Making the System a Relational Partner: Users' Ascriptions in Individualization-focused Interactions with Companion-systems

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***Abstract*—Whether or not a Companion-system is experienced as a confidant and empathic assistant depends on users' individual ascriptions to it. An ascription-based understanding of users' experiences in user-companion interaction is proposed, which focuses primarily on ascriptions of human-like characteristics, intentions, motivations or emotions to the system. It is examined with regard to the individualization-focused interactions pivotally required for the adaptation of a Companion-system to the user. The study is based on a Wizard of Oz experiment and subsequently conducted in-depth user interviews. By applying qualitative content analysis, four categories describing dimensions of users' ascriptions to the system were worked out (nature, capabilities, requirements, and relational offer) as well as two categories describing users' reactions based on these (adaptation work and self-disclosing behavior). The findings are discussed with regard to theories of psychology, philosophy and human-robot interaction. Moreover, two needs inherent in humans, which seem to be relevant for users' ascriptions in user-companion interaction, are referred to: the need for safety and the need to belong.**

Keywords-users' ascriptions; user experience; Companion-systems; individualization; human-computer interaction.

I. INTRODUCTION

Claims of individual-centered human-computer interaction (HCI) culminate in visions like that of technical systems adopting the "Companion-metaphor" [1]. Under terms like "relational agents", "sociable robots", "artificial companions" or "Companion-systems", these systems provide monitoring, personalized assistive and/or companionship services [2]. They shall i.a. be experienced as confidants [3] by their users and enable them to form emotional and long-term social attachments with them [4].

A. Companion-systems

Following the understanding of the German Transregional Collaborative Research Centre SFB/TRR 62, which aims at developing a Companion-technology for cognitive technical systems, Companion-systems are defined as follows: These are visionary cognitive technical systems which adapt their functionality to each individual user by considering his preferences, needs, abilities, requirements, current emotional state and situation. Hence, they represent available, reliable, cooperative and trustworthy empathic assistants providing also an emotional dimension to the interaction [5][6].

B. Users' Ascriptions form Users' Experiences

Besides a robust technical realization of these Companion-features, it seems crucial for the success and acceptance of Companion-systems that these features are *individually experienced* by their users.

It can be assumed that this individual experience is based on the user's interpretations of the implemented system characteristics and the system behavior. Following a *constructivist view* (e.g., [7]), these interpretations can be understood as individual *user's ascriptions* to the system [8][9]: The user himself 'constructs' his view on the system by (consciously, as well as mostly unconsciously) ascribing to it and experiences his ascription-based system view as 'objective reality'. Consequently, he chooses his behavior in reaction to his ascriptions, so that system- and self-related experiences are mutually influential. According to this understanding, users' ascriptions can be understood as 'interpretation foil' for individual *users' experiences* of Companion-systems. By following this perspective, the large body of user experience studies may be supplemented, which examine relationships between distinct psychological constructs and users' experiences as summarized overall evaluations [10][11].

It is proposed that in the case of Companion-systems, functional and structural ascriptions (like described in mental models, e.g., [12]) will supplement or even become secondary to *anthropomorphic ascriptions* of human-like mental states, e.g., motives, wishes, aims and feelings [8][9] (multiple examples can be found in literature, e.g., already [13] regarding ELIZA; [14] regarding robots like "Furbies" or "Tamagotchis"): Firstly, because Companion-systems will provide social cues to realize their Companion-functionality which may trigger the perception of interacting with a social actor (this assumption is in line with the *theory of social response* in HCI, e.g., [15]); and secondly, because the average user will be unable to explain and predict the system behavior on the basis of their complex construction and functioning and consequently will draw on ascribing mental states to it in order to interact effectively with them (*Intentional Stance* [16]).

 ISBN: 978-1-61208-440-4

C. Users' Ascriptions and Self-disclosure in Individualization-focused User-Companion Interaction

This study aims at examining users' ascriptions which arise in user-companion interaction (UCI). Therefore, researching initial interaction sequences seems promising. Therein, the user gets to know the system for the first time and questions like "How can I interact with this system?" or "What can I expect from the system?" arise, which are likely to imply lots of ascriptions to the system.

Initial situations in UCI will mostly focus on *gathering user information* to realize individual adaptation to the user and fully evolve Companion-functionality. In such sensible UCI, positive ascriptions to the system like willingness to pursue user's goals, sensibility and trustworthiness seem to be necessary to enable users to cooperatively disclose relevant information without feeling uncomfortable. Especially *intimate self-disclosure*, which may be necessary in usage contexts like, e.g., E-health or E-mental health, may entail high-risk information and induce feelings of vulnerability [17]. Ascriptions like malice or pursuit of dominance may induce such negative emotions and result in a decrease of cooperativeness, reactance and even communication break-ups. Hence, it can be assumed that users' ascriptions to the system have potential to *mediate users' self-disclosing behavior*.

For recommender systems [18] describe a mediation of self-disclosing behavior by users' individual interpretations of system characteristics and user experience: Objective system aspects are perceived by the user (e.g., recognition of differences in recommendation quality based on different algorithms) and make up the user experience which in turn constitutes the user's self-disclosing behavior. Regarding the so-called 'subjective system aspects', solely conscious user's evaluations of certain aspects, namely interaction usability, perceived quality and appeal of the system, are considered.

All in all, besides the large body of research in strategies for enhancing users' self-disclosure (*behavior-centered approach*; for an overview cf. [19]) still only little is known about users' experiences of and motives for self-disclosure to personalized systems [20] or experiential factors that mediate self-disclosure choices (*experience-centered approach*). An understanding of ascriptions in individualization phases may help to explain the often surprising findings in research on privacy decision making, namely that decisions on self-disclosure are made neglecting rational principles [21].

