Translation and Adoption: Exploring vocabulary work in expert-layperson encounters

Mateusz Dolata✉, Gerhard Schwabe
Department of Informatics, University of Zurich
{dolata, schwabe}@ifi.uzh.ch

Abstract. An advisory service encounter brings together a domain expert with a layperson in a complex life situation. Because of the different backgrounds and expertise levels, the interlocutors require a common lexicon to guarantee for smooth collaboration. Consequently, the negotiation of terms and meanings is an essential part of advisory services and, generally, of expert-layperson collaboration. Establishing and maintaining a common lexicon is a specific and, at the same type, frequent type of collaborative work. Nevertheless, it remains unclear what efforts this collaborative work involves and what role collaborative IT applications play in this regard. A collaborative application can well support the maintenance of a common lexicon by providing a way to externalize terms or definitions. Or it can generate additional work by providing further terms and definitions to be incorporated in the common lexicon. That puzzle gets reflected in specific design dilemmas: should the system use expert or conventional terms, what is the source of the adequate terminology, to what extent should the system adapt to the individual lexical choices, etc. This manuscript explores the work involved in establishing and maintaining a common lexicon in advisory services between an expert and a layperson. In particular, it demonstrates how external material, a dedicated collaborative application developed for supporting advisory services, impacts the maintenance of a common lexicon. First, the manuscript depicts practices involved in translation and adoption of terminology from the system into the conversation. Second, it characterizes the system's impact on interlocutors' vocabulary. Overall, the study contributes to the discourse on expert-layperson collaboration by characterizing an important type of work, the vocabulary work, and by depicting the role of collaborative applications for this type of work.

1 Introduction

In a complex life situation people often rely on experts' advice in an advisory service encounter to cope with conflicting emotional and informational cues (Rotter, 1981). An advisee, who attends to an encounter, expects to develop a new perspective on his situation and receive a recommendation on how to improve it (Dolata and Schwabe, 2017). Accordingly, service encounters instantiate collaborative problem solving (Dolata and Schwabe, 2017). Advisees often know about the desired state, but little about reaching it. Advisors know much about potentials for taking action but need to understand the advisee's situation as exactly as possible to make adequate suggestions. Consequently, successful communication and mutual understanding is a prerequisite for an effective advisory service. It is to the advantage of both interlocutors to establish and maintain a common lexicon, a set of terms and their meanings, which they can easily understand and use in the context of an advisory service (Clark and Wilkes-Gibbs, 1986; Isaacs and Clark, 1987; Holler and Wilkin, 2009) and, also, beyond it, e.g., when contacting other relevant stakeholders. To establish a common lexicon, the interlocutors negotiate meanings and terminology, accommodate for specific wording and phrasing, clarify and explain terms where necessary, and control for its understanding with the other party. Short: they engage in a form of collaborative work with the goal of sharing a lexicon, which we refer to as *vocabulary work*. Explicit or implicit vocabulary work forms an essential part of collaboration between an expert and a layperson. Thus, it surprises, that the research leaves the *how* and *why* of vocabulary work underexplored. This paper addresses two research questions of great importance to the designers of collaborative technologies: (1) *How do advisors and advisees engage in vocabulary work during advisory services?* (2) *How does usage of a digital collaborative application influence the vocabulary work?* The answers to those questions emphasize the importance of vocabulary work and provide insights to support design efforts concerned with expert-layperson collaboration.

The user-centred design paradigm requires interfaces to minimize cognitive complexity (Thomas and Richards, 2009). This also affects the choice of vocabulary to be used in the interface. In general, the research advocates using simple vocabulary which requires little processing from the user (Thomas and Richards, 2009). However, a collaborative application for expert-layperson encounter has two users: the expert may prefer professional vocabulary, while the layperson may have problems understanding it. In other words, the user preferences concerning vocabulary will differ between the expert and the layperson. There are arguments going each direction. It has been shown, that expert and layperson understand each other better if the expert adapts layperson's lexicon (Bromme et al., 2005b). Adapting a simple vocabulary reduces the negative effects of "the course of expertise", i.e., the too optimistic experts' assumptions about laypersons' knowledge (Hinds, 1999;

Jucks and Bromme, 2007). This line of reasoning supports the use of simple vocabulary in collaborative interfaces. However, there are strong arguments for using expert vocabulary too. Primarily, confronting a novice with professional termini enhances their literacy in the specific domain, which in turn rises the efficacy of the layperson (Ozer and Bandura, 1990; Bandura, 1997; Yaniv and Kleinberger, 2000; Topol, 2015). As a consequence, the layperson can better interact with other stakeholders in this domain and, thus, become independent from the expert. A collaborative interface can support this development by introducing expert vocabulary in its interface to be taken up by the collaboration partners. But what if the use of expert vocabulary undermines the mutual understanding? This research explores how the use of professional vocabulary in a collaborative application designed for expert-layperson encounter affects the interaction.

This study analyses a particular type of expert-layperson encounters: crime prevention advisory services offered by police and other public agencies. This service brings together a trained police officer and a homeowner or a resident of a property at risk. The police officer possesses extensive knowledge about mechanisms and improvements that can prevent burglars from entering a flat or a home. During an advisory service of about an hour she[1] tries to make this knowledge accessible to the resident. The resident, normally, has information about the routines in the household which narrow down the advice and suggestions an advisor can make. Even if an advisee has rudimentary understanding of mechanics of doors, windows or locks, he mostly lacks the expert proficiency about security-relevant details. An essential part of the expertise resides in the language: technical terms and definitions are precise and powerful tools when used among experts, but they remain inaccessible to the layperson. For instance, burglary prevention advisors often advise the residents to replace traditional *roller cams* in window frames with *mushroom cams*. Whereas these terms precisely denote mechanisms and convey a clear message to an expert (window fitter, craftsperson, specialized architect), their meaning, form and role in preventing burglary is not straight away accessible to a layperson. Through vocabulary work the advisor and the advisee collaboratively engage in making this terminology more accessible.

This study conceptualises vocabulary work as an essential part of the expert-layperson conversation. At the example of burglary prevention service, it characterizes practices involved in vocabulary work. In particular, this study identifies two types of vocabulary work practices: *translation* and *adoption*. Translation occurs when a new professional term gets introduced into the conversation along with an explanation which *translates* the new concept into the parlance and context of the conversation. Adoption occurs when a participant takes on a professional term introduced to the conversation through a mention on another person's utterance or

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1 For a simple gender balance and for the sake of clarity, we refer to the advisor as a female (*she, her, policewoman*) and to the advisee (client, homeowner) as a male (*he, his*).

through material used in the encounter. Finally, the study exemplifies how terminology used in a collaborative application prompts the users to engage in vocabulary work. Overall, the manuscript describes how professional vocabulary propagates from the collaborative application to the expert and the layperson and makes clear that this propagation requires dedicated effort from the human actors. The insights from the current study contribute towards better understanding of expert-layperson interaction and have implications for design, thus affecting institutional talk researchers and designers of collaborative technologies.

2 Related work

2.1 Collaboration as negotiating and sharing meaning

The perspective which links communication and collaboration attracts much attention in communication studies and in CSCW. Research defines communication more and more as sharing of meaning rather than transferring information. Accordingly, communication is not an abstract transfer of knowledge, not even a transfer of information packages, as claimed by older models (Shannon and Weaver, 1964), but it consists in successfully solving lexical and referential ambiguities (Krauss and Fussell, 1990; Schober and Brennan, 2003; Bromme et al., 2005a; Wittwer, 2005). Successful vocabulary entrainment is not a supporting function of a conversation, but its key element (Krauss and Fussell, 1990; Ricard, 1993). In other words, effective communication involves adaptation to the dialogue partner especially with regard to the semantics of particular words – higher-level dialogue features like syntax or the overall structure play a secondary role (Wittwer, 2005). Overall, the view on communication has evolved: whereas earlier theories framed communication between humans in terms of knowledge transfer or adaptation at turn levels, recent insights point to the importance of negotiating and sharing meaning as the key communication processes.

So far, only little attention was given to the processes of lexical adaptation in conversations supported with technology. However, shared artefacts of work like collaborative applications significantly impact the sharing of meanings and concepts. IT reduces the flexibility of a natural, spontaneous dialogue (Brennan, 1996): interlocutors in a spontaneous situation can flexibly redefine meaning of a word, the meaning of a term in an IT system comes predefined and remains static. For instance, a "save" command has a strict, constant meaning in the given application and that neither the wording nor the function it triggers cannot be adapted by the user easily. It suggests that a collaborative application might impede the effective collaboration between humans: in terms of vocabulary, it means introducing a third party into the conversation, which rises the effort to coordinate the meaning of terms (Chen, 1994). However, as research concerned with distributed collaboration

shows, IT can help with establishing and maintaining a common lexicon among collaborators - be it through providing mechanisms for negotiation of meaning in form of folksonomies or through enforcing or proposing a controlled vocabulary (Lee and Schleyer, 2010; Jörgensen et al., 2012; Zarro and Hall, 2012; Jackson et al., 2018). While the research on coordinating meaning in online communities has been flourishing in the last years, the impact of collaborative application on vocabulary entrainment in co-located settings remains unsure. A face-to-face dialogue can leverage the freedom of unrestricted rich media to ad-hoc coordinate meaning and terminology. What mechanisms does a collaborative application trigger when introducing specific termini: do the human individuals negotiate the meanings between them and the application, which would resemble a folksonomy, or do they rather take on the proposed vocabulary?

Most of the research considering role of IT in negotiating and sharing meaning focuses on a single-user scenario. Research claims that human-computer interaction has many similarities with the conversation between humans (Brennan, 1998), and so proposes to see the human-computer interaction as a kind of conversation (Brennan, 1990). This aligns with the general *computers-are-social-actors* paradigm, according to which humans tend to intuitively treat technology similar to how they treat other humans. They, for instance, apply gender, role or personality stereotypes (Nass et al., 1995; Reeves and Nass, 2003; Edwards et al., 2019). The roots of this paradigm date back to early observations on how humans cope with interactive interfaces (Foley and Wallace, 1974). However, if it comes to language and lexicon, humans seem to accept that there will be little reciprocity from the computer. Humans adapt to the language of computers: they try to formulate their thoughts in a more computer-accessible manner, make efforts to simplify the message, and, finally, make lexical choices according to what fits the system (Brennan, 1998). Overall, interaction with computer systems changes users' language patterns (Brennan and Ohaeri, 1994). Whereas research has studied numerous scenarios (including computer-mediated communication between humans) the body of research on language adaptation in face-to-face computer-supported collaboration remains non-existent. While the reported impact of IT on human language and lexicon patterns is key to the current study and allows us to assume that representing terms in the interface can in fact support vocabulary transfer, the situation in co-located collaboration between humans acting in an institutional setting is far more complex.

