How to Refer to ‘Diabetes’? Language in Online Health Advice

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SUMMARY

The adaptation of vocabulary between communication partners, i.e. the lexical entrainment phenomenon, is well documented. This study investigates whether the phenomenon can also be found in computer-mediated communication between experts and laypersons. The respondents, who are medical experts ($n = 46$), answered to fictitious patients’ queries on health problems. Language technicality within patients’ queries was manipulated. One version contained certain concepts in everyday language, the other in technical language. Do experts adapt the vocabulary in their replies to that in the inquiry? Detailed analyses provide evidence that experts not only use the inquiry vocabulary, but also adapt the content of their answers to the technicality of the inquiry. Surprisingly, though queries differ in the use of vocabulary experts attributed very similar prior knowledge to the fictitious patient while providing them with very different replies. The results are discussed with respect to the implications for health counselling and for theoretical assumptions about adaptation in net-based discourse. Copyright © 2005 John Wiley & Sons, Ltd.

With increasing access to the world wide web, access to health-related internet pages is also constantly growing (Baker, Wagner, Singer, & Bundorf, 2003; Cline & Haynes, 2001). Completely new ways of distributing health information have evolved (Bass, 2003). Patients search the internet for information about medical issues. Furthermore, they ask ‘cyberdoctors’ to supplement information they received during a visit to the doctor. The pharmaceutical industry, magazine web-sites and non-profit organizations provide ‘ask the expert’ sites. With some delay, patients receive written answers from these experts, that either remain private or become part of web-site archives so that other users can also read them. There is substantial variation in the quality, content and purpose of the various sites. Medical research in particular has a strong tradition of evaluating the quality of internet health information, generally addressing the content quality of online information, e.g. the correctness of advice (Ademiluyi, Rees, & Sheard, 2003; Gagliardi & Jadad, 2002; Kunst, Groot, Latthe, Latthe, & Khan, 2002). In comparison, the communication-related aspects of understandability and adaptation of health information to the level of user understanding have received less attention (Kim, Eng, Deering, & Maxfield, 1999).

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These issues are the focus of the study of net-based medical advice presented here. We proceed from the basic assumption that online advice is a communicative activity that is demanding for both those who provide information and for those who request it. This assumption is based on Clark’s (1996) theory of communication. As Clark and Krych (2004) point out speaking and listening together form a joint activity. Speakers monitor others and design ‘their utterances to be understood not by just anybody, but by the addresses’ (Clark & Schaefer, 1987, p. 209). Clark’s theory was developed for the analysis of face-to-face settings. However, it also provides a good starting point for an empirical and theoretical analysis of the characteristics of computer-mediated communication (CMC) (Clark & Brennan, 1991; Monk, 2003). For example, based on this theory Newlands, Anderson, and Mullin (2003) demonstrated how communication partners adapt to the conditions of this medium when they have to solve a problem mutually. Participants that solved a Map Task via text-based CMC performed initially poorer compared to the speaking interlocutors. After they gained some experience with the medium they caught up and—by using a concise style of communication—adapted to the restricted context.

TWO HEURISTICS USED TO ESTABLISH COMMON GROUND: HOW RELEVANT ARE THEY IN CMC BETWEEN EXPERTS AND LAYPERSONS?

In the following section, we focus on a specific variant of CMC, namely short (one-turn) text-based asynchronous interactions, scenarios in which laypersons send a request and medical experts respond in writing. These scenarios are not only of practical interest, but also provide a sound experimental setting for examining the usefulness of Clark’s theory about the comprehension of CMC between experts and laypersons.

Establishing common ground between health experts and laypersons is difficult enough in face-to-face communication. If a health expert overloads a patient with specialist terminology, the lack of common ground is obvious. In face-to-face communication, such misunderstandings can be corrected more easily, for example by nodding, frowning or verbal signals indicating whether the message has really got through to its recipient. Grounding is a process described by Clark and Brennan (1991) which ensures that the other person has received and understood the message. In computer-based asynchronous written communication, such grounding is not possible (Monk, 2003). The lack of these signals makes it all the more necessary for the expert to resort to certain heuristics in order to infer what the interlocutor already knows (Clark & Murphy, 1982). Two heuristics might be particularly relevant in internet advice: the first derives from the perceived group membership of the communication partner (community membership heuristic), the criteria being age, sex, and, most importantly here, the perceived expertise of the communication partner (Clark & Marshall, 1992; Isaacs & Clark, 1987). Most of the internet health-related sites are intended for laypersons, which makes community membership heuristic an important element for the assessment of so-called communal common ground. It enables the expert, for example, to realize and adapt to the systematic differences in knowledge between him/herself and the recipient. This is quite different from communicating with a colleague. In the case of varying expertise status (layperson vs. co-expert), this heuristic has considerable influence on the reply given by the expert (Bromme, Jucks, & Runde, 2005). However, in internet hot-lines, which are directed only at laypersons, the community membership heuristic provides no indication of individual adaptation of
replies to inquiries from laypersons with different backgrounds, i.e. for the assessment of personal common ground. (Exceptions: the expert receives explicit information about the layperson’s prior-knowledge, Nückles & Bromme, 2002, or sends out a questionnaire before answering the specific inquiry, Nückles & Stürz, in press.)