This study on users' ascriptions and their influences on users' behavior using the example of individualization-focused UCI is guided by the following *research questions*:

1. What do users ascribe to a Companion-system asking for personal and intimate user information (system-related experiences)?
2. How do users experience themselves in reaction to their individual ascriptions to it (self-related experiences)?

The paper is structured as follows: In Section II, the research approach will be described. Afterwards, the results will be presented in Section III and discussed according to theories of psychology, philosophy and human-robot interaction in Section IV. In Section V, future work on users' ascriptions in UCI will be outlined.

II. MATERIAL AND METHODS

Users' ascriptions are unobservable, highly individual and often unconscious. Thus, a qualitative research rationale was applied in order to examine them. It aims at describing individual meaning making processes and the resulting variety and contrasts of phenomena in the material rather than at quantifying and statistically generalizing their allocation in a population (e.g., [22]). The study bases on in-depth user interviews conducted subsequently to Wizard of Oz (WOz) experiments, which were analyzed interpretatively.

A. Experimental Basis

In order to do basic research on UCI, a widely standardized WOz experiment was conducted (cf. [23][24]). The simulated speech-based interactive dialog system should represent a kind of preliminary step towards visionary Companion-systems. It was represented by a male machine-like computer voice and a graphical interface on a computer screen (no agent). Some of the leading dialog design principles were continuous system-initiative and the avoidance of self-references (personal pronouns, active forms).

In the study presented here, the focus was on users' experiences of the first experimental module of the WOz experiment, called 'Initial Dialogue' (for details cf. [23][24]). Therein, personal, and even intimate user information were gathered for the purpose of simulating the individualization process of a future Companion-system: The text "Individualization and personalization for xxx" appears on the screen. The user is asked to give and spell his name whereupon it is complemented in the text (the display remains constant during the 'Initial Dialogue'). Hereafter, he is asked openly for self-introduction. The system summarizes all the information relevant for individualization and asks for revisal. The aim is to gather information about age, place of residence, profession, place of work, family, body height, clothing size and shoe size. Still missing information is requested on inquiry. Furthermore, users are asked about recent events in which they were emotional (happy and angry) as well as about hobbies. Finally, some questions concerning the use of and former experiences with technical devices (which devices are used for what purpose in everyday life; exemplification on positive and negative experiences) are asked. In case of very short answers, the system requested further elaboration.

All in all, the system design (no self-reference, speech-based interaction, introduction as personal assistant) and the design of the 'Initial Dialogue' (extensive standardization, minimal visualization, pretension of individualization purpose) seem appropriate for this study, because they provide openness for any kind of users' ascriptions.

 ISBN: 978-1-61208-440-4

B. Interview Design

Semi-structured interviews were conducted subsequent to the WOz experiments. They focused on users' subjective experiences of the simulated system and the interaction with it. The interview guide included an initial open narration stimulus: Users were asked to report freely on the experiment and tell about their thoughts and feelings concerning the interaction [8]. For this study, the so-called initial narrations evoked by this stimulus were analyzed. These were proven to be suitable to elicit spontaneous experiential expressions.

C. Sample

Following the criterion of theoretical saturation (cf. Section III-D; [25]) 31 interviews were analyzed. In order to maximize variance, interviews were chosen on the basis of a qualitative sample plan [26], which allowed to consider sample heterogeneity regarding age (18-28 and >60 years), gender and educational level [8].

D. Interview Analysis

The interviews were transcribed according to the guidelines of GAT-2 'Minimaltranskript' [27]. The initial narratives of the 31 interviews made up 410 transcribed pages. These were analyzed applying methods of summarizing qualitative content analysis [28]. The analysis process was accompanied by regular discussions in a group of qualitative researchers. It consisted of three main steps:

1) Breaking down the Text into Meaning Units

The initial narratives of at first 16 interviews (heterogeneous regarding age, gender and educational level) were divided into so-called meaning units (MUs) varying from word groups to paragraphs in length. MUs are text segments, which are understandable by themselves and contain one episode, idea or piece of information [29].

2) Qualitative Content Analysis, Initial Category System

MUs representing reflections upon the 'Initial Dialogue' were further processed. They were paraphrased, generalized and reduced using the methods of summarizing qualitative content analysis [28]. The resulting condensed MUs were grouped according to similarities and differences across all 16 cases. These groups constituted a first set of subcategories (third level categories), which in turn could be arranged into main categories representing a higher abstraction level (second level categories). According to the research questions, these second level categories were assigned to system- and self-related experiences (first level categories) (cf. Table 1). All first, second and third level categories made up an initial category system.

3) Maximization of Variance, Final Category System

In order to maximize variance of system- and self-related experiences, additional initial narratives were added. One by one these were broken down into MUs, which were summarized as described above. The reduced MUs of each initial narrative were arranged according to the initial category system. Categories were reformulated or new ones (second and third level) were created during this process if necessary. After adding another 15 initial narratives, no further substantial increase of variance regarding the revealed categories and their contents could be detected (theoretical saturation [25]). Thus, the category system was final.

III. RESULTS

The range of users' system- and self-related experiences during the 'Initial Dialogue' represented by first and second level categories is shown in Table 1. It was desisted from listing third level subcategories in favour of describing main issues represented by them in Sections III-A and III-B.

TABLE I. OVERVIEW OF THE CATEGORY SYSTEM

First level category	Second level category (No. of third level subcategories)
system-related experiences	Nature of the system: between man and machine (7)
	Capabilities of the system: between impressing and frightening (7)
	Requirements by the system: between expectable and strange (8)
	Relational offer of the system