Agreement on word meaning and reference is a complex process (Clark and Wilkes-Gibbs, 1986; Clark, 1992). First, the involved parties implicitly identify differences and lack of agreement if it comes to a meaning or a reference. Then, they locate the disagreement in a series of turns. And, finally, they engage in a recursive process which ends up with a mutual acceptance of a word's meaning (Clark and Wilkes-Gibbs, 1986). This shows that establishing a meaning of a word is a highly collaborative process which involves communication and coordination, as well as negotiation if such is necessary (Clark and Wilkes-Gibbs, 1986; Clark,

1996). As explained, those processes can become more complicated if an external actor or IT proposing its terminology gets introduced into the setting – the number of potential candidate references and meanings grow which makes the identification, location and negotiation of a disagreement more complex. However, visual support can also make conversational coordination more efficient (Brennan, 2005). IT, if carefully designed, can even take the role of a boundary object (Star and Griesemer, 1989; Star, 2010), i.e., a computer can provide room for flexible interpretations, such that each group of users sees them as coherent with their own environment, while keeping a fixed and unambiguous core. While collaborative technology has been proposed as a boundary object in multiple scenarios (Henderson, 1991; Lee, 2007; Star, 2010), it is necessary to delineate the original concept from the notion of technology proposed in this manuscript. A boundary object allows members of different groups to read different meanings specific to their needs from the same material (Henderson, 1991) – the meanings they identify do not need to be identical, but form a common denominator such that work on the individual or collaborative tasks can be continued (Lee, 2007). However, this can exactly pose danger to the effect of a service encounter: if an advisee accepts his own, inadequate vision of a concept which is not equal with the advisor's one, and does not negotiate it, he may fail in the implementation phase. In other words, while research has identified potential of technology for sharing core meaning across groups of users, no conclusive answer can be given on whether IT use will make vocabulary transfer and entrainment easier (due to its boundary character) or harder (due to its role as a third collaborator with its own lexicon). Thus, the research questions we ask in the current study are neither trivial nor irrelevant.

Whereas most research regarding sharing of meaning considers either spontaneous dialogue or team interactions, only limited insights are available on service encounters. This is surprising – the success of an expert-layperson service encounter relies explicitly on whether the layperson adequately understood the expert and can implement the recommendation (with other stakeholders, if necessary). A notable exception forms the research conducted by Bromme and his group (Bromme et al., 1999; Bromme et al., 2005a; Bromme et al., 2005b; Bromme et al., 2006; Jucks and Bromme, 2007; Jucks and Bromme, 2011): they study the lexical choices in patient-doctor, technician-client communication and other scenarios belonging to the expert-layperson realm (Ten Have, 1991; Heritage, 2005). While there are differences among the settings, they all share the presence of a certain knowledge asymmetry between the protagonists. Bromme and colleagues focus on the online communication in simulated experiments (Bromme et al., 2005b) as well as in online communities (Bromme et al., 1999). They argue that the lexical entrainment in such communication should be seen as collaborative effort: the advisor and the advisee need to engage in common effort to establish a common lexicon. This view contradicts to what is being proposed in communication handbooks, e.g., for doctors, which require the expert to follow layperson's lexical choices (Bromme et al.,

1999). In fact, experts more frequently initiate and engage in vocabulary transfer efforts than the layperson, e.g., they actively adapt to the layperson (Bromme et al., 1999; Bromme et al., 2006), thus trying to reduce barriers and biases between the expert and the layperson (Bromme et al., 2005a). This is crucial for distributed communication via Internet since this channel offers limited repair resources. While Bromme offers extensive insights on the nature of vocabulary entrainment and transfer in expert-layperson communication, it is limited to computer-mediated rather than computer-supported communication (Jucks and Bromme, 2011). This paper takes on the challenge of observing lexical entrainment in face-to-face expert-layperson services.

What is crucial here: the literature often treats the topic of expert-layperson vocabulary transfer in face-to-face collaboration in prescriptive terms. It conventionally proposes the usage of simple language, thus encouraging experts to adapt layperson's vocabulary (Bromme et al., 1999; Bromme et al., 2005b; Nückles et al., 2005; Nückles et al., 2006). Those suggestions have various origin: adaptation to the layperson's vocabulary may prevent the negative effects of "the course of expertise" (Hinds, 1999), it is likely to enhance the efficiency of advice provision (Nückles et al., 2005), or it simply makes the creation of a common ground easier (Brennan, 1990; Brennan, 1996). However, if one considers that expert-layperson collaboration should help emancipate and empower the laypeople (Topol, 2015), the suggestion to limit professional vocabulary is counterproductive. A layperson, who possesses the knowledge of right terms can more effectively tackle the problems on his own by consulting external sources or taking action in collaboration with relevant stakeholders (Topol, 2015; Obot et al., 2018). Consequently, creating opportunities for vocabulary work (a) by triggering the usage of specific professional termini and (b) by providing a shared artefact to establish common understanding might offer an alternative strategy to allow for lexical entrainment without the need to omit expert vocabulary. This manuscript explores this proposition, while capturing the impact of expert vocabulary on expert-layperson conversation in quantitative and qualitative terms.

2.2 Service encounter as collaborative problem solving

Advisory service encounters are currently evolving more rapidly than even before. On the one hand, those changes are consequences of regulatory efforts for consumer protection (ISO/TC, 2007; Oehler et al., 2010; EU, 2014; CH, 2015; DE, 2016). On the other hand, the workplace digitalization is accelerating and comprises more and more areas, including those which are traditionally considered emotional and human, i.e., "high touch" as opposite to "high tech", such as counselling (Wunderlich et al., 2013; Arwas et al., 2016). Extensive efforts have been made to provide effective IT-support to human-based service encounters by com-

bining the touch with tech. Additionally, the unlimited access to Internet-based information sources and self-service forces the traditional service encounters to change: while such service encounters are less attractive to an advisee in a standard situation – he can easily find the relevant data online and engage in self-service, face-to-face service encounters provide an excellent environment for handling complex life situations. Complex life situations denote situations in which an individual experiences a variety of information and emotional cues "that in themselves may interact, thus making both classification and prediction extremely difficult" (Rotter, 1981). Therefore, this notion is related to subjective emotions rather than objective features. However, the literature refers to individual conditions, which are likely to be considered complex and generate the specific emotional response, such as severe illness (Missel and Birkelund, 2011), emigration (Becker et al., 2000), or transitioning from adolescence into adulthood (Herman, 2009). People seeking burglary prevention support are in a similar situation: they may have experienced a burglary in their home or in the neighbourhood, they feel anxious owing to societal changes, they plan a major renovation of their property, or have recently moved houses. In any case, they consider multiple cues from society, media, friends, or relatives, and face various options on how to make their property more secure – these changes often impact daily routines (turning on the alarm when they leave the house, locking all windows, etc.) or attitudes (strengthening bonds with neighbours, giving up privacy for security, etc.). People facing complex life situations require assistance rather than simple information provision and thus attend to expert-layperson service encounters and expect to elaborate a solution in an interactive manner (Dolata and Schwabe, 2017). The evolution to problem-solving service encounters has been accompanied by the development of modern tools for supporting service encounters.

IT offers many advantages for modern advisory service encounters: documentation support, enhanced visualizations, inclusion of external databases with potential solutions, linking problem and solution, grouping and prioritization of atomic singular issues, and more (Dolata and Schwabe, 2017; Kilic et al., 2017). Research on supporting advisory services builds upon the assumption that shared artefacts establish shared understanding (Schrage, 1991; Dix, 1994; Novak et al., 2008). It defines shared understanding as general agreement between the advisor and the advisee on the issue under consideration and a prerequisite for collaborative advisory encounters (Schmidt-Rauch et al., 2010; Giesbrecht et al., 2014; Giesbrecht et al., 2016a). The use of an IT-system for collaborative clarification of client's problem, be it in form of collaboratively taken pictures (Giesbrecht et al., 2015) or in form of textual descriptions (Novak et al., 2008) can support shared understanding. Furthermore, interactive and collaborative externalization of advisory process is suggested as a way to share understanding of the client's and advisor's role in an advisory service (Giesbrecht et al., 2016b) as well as of the relation between particular activities and the overall goals of the encounter (Giesbrecht et al., 2013; Kilic et

al., 2017). Additionally, collaborative applications are proposed as a way to educate the client to understand complex professional concepts by making him interact with dynamic visualizations in dedicated episodes of the advisory service (Heinrich et al., 2014). Overall the discourse provides evidence that a collaborative application used to explicate a difficult concept (or problem, or solution) enhances sharing the understanding of this concept (or problem, or solution). This is supported by self-assessment measurements and qualitative accounts of enhanced understanding of advisors and of advisees. However, it leaves open what work is actually done in service encounters to establish that shared understanding when a collaborative IT is used. This paper aims at exploring this issue while focusing on the verbal and non-verbal conduct of the interlocutors.

Following the earlier research, we frame burglary prevention advisory services as persuasive encounters, i.e., ones that aim at changing advisee's behaviour or attitude (Dolata et al., 2016; Dolata and Schwabe, 2018). In persuasive service encounters, an effective process should consider the decisions to be taken after the advice, as well as the roles of the advisor and the advisee as a persuader and a persuadee. However, burglary prevention advisors and advisors from other non-commercial services (e.g., energy saving advisors (Fischer et al., 2014)) lack means or resources to structure their advisory encounters in a persuasive style. They act spontaneously and are driven by the issues or security flaws they encounter (e.g., weak cellar windows) or by the requests from the advisee (e.g., ventilation in the cellar) (Comes and Schwabe, 2016a). An effective advisory service would make the advisees aware of the issues under consideration as well as changes or investments at stake, thus allowing for structured solutions (Petty and Cacioppo, 1986) – it would empower the advisee to take an informed decision without hesitation. IT support for persuasive service encounters should, therefore, provide affordances for establishing a rational problem solving process which prepares the advisee for an informed decision, because elaborated decisions made consciously and rationally are likely to remain stable for longer than spontaneous or biased ones (Petty and Cacioppo, 1986). Without clear terminology and clear concepts behind it, formulating the right queries or decisions remains challenging to the advisees. Therefore, effective vocabulary work is a matter not only of understanding the advisor during the encounter, but also of gaining efficacy to address the issues after the encounter. We provide further information on the project context of the current study in the Methodology section.

3 Methodology

3.1 Preliminary studies and the design of the SmartProtector

The study was conducted as a part of a research program on advisory services in burglary preventions realm. A part of the program was the development of a collaborative application to support the advisory service and understanding its impact on the service encounter. The SmartProtector was designed in collaboration with burglary prevention advisors and their respective police agencies (two police departments in Switzerland, two state offices of criminal investigation in Germany). Before its roll-out, the SmartProtector was tested in realistic advisory services to study how the advisors adopt the tool in their daily practice and how the interaction with the advisee changes. Overall, the research program intended an improvement of the interaction between the interlocutors to make the encounter more appealing to the advisee, such that he engages more likely in the implementation of the advice.

A burglary prevention advisory service encounter involves an advisor, normally a dedicated and trained policeperson, who visits a homeowner at his property to independently advise him on how to make his home safer against burglary. During an advisory encounter, the homeowner together with the advisor inspect the property, discuss security flaws and opportunities for improvement. The advice may include suggestions to improve windows and doors with modern and specific technical solutions, install an alarm, redesign the environment or change behaviour of the residents and neighbours. The advisor often engages in persuasion to make their advisees address the recommendation without leaving gaps (Dolata et al., 2016; Dolata and Schwabe, 2018): the burglars are good at finding the weakest point.

