Experts' Adaptation to Healthcare Consumers' Language and Understanding: A Psycholinguistic Approach on Online Health-Advice

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Abstract

Communication between medical experts and patients is considered from a psycholinguistic point of view. The paper briefly introduces our research program that is focussing on mutual knowledge assessment and adaptation in expert-layperson communication. Here, we focus especially on the overlapping of words between doctor and patient. Starting from research on lexical entrainment we developed a software tool that improve written communication between expert and layperson. The Concept Revision Tool (CRT) supports experts' adaptation to laypersons by reflecting expert's word use and fostering revision in order to gain patient-orientated explanations.

More and more patients are turning to the Internet as their source of medical information (Baker, Wagner, Singer, and Bundorf 2003; Cline and Hayes 2001). A report recently published by the Institute of Medicine (Nielsen-Bohlman, Panzer, and Kindig 2004) states that 70 million Americans use the Internet for health information. Compared with other data (e.g., Harris Interactive 2005), this would even seem to be a conservative estimate. Several health portals such as www.netdoctor.com do not only provide up-to-date information on many illnesses and access to encyclopedias, but also allow users to post individual queries to an expert in the specific field (McMillan 1999). It is a relevant aim to build and improve intelligent systems that interact directly with healthcare consumers in the future. We claim that health portals where medical experts communicate individually with laypersons are an interesting research topic as understanding the difficulties as well as the implicit rules of net based interaction between laypersons and experts might help to improve human- as well as system-based health portals.

Online patient-doctor interaction has both potential advantages and disadvantages compared to traditional face-to-face settings. Communicating via the Internet allows patients to inform themselves at almost any time they like without having to make a prior appointment. Particularly when the topic of communication is personally embarrassing, it may be advantageous to be able to hide one's physical attributes and remain anonymous. Moreover, because Internet-based interaction on health matters is mostly asynchronous and written, experts have more time to compose and revise their message before sending it to their addressee. Such time for reflection is rarely available in face-to-face interactions (Bromme, Jucks, and Runde, accepted). Furthermore, one can argue that the above-mentioned features of Internet-based communication might increase patient participation and decrease the power imbalance that typifies traditional doctor-patient communication (Bensing, van Dulmen, and Tates 2003; Runde, Bromme, and Jucks 2005).

Besides these possible advantages, Internet-based health communication also has drawbacks compared to face-to-face interaction. One is the substantial variation in the *quality* (trustiness, content, and purpose) of different services (Ademiluyi, Rees, and Sheard 2003; Gargliardi and Jadad 2002; Kunst, Groot, Latthe, Latthe, and Khan 2002), and the difficulty that patients have in assessing the actual quality of information (Eysenbach, Powell, Kuss, and Sa 2002; see, for attempts to minimize this problem, HONcode n.d.). A second problem is the *comprehensibility* of the medical information publicly available on the Internet. To what extent are laypersons able to understand the advice given by medical doctors? Nielsen-Bohlman, Panzer, and Kindig (2004) have argued that almost one-half of the American adult population is unable to understand or use written health information properly. Therefore a particular disadvantage lies in the fact that medical experts have much less possibilities of identifying patients' knowledge gaps and misconceptions than in face-to-face interaction. Online written communication also lacks access to the additional verbal or visual signals that usually facilitate mutual understanding (Monk 2003). Hence, when explaining medical issues in a way that is understandable to non-experts, it might be particularly difficult to *adapt* to a consumer's individual background knowledge.

Mutual knowledge assessment and adaptation in communication between experts and laypersons: A research program

Our research program focuses on experts' assessments of laypersons knowledge (Bromme, Nückles, and Rambow 1999; Bromme, Rambow, and Nückles 2001) as well as on mutual adaptation of explanations between laypersons and experts in the context of Internet-based healthcare (Bromme, Jucks, and Runde 2005). We will report a series of studies focusing on one example of mutual adaptation, that is the so called *alignment* (sometimes also called *entrainment*) between consumers and medical experts when choosing their words (especially specialist concepts) in order to express their concerns and their explanations. In these studies we have found that patients impact on the way medical experts respond to such queries by choosing a certain way of wording. As specialist concepts are not just words, but labels referring to complex units of knowledge, such alignment of word use might be problematic. In the following we will at first sketch the psycholinguistic background of our research very briefly. Then the just mentioned impact of health care consumers' word choice on the experts' language will be described. Finally, a software tool, the Concept Revision Tool, which provides support and enables the expert to reflect his/her explanation to a layperson, will be described and demonstrated.