The second heuristic is called the linguistic copresence heuristic. This is the tacit assumption that if a word is introduced into conversation and not objected to by the addressee, it can be assumed that its meaning is known to both interlocutors and can therefore be used from then on. Word use is an interesting indicator of mutual adaptation in conversation. If speakers refer to the same object several times, it is economical to use the same vocabulary again, referred to as ‘lexical entrainment’ (Garrod & Anderson, 1987) or ‘alignment’ (Garrod & Pickering, 2004) occurs. Imagine two students sitting in a library together. The first one says ‘Oh, I’m suffering from migraine today. Do you have a tablet?’ Her friend might answer: ‘Oh yes, I have, it is really migraine weather today’. If the first sentence was instead ‘Oh, I’ve got a headache today. Do you have…’, the interlocutor will also very likely use headache as the referent in her answer.

In basic psycholinguistic research, there is substantial incontrovertible evidence that such standardization of vocabulary takes place very quickly in face-to-face communication in everyday contexts, but why lexical entrainment occurs is controversial (Pickering & Garrod, 2004). In brief: one side assumes that speakers take into account the interlocutor’s presumed understanding in the seconds it takes to plan and produce speech (Brennan & Clark, 1996; Gerrig, Brennan, & Ohaeri, 2000; Metzing & Brennan, 2003; Polichak & Gerrig, 1998). This group believes that interlocutors follow the linguistic copresence heuristic and agree on ‘conceptual pacts’, that is agreements about a specific lexical decision once made in order to refer to an object. Speakers decide to refer to a shoe as a loafer if they both assume that this conceptualization is necessary to make an object reference as clear as possible for the specific interaction context. Once the term in question has been introduced and agreed upon, they continue to use it, keeping in mind that this was the shared conceptualization.

The other view (Horton & Keysar, 1996) claims that the production of utterances is much more ‘egocentric’ and not as ‘cooperative’ as Clark and Marshall (1981) have assumed. Terms introduced earlier are picked up by the other speaker because they have become mentally available. What the recipient already knows is taken into account only if a misunderstanding occurs or cognitive resources allow it (Barr & Keysar, 2002).

Keysar (1994) demonstrated experimentally that it is very difficult for speech partners to distinguish between their own knowledge of a particular subject and what the other speech partner already knows. Quite often, there is privileged information that is known only to the speaker, but not to the recipient. In our context of text-based communication, it is also relevant that similar misleading effects of privileged knowledge have been reported in experiments on the writing and revising of texts (Jucks, 2001; Lumbelli, Paoletti, & Frausin, 1999). The basic idea behind Keysar’s investigations is important in the present context of communication between experts and laypersons. His assumption that participants have difficulty in distinguishing between privileged and shared information, and that these difficulties impact on the design of statements, may be especially true for experts.

There is a good deal of evidence that experts have difficulty in adapting their advice to the information needs of laypersons. One can assume that experts’ extensive and highly integrated knowledge of their own domain makes it very difficult for them to comprehend the completely different perspective of a layperson. This was termed ‘the curse of expertise’ by Hinds (1999), whose experimental study demonstrated that experts...
underestimated the difficulties novices face when performing a complex task (also see Bromme, Rambow, & Nièckles, 2001; Hinds, Patterson, & Pfeffer, 2001; Nièckles & Bromme, 2002, for studies on similar expertise effects). Particularly in the medical field, many research findings indicate that experts do not orientate their explanations to laypersons’ ability to understand what they hear or read (Boyle, 1970; Chapman, Abraham, Jenkins, & Fallowfield, 2003; Chapple, Campion, & May, 1997).

**LEXICAL ENTRAINMENT IN WRITTEN INTERNET COMMUNICATION BETWEEN LAYPERSONS AND EXPERTS: RATIONALE OF STUDY 1**

The above mentioned studies on lexical entrainment mechanisms in verbal interaction did not consider computer-based communication. Therefore, it needs to be investigated empirically whether the use of preceding terms (lexical entrainment) occurs at all in written net-based communication between experts and laypersons. In this scenario, both sides are aware of their roles (and knowledge status), but have no further opportunity to explore in detail the relevant knowledge background of their interlocutors.

The current study investigates whether medical experts in such settings do anything at all to adapt their answers to the way laypersons verbalize their concerns. In an internet-based hot-line scenario, medical experts were supplied with questions from fictitious laypersons. For each inquiry about medical issues, there were two versions which differed only in a few terms. These were encoded in either medical technical language (MTL), e.g. Diabetes Mellitus Type 2, or in medical everyday language (MEL) terms, e.g. blood sugar. Experts replied to the inquiries in writing.