The SmartProtector was designed to support the advisors at conducting routine advisory encounters by supporting and improving their regular activities: collecting information about security flaws, assessing them and explaining the assessment to the advisee, presenting multimedia for security flaw explanation or advisee's motivation to handle, prioritizing the security flaws together with the advisee. Its design originates in a user-centred process under consideration of the requirements collected from the stakeholders: the home security advisors requested access to valuable materials and wanted to receive a device light enough to carry along and the homeowners requested a better understanding of the complex information advisors provide and personalization of the material they receive. Since the domain of application is very technical and specific, it was essential to support the advisors at explaining the technical solutions to the client. Accordingly, the technical terms used in the tool were elicited through workshops and, where available, originate from the materials such as brochures used by the advisors during regular advisory sessions. Overall, the interface of the SmartProtector, including the choice of terms used therein, was designed in a highly interactive process with advisors and homeowners to guarantee for high acceptability of the system.

The prototype of SmartProtector used in the current study follows the requests collected in the preliminary studies. The steps of the advisory process represent the ones from the advisor's practice: protection object, protection needs, exploration of the object, and security plan (cf. Figure 1). In the other screens, the SmartProtector provides predefined object categories (e.g., 'balcony door' or 'ground floor window'), phrases (e.g., 'window hinges too weak'), and lists of technical solutions consisting of a name and a picture to choose from (e.g., 'fit hinge-side locks to the window', cf. Figure 2, 3, and 4) – those areas are filled with textual data, however provided not in form of continuous text passages, but always in form of keyword or key-phrases distributed across the screen. Notice the use of technical vocabulary visible to both interlocutors ('window fittings', 'mushroom cams', 'roll bolts', 'mechanical security device'). Only at some places, the advisors can type in own comments and suggestions through the available on-screen keyboard (cf. 'Store key…' in Figure 3). Additionally, she can take and highlight pictures. Overall, three input mechanisms were implemented: picture taking, on-screen keyboard, and selection of predefined content. Multimedia content in form of videos or pictures was free of written text and needed to be explained by the advisor. The software was designed for and deployed on a 10" MS Windows-based tablet, it was put in a solid case with a bend such that it was easy to carry around the device and to easily hold it while gesticulating. The SmartProtector's design supports collaborative use during face-to-face encounters, i.e., it shall be a shared artefact of work which gives at least passive access to the advisee and active access to the advisor. The choice of font size, icons and multimedia was driven by this rationale and enabled for common gazing at the screen and collaboration over the screen when it was placed on a table. By now, the SmartProtector reached the maturity of a productive system and is used by the advisors in large areas of Germany and Switzerland in their daily work. A more detailed description of this artefact is provided by several other publications (Giesbrecht et al., 2015; Comes and Schwabe, 2016a; Dolata and Schwabe, 2018).

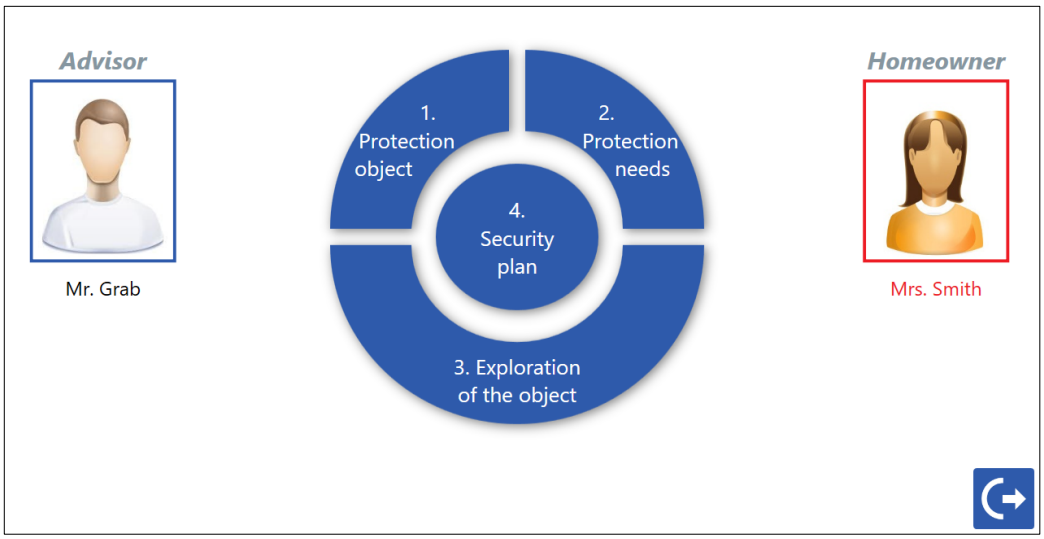

Figure 1. The navigation screen from SmartProtector showing the process of an advisory encounter.

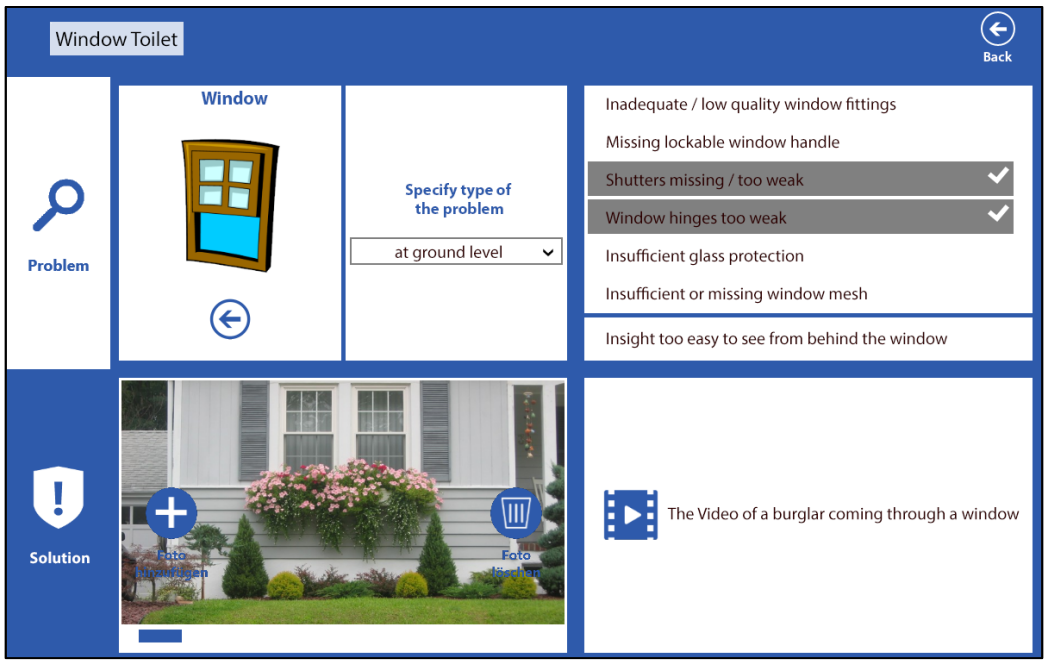

Figure 2. The problem-identification screen for grouping and selection of security issues; here an example of an insufficiently secured toilet window.

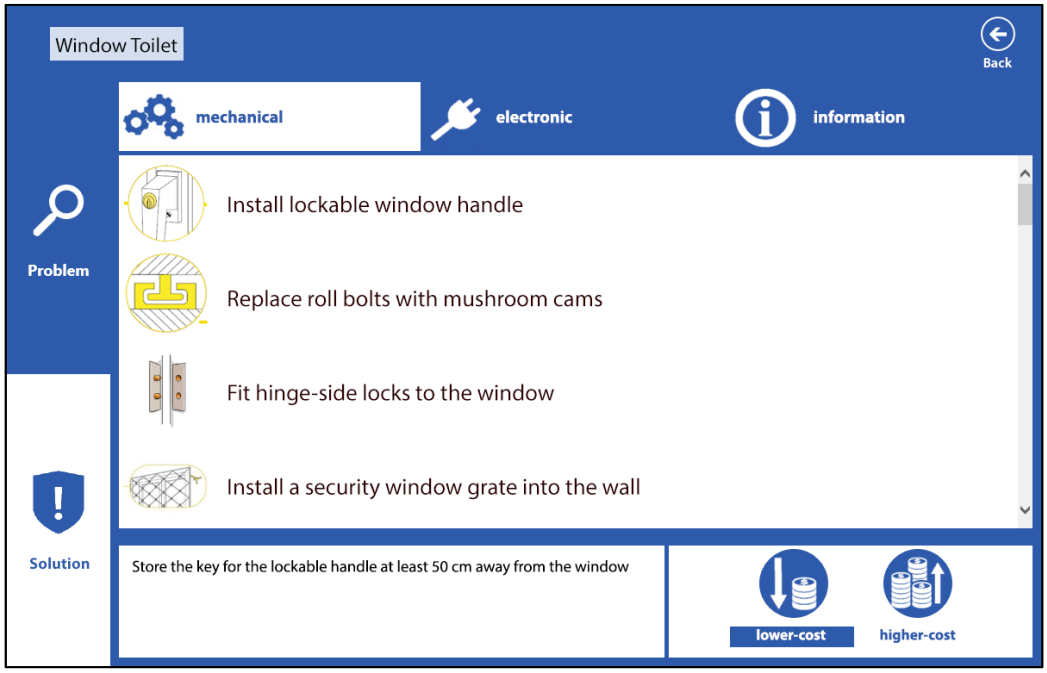

Figure 3. The solution-choice screen for selecting appropriate mechanical security of a specific security issue; the advisor can click on the picture to present a graphic or video illustrating the solution or select an element in the list to save it as an adequate solution to the problem under consideration.

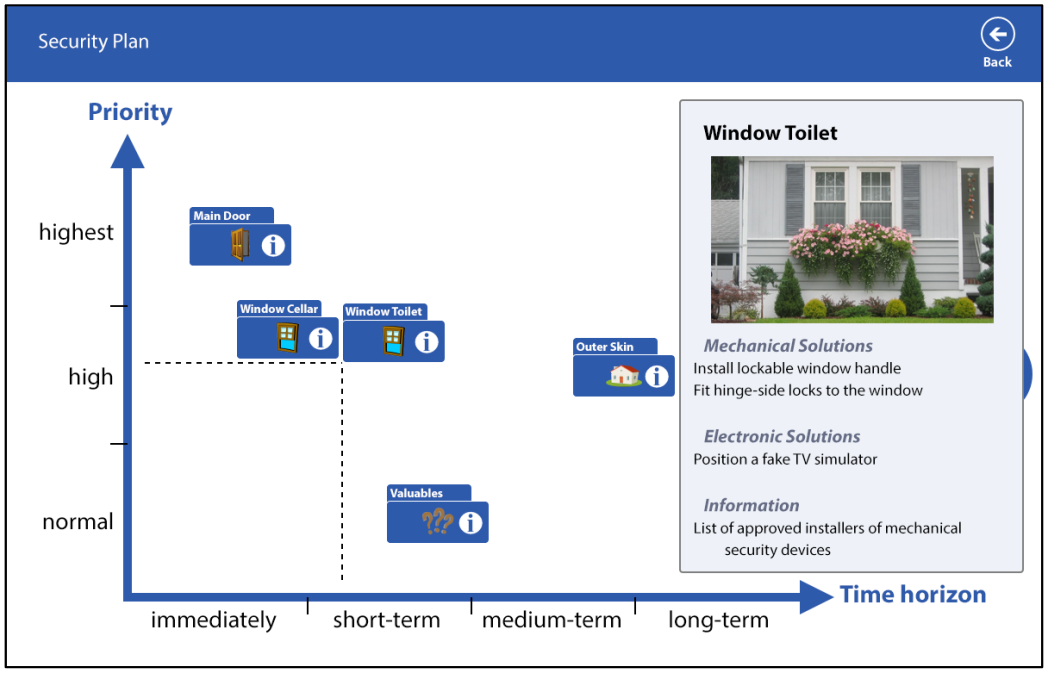

Figure 4. The security plan screen for adjusting the urgency (X axis) and priority (Y axis) of the security issues; it allows for previewing the selected solutions for a given issue.