Research has revealed repeatedly that individualized, tailored messages are easier to understand and lead to better learning outcomes than standardized information (Kreuter, Oswald, Bull, and Clark 2000). Adaptation can be made with respect to content, word choice (lexical decisions about how to encode a certain message), and syntax. In verbal communication, it can also be made to prosody and volume. Health experts have several ways to tailor and downsize their message to a non-expert audience: They can motivate their patients by personalizing their message, enhance understanding by providing examples, analogies, and metaphors, focus on practically relevant information in order to increase patient compliance, and avoid technical language (Haug 1996).

Research shows that such adaptation does not occur automatically, and that it is often not sufficient to meet the addressee's needs. Particularly in the medical field, many findings indicate that experts do not orient their explanations toward the laypersons' ability to understand what they hear or read (Boyle 1970; Chapman, Abraham, Jenkins, and Fallowfield 2003; Chapple, Campion, and May 1997). One can assume that experts' extensive and highly integrated knowledge of their own domain makes it difficult for them to grasp the completely different perspective of the layperson (Schmidt and Boshuizen 1992).

Thus, how do speakers know what is appropriate for a specific target audience? In some cases, information is given explicitly by the addressees themselves. In other cases, speakers have to make *assumptions* about the target audience. Speakers design their utterances on the basis of these assumptions, which themselves results from evidence of the communication setting. In written communication language use is such a hint. Hence, the way interlocutors design their contributions impacts on the way speakers design their contributions. This results in an overlap in the choice of words between communication partners, a phenomenon that psycholinguistic research has called *lexical entrainment* (Garrod and Anderson 1987) or *lexical alignment* (Garrod and Pickering 2004).

Lexical Alignment in online health advice

Imagine a woman telling her neighbor: "Oh, I'm suffering from hypertension." Her neighbor might well answer: "Hypertension? That's really unpleasant." However, if the first sentence had been "Oh, I'm suffering from high blood pressure" instead, it is likely that the neighbor would also have used high blood pressure as the referent in her answer. There is evidence that such a standardization of vocabulary becomes established quickly in everyday oral communication (Brennan and Clark 1996; Isaacs and Clark 1987) and also in computer-related communication (Garrod and Anderson 1987; see Garrod and Pickering 2004, for possible explanations of the underlying mechanisms).

Bromme, Jucks, and Wagner (2005) showed that this phenomenon also occurs in Internet-based doctor-patient-communication. In an experimental setting they simulated a patient's email query on different medical topics. For each query, there were two versions which differed only in a few terms. These were encoded in either medical technical language (MTL), e.g. blood glucose concentration, or in medical everyday language (MEL) terms, e.g. blood sugar level. Expert's job was to answer the query by writing a response email. Data analysis shows more of the critical MEL terms in the replies to MEL-term requests and likewise there were more critical MTL terms in the answers to MTL-term questions (see Jucks, Bromme, and Becker 2005, for additional support).

Jucks et al. (2005) found evidence that lexical entrainment does occur in a more automatic way. Their results support the idea that experts are triggered by patient's word use, just as priming.

The tendency to adopt patient's language has also been found in natural settings. Jucks and Bromme (2005) analyzed seven German Internet health portals and found evidence of experts entraining to patients' word use. When at least one medical term was used in the laypersons' query (n = 101), experts entrained an average of 1.18 (SD = 1.18) different terms. This was equal to 34% of all medical terms introduced by patients. Moreover, they used more medical terms when these occured more often in the patient's question. Thus, the way laypersons formulate their inquiries clearly influences the experts' replies.

The Difference between Words and Meaning

Using the same expression to indicate the same meaning may be helpful for interlocutors. However, this cannot be taken for granted when using *technical jargon* in doctor-patient communication. As research on medical expertise has shown, experts compared with novices associate not only more but also different information with a certain specialist term (Hadlow and Pitts 1991; Patel and Groen 1991). Hence, from an expert point of view, changes in medical vocabulary might also indicate changes in meaning. When medical doctors use the term "migraine", this might be related to a certain type of headache, referring to a kind of pain that occurs repeatedly, is presumably unilateral, and is caused by a certain set of biological mechanisms. When, on the other hand, patients speak about migraine in their inquiry, they might be referring merely to a normal, painful headache—using the term migraine with no or at least not very detailed assumptions about underlying causal processes.

Hence, the interesting point with the phenomenon of lexical entrainment in doctor-patient communication is whether doctor and patient interpret the same words and expressions differently, even though both sides seem to agree silently on what they mean. Therefore, if a patient uses the expert's terminology but does not necessarily know the conceptual meaning, misunderstandings may occur, if the expert adopts the terms. For example, Thompson and Pledger (1993) found that patients lacked knowledge about those medical terms that medical doctors had identified as "common". Additionally, we conducted a study where laypersons' knowledge of common medical concepts (like diabetes, heart disease, arteriosclerosis) and experts' estimation of that knowledge was assessed. Results clearly indicate laypersons' lack of knowledge on medical topics. Furthermore, medical experts misjudge laypersons' knowledge, both overestimation and underestimation occur in the majority of cases.