In the experts’ answers, the number of *adopted terms*, i.e. those words that had already been used in the preceding request, is revealing when it comes to deciding between two contrary hypotheses on lexical entrainment. The *lexical entrainment hypothesis* postulates a significant adoption of terminology from the inquiry. It can be argued that picking up the speech partner’s lexical choices is a powerful conversation pattern which occurs automatically in everyday communication, and that this will also apply here.

The *lexical constraint hypothesis* assumes that irrespective of the question, experts prefer their technical language simply because they think in these terms when dealing with problems in their domain. In other words, the internal lexicon of specialist concepts (the building blocks of expert knowledge) constrains lexical choices. This hypothesis is confirmed if, in both experimental conditions, technical terms are preferred for the encoding of the critical issues. Both hypotheses refer to the thematic issues for which there is different encoding in the inquiries. Over and above this issue, the question arises as to whether there are other relevant terms which do not occur in the inquiries. In this connection, we analyse whether, with respect to the number of newly introduced MTL terms (new MTL terms), answers vary according to the two types of inquiry. If differences occur, we can assume that the experts *generalize* in some way from the laypersons’ use of terms. Here again, there are reasons for both possibilities. Experts might try to answer in accordance with the wording used in patients’ questions, i.e. with either more or fewer MTL terms. However, it is also conceivable that, even in the case of newly-introduced concepts, the choice of words is not affected by the style of inquiry.

With regard to generalization, the number of *non*-medical foreign words is also relevant. In everyday German, many words of Latin or Greek origin—especially those introduced into German in the last four centuries—can be replaced by a synonym of German origin.
Using such foreign words generally correlates with higher education. However, the reverse conclusion is not possible because words of German origin are also part of the standard language. Since MTL terms are mostly of Latin or Greek origin, systematic differences in the use of non-medical foreign language (N-MFL) terms in the replies would be a clear indication of generalization in lexical decision-making.

Adapting to the assumed understanding of a layperson does not necessarily occur only at the level of lexical choices, it could also occur on a more semantic level. In that case the experts’ answers would differ with regard to content variables. We analyse the number of different issues considered, the number of explanations, the number of behavioural tips and the way the layperson is addressed.

Method
Participants
A total of 50 advanced medical students from two German universities participated and were paid 8 Euros for their contribution to the study. Due to technical problems, the data sets for two participants who took part in the experiment over the internet were entirely lost. On average, the medical students were in their fourth year of university education ($M = 9.04$ semester, $SD = 1.76$) and between 22 and 28 years of age ($M = 24.67$, $SD = 1.41$). Fifty-nine per cent of our sample were female. The native language of all of our participants was German.

Participants stated that they used computers with a mean of 13.76 h a week ($SD = 7.82$) and the internet 6 h per week on average ($SD = 4.18$). Eighty-nine per cent of our participants had internet access at home. More than half of the participants used the internet for study or work-related topics (57%).

With respect to counselling experience, more than 70% commented that at least sometimes they explained medical content to friends or family members.

It should be noted that in our context the concept of ‘expert’ is used in contrast to novices, unlike many studies where experts and novices within medicine are compared (for a more detailed discussion of this distinction see Bromme et al., 2001). Therefore it was possible to run this study with advanced medical students as ‘experts’. In the context of our research, the domain-related knowledge is critical. A test of medical knowledge in the fields of diabetes and the thyroid gland was administered. On average, the participants answered nine out of 11 diabetes items correctly ($SD = 1.41$) and 12.5 out of 15 thyroid items ($SD = 1.76$). Two participants were excluded from the data set because they achieved less than 50% correct answers on a domain-specific expertise test.

Materials
The main activity of the participants was to answer two consecutive questions on different topics (diabetes and thyroid problems) allegedly submitted by patients. The texts supplied to the participants depicted a situation recently encountered by a fictitious patient. In both cases, the doctor’s diagnosis was unfamiliar to the patient, and certain aspects on which he or she was seeking advice, remained unclear (see the queries in Appendix A). The German query on diabetes contained 170 words; the one on the thyroid problem 114 words.

Both texts were produced in two different versions. In the MTL version, seven concepts were encoded in MTL, whereas in the MEL version these terms were substituted with everyday words. An example for diabetes is the use of blood glucose concentration for the medical term, whereas the everyday term condition used the blood sugar level. There were no further differences between the two versions. The different types of encoding are listed in Table 1. It should be noted that there were a few more terms in both inquiries which are part
of medical specialist language, but have no technical or everyday German equivalent (e.g. hormones in the question on the thyroid gland). The terms appear in the table in italics.

**Design and procedure**

The entire experiment was conducted online using an internet browser. The data bank program FileMaker® was used to store the data. The experiment was held in a non-public form, i.e. only people who had received an invitation could take part. Each participant was presented with one request on the topic of diabetes and one on thyroid problems, one in the MTL, and the other in the MEL version. Both the sequence of MTL vs. MEL queries and the sequence of the two topics were balanced out in our sample. In this manner, each research participant worked with both topics and both levels of technicality, resulting in a one-factor repeated-measurement design.

