrozuckerkristalle in der Blutbahn bilden und an ihren Gefäßwänden haften bleiben. Dieser Vorgang kann irgendwann dazu führen, dass so ein Gefäß langsam verschließt.

Appendix D1. German instruction versions

Control instruction
Liebe TeilnehmerInnen,
die Bedeutung des Internet nimmt im öffentlichen wie im privaten Leben immer weiter zu, und von Privatpersonen werden immer häufiger auch gesundheitsbezogene Internetseiten aufgesucht. Hierbei nutzen medizinische Laien verstärkt das Angebot verschiedener Gesundheitsdienste, medizinischen Experten eine Email zu senden und Antwort auf ihre Fragen zu erhalten. Patienten fehlt meist das Vorwissen, um medizinische Zusammenhänge einschätzen und verstehen zu können. Für Mediziner heißt das, dass sie ihre Informationen so formulieren müssen, dass Patienten diese auch verstehen können.
Innerhalb des breiten Angebotes der Gesundheitsdienste ist der direkte Kontakt mit einem Mediziner per Email (neben anderen Angeboten wie z.B. Lexika zu spezifischen Krankheiten und Symptomen oder Newsletter) ein häufig genutzter Service. Die Anfragen werden direkt über ein Email-Formular versendet. Mit einiger Verzögerung erhält dann der medizinische Laie die Antwort des Arztes.

Unsere Untersuchung besteht darin, einen solchen Emailaustausch nachzustellen.
Auf der nächsten Seite finden Sie eine typische Anfrage aus dem Internet. Bitte beantworten Sie als Fachfrau / Fachmann für Medizin dem Patienten seine Fragen.

Klicken Sie auf WEITER um zur Anfrage zu gelangen

Metapragmatic instruction

Liebe TeilnehmerInnen,

die Bedeutung des Internet nimmt im öffentlichen wie im privaten Leben immer weiter zu, und von Privatpersonen werden immer häufiger auch gesundheitsbezogene Internetseiten aufgesucht. Hierbei nutzen medizinische Laien verstärkt das Angebot verschiedener Gesundheitsdienste, medizinischen Experten eine Email zu senden und Antwort auf ihre Fragen zu erhalten. Patienten fehlt meist das Vorwissen, um medizinische Zusammenhänge einschätzen und verstehen zu können. Für Mediziner heißt das, dass sie ihre Informationen so formulieren müssen, dass Patienten diese auch verstehen können.

Dabei hilft es nicht, wenn der Arzt alles vermeidet, was dem Patienten unangenehm sein könnte. Ein Patient braucht sich zum Beispiel nicht dafür zu schämen, dass er viele Dinge nicht weiß. Patienten, die die „Frage den Arzt"- Option im Internet nutzen, wollen ja gerade medizinische Sachverhalte besser verstehen. Die Gefahr, dass sich der Patient durch Äußerungen des Arztes in seiner Unwissenheit bloßgestellt fühlt, muss der Arzt das in Kauf nehmen und das, was er wichtig findet, klar sagen. Nur so kann er dem Patienten zu einem besseren Verständnis verhelfen.

Unsere Untersuchung besteht darin, einen solchen Emailaustausch nachzustellen.

Auf der nächsten Seite finden Sie eine typische Anfrage aus dem Internet. Bitte beantworten Sie als Fachfrau / Fachmann für Medizin dem Patienten seine Fragen.

Klicken Sie auf WEITER um zur Anfrage zu gelangen.

Appendix D2. German version of patient query

Guten Tag,
ich bin 55 Jahre alt und wiege 87 kg bei 1,70m, aber Fettleibigkeit ist ja an sich nicht schlecht für die Gesundheit. Ich hatte noch nie ernsthafte gesundheitliche Probleme, aber nun hat mein Hausarzt bei einer Routineuntersuchung einen erhöhten Blutzuckerspiegel festgestellt, ich hatte aber auch am Tag zuvor Schokoladentorte gegessen. Er hat gesagt ich habe Diabetes Typ 2. Diabetes hat meine Mutter übrigens auch, das ist schon ein Zufall. Jetzt soll ich mich mit einer Diätassistentin treffen, Sport machen und Gewicht abnehmen. Das finde ich schwierig, weil mir mein Beruf dazu kaum Zeit lässt.
Sport und Abnehmen seien auch nötig, um einer Arteriosklerose vorzubeugen, und verschlissene Gelenke will ich auch wirklich nicht haben. Ich habe meinen Arzt gefragt, warum ich nicht einfach Insulin spritzen kann. Aber er hat gesagt, ich hätte genug Insulin im Blut, scheinbar nehme ich also genug Insulin mit der Nahrung auf.
Nun frage ich Sie:
Wieso habe ich diese Krankheit, wenn ich doch genug Insulin im Blut habe? Und auf welche Weise hat Diabetes etwas mit Arteriosklerose zu tun?