3.2 Data Collection

Overall, the study follows a multi-method approach to study vocabulary work and its relation to the use of a collaborative application. To characterize the vocabulary work (RQ 1), we analyse the verbal and non-verbal behaviour of the interlocutors in a turn-by-turn fashion. This leads to the identification and description of several vocabulary work practices. To understand the impact of SmartProtector on the vocabulary work (RQ 2), we combine several methods. First, we pay special attention to the material conduct in the turn-to-turn analysis of vocabulary work practices. Second, we study the frequency of identified practices in encounters supported with SmartProtector and in those where SmartProtector was not used. Third, we quantify and analyse changes in the vocabularies of the interlocutors. Those multiple analyses contribute all to the exploration of vocabulary work in expert-layperson encounters. In order to employ this broad methodological arsenal, a set of rich material was necessary.

The proposed approach, in particular the turn-by-turn analysis, requires access to recorded burglary prevention advisory sessions. Optimally, a set of genuine conversations would be available, however, genuine homeowners and police's security department did not agree on fully fledged recording of the highly sensitive information. Consequently, we use data collected during a design experiment (Mettler et al., 2014) where recording of the conversations was accepted. The experiment

was designed to collect user assessment of the SmartProtector's value for persuading the advisee (Dolata et al., 2016) and to observe SmartProtector's impact on vocabulary. The experiment followed the within-subject design with two conditions: *SP* – where the SmartProtector was used – and *regular* – the conventional situation. Each advisee participated in two advisory sessions with the same advisor. Each advisor advised two different advisees, i.e., provided four advisory sessions a day. The houses were chosen to be of various categories: while some were modern villas or one-story properties with open layout, others were more traditional family houses with conventional floor plan. As a consequence, they differed in terms of hardware and features: some had garage doors, others did not; some had large sliding doors for the balcony, others had simple wing doors; some featured a basement, others did not, etc. To compensate for other potential order effects, we alternated the order of the conditions. Overall, 20 advisees and 10 advisors participated in the experiment: The advisors were police officers, who work as burglary prevention advisors and had at least two-years of experience in conducting conventional home advisory services at the time of the experiment. The advisees were a convenience sample acquired through online advertisement – their age, status, and gender varied but all advisees had timely experience with buying a house. They were not paid for the participation in the experiment, but received inexpensive gifts (sweets, Swiss knife, police gadgets) after the test. The test was conducted on five days in March 2015 in Mannheim and Frankfurt, Germany, at pre-fabricated houses fairs. We adhered to a consistent scenario across the whole experiment: the advisee acted as house buyer who visits two different houses with a burglary prevention advisor and because of recent burglary cases he now looks for opportunity to make his new house safe straight from the beginning. The test was designed such that no advisor and no advisee saw the same property twice – this should improve the realistic character of the conversations. No constraints were imposed on how the advisors conduct their service – they could freely choose how they want to approach each property and advisee. Before the experiment, each advisor participated in a day-long training regarding the features of the SmartProtector and tried it out in a role-play exercise. The trainings took part in the same week as the experiments. Additional brush-up trainings were conducted on the day of the experiment. Overall, the conversations for the current study originate in an experiment designed to keep each encounter as realistic as possible.

To collect the rich material needed for the exact description of vocabulary work, we collected video and survey data. Each experimental session was recorded in full with a handheld camera. After passing through both conditions, the advisees were asked to assess their advisory encounters. They were asked to fill out a survey to assess their impression regarding the following: advisor's Communication Encoding Competence (CE; Monge et al., 1982; Ko et al., 2005), advisor's Communication Decoding Competence (CD; Monge et al., 1982; Ko et al., 2005), and own Learning Achievement Emotions (AEQ; Pekrun et al., 2011). The measurements

refer to how the advisees perceived the communication between them and the advisor. CE and CD are components of communication competence and assess how easy it was to understand advisor's statements (CE) and how the advisor performed at understanding advisee's statements (CD); AEQ assesses advisee's personal assessment of how much they learned during the encounter. The collection of video recordings and the survey enabled a range of analyses.

3.3 Analysing the vocabulary work practices

This study intends to characterize vocabulary work as conversational conduct to illustrate *how* it happens. The vocabulary transfer may be intensive in some parts of a conversation, while elsewhere it does not play a key role. To identify relevant episodes, a catalogue of criteria was identified by a researcher trained in multimodal analysis (Kress, 2009; Bezemer and Jewitt, 2010) and conversation analysis (Hutchby and Wooffitt, 1998; CA; Have, 2007). He developed the criteria based on 10 samples (of 15 minutes each) from the whole data set comprising approx. 24 hours of recording. The primary criterion was: 'the advisor or the advisee uses a specific professional term for the first time during the encounter'. The professional terms denote typical technical concepts from the burglary prevention and security mechanics realm. Overall, 250 episodes were identified. Situations in which the participant did not use professional terms simple language (e.g., to explain how a burglar proceeds when approaching a property, to introduce oneself, or to explain his or her security concerns) or used a professional term for a second or further time were not in the scope of this study. Each chosen episode was transcribed and annotated with information on the non-verbal behaviour of the parties such as: their movements, use of the SmartProtector, and use of other material. This was necessary to identify what could cause the usage of a specific term or to observe reactions of the other party, which are often non-verbal. The basic prosodic information (stress, melody), as well as semi-language was included to observe if there were insecurities related to the introduction of a term and what words were stressed when a term was introduced. Turns preceding and following the episode were considered as well to capture the *sequential* nature of conversation and allow for the *next-turn-proof* procedure (Hutchby and Wooffitt, 1998). The analysed sequences (episodes with preceding and subsequent turns) were on average 90 seconds long. The researchers collaboratively grouped the episodes into clusters based on the sequence of actions in each episode. For instance, one cluster included episodes where the first mention of an expert term preceded the explanation of its meaning, another cluster included episodes where the expert term followed an explanation, etc. The Results provide the overview and describe the characteristics of each cluster. They also provide conversation analysis of particular episodes to identify mechanisms involved in vocabulary work across the clusters. Overall, the analysis yielded a list of practices and typical behaviours of the advisor and of the advisee.

The Results section describes the identified practices while using transcriptions to illustrate the sequential and non-verbal elements of the practices. The exact description makes the material, non-verbal and subtle nature of vocabulary work accessible to the reader. The original Swiss German transcription was translated into English for this article. To make the transcription both rich and accessible to an international audience, we use normalized English (e.g., you instead of u:) but take care for maintaining general prosodic signals: [stands for overlapping speech, : signalizes a stretched sound, (.) and (X.Y) stand for silent breaks and pauses, CAPITALS indicate louder syllables or words, ° indicates quiet or softly-spoken words, / and \ indicate rising and falling pitch. A refers to the advisor and H to the advisee (house buyer). The spoken turns are in bold. The episodes represent *typical* sequences observed across the data.

3.4 Analysing the interlocutors' lexicon

This analysis of the interlocutors' lexicon was conducted to capture to what extend the SmartProtector supports or hinders the vocabulary transfer between interlocutors. As opposite to a turn-by-turn analysis, the lexicographic perpective allows for the observation of effects in the whole conversation and not only in specific short episodes. To model the lexicon we use a bag-of-words model (Manning and Schütze, 1999). Because the burglary-prevention terms were in German and consisted of single compound words (e.g., *Pilzkopfbeschlag*, *Sicherheitsglas*), we do not consider n-grams. The vocabulary of each participant is represented as a set of words he or she used during the conversation. By computing operations on the sets, one can compare the vocabularies and identify what conditions facilitate higher overlap between the expert's and the layperson's lexicon. We argue that taking over the vocabulary of another interlocutor implies a more effective vocabulary work.

To conduct the analysis of interlocutors' vocabularies, a range of steps was necessary. The full transcripts of 40 advisory encounters went through a pre-processing procedure: First, the text was transformed in lists of single tokens (words). Second, all tokens were transformed into their basic forms, i.e., lemmatized with use of the TreeTagger (Schmid, 1995) – these lemmatized forms are types (Manning and Schütze, 1999). Third, stop words were removed– standard stop words for German (Bird et al., 2009) and words with high frequency in the given context (e.g., "house", "security") were deleted. As a consequence, for each conversation we obtained a set of meaningful types used by the interlocutors. Based on this, we compute the vocabulary overlap between the advisor and the advisee to study the effectiveness of the vocabulary work when SmartProtector was and was not used.

Finally, to test whether the overlap between advisee's and advisor's vocabularies corresponds to advisees' assessment of the communication, we employ the survey's results. In particular, we compute Pearson's correlation between the assessment of the advisees on CE, CD, and AEQ and the lexicon overlap between the

interlocutors. This was done to test whether the objectively measurable effects correspond to the subjective perception of interpersonal communication.

The section 4.2 summarizes the results from the lexicographic analysis. The description of the results relies on the distinction between types and tokens (cf., Manning and Schütze, 1999). Types are distinct strings, while tokens are occurrences of those strings in the text. Accordingly, lemmatizing the phrase 'Ann buys chocolate. Yesterday she bought sugar.' yields 'Ann buy chocolate yesterday she buy sugar'. This sequence includes 6 types ('Ann', 'buy', 'chocolate', 'she', 'sugar', 'yesterday'). In the above lemmatized statement, type 'buy' occurs twice (at the second and sixth position). Furthermore, we use set-based notation to describe relations between the lexica. The calculations use the following sets: A – set of all types used in the conversation by the advisor, H – set of all types used in the conversation by the house buyer (advisee). $A \cap H$ denotes the set of types that were used by the advisor as well as the advisee during a conversation (i.e., the intersection between A and H). $|X|$ denotes the size of the given set $|X|$. Let us assume $Y = \{'Ann', 'buy', 'chocolate', 'she', 'sugar', 'yesterday'\}$, then $|Y| = 6$. The analyses consider frequency of a type in the given set. Since we removed the most typical words for the current context (e.g., 'house' or 'security') and stop words in the pre-processing step, we can assume that the higher frequency of a type, the more important it is content wise for the conversation. The frequency of a type x describes how many tokens in the conversation belong to the given type – we denote it by $\mathrm{F}(x)$. For instance, in the above example $\mathrm{F}('buy') = 2$ and $\mathrm{F}('she') = 1$. $\mathrm{F}(x) \geq 2$, where $x \in A \cup H$, means that the type x occurred at least twice during an advisory service. The calculations provide a basis for the analysis of influences between the advisor, the advisee and the SmartProtector.