The experimental environment consisted of 15 web pages that could only be viewed in a predetermined sequence. After a brief introduction to the task, participants were asked to answer several questions about their computer and internet use before they proceeded to answer the two questions from patients. Once the first answer was completed and sent, it was no longer possible either to review or edit it. Figure 1 shows an example of the browser-based environment.

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**Table 1. Manipulated concepts (and German originals) for the two topics and both versions, medical everyday language (MEL) and medical technical language (MTL)**

<table>
<thead>
<tr>
<th>Topic: Diabetes</th>
<th>MEL version</th>
<th>MTL version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity (Fettleibigkeit)</td>
<td>Adiposity (Adipositas)</td>
<td></td>
</tr>
<tr>
<td>Visit (aufsuchen)</td>
<td>Consult (konsultieren)</td>
<td></td>
</tr>
<tr>
<td>Blood sugar level</td>
<td>Blood glucose concentration</td>
<td></td>
</tr>
<tr>
<td>(Blutzuckerspiegel)</td>
<td>(Blutglukosekonzentration)</td>
<td></td>
</tr>
<tr>
<td>Found (stellte fest)</td>
<td>Diagnosed (diagnostizierte)</td>
<td></td>
</tr>
<tr>
<td>Adult-onset diabetes</td>
<td>Diabetes Mellitus Type 2</td>
<td>(Diabetes Mellitus Typ II)</td>
</tr>
<tr>
<td>(Alterszucker)(^a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet expert/adviser</td>
<td>Nutritionist (Diätassistentin)</td>
<td></td>
</tr>
<tr>
<td>Shot (Spritze)</td>
<td>Injection (Injektion)</td>
<td></td>
</tr>
<tr>
<td>Insulin (Insulin)(^b)</td>
<td>Insulin (Insulin)(^b)</td>
<td></td>
</tr>
<tr>
<td>Fatty tissue (Fettzellen)(^b)</td>
<td>Fatty tissue (Fettzellen)(^b)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic: Thyroid problems</th>
<th>MEL version</th>
<th>MTL version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra sonic testing</td>
<td>Sonography (Sonografie)</td>
<td></td>
</tr>
<tr>
<td>(Ultraschalluntersuchung)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Found (stellte fest)</td>
<td>Diagnosed (diagnostizierte)</td>
<td></td>
</tr>
<tr>
<td>Enlarged (vergrößert)</td>
<td>Hypertrophy (Hypertrophie)</td>
<td></td>
</tr>
<tr>
<td>Results of a blood test</td>
<td>Blood status (Blutstatus)</td>
<td></td>
</tr>
<tr>
<td>(Ergebnisse der Blutuntersuchung)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pituitary gland</td>
<td>Hypophysis (Hypophyse)</td>
<td></td>
</tr>
<tr>
<td>(Hirnanhangdrüse)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subfunction (Unterfunktion)</td>
<td>Hypothyroidism (Hypothyreose)</td>
<td></td>
</tr>
<tr>
<td>Goiter (Kropf)</td>
<td>Struma (Struma)</td>
<td></td>
</tr>
<tr>
<td>Iodine (Jod)(^b,c)</td>
<td>Iodine (Jod)(^b)</td>
<td></td>
</tr>
<tr>
<td>Hormone (Hormon)(^b)</td>
<td>Hormone (Hormon)(^b)</td>
<td></td>
</tr>
<tr>
<td>Concentration (Konzentration)(^b)</td>
<td>Concentration (Konzentration)(^b)</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)In German more everyday medical words which are not of Latin or Greek origin are available compared to English, for example ‘Zuckerkrankheit’ [literally: sugar-illness] is a word widely used for diabetes (see Schorling & Saunders, 2000, about the use of ‘sugar’ among African American patients). German medical specialists—of course—use the same technical language as medical staff in other countries do.

\(^b\)Words in italics indicate specialist terminology that was not manipulated across conditions.

\(^c\)With this word, in German two different spellings exist (Jod and Iod) that are equivalent in their meaning, but the version spelled with an ‘I’ is the more technical or chemical term. There is no difference in pronunciation.
Figure 1. Screenshot of the MEL query on diabetes

Question on Diabetes:
I am 55 years of age and weigh 87 kg and my height is 180 cm. I am aware of the fact that it is not healthy to weigh so much but so far I have not seen any evidence of problems due to my obesity. But I had the impression that my eyesight is deteriorating. It turned out that from an eye specialist's point of view, everything is ok. I visited my general practitioner and he said that in the long run I should go on a diet. And you say that a weight loss of 10 kg would be ideal. But my blood sugar level is also high. My doctor said that I should go on a diet and lower my blood sugar level. And you say that I need no drugs. I was really surprised. I was sure that always say that you have to get treatment. So what will I do in the body? And what does my body have to do with it?
Subsequently, the expert was required to answer on his/her perceptions of the patient’s level of knowledge. The experiment ended with a medical knowledge test, some demographic questions and questions about participants’ attitudes to online health counselling. The average participation time was 45 min.