Hence, entraining on patient's word use might lead to misunderstanding and misestimating of patient's knowledge and therefore difficulty in writing tailored explanations. Our results clearly indicate the crucial role of technical terms in written doctor-patient communication. This role becomes even more critical, if experts use these terms without considering patients' knowledge.

Language production and adaptation

There is strong evidence that speech planning occurs primary automatically. Horton and Keysar (1996) come to the conclusion that language production is primarily egocentric. Only in a second step, speakers review and/or revise their plan and include other's perspectives.

This is also consistent with the findings of Brown and Dell (1987) who found that recipient's knowledge is only considered secondary, like a later monitoring process. This process is initiated when the speaker considers a message as inappropriate. It is therefore necessary for the expert to be aware of the adequacy of a certain message Thus, perspective taking is central in expert-layperson-communication as it provides a basis for patient-tailored explanations. It is consequently even more important to support experts in focusing on underlying (automatical) processes and make them aware of these processes.

Thus, how can written communication between experts and laypersons be improved? How can new media enhance experts in tailoring their explanations to laypersons? The aim of this paper and our research approach is to make the expert conscious of these underlying processes. How can this happen?

One can effectively trigger tailored explanations by giving explicit information. Nückles, Wittwer, and Renkl (2005) for example, fostered perspective taking by giving the experts explicit individual information of laypersons' knowledge. This approach promises increasing efficiency and effectiveness of experts' answers to laypersons' questions. That is, making the expert aware of the specific communication situation is a good starting point to enhance experts' explanations.

Our approach takes into account the above mentioned outcomes and focuses on both the lack of awareness in speech production and the difficulty in estimating layperson's knowledge.

Supporting experts' adaptation

Based on these findings, we developed an Access®-based software that supports experts' adaptation to laypersons. Results give strong evidence that technical terms play a major role in expert-layperson communication. That is the point from which we set out.

The *Concept Revision Tool* (CRT) analyzes written texts referring to prior defined terms (mostly: specialist terms, but possibly also everyday language terms which are known for widespread misunderstandings about their medical content), reflects these terms to users, and enables them to revise their explanation before sending the explanation to the consumer. In practice, a medical expert responds to an email-query on a specific topic and then runs the CRT to identify "difficult" terms. The identification process is based on a data bank (which can easily be expanded). After this, the program highlights the terms one-by-one and poses questions to the user each time (like "Is the term *diabetes* common for patients?" or "Is it required to describe the term *diabetes* in more detail?"). Hence, by asking pointed questions, it is possible to draw the experts' attention to prior unconscious decisions in text production. Following the ratings, the medical expert has the opportunity to revise his/her explanation. Figure 1 shows a screenshot of the CRT.

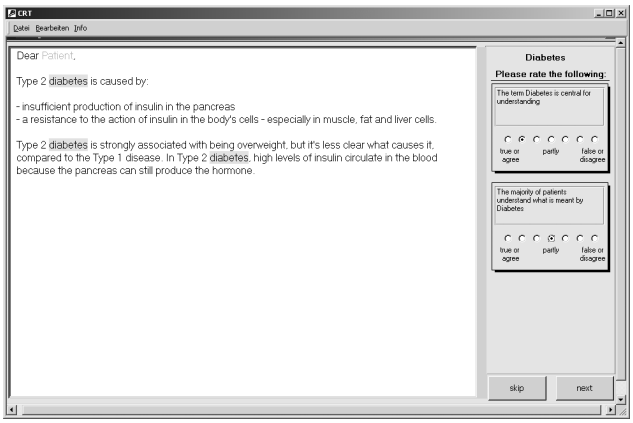

Figure 1: Screenshot of the CRT

We expect the revision starting at a lexical level has influences on other levels (e.g. the semantic level), too. Focusing on a technical word level first brings lexical choices and medical concepts to mind and makes them aware to the expert. As a result, we assume to get better, consumer oriented explanations.
At present we are running a first series of tests with the Concept Revision Tool. We will be able to present first results at the AAAI Conference which might help to exemplify ways of improving experts' abilities to provide explanations for consumers.

Finally we will discuss our approach as a way to construe the interfacing between medical experts and consumers theoretically. The promises as well as the limitations of such a psycholinguistic perspective on providing medical explanations will be discussed.

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