4 Results

4.1 Analysing vocabulary work practices

The initial analysis of episodes in which the advisor or the advisee use a technical term for the first time in a conversation revealed that the episodes fall into two categories: *translation* and *adoption*. Translation occurs when an interlocutor introduces a term, they consider unusual and possibly unknown to the other party and explains it. Except for a single case, it is the advisor who engages in translation practices in the studied data. Adoption occurs when an interlocutor takes on a term new to them, which they assume is known to the conversation partner (because the partner has used it or because there are other signals, that they will understand it). In the studied data, the advisee is the one, who engages in adoption practices when using technical terms for the first time. This section characterizes the practices interlocutors employ for translation and adoption.

Translation: This category includes episodes where the advisor introduces a technical term related to home security and explains its meaning. The act of explanation implies that the advisor perceives this technical term as unusual and likely to be new or confusing for the advisee. In general, the episodes include a technical term and variations the following: (1) a phrase that links the term with a definition/explanation or (2) a phrase or behaviour that links the term with an object (e.g., an element of the door or window), an abstraction, or its representation in the SmartProtector or a brochure. We refer to the practices found in such episodes as *translation* practices, because the advisor acts as translator of professional terms and makes them accessible to the advisee.

The advisor, being the information provider and moderator in one person, introduces new terms into the conversation on a regular basis. In the considered 40 recordings, we identified 174 episodes in which the advisor introduces new terms and explicates their meaning. We identify three typical translation practices: *defining*, *designating* and *correcting*. They differ, primarily, by the sequence in which the advisor introduces the term and provides its explanation to the advisee.

When *defining* a term, the advisor first introduces the term and then provides a definition (cf. Table 1, row 1). This is the most common translation practice, which occurs 56 times in the SmartProtector (SP) condition and 60 times in regular services. We observe a variety in how the advisors provide the definition. They define a term through words only (42 cases), through words and pointing to a real object (24), or through words and use of brochure (11) or a schema in the SmartProtector (18). In 21 cases the *defining* involves multiple modes: the advisor extends the definition by complementing the verbally provided information with gesture, pictures from SmartProtector or brochure, and reference to objects. Overall, the physical reference to an object or to a graphical representation form a key aspect of *defining* a term in burglary prevention services. The second important aspect of is the elaboration on how the introduced concept supports the security. The explanation includes argumentation on the advantages or disadvantages of the introduced concept for the burglary prevention. During *defining*, the advisors do not only discuss the mechanical or technical aspects but link them to the topic of burglary.

When *designating*, the advisor first explains a concept and then provides a name or a label for it. This practice occurs with similar frequency in both conditions (SP: 19, regular: 25). The explanation involves pointing to an element of a real object (30 cases) or a visualization in a brochure (5) or in SmartProtector (9) accompanied by speaking. The explanation employs again a whole range of verbal and non-verbal means including deictic references and usage of gesture to display mechanics of a solution. Advisors engage in *designating* to emphasize a specific label. The practice mostly occurs when the advisor encounters a specific or unusual feature when inspecting an object (cf. Episode 2) or when they notice that an important feature is missing. In the latter case, they first explain why something is missing by

arguing how insecure a window or door is in the encountered state to later introduce the term as a solution. When the advisor is surprised, they first shortly explain the reason of why they are surprised before explaining the actual concept. Anyway, the first usage of the new term involves slow or loud intonation as a marker of importance. *Designating* prepares the advisee for the introduction of a new concept.

When *correcting*, the advisor provides explanation of a term only after she notices that the advisee misunderstands a concept based on how he uses it or she notices that she herself uses a different term than SmartProtector. The meaning emerges primarily through comparison of features or objects. It involves little elaboration on the relevance towards preventing a burglar from entering the house. We observed *correcting* only in the SP condition (14 times). The situation mostly involved advisee taking on a technical term from the SmartProtector's interface and using it in an inappropriate manner or the advisor using a specific term from the interface. The *correcting* explanations were short and remained superficial, which may suggest that the considered term played only a secondary role but its understanding was necessary to continue the conversation. Overall, *correcting* involves less communication effort than other translation practices.

Translation practices	Examples
***Defining**:* The Episode 1 illustrates how defining comes about in a service. We encounter the participants walking by the balcony door. The long "yes" at the beginning as well as the change of the location induce an activity shift (Mikkola and Lehtinen, 2014). The advisor starts the new activity with a question; she stresses the beginning of the term she wants to introduce ("mushroom cam", German: "Pilzkopf"). In this particular example, she first chooses to establish the relevance of the technical solution, by saying where they will be installed. With "it means" she goes over to the explanation which involves (1) comparison to the "tongues", (2) illustration of the mushroom cam principle with gestures accompanied by deictic speech ("those ones"), (3) elaboration on how the mushroom cam generates enhanced security. The advisor uses the definition in her subsequent turn – she builds upon this to characterize the *modus operandi* of a typical burglar ("normally") and the overall idea of the burglary prevention ("it is about..."). The advisee's contribution are limited to confirmatory statements and gestures (Svinhufvud, 2016).	**EPISODE 1** *(B35, E137)* ((A and H walk and stop at the balcony door, A looks at the balcony door)) A: **ye:s (.) does this tell you something (.) MUSHROO:M [cam/** H: **[eh no:** ((A and H stand next to a balcony door. A gesticulates and explains. H looks at A. A opens the balcony door.)) A: **yea: I will then show you [sketch in a minute=** H: **[glad (.) yeah** A: **=it will be installed (.) here (.) with plates (0.6) it means (.) these tongues he:re can be levered [easily** H: **[right** ((A gesticulates at the door and forms her fingers into hooks. H looks at A. A points to the door frame.)) A: **those ones hook (.) virtually (.) into the plates (0.5) they dig into (.)** (...) A: **that is (.) we ha:ve burglars held outside he:re (.) who wants to lever here** ((A points through the door. H nods.)) A: **what means held outside/ (.) when he had half an hour (.) i do not kno:w (.) [ri:ght/** H: **[yeah** A: **but (.) it is about ma:king it difficult for the perpetrator (.) so that he does not come in here in fe:w minutes (.) and normally they stop after three: to five minutes**
***Designating**:* The Episode 2 shows how the advisor designates the term "mushroom cam locking". The advisor first points to a hardware element and describes it as a part of the "anti-burglary fitting" – this forms the initial explanation. The repetitions and pauses point to moments of hesitation and surprise, probably, be-	**EPISODE 2** *(B17, E46)* ((A and H both next to an open window. A looks at the window hardware – from top to down. H nods. A points with finger to an element of the window's hardware.)) A: **that there a:re possible solutions (.) we see here in parts (.) now (0.5) but**

cause the installed feature is "not done consistently". The introduction of the term is preceded by "so called", a construction typical for reported speech and signalizes a distance to the subsequent term (Holt, 1996; Gülich et al., 2008) – it makes the term stand out as an independent entity (Suzuki, 1999). The advisor speaks out the term ("mushroom cam") in a very slow manner by extending each vowel. Thereby she emphasizes the newly introduced label. Thereafter she several times uses the term to illustrate how a proper window hardware should look like and work. She also uses her body and gestures to explain how the part contributes to the security. The advisee shows his understanding of the explanation by asking a question where he compares the two types of bolts – while missing the right term to denote a closing part, he speaks of a "round part down there".	**just no:t done consistently (.) we see here (.) that is a so: called (.) antiburglary fitting (.) part of an antiburglary [fitting** H: **[mhm** A: **that is a so: called (.) mu:shroo:m ca:m [locking** H: **[yes** A: **and he:re we have a corresponding (.) closing part (.) where this mushroom can retract (0.4) properly stable** ((A points to an element on the window's frame)) A: **when the mushroom head is namely simply set behind (.) then we have just this pre[ssure** H: **[ye:s** ((A gesticulates and crosses fingers)) A: **but if it can mo:ve really stable in such a closure piece (0.7) can show you later also (.) then hangs the right stable in the:re (.) right/** H: **so: (.) tha:t is different from the (0.5) round part (.) down there/** ((H points to a part up and then down)) A: **that looks like (.) so: (.) a mushroom head**
Correcting: In Episode 3 one encounters the advisee and the advisor sitting at a table with the tablet between them. They reiterate the identified problems and proposed solutions generated during the inspection of the property – they look at a list of potential electronic solutions (similar to Figure 3). The advisor intends to introduce a term when stating "here would optimally be outer skin protection by" and then, inspired by what she can see on the table, she says "motion detection" instead of the intended "break contacts". When she tries to repair her utterance ("not motion detection"), the advisee engages in the repair sequence by contributing another candidate ("outer skin in the window") – a term advisor has recently used and is visible on the screen. After completion of the repair sequence, the advisor first corrects the advisee by explaining the meaning of "outer skin" ("outer skin is outside") and then by explaining the term she intended to introduce ("magnetic break contacts"). Episode 3 includes a self-correction and the correction of advisee's statement.	**EPISODE 3** *(B3, E12)* A: **that is (.) as an alternati:ve to mechanics (.) which is our top priority (.) because it prevents or impedes the breaking in (.) of course you can also drag an electronic fuse into consideration** ((A and H at the table. A looks at the tablet on the table. A then looks up to H. H looks at A.)) A: **that is (.) the lighting for determent (.) an alarm system would be possible too** ((A looks at the tablet, uses his finger to point to a list of potential solutions)) A: **here would optimally be outer skin pro:tection by motion (0.6) not [motion detection** H: **[outer skin in the [window/** A: **[break contacts (.) outer skin is outside (0.3) so: (.) all the windows** ((A points to the tablet. H looks at it)) A: **those magnetic break contacts and glass break detectors (.) then you have a very e:arly alert (.) and in conjunction with the mechanical safety (.) of course (.) better security level.**

Table 1. Episodes illustrating advisors' translation practices (A – advisor, H – advisee).

Several observations emerge from the analyses of translation practices. First, the translation in face-to-face encounters involves external material, bodily and non-verbal means of communication, as well as physical reference to objects of interest. Second, the expert tries to establish a reference to the overall goal of the advisory service when translating a concept. Third, objects and features in the environment function as inspiration for the advisor to introduce a new technical term into the conversation. Fourth, vocabulary used in SmartProtector also inspires the participants to introduce or explain specific concepts, however the explanation itself uses the verbal and non-verbal means of communication rather than the SmartProtector

itself. The results explicate how strongly the translation in face-to-face encounters depends on the material environment and objects.

Adoption: This category includes episodes where the advisee uses a technical term for the first time in the conversation. The term might have been introduced earlier by the advisor, but it may also be that the advisee repeats a term he saw in the SmartProtector, in a brochure during the advisory service or knows from somewhere else. We refer to the practices found in such episodes as vocabulary *adoption* practices, because the advisee acts as adopter of terms and uses them. The act of adopting a term to the active vocabulary shows that the advisee tries to make sense of the concept behind it and engages with the considered matter. Given the fact that advisees often remain passive during an advisory service, making a contribution while using technical terms is a significant effort towards establishing a common lexicon with the advisee. Additionally, by adopting a term, the advisee prepares for future interactions with third parties, e.g., the craftsman hired to improve the windows. Thus, we consider *adoption* a second type of vocabulary work.

Advisee only occasionally has a chance to make a full utterance, because it is the advisor who dominates the encounter and distributes conversational rights. Nevertheless, we observed 76 occurrences of adoption practices: 50 cases in SP condition and 26 in regular services. For each occurrence we identified the trigger of the adoption, i.e., the source of the term, being the advisor, the interface of the SmartProtector, or a brochure. In 58 cases, the advisee repeated a term shortly introduced by the advisor, in 16 other cases the SmartProtector acted as trigger, and a brochure triggered an adoption two times. Whereas translation relied strongly on environmental triggers, adoption relies on triggers within the conversation itself. Three adoption practices occur in the data: *asking*, *confirming* and *complementing*.