**Measures**

Experts’ answers were examined with regard to the following parameters.

**Number of words.** The total number of words used by experts in the explanation phase was counted. Text processing software counted the number of words in each answer.

**Lexical encoding of manipulated concepts.** In order to measure the lexical entrainment effect we had predicted, the number of manipulated words (see Table 1) that occurred in experts’ answers was counted. For example, in the query on diabetes, either obesity (non-technical wording) or adiposity (technical wording) was used in the query. Each answer was checked for MTL as well as for MEL terms, yielding individual scores for both types of terms. If only minor grammatical changes occurred (e.g. using the word *nutritionists* instead of *nutritionist*) the term was included as an item in the list of critical terms.

**Use of MTL terms.** Using the standard German reference book for medical terms (*Pschyrembel clinical dictionary*, 2002), we analysed how many MTL terms were used by the experts. All words listed in *Pschyrembel* and which did not occur in the general dictionary (Rechtschreibduden) were counted. By means of this method, non-technical language concepts (like leg) were excluded.

Experts’ use of MTL terms were assigned to one of two categories: *Query MTL* are terms already contained in the requests. These include all technical medical terms used in one of the two inquiries (i.e. part of the lexical entrainment manipulation) or in both inquiries. *New MTL* terms are words that are not part of one of the queries and are hence newly introduced by the experts. The interrater reliability for identification of MTL terms \((n = 20)\) was \(r = 0.93, p < 0.001\).

**Use of non-medical foreign (borrowed) terms (NMF terms).** Analysing the texts again, we categorized those words that are listed only in the classic German dictionary of foreign terms (*Duden 5-Das Fremdwörterduden*, 2002) and not in the medical dictionary (e.g. production, reduction). Interrater reliability for identification of NMF terms \((n = 20)\) was \(r = 0.72, p < 0.001\).

**Use of direct address.** The number of times the expert addressed his explanation directly to the (fictitious) recipient was counted. This was achieved by counting the personal pronouns indicating a direct reference to the patient as the recipient of the written answer (e.g. you, yours, we, our). Interrater agreement for identification of direct address \((n = 18)\) was \(r = 0.92, p < 0.001\).

**Content of the answers.** In addition to examining the use of words, we used content analysis to answer the question: What did the experts write about? For each of the two topics, six or seven pieces of information that address different aspects of the subject matter were identified. For example, answers to diabetes queries could address the fact that
glucose absorption into cells is inhibited, the role of adiposity as a predisposing factor in adult onset diabetes and so on. Here, we established the number of such topics that was treated. The interrater agreement exceeded 84%.

Explanations of technical terms. We developed a coding system to analyse explanation units that were provided in the answers. Our focus was on breaking down explanations on selected medical concepts. Based on theoretical assumptions, we defined possible explanatory units, e.g. function, property/characteristic feature, German synonym, comparison, etc. The frequency of occurrence of these explanatory units throughout the texts was rated. Medical concepts could be explained more than once and with more than one explanatory unit. Every text segment was rated only once as an explanatory unit to avoid repeated counting of explanations, and therefore constituting an artificial multiplication of explanations. Explanations were counted independently of the specific lexical encodings of the explananda. The concept of insulin resistance was also coded as explained when the word numbness instead of resistance was the explanandum. Interrater reliability for all texts was $r = 0.97$, $p < 0.001$.

Use of behaviour-related tips. Giving medical advice includes providing patients with specific tips about what to do in order to reduce pain or avoid further health problems. A statement was classified as a behaviour-related tip if such explicit appeals were made (e.g. ‘You should engage in more physical activity to control your weight . . . ’). Interrater agreement exceeded 90% for both topics.

Results

All significant data are reported two-tailed unless specified otherwise. Our data allow two ways of answering our research question. Using the repeated measurement design, the entire data set was analysed. Because this approach cannot fully exclude contrast effects, we also employed a supplementary approach, too. In order to establish whether the results remain stable, we used a between-subject-design, comparing only experts’ first answer (with either a high or low level of technicality). Below, we refer to these analyses as t1 analyses.

Number of words

Experts’ answers to the less technical query contained a mean of 182.96 words ($SD = 86.89$). Answering the technical query, experts used a mean of 176.28 words ($SD = 91.22$). No difference emerged between the answers to the queries which were high and low in technicality, $F(1, 45) = 0.20$, $MSE = 5261.42$, ns. Comparing the t1 answers alone, no differences were found either, $F(1, 44) = 0.11$, $MSE = 11523.73$, ns.