Appendix D3. German version of computer, Internet, & text processing software use questionnaire

Wie häufig nutzen Sie einen Computer?	____ Stunden pro Woche	
Wie häufig nutzen Sie das Internet?	____ Stunden pro Woche	
Wie häufig arbeiten Sie mit einem Textverarbeitungsprogramm?	____ Stunden pro Woche	
Haben Sie einen Internetzugang zu Hause?	□ JA	□ NEIN

Welche Internetdienstleistungen nutzen Sie?

World Wide Web (WWW)	Email	Chat	Telnet	FTP	Sonstige	Keine
□	□	□	□	□	□	□

A CELL IS A CELL IS A CELL – LAY MEDICAL UNDERSTANDING AND ITS ROLE IN ONLINE HEALTH TUTORING

Deutsche Zusammenfassung der Dissertation

Im Laufe ihres Lebens erwerben Menschen in Wissensbereichen, mit denen sie sich vertiefend beschäftigen, erweiterte Fähigkeiten sowie eine breite Wissensbasis; sie werden zu Experten in einem Gebiet. Hierbei findet im Laufe mehrerer Jahre eine expertenspezifische Restruktierung des bereichsspezifischen Wissens statt, die zu einer effizienteren Art der Wissensorgansiation führt (Kapitel 2.1.1). In Bereichen, in denen keine intensive Beschäftigung stattfindet, verfügen Menschen über Laienwissen, welches durch eine laientypische Art der Wissensrepräsentation charakterisiert ist. Dieses Laienwissen zeichnet sich meist nicht durch schlichtes Unwissen, sondern durch das Vorhandensein naiver Annahmen und Theorien aus (Kapitel 2.1.2). Damit Erklärungen eines Experten nun für einen Laien verständlich sein können, muss der Experte sein eigenes Wissen ‚übersetzen', und seine Erklärungen vom Wissen seines Adressaten ausgehend und daran anknüpfend verfassen, was hohe Anforderungen an den Experten stellt (Kapitel 2.1.3).

Die Kommunikation von Experten und Laien findet in den verschiedensten Kontexten statt. Zahlreiche Untersuchungen kommen hierbei aus dem Bereich der Tutoringforschung, in der die Kommunikation von Tutoren mit Laien (sog. Tutees) in formalen Lernkontexten untersucht wird. In der vorliegenden Dissertation wird eine Parallele zwischen der Experten-Laien-Kommunikation in formalen Lernsettings und der informellen Beratung von Laien durch Experten gezogen. Aufgrund der strukturellen Ähnlichkeiten der beiden Kommunikationssettings ist es somit möglich, die in dieser Dissertation (im Bereich der Email-Gesundheitsberatung) gewonnenen Ergebnisse mit Forschungsergebnissen aus der Tutoringforschung in Bezug zu setzen und für diese ‚fruchtbar' zu machen.

Studien aus dem Bereich der Tutoringforschung haben aufgezeigt, dass Tutoren sich häufig wenig an den individuellen Tutee anpassen, sondern eher ein standardisiertes Tutoringverhalten zeigen. Im tutoriellen Dialog von den Tutees geäußerte Fehlvorstellungen werden häufig von den Tutoren übergangen, zudem haben sie Schwierigkeiten, das Wissen der Tutees korrekt einzuschätzen (Kapitel 2.2). In der vorliegenden Dissertation wurden das Erklärverhalten und die Einschätzung des Laienwissens von Experten für die medizinische Emailberatung untersucht. Hierbei wurden auch Ansätze aus der psycholinguistischen Forschung berücksichtigt, die untersuchen, inwiefern Konversationsmechanismen aus der Alltagskommunikation (Kapitel 2.4) das Erklärverhalten der Experten beeinflussen. Zusätzlich wurden auch die speziellen Charakteristika des Gesprächssettings Email-Gesundheitsberatung (Kapitel 2.4) berücksichtigt.

Studie I: Fragebogenuntersuchung zu medizinischen Annahmen von Laien (Kapitel 4)
Für das thematische Feld der Dissertation wurde das Wissen einer studentischen Laienstichprobe (N=100) mit Hilfe eines Fragebogens untersucht und deskriptiv beschrieben. Die Ergebnisse zeigen eine hohe Prävalenz falscher Annahmen auf. Auf der Grundlage der Ergebnisse von Studie I wurden verschiedene Versionen einer fiktiven Laienanfrage entwickelt, in denen ein Laie entweder falsche Annahmen, keine Annahmen oder korrekte Annahmen bei ansonsten gleichen Anfragen äußerte. Diese Anfrageversionen wurden in den Studien II und III eingesetzt.

Studie II: Antizipation von Laienwissen durch Experten (Kapitel 5)
Medizinische Experten (N=72 Medizinstudierende der Abschlusssemester) lasen die Anfrage in einer der Versionen und schätzten das Wissen des Laienverfassers in einem Fragebogen ein; diese Einschätzung bezog sich sowohl auf Wissen, welches sich inhaltlich auf die manipulierten Annahmen bezog als auch auf anderes Wissen. Die Ergebnisse zeigen eine spezifische Verarbeitung der geäußerten Annahmen durch die Experten auf. Über das annahmenbezogene Wissen hinaus wirkten sich die geäußerten Annahmen nicht auf die Wissenseinschätzungen der Experten aus.

Studie III: Beantwortung einer Laienanfrage durch Experten (Kapitel 6)
Medizinische Experten (N=83 Medizinstudierende der Abschlusssemester) beantworteten eine der Versionen der Laienanfrage. Ihre Antworten wurden hinsichtlich der Anpassung der Erklärungen an den Laienrezipienten untersucht. Zudem wurde für die Antworten in der ‚falsche Annahmen'-Bedingung im Rahmen einer qualitativen Analyse untersucht, wie die Experten auf die geäußerten falschen Annahmen eingingen. Die Ergebnisse der Analysen zeigen außer einer lokalen Fehlerkorrektur keine Anpassungen an den Laien auf. Die Annahmen wurden zudem eher auf indirekte Art korrigiert (z.B. durch indirekte Anspielungen auf die geäußerten Fehler und Übermittlung der korrekten Information).

Studie IV: Die Rolle von Höflichkeit in der medizinischen Emailberatung (Kapitel 7)
Die vierte empirische Studie widmete sich der Frage, inwiefern die Berücksichtigung des Prinzips der Höflichkeit eine Erklärung für das Erklärverhalten der medizinischen Experten in Studie III darstellen kann. Hierzu wurden 70 medizinische Experten (Medizinstudierende der Abschlusssemester) entweder mit einer Kontrollinstruktion instruiert oder mit einer metapragmatischen Instruktion, in der die Experten Informationen bekamen über die Wichtigkeit direkter (und somit weniger höflicher) Kommunikation mit den Laien. Die Ergebnisse zeigen deutliche Einflüsse der metapragmati-

schen Instruktion auf die Expertenantworten, welche direkter (mehr 'lehrerhaft') und weniger höflich gestaltet wurden. Die Ergebnisse von Studie IV stellen indirekte, aber starke Hinweise auf eine Rolle von Höflichkeit für das untersuchte Setting dar.

In einer abschließenden Gesamtdiskussion der Dissertation werden die Ergebnisse der empirischen Studien zunächst vor dem Hintergrund der Tutoringforschung diskutiert (Kapitel 8.2). Während in vielen Studien aus dem Bereich der Tutoringforschung indirekt aus dem Eingehen auf Fehler darauf geschlossen wird, ob Tutoren diese erkannt haben, wird mit dem in Studie II verwendeten Paradigma ein direkter Weg vorgestellt, den Einfluss von geäußerten Fehlern auf die Laienwissen-Repräsentation von Tutoren zu untersuchen. Eine derart direkte Untersuchung sollte auch im (zumeist face-to-face tutorielle Dialoge untersuchenden) Bereich der Tutoringforschung Anwendung finden, hierzu wird eine mögliche Verfahrensweise vorgeschlagen. Als weitere Folgerung wird die Notwendigkeit des Einbeziehens des Prinzips der Höflichkeit für die Tutoringforschung hervorgehoben.

Im folgenden Teil der Diskussion (Kapitel 8.3) wird der Einfluss pragmatischer Prinzipien der Alltagskommunikation auf das in der Dissertation untersuchte Setting der Email-Gesundheitsberatung diskutiert. Hierbei finden sowohl die empirischen Studien der Dissertation als auch weitere Untersuchungen zur Email-Gesundheitsberatung Berücksichtigung. In der Darstellung wird herausgearbeitet, dass die Konversationsmechanismen in der Alltagskommunikation zu effizienter Kommunikation beitragen, allerdings bei großer Wissensdivergenz von Gesprächspartnern (Experten-Laien-Kommunikation) erfolgreiche Verständigung gefährden können. Aus der Darstellung werden in einem weiteren Schritt Rückschlüsse für die psycholinguistischen Ansätze abgeleitet.

Im vierten Abschnitt der Gesamtdiskussion (Kapitel 8.4) wird der Einsatz metapragmatischer Instruktionen reflektiert und das Potential einer solchen Instruktion für die Verbesserung von Experten-Laien-Kommunikation in formalen und informalen tutoriellen Kontexten diskutiert.

Die Dissertation schließt mit einem Ausblick auf weitere sich aus der Dissertation ergebende Forschungsfragen (Kapitel 8.5). Hierbei wird schwerpunktmäßig auf die Übertragbarkeit der Ergebnisse auf andere Stichproben sowie auf weitere mögliche Einsatzgebiete des für die Dissertation entwickelten Forschungsparadigmas von Studie II und III eingegangen.