When *asking* a question, advisees often refer to the knowledge they gained recently. There are two variations on how the advisees learn about the meaning of a term before producing a question: they ask about a technical measure introduced and explained earlier using the term introduced by the advisor (or its slight variation) or they formulate a question using a term from the SmartProtector, whose meaning can be derived from the context or the term itself. In Episode 3 in Table 1, the advisee asks about the "outer skin of the window" based on what he sees in the SmartProtector's interface and assuming a meaning (which turns out to be wrong and gets corrected later on). In Episode 4 below we encounter an adoption of a term introduced by the advisor – in this case, the advisee relies on a meaning introduced earlier. The questions involving a new term are mostly closed questions and imply a suggestion; we did not observe a direct inquiry or request asking directly "What is X?". This shows that vocabulary work uses subtle parlance. The answers to the questions are, consequently, confirmation and negations with short explanations. *Asking* occurs in SP (22 occurrences) and in regular condition (12). By *asking* a closed, subtle question using a new term, the advisees can check

whether their understanding of a term is right without exposing oneself or snub the advisor over their communication competence.

When *confirming*, advisees include a term they heard from the advisor into a declarative sentence which confirms advisors' argumentation. Sometimes, it is complemented by a declaration that the advisee will fit or apply the discussed feature or burglary prevention measure. Given the fact that new terms get introduced and translated with reference to the environment, *confirming* also includes deixis ("those", "that"). Advisees often engage in *confirming* to signalize that they accept the explanations and arguments of the advisor. Consequently, confirming often initiates an activity shift. Advisors' reactions to *confirming* remain very short and, like in *asking*, consist of a short confirmation, affirmation or, in few cases, clarification. *Confirming* occurs in SP (14 occurrences) and in regular condition (6). By *confirming,* the advisees signalize the understanding of a term without implying a check on whether their understanding is right or wrong.

When *complementing*, advisees contribute a term or a phrase that fits the advisor's statement without letting the advisor finish the turn. The observed instances of *complementing* resemble the behaviour of finishing someone else's utterance, which is a marker of understanding (Sacks and Jefferson, 1995; Koschmann, 2013). Often, the advisees echo a term just used by the advisor or complement advisor's utterance with a specific term. It may be that the advisor has just spoken the term and the advisee simply repeats it (15 cases) or he reads out loud words visible in the SmartProtector's interface (5 cases) or in a brochure (2 cases). *Complementing* occurs 14 times in the SP condition and 8 times in the regular condition. The advisees normally produce soft and quiet utterances when *complementing* and get louder only when the advisor stops speaking. As opposite to the other adoption practices, material (brochure or SmartProtector) may trigger the use of specific terms, but there is no deictic reference to the material or the environment in those utterances. The advisors normally continue speaking without responding to the complementing contribution. *Complementing* gives the advisee the opportunity to show interest and understanding without producing a turn in its own right.

Adoption practices	Examples
***Asking**:* In Episode 4 one encounters the advisor and the advisee inspecting a window. This episode includes several practices: First, the advisor *defines* a mushroom cam by pointing to it, explaining its role and using bodily movement to imitate a mushroom cam. Second, the advisee *complements* the advisor's utterance while saying "mushroom". Finally, in a partially overlapping turn, he asks: "and a han... lock handle would prevent that?". Even though the term ("lockable handle"; German: "abschliessbarer Griff") was used by the advisor in the preceding utterance, the advisee does not manage to use the term in its full form; instead a shorter version emerges after a sign of hesitation ("ha:n"). The	**EPISODE 4** *(B16, E26)* ((A and H at the window. H stands behind A. A looks to the bottom of the window frame)) A: **in here its like that (.) there is no:w such a (.) MUSHROOM CAM (0.5) mushroom cam because on this roller pin (.) there is such a cap (.) then it looks in pro:file like a [mushroom** H: **[mushroom (.) yea:** ((A points to the bottom part of the window frame, then looks up at H, imitates a hook with fingers)) A: **exactly (0.4) and this goes in here in these closed track (0.5) a:nd there i:s (0.5) it digs in the:re whenever force is exerted on it (.) If those were now around the whole e:leme:nt** **(...)** **then you would have protection against**

advisor provides a short affirmative answer ("exactly right") and makes a short pause. The advisee uses the pause to produce another turn which complements his previous question ("...in addition to those mushroom cams around the frame?"), which yields another confirmation from the advisor. Interestingly, the advisee uses a deictic construction and stresses the determiner ("those mushroom cams"), even though they are yet to come. The two questions from the advisee summarize the message from the advisor, namely that security of a window depends on the combination between the mushroom cams and the lockable handle.	**levering (1.0) and what belongs to that too: is a (.) lockable handle (0.4) because there are pe:ople (.) who knock in he:re a ho:le (.) take handle and then unlock [and then holds the** H: **[and a ha:n (.) lock handle would prevent that/** A: **exact[ly=** H: **[okay** A: **=right\ (0.5)** H: **good (.) in addition to: THOSE mushroom cams [around the frame/** A: **[exactly**
***Confirming**:* In Episode 5 the advisor and the advisee just entered the house. Directly at the door, the advisor takes the opportunity to explain to the advisee how hinge lock bolts would improve the security of this door. The interlocutors discuss options for installing the lock bolts but remain inconclusive as signalized by many unfilled pauses and markers ("I mean", "perhaps", "something like"). Finally, the advisee introduces a summary ("in any case") and makes a conclusion ("it would be better with that lock bolt"). Thereafter, the advisor makes an explicit activity shift and they continue the inspection of the property.	**EPISODE 5** *(B14, E25)* ((A and H standing next to the door. A holds the handle. H few steps away from the door. H looks at A)) A: **you:d ve to build it into [the door frame [then** H: **[somehow (.) [ye:s** A: **and then (.) thi:s goes with that lock [bolt** H: **[i mean (.) there is (.) perhaps (.) something like tho:se (.)** ((A moves nearer to H. Door behind A. Both looking at the door.)) A: **[ye:s (.)** H: **[in any case (.) it would be: better with tha:t (.) lock bolt** A: **exactly (0.8) shall we now just go (.) through the roo:ms/ (.) and watch how it is he:re as compared to the o:ther house [of you/** H: **[eghm (0.5)**
***Complementing**:* In Episode 6 the interlocutors sit at a table after the inspection of the house. They look through the Security Plan (cf. Figure 4) as clearly announced by the advisor. She points to the solutions chosen for a particular window ("window fitting", "lock bar"). Whereas the advisee first just confirms the listing ("yes"), with the third element ("lockable window handle"), he joins the advisor and reads out loud the two remaining elements on the list ("window handle", "window grate"). Thereby he looks at the tablet and follows advisor pointing to the elements. The affirmative "exactly" signalizes that he agrees with the list and knows the concepts. The advisor then continues with additional information.	**EPISODE 6** *(B38, E77)* A: **so: security plan** ((A looks on the tablet. H looks on the tablet too and looks like was trying to read the list on the screen. Tablet on the table between H and A. A uses his finger to point to the tablet, moves the finger top to bottom and talks)) (...) A: **so: (.) then down here are the suggestions (.) that we have made (0.5) this is the window fitting (0.8) that here is the window [lock bar** H: **[ye:s** A: **this is the (.) [lockable window handle** H: **[°window handle° (.) exactly (.) window [grate** A: **[and that is the grate (0.5) and there are (.) also the data about grate (.) as well (.) alarm i:s what we had in here**

Table 2. Episodes illustrating advisees' vocabulary adoption practices (A – advisor, H – advisee).

The study of adoption practices unveils additional facts about the vocabulary work in expert-layperson dyads. In the observed cases, the SmartProtector often took the role of a trigger, such that the advisees used terms visible in the interface. Furthermore, the access to the term in a written form made the advisees more secure about the actual form of the term. Especially the comparison between Episode 4 and Episode 6 make the difference apparent: while reusing a professional term heard before generates hesitations, reading out terms from the SmartProtector is

easier. Finally, when using new professional terms, the advisees often use determined pronouns to mark the terms. The collected data shows that adoption of a term involves work: the advisees employ specific conversational devices to obtain a confirmation from the advisor, that the understanding of the concept – reflected in their usage thereof – is compatible with the advisor's meaning.

The analysis of vocabulary work practices points to the multiple ways in which the SmartProtector impacts how technical vocabulary enters the expert-layperson conversation. The SmartProtector as an element of the environment triggers the advisor and the advisee to mention specific terms. The advisor aligns to the vocabulary used in SmartProtector's interface. And, finally, the advisee can use the SmartProtector as a hint when trying to adopt specific terms. Also, some practices occur more or less frequently, when the SmartProtector is present. This confirms the overall micro-level impact of the SmartProtector on the vocabulary work.

4.2 Analysing the impact of SmartProtector on the lexicon

We complement the micro-level analysis of the Section 4.1 with global analysis of vocabulary transfer between the interlocutors. The analyses consider meaningful types (without stop words and most frequent context words) for types with different frequency $\mathrm{F}(x)$. Additionally, we compute the correlation between the vocabulary overlap and the advisees' assessment of communication quality to prove whether and to what extend the overlapping vocabulary impacts the advisees' perception of the advisory service. The emerging picture points to SmartProtector as a factor contributing towards a common lexicon.

Use of SmartProtector and lexical entrainment: To study the impact of SmartProtector on lexical entrainment, we explore whether the overlap between interlocutors' vocabularies differs under the tested conditions. We compute the proportion between the types shared by the advisor and the advisee, $A \cap H$, in the overall lexicon of the advisee, H. To do so, we divide the size of the overlap between the advisee's and advisor's lexicon by the size of the advisee's lexicon: $|A \cap H| \div |H|$. In other words, we operationalize lexical entrainment by computing the proportion of the meaningful types used by the advisee to the ones also used by the advisor in a conversation. This measure was derived from the Jaccard's index (Manning and Schütze, 1999). Instead $|A \cup H|$ we use $|H|$ in the denominator of the formula for two reasons. On the one hand, this highlights the fact that we are focusing on the transfer of expert terminology to the advisee's vocabulary. On the other hand, it accommodates for the fact that the size of advisor's lexicon is much larger simply because she normally speaks several times more than the advisee. Having calculated the proportion for each conversation, we computed the average over all conversations, which leads to the data presented in Table 3. We identify significant differences between the conditions (SP vs. regular) for $\mathrm{F}(x) \geq 2$, $\mathrm{F}(x) \geq 3$, and

$F(x) \geq 4$. The overlap between advisee's and advisor's vocabulary in the SP condition is higher. In the regular condition, over 91% of types used twice or more by the advisee are shared with the advisor – in the SP yields 95% (cf. Table 3). For types with higher frequencies, those figures become higher. The differences between conditions are significant but small. This is so because the vocabulary overlap is very high in the regular condition already – there is little possibility for it to grow further. While we observe the same tendency for types with $F(x) \geq 1$, the difference is not significant. Overall, the results suggest that the advisee is more likely to take over the advisor's terminology when SmartProtector is used to support the advisory service.