Lexical encoding of manipulated concepts

A repeated measurement multivariate analysis of variance (MANOVA) revealed a highly significant effect, $F(2, 44) = 34.27$, $p < 0.001$. More non-technical wording was used in the answers to the MEL version than in the answers to the MTL version, $F(1, 45) = 38.86$, $MSE = 0.57$, $p < 0.001$. Likewise, more technical wording was used in the answers to the MTL versions than in answers to the MEL version, $F(1, 45) = 35.40$, $MSE = 0.52$, $p < 0.001$. Figure 2 shows the results. In correspondence with these results, comparing
only the t1 answers, a significant disordinal interaction effect was found, $F(1, 44) = 19.86, p < 0.001$. Both main effects cannot be interpreted as the lines cross.

As already mentioned, both kinds of vocabulary were counted for each of the seven manipulated concepts. Altogether, there were only 17 cases in which both types of vocabulary were used (e.g. ‘sugar illness’ and Diabetes Mellitus Type 2). In 65% of such cases, experts first adopted the inquiry vocabulary and only then selected other vocabulary not used in the query.

**Use of MTL terms**

A MANOVA for repeated measures revealed a significant multivariate effect with respect to both categories of MTL terms (those already included in the experimental materials and those that had been newly introduced by experts), $F(2, 44) = 4.72, p = 0.014$. Univariate analysis yielded a significant difference for the use of Query MTL, $F(1, 45) = 9.24, MSE = 1.28, p = 0.004$. Experts’ answers to the MTL version contained more of those medical technical terms than experts’ answers to the MEL version. No differences were found with respect to the use of New MTL, $F(1, 45) = 0.03, MSE = 17.00, ns$. Figure 3 shows the results that remain significant (multivariate as well as the univariate effect for technical terms already contained in the materials) when using only t1 data, all $F > 2.70$.

**Use of non-medical foreign words**

No differences were found with respect to the use of NMF terms, $F(1, 45) = 0.28, MSE = 3.87, ns$. The results are the same, using t1 data, $F < 0.65$.
Use of direct address
Answers to the MEL version and answers to the MTL version did not differ with regard to use of personal pronouns, $F(1, 45) = 0.03$, $MSE = 21.50$, $ns$. The results are the same, using t1 data, $F < 0.17$.

Content of the answers
Answering the MEL version, experts referred to more of the central characteristics of the illness than they did when answering the MTL version, $F(1, 45) = 4.88$, $MSE = 1.28$, $p = 0.032$. These results do not occur when using the t1 data, $F < 1.23$.

Explanations of technical terms
Answering the MEL version, experts used more explanations than when answering the MTL version, $F(1, 45) = 14.62$, $MSE = 1.07$, $p < 0.001$. The results are stable when using t1 data, $F = 3.99$.

Use of behaviour-related tips
Answering the MEL version experts used more behaviour-related tips than when answering the MTL version, $F(1, 45) = 2.90$, $MSE = 0.96$, $p < 0.096$. The results are constant when using the t1 data, $F = 5.29$.

Discussion
The results of Study 1 confirm the lexical entrainment hypothesis. In the replies to MEL-term requests, more of the critical MEL terms were used and likewise there were more critical MTL terms in the answers to MTL-term questions. If the critical term was used
several times, experts tended to keep to the encoding supplied in the question. If experts switched at all, they did so more often after they had adopted the variant of the concept in the inquiry. The findings clearly confirm that lexical entrainment occurs in CMC one-turn interactions, but they do not answer the question as to why medical experts adapt so clearly to the laypersons’ lexical choices with respect to the critical terms. The question remains open as to whether experts adopt the laypersons’ terms merely because they became more salient through the inquiry or because they assumed, in accordance with the linguistic copresence heuristic, that these were the terms which the layperson was likely to know and could therefore be assumed as common ground. This interpretation would be supported if experts attributed more knowledge to laypersons who use MTL vocabulary than to laypersons using MEL terms.

**EXPERTS’ ASSUMPTIONS ABOUT LAYPERSONS’ KNOWLEDGE: RATIONALE OF STUDY 2**

Study 2 was intended to answer this question. For this purpose, a further sample of advanced medical students was asked to assess the medical knowledge of the (fictitious) laypersons who had formulated the inquiries. We employed an independent sample of comparable medical experts, because if we had questioned the participants in Study 1 before their work on the inquiries, it would have had the effect of an intervention by drawing attention to the significance of lay knowledge. Questioning participants after they dealt with patients’ inquiries would probably have produced answers which were influenced by working on the inquiries.

**Method**

**Materials**

A knowledge assessment questionnaire was constructed, consisting of one holistic question (In your opinion, how much does this patient know about the subject of diabetes [thyroid]?) and 15 specific knowledge items for each topic (e.g. In your opinion, how much does the patient know about the nature of thyroid hormones?). All items had to be answered using a 7 point Likert scale with verbally anchored points ranging from very much to very little. Three knowledge assessment items asked for concepts that had been manipulated in the question, the others asked for content which was closely related to the two topics, but not covered explicitly in the requests.

Participants were asked to fill in the knowledge assessment questionnaire immediately after they had read a short description of the advice-scenario and read one of the requests used in Study 1. Both the MTL-term and MEL-term inquiries were presented in a between-design to groups of advanced medical students. Finally, the same knowledge test used in Study 1 was employed in order to confirm the expertise of the participants. In order to reduce time and effort, this was a paper and pencil test.

**Participants**

Advanced medical students (n = 68) in their fourth year (M = 7.4 semester, SD = 0.59) were asked at the end of lectures to participate in our study. Five participants were not medical students or failed to mention their major and were therefore excluded from further analysis. Three participants did not pass the knowledge test (see above) and were also
Results

The knowledge assessment items were subjected to a multivariate analysis with query vocabulary (MTL terms vs. MEL terms) from the requests previously dealt with as the between-subject factor. Global and specific knowledge assessment were dependent measures. Specific knowledge assessment was split into two parts. One contained all the items that explicitly asked for manipulated words (three items in both topics). The second part contained the remaining nine items. The multivariate analysis revealed a marginally significant effect of request wording, $F(3, 56) = 2.43, p = 0.075$. Univariate analysis revealed a significant difference between the two experimental groups regarding the specific knowledge assessment for the manipulated items, $F(1, 58) = 6.14, MSE = 0.85, p = 0.016$. The knowledge of laypersons who used MTL terms in their requests was rated significantly higher with respect to the items which referred directly to the concepts contained in the inquiry text compared to the knowledge of laypersons who used MEL terms in their inquiries. Conversely, there were no significant differences in assessment from the two expert groups with regard to the items that did not refer closely to concepts in the requests which varied in formulation. Likewise, there were no significantly different knowledge assessments with regard to the ‘overall’ item, $F(1, 58) = 1.87, MSE = 1.09, p = 0.177$. These results are displayed in Figure 4.

GENERAL DISCUSSION

The results can be summarized as follows. The way laypersons formulate their inquiries clearly influences the experts’ replies. This relationship is revealed in the lexical entrainment: If laypersons use technical language, experts prefer to continue using these terms. If laypersons use everyday language, experts will follow suit. It is rare for both kinds of terms to be used within one reply. When this does happen, experts first adopt the term ‘proposed’ by the speech partner in the majority of cases, but find a substitute when the term recurs. These findings clearly confirm the lexical entrainment hypothesis. However, experts’ lexical adaptation to laypersons is limited to the terms already used in the inquiries. As far as both newly-introduced medical terms and non-medical foreign words are concerned, the way the request is formulated makes no difference to the way experts formulate their replies. More surprisingly though, there are clear differences at the semantic level: Experts gave more explanations of important concepts, introduced more critical issues and gave more behavioural tips in their replies to inquiries written in MEL. All these differences match up. This suggests that our experts might have thought that requests mainly formulated in everyday language should be answered providing more information than requests that included technical language.

To what extent are these findings the result of a conscious adaptation to the perceived prior-knowledge? Study 2 provides some explanations. As far as the directly manipulated terms are concerned, more knowledge is attributed to laypersons who present MTL than to
those who use more everyday language. This result supports the assumption that the experts in our study used the linguistic copresence heuristic when making lexical decisions. In other words, they presumed shared knowledge with regard to the terms introduced by the speech partner. Beyond that, there are no significant differences in the assessment of laypersons’ knowledge in Study 2. This corresponds with the fact that no other generalizable lexical decisions were found in Study 1.

This makes the semantic differences in the replies to both variants of inquiries all the more remarkable. The lexical features of the inquiry obviously evoke adaptation at two levels: first at the immediate and probably intuitive level of adoption of laypersons’ terms. However, the terminology is only used if activated by the preceding inquiry. Otherwise, experts revert to their own repertoire of MTL. The second kind of adaptation is at the content level. It is obviously easier for experts to adapt to laypersons at the semantic level than at the lexical level, except when the inquiring person already provides the opportunity for lexical adaptation.

Our participants were advanced medical students who stated that they had computer as well as counselling experience. Nevertheless it is an open question if medical doctors at a later career stage also show lexical adaptation to patients’ formulations.