$x \in A \cup H$	$F(x) \geq 1$	$F(x) \geq 2$	$F(x) \geq 3$	$F(x) \geq 4$
$\frac{\lvert A \cap H \rvert}{\lvert H \rvert}$ whole conversation	SP: .5940 Regular: .5841 $t = 0.5$; $p > 0.4$	SP: .9482 Regular: .9183 $t = 3.0$; $p \leq 0.01$	SP: .9871 Regular: .9758 $t = 2.4$; $p \leq 0.05$	SP: .9950 Regular: .9882 $t = 1.7$; $p \leq 0.1$

Table 3. Proportion of shared vocabulary in advisee's lexicon for types with various frequencies.

Lexical entrainment and communication quality: The intuition and the previous literature suggest that common lexicon contributes to the quality of communication. To explore this relation specifically for expert-layperson communication, we employ the following measures: CE (the advisee's assessment on the Communication Encoding Competencies of the advisor), CD (Decoding Competence of the advisor), as well as AEQ (self-assessment of Learning Achievement Emotions). We identify dependencies between CE and the amount of common vocabulary in the advisee's vocabulary, $|A \cap H| \div |H|$, for various type frequencies $F(x) \geq 2$ with correlation coefficient reaching up to $r = 0.517$ (moderate and moderate-to-strong positive correlation (Rubin, 2012)). It means, there is a positive relationship between the vocabulary overlap and CE, and this relation is significant. In other words, the advisees assess the advisors to better encode their messages, if both interlocutors share a lot of vocabulary, and less in the opposite case. No correlation with lexical entrainment can be confirmed for CD or AEQ: we cannot confirm that the lexical entrainment affects how advisees feel about their learning achievement or the advisors' decoding abilities. Table 4 summarizes these results.

	$F(x) \geq 1$	$F(x) \geq 2$	$F(x) \geq 3$	$F(x) \geq 4$
$\mathrm{corr}(\boldsymbol{CE}, \frac{\lvert A \cap H \rvert}{\lvert H \rvert})$	$r = 0.127$ $p > 0.4$	$r = 0.334$ $p \leq 0.050$	$r = 0.517$ $p \leq 0.001$	$r = 0.378$ $p \leq 0.050$
$\mathrm{corr}(\boldsymbol{CD}, \frac{\lvert A \cap H \rvert}{\lvert H \rvert})$	$r = 0.019$ $p > 0.5$	$r = 0.005$ $p > 0.5$	$r = 0.159$ $p > 0.3$	$r = 0.075$ $p > 0.5$
$\mathrm{corr}(\boldsymbol{AEQ}, \frac{\lvert A \cap H \rvert}{\lvert H \rvert})$	$r = 0.285$ $p > 0.05$	$r = 0.123$ $p > 0.4$	$r = 0.179$ $p > 0.2$	$r = 0.165$ $p > 0.3$

Table 4. Pearson's correlation coefficient ($\boldsymbol{r}$) and significance values ($\boldsymbol{p}$) for CE, CD, AEQ and lexical entrainment measures for various type frequencies.

5 Discussion

5.1 Understanding vocabulary work in expert-layperson encounters

Vocabulary work plays a key role in communication between an expert and a layperson. The conventional suggestion that the expert should adapt the layperson's view and vocabulary (Bromme et al., 1999) is not applicable everywhere. In particular, expert-sided adaptation in dialogue comes too short, if the layperson needs to transfer the precise information to other stakeholder after the service, if he should be able to make an informed decision, or if he seeks empowerment in a specific area of his life. Without the right terms to express their thoughts and understand incoming information, their efficacy will remain limited (Bromme et al., 2005b). Thus, modern advisory services include elements of customer education (Oehler et al., 2010; Heinrich et al., 2014) and try to support shared understanding of problem and solution between the interlocutors (Novak et al., 2008; Giesbrecht et al., 2013; Giesbrecht et al., 2015; Comes and Schwabe, 2016a). The above results make clear that establishing shared understanding of a concept is a collaborative work.

However, this collaborative effort often gets ignored – not only in the research, but also by the interlocutors. The vocabulary work often gets lost in the shuffle of higher-level goals such as persuasion, rapport building, or matching solutions to problems. The advisors engage in the translation based on an external stimulus and employ the means, they have at hand, to introduce a term. The advisees take on terms easily accessible to them either in their short-term memory or in the material they see. Nevertheless, the translation and adoption performances are well-coordinated work episodes necessary for higher-level tasks. In the following we discuss *how advisors and advisees engage in vocabulary work during advisory services*.

Previous understanding of lexical entrainment in expert-layperson encounter focused strongly on the words, terms, and how participants in a dialogue can agree on what they mean (Bromme et al., 1999; Bromme et al., 2006; Jucks and Bromme, 2011). The perspective on vocabulary work we offer in this manuscript highlights the role of bodily (visual, sensual) experience, the role of contextualization, and the role of for the lexical entrainment in conversations. This makes clear that translating and adopting vocabulary are multimodal performances rather than operations on words. This leads to the identification of *four functions*, that a collaborative application can play with regard to vocabulary work: stimulus, specimen, context provider and retention support.

A consideration of the translation practices points to the material and contextual aspects of vocabulary work. The available material (brochures, application) and the environment (windows, doors) trigger the introduction of a term (cf. Episode 2) and are used to explain the meaning of the term (cf. Episode 1). This includes touching and moving the elements in the real world as well as in the collaborative application (cf. Episode 3). It is mostly the advisor, who engages in the interaction with the

material and the environment, but the advisee follows the actions carefully and signalizes participation through semi-language or the identified adoption practices. The material aspect of vocabulary work invites to the usage of the collaborative application as *stimulus* and as a *specimen*.

The *stimulus* triggers usage of specific terms or discussions on a specific topic. In the analysed episodes the features of windows and doors often induced specific topic in the expert while the terms in the interface or brochure induced the advisee to use them. The presence of a stimulus can contribute to the natural occurrence of technical terms in a conversation. This might be central for advisory services where the physical environment does not provide any triggers for explanation of specific concepts. Whereas burglary prevention advisors get inspired by security features and physician are prompted by what they see in X-rays or on patients' body, advisors in a bank or employment agency do not possess such a natural source of stimuli. Providing them with triggers to introduce and explain specific concepts might contribute to communication enhancement. Previous designs for advisory services implemented graphical stimuli for other reasons than vocabulary work and reported on improvements concerning the amount of transferred information (Kilic et al., 2015) and empowerment of the advisor (Giesbrecht et al., 2016a). This paper extends on this while claiming that collaborative applications can be well used to trigger the translation of specific terms and their adoption.

The *specimen* helps explaining a term by providing an illustration or allowing for comparison to other concepts. In the analysed episodes, the advisors often use elements of their environment and their own body to explain what a thing is and what it is not. They rely on the presence of specimens in their translation work. Interestingly, even though the SmartProtector provided simple means for explaining the technical concepts (e.g., a picture of the mushroom cam), advisors preferred to use other means during explanation. But, first of all, they combined the various means they had access to: gesticulation, pointing to a feature in the environment, verbal explanations or a picture. The great richness of employed communication means points out how much effort is needed to translate a term. Consequently, to act as a specimen, a collaborative application should support multimodal explanation sequences. Previous systems designed for use in advisory services confirmed the value of multimodal representations for persuasion (Comes and Schwabe, 2016b) and for understanding abstract relationships in financial services (Heinrich et al., 2014). This study supports those design efforts by making clear that lower-level aspects of the conversation rely on multimodal explanations as well.

The context plays a role in translation practices as well. In the burglary prevention services, the context is defined through the topic of the conversation, which in turn reflects the physical position of the involved parties – at the window, at the door, at the balcony door, etc. The context evokes association to terms and concepts typical for the given context. In the Episode 1, after changing the physical position, the advisor introduces the term "mushroom cam". Given that the change of the

context is very clear to both interlocutors (changing space implies context change and makes it very explicit), the explanation of the introduced term uses the context – the advisor does not need to explain that a mushroom cam is related to windows or balcony doors, but focuses on explaining the meaning by using the resources provided in the context (elements of the balcony door). Similar performances occur in Episode 2 and Episode 3 as well. This points to vocabulary work as a highly contextualized performance and invites to the usage of a collaborative application as a *context setter*.

The *context setter* helps making clear to the interlocutors what is the overarching topic of the conversation and provides the adequate means to support the conversation in this context. Whereas in the analysed episodes, the context was set by physical environment, other advisory services may have their specific contexts. For instance, the interaction between a physician and a patient changes from symptom analysis and anamnesis, over to initial examination, diagnosis, and treatment. The changes may, but do not have to imply physical location changes. Making the switches between contexts clear can evoke topic specific associations and make the vocabulary work easier. Previous works on supporting advisory services focused on differentiating between problem and solution – they established problem context and solution context that were visualised in the application (Giesbrecht et al., 2015; Comes and Schwabe, 2016a; Giesbrecht et al., 2016a), as well as client education context which was separated from the actual problem and solution (Heinrich et al., 2014). However, contextualization can go beyond that process perspective and make the topic-related changes more accessible to the interlocutors.

The analysis of *adoption* practices provides evidence that laypersons need help when adopting a new term. The analysis of Episodes 4-6 points to a common characteristic of all terms adopted by the advisees: they were easily accessible to them either because they were shortly introduced by the advisor (Episode 4 and Episode 5) or because they were visible at the right moment. Further, trying to repeat a term from memory caused hesitations and mistakes, but if an advisee had access to a written word, he seemed more straight forward in using it. Retention of a term, thus, seems to be an important aspect that drives the advisee to use it (or try to use it) actively. This suggests that a collaborative application can play the role of an *retention support*.

The *retention support* brings a technical term to the advisee's attention or working memory. In the analysed episodes, SmartProtector as well as the recent utterances of the advisor complemented each other in the role of retention support. The advisee could refer to the terms, assure that he understands them correctly and signalize the understanding by referring to words or phrases from the recent conversation and from the screen. Previous research suggests that individualized pictures can help with reminding oneself of specific issues discussed during collaboration (Giesbrecht et al., 2015), but it leaves open whether the participants can remember the way to precisely describe the issue or potentials to solve it. This study calls for

further investigations in this regard: how can a collaborative application make terminology accessible to the interlocutors at the right moment?

Overall, this study sees vocabulary work as a collaborative effort of the participants. This has several implications. First, embracing an expert term in an expert-layperson conversation means work: it may be as little as assuring that the other party understands the term, but it may also involve explanation involving use of external material. Second, embracing an expert term means work from both the expert and the layperson: translation and adoption efforts involve reciprocation such as acknowledgment or correction, i.e., effort from the collaboration partner. Third, as many other types of collaborative work, vocabulary work also relies on shared material, which – depending on its relationship with the particular term – can play various roles during embracing the expert vocabulary. Finally, vocabulary work is a prerequisite for successful expert-layperson collaboration: it is necessary for establishing common ground and thus relevant for effective communication, but it is also necessary for subsequent implementation of the advice. Words are like tools for thinking and approaching a complex life situation might be easier, if the affected person gets the adequate tools to deal with it.

5.2 Understanding the role of IT artefacts in vocabulary work

The above analysis suggests that a collaborative application can enhance vocabulary work based on the in-depth analysis of the episodes. The SmartProtector does not explicitly implements the four functions, but – as suggested by lexical analysis – it contributes to a better transfer of vocabulary. This section discusses *how the usage of a digital collaborative application influences the vocabulary work*. The analysed episode suggests that simply representing some of the technical terminology in the interface of SmartProtector helped the interlocutors when choosing the appropriate terms. Furthermore, the SmartProtector positively influenced the vocabulary entrainment between the interlocutors as suggested by quantitative data. The results also suggest that an effective vocabulary transfer and adoption supports understanding between the interlocutors. In the following we elaborate on the mechanisms behind SmartProtectors' impact on the vocabulary work.

The current manuscript confirms that IT's influence on language goes as far as it constraints lexical choices of the users (Brennan, 1990; Brennan and Ohaeri, 1994; Brennan, 1998; Brennan, 2005). The study shows that this effect does not only hold in a single user scenario, but also in a collaborative expert-layperson setting. We did not observe situations, where participants would negotiate the meaning of a term or the term itself with the application (e.g., by discounting or criticizing the vocabulary selection to be used in the SmartProtector). Consequently, the way the advisor and the advisee reacted to the interface vocabulary reflected more the controlled-vocabulary rather than folksonomy scenario from online studies (Lee and Schleyer, 2010; Jörgensen et al., 2012; Zarro and Hall, 2012; Jackson et al.,

2018). Specifically, as exemplified in the *correcting* practice episode, the advisee and the advisor incorporate terms from SmartProtector and this behaviour initiates further specification and elaboration. Such situations occur throughout encounter and both interlocutors initiate discussion based on terms from the tablet. The Episode 3 and some other cases of *correcting* practice suggest that the advisees may even tend to use words they have not yet fully understood if they are shown on the screen. It seems that the SmartProtector has functioned as *retention support* in those situations.

The provided results invalidate the fear which sees collaborative artefacts as a potentially dangerous source of incompatible meanings and references – a third party to be incorporated. Representing professional terminology in a collaborative system supports its position as an object, which enables both interlocutors to establish a common meaning and reference of lexical units. Such a system complies with the principles of boundary objects (Star and Griesemer, 1989; Henderson, 1991; Lee, 2007; Star, 2010). After identifying differences in meaning or reference, the advisee and the advisor locate the difference and eliminate it (Clark and Wilkes-Gibbs, 1986; Clark, 1992; Clark, 1996). Episode 6 illustrates how a simple pointing and reference to a representation of a term in the SmartProtector helps localizing and resolving the disagreement – communication is an ongoing disambiguation of lexical and referential ambiguities (Krauss and Fussell, 1990; Schober and Brennan, 2003; Bromme et al., 2005a; Wittwer, 2005). The SmartProtector *stimulated* the usage of specific terms and, thus, generated sequences where terms needed to be clarified.

This study adds to the research analysing lexicon in expert-layperson communication, which previously focused on written online communication (Bromme et al., 1999; Bromme et al., 2005a; Bromme et al., 2005b; Bromme et al., 2006; Jucks and Bromme, 2007; Jucks and Bromme, 2011). This study confirms the collaborative nature of vocabulary transfer and adoption and claims that this collaboration (as most other types of collaboration) can be effectively supported and constrained with dedicated technology. Based on the results, this manuscript agrees with Bromme's et al. (1999; 2006) conclusion that advisors tend to initiate lexicon-oriented efforts, but – opposite to what previous research says – instead of adopting advisees' terminology, they tend to push and support the advisee at using the professional terminology (they either correct the advisee as in Episode 6 or confirm advisee's use of professional term as in Episodes 4 and 5). We claim that this follows from the inflexible character of vocabulary provided in the SmartProtector which cannot and should not adapt to the advisee. As a consequence, the advisor must take on the role of a "mediator" teaching the SmartProtector's vocabulary and professional terminology to the advisee.

Finally, this manuscript provides evidence which links the use of a shared artefact of work with better communication (and, consequently, better understanding): (1) It shows that using SmartProtector impacted the vocabulary of the interlocutors,

such that their vocabularies overlapped more (cf. Table 3); (2) It confirms the link between vocabulary overlap and perception of advisors' encoding competence (cf. Table 4). The results provide a possible explanation to why a collaborative application contributes to an enhanced shared understanding (Schmidt-Rauch et al., 2010; Giesbrecht et al., 2014; Giesbrecht et al., 2016a; Kilic et al., 2017): The SmartProtector induced specific episodes for term clarification through it inflexible terminology, it stimulated the use of specific terms, and it gave the advisee better access to them. Collaborative applications can take other functions as well (specimen, context provider), but the link requires further and deeper research.

Overall, the choice of vocabulary in a collaborative application is essential for vocabulary work in expert-layperson encounters. This leads to several practical implications on the design of such collaborative applications. First, the terms and phrasing used in the interface should be *consistent* throughout the application. This might imply consistency checks not only in the elements of the interface itself (buttons, names of screens, etc.) but also in the data presented in this interface (e.g., data bases of possible solutions), as it was the case with the SmartProtector. Second, the terminology propagated in the collaborative application should reflect the experts' *standardized* vocabulary, otherwise the expert might produce contributions inconsistent with the interface. This might imply updating the vocabulary periodically and making adaptations to groups of users – in the case of SmartProtector specific adaptation for Germany and Switzerland were necessary. Third, the used terminology should make use of *associative* processing if possible. This implies the use of easy terms instead of complex ones if both are equally popular and understandable as well as leveraging the context by grouping terms associated with a specific topic. The SmartProtector presented terms organized by type of feature (window, door, facade, etc.) that were consulted with advisors as prospective users of the system to assure consistency and adherence to standards.

People in complex life situations (Rotter, 1981; Becker et al., 2000; Herman, 2009; Missel and Birkelund, 2011) require more than information or a transaction – they require an individual solution (Dolata and Schwabe, 2017) and, even further, they require assistance end empowerment (Ozer and Bandura, 1990; Bogaard and Wiegman, 1991; Davis and Smith, 1994; Bandura, 1997). A part of that consists in preparing the advisees for interaction with other stakeholders and for understanding information from other sources, such that they reach higher levels of self-efficacy. This holds especially for burglary prevention advisees who may be victims or potential victims of crime and experience resignation or fear. However, people attending to an encounter with a doctor or a teacher can also benefit from enhanced understanding during the encounter and when implementing the elaborated action plan (Frymier and Houser, 2000; Swindell et al., 2010; Coultas and Salas, 2015). While essential differences exist among the domains in which expert-layperson di-

alogue occurs and there might be individual or regional variance, all expert-layperson settings bear the wish to reduce asymmetry between the involved actors (Clark and Wilkes-Gibbs, 1986; Isaacs and Clark, 1987; Ten Have, 1991).

We question the conventional approach, in which the expert tries to match vocabulary choices of the layperson (or even oversimplifies in terms of lexicon used) (Bromme et al., 1999; Hinds, 1999; Bromme et al., 2005b; Nückles et al., 2005; Nückles et al., 2006) and view transfer of vocabulary a practice worth retaining and supporting. We claim that breaking "the course of expertise" is not about simplifying the expert's lexicon, but about granting access to the professional vocabulary to the layperson. Collaborative applications can play a major role in this process. This particular study indicates that as simple intervention as inserting professional vocabulary in the interface of a collaborative application prompts translation practices and it prompts the advisee to adopt and use the professional vocabulary. We claim that this can be seen as a specific type of empowerment, which we propose to call *lexical empowerment*. Given that the low level of efficacy is seen as a major reason for not implementing expert's advice (Ozer and Bandura, 1990; Bandura, 1997; Yaniv and Kleinberger, 2000), learning professional language can help giving the layperson a feeling of knowing one's way around, thus making him more likely to implement the advice and/or engage with the topic under consideration on his own. Given the emancipatory tendencies of clients, patients, citizens and advisees across domains, which are strengthened by open and easy access to various knowledge sources, it seems timely to acknowledge the role of vocabulary work in expert-layperson interaction and consciously support it with technology.

6 Limitations and conclusion

We propose to take this study as a starting point for further exploration of how collaborative applications can enhance vocabulary transfer. First and foremost, we require more understanding of the real value, vocabulary transfer has for the advisees: Does it really enhance their skills and self-efficacy considering the issue at hand? How to identify vocabulary with especially positive effect and distinct it from terminology without real value to the advisee? Second, a deeper dive into advisors' view on vocabulary transfer could extend the results: How much do they pay attention to the terminology they use in their daily work? What triggers them to use a specific term? What triggers them to adopt a term proposed by the advisee or by a collaborative system? Does their vocabulary effectively and persistently change based on what they use as an artefact of work? Beyond that, further research is necessary to successively address the limitations of the current study: The data from design experiments may differ from real service encounters – even though it is extremely difficult to collect recordings of real conversations with advisees affected by a complex life situation, efforts are necessary to establish a corpus of such

recordings for study of this fascinating domain. Additionally, replication of the results is needed to assure the applicability of the observations to other types of advisory service encounters. While doctor-patient, teacher-student or clerk-citizen encounters share some essential features, they all have their specific characteristics. For instance, some disciplines use vocabularies and ontologies which are controlled externally (e.g., ICD codes in medicine) or differ regionally (e.g., law terms depending on jurisdiction). A discipline-independent study on vocabulary work is still missing. Also, similar experiments with tools using different vocabulary could further strengthen the results and their validity. In fact, running a controlled experiment in a between-subject design rather than a design experiment could lead to a more precise, quantitative model of how IT influences the vocabulary choices. A controlled experiment can accommodate for more advanced testing and analysis procedures: varying the vocabulary used in the tool (e.g., using professional, semi-professional, or simple language), testing for adoption and translation of n-grams and phrases as opposite to single words, and varying the graphical designs to explore most and least effective ones for the occurrence of specific vocabulary work practices. This article provides potential hypotheses, the implications for design, to be tested in a controlled experiment and further fieldwork. Implementation of the functions identified in 5.1. in a collaborative application could further help understanding the nature of IT-supported vocabulary work. The current study points to patterns and regularities which require further investigations beyond the CSCW.

Still, the manuscript provides insights valuable for practitioners and researchers. It approaches the puzzle on the impact of IT on vocabulary entrainment. It provides evidence that a collaborative application can positively contribute to vocabulary transfer by facilitating specific practices and by contributing to better vocabulary alignment. To our best knowledge, it is the first study that indicates that expert vocabulary used in collaborative application can trigger adoption on the layperson's side. Furthermore, the manuscript describes and frames the vocabulary work as a distinct type of work occurring in advisory services. Specifically, the analysis of instances where vocabulary work embraces a collaborative application exemplifies how elements as simple as terms included in the interface govern the vocabulary choices of the participants. Service designers and collaboration engineers benefit from insight regarding the role of vocabulary they use in technological and regular artefacts they propose to employ during services. They also can take the four functions of collaborative applications in vocabulary work as inspiration and the design implication as guidance when designing for expert-layperson settings. Communication science and conversation analysis researchers benefit from a multimodal description of vocabulary transfer in an instance of institutional talk. The exact, turn-by-turn description of vocabulary work forms a contribution on its own. Finally, CSCW researchers studying human behaviour benefit from a better understanding of conversational conduct in collaborative scenarios and potentials for supporting it with dedicated collaborative applications. Overall, the paper unveils

vocabulary work as a multimodal performance – transferring and negotiating meaning goes far beyond words. This insight calls for design efforts to support vocabulary work with modern technologies and multimodal representations.

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