At the beginning of this paper, we mentioned the debate about the ‘cooperative’ v. egocentric character of planning and completion of communication. In basic psycholinguistic research, the current debate focuses, in a technical sense, only on adjustments in the planning, production and reception of speech which take place in milliseconds (critical variables being, for example, delays in eye movements during the search for referents for simple nouns, e.g. Metzing & Brennan, 2003). In this sense, our results cannot contribute to the debate. However, behind the debate itself there are fundamentally different approaches to the nature of communication. Therefore, we might ask which of the
positions our results approximate. However, the results are not clear-cut. On the one hand, our findings demonstrate that the responding experts clearly perceive the knowledge differences among recipients and adapt their language accordingly, as the cooperative point of view postulates. However, they only do so if the laypersons make the appropriate terms salient. To this extent, there is a recipient adaptation. Further lexical decisions (i.e. the use of further technical terms) remain rather egocentric, i.e. oriented towards the expert’s perspective. Otherwise, on a more semantic level, we have again found adaptations to the laypersons’ assumed knowledge level. Garrod and Pickering (2004) argue lexical entrainment can also be explained by automatic—in contrast to controlled—processes that occur in interactions. Hence, our experts might have made their lexical decisions (use of patient’s terms) ‘automatically’ and their assumptions about the laypersons’ knowledge might have influenced their semantic decisions (what to explain) only. Garrod and Pickering (2004) have suggested that alignment between interlocutors occurs on multiple levels (phonological, syntactic, semantic and situation-representations) and that these levels impact each other within as well as between interlocutors. But it is still an open question how those different levels of linguistic alignment are related. Based on our data we assume that alignment processes do not necessarily occur on all levels homogeneously. Further research on communication between experts and laypersons will be especially helpful here, as—because of the differences in perspectives and knowledge—both partners should create distinct representations. With respect to the current basic psycho-linguistic research controversy mentioned above, the semantic adaptations we found can be studied further on. Adaptations at that level, are not in the view of the preferred experimental designs (the referential communication task) used in the recent debate on the cooperative nature of communication. In the future, it would be both possible and worthwhile to investigate, whether not only in the expert-layperson situation, but also in everyday contexts, adaptations by the interlocutor occur at a semantic rather than a lexical level.

Practical implications

Despite minor manipulation, we found very substantial differences in experts’ replies that concerned only the wording of seven concepts. It is important to emphasize that it has by no means been fully established whether the lexical entrainment found here contributes to better mutual understanding in expert-layperson contexts, as it does in interaction on everyday topics among interlocutors with similar background knowledge. The expert cannot be sure that the layperson who uses a medical term understands its real medical meaning (Boyle, 1970; Chapman, Abraham, Jenkins, & Fallowfield, 2003; Reid, Kardash, Robinson, & Scholes, 1994; Thompson & Pledger, 1993). A case in point is the term ‘migraine’ which we used at the beginning to illustrate the meaning of lexical entrainment. If a layperson speaks of migraine in his inquiry, the expert cannot be sure whether the patient is referring to an already diagnosed actual illness or is merely referring to a normal headache as migraine. This is, after all, a widely-held misconception, and a clear case of overgeneralization.

Applying heuristics in expert-layperson interactions which are automatically used in everyday contexts could be problematic. Experts working in internet-based health counselling have to realize how dangerously easy it is to succumb to the temptation of using medical technical terms which have already been used by patients, even if they have not understood their meaning. As Keysar, Lin, and Barr (2003) point even if the ability to
reflectively distinguish one’s own beliefs from others’ is given it is hard to deploy this ability during task performance. It is especially important to become aware of one’s own use of terms ‘suggested’ by patients, as such adaptations of language might occur automatically (Garrod & Pickering, 2004).

For their part, patients could be advised to avoid technical medical terms if they do not fully understand them. They should not assume that medical experts take their incomplete understanding of such terminology into account, especially if they themselves introduce medical terms into a conversation. Additionally, research on comprehension monitoring provides evidence that a patient may think that he has understood what he has been told, even though he has not (Lin & Zabrucky, 1998; Lin, Moore, & Zabrucky, 2001). Further research is necessary to gain insight into the processes that control the choice of words not only for experts, but also for laypersons.

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APPENDIX A—QUERIES

Question on Thyroid Problems (MEL-version)

Two weeks ago I visited my general practitioner for my annual check up. The examination included an ultrasonic test. Again this year the results were negative, apart from the fact that my thyroid gland has apparently changed. My physician found that my thyroid gland is enlarged. In addition, results of a blood test showed a too high concentration of a hormone from my pituitary gland. My doctor told me that my thyroid is not functioning properly and gave me an iodine prescription. He also told me that if I didn’t take my medicine regularly, I would run the risk of getting a goiter. So I would like to know: What does iodine have to do with my thyroid gland, and why does the thyroid change when iodine is missing?

Question on Diabetes (MEL-version)

I am 55 years of age and weigh 87 kg and my height is 1m. 70. I am aware of the fact that it is not healthy to weigh so much but so far I didn’t have any serious health problems due to my obesity. But I had the impression that my eyesight is deteriorating. It turned out that from an eye specialist’s point of view everything is ok so I visited my general practitioner. A blood test showed that my blood sugar level was too high. My physician found adult onset diabetes. Now I am supposed to see a diet advisor and do some physical activity. I asked my physician why I couldn’t just get insulin shots but he told me that I have enough insulin in my blood and that I need to reduce fat. This really surprised me because they always say that you have to get insulin shots. So my question is: 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 what does my fatty tissue have to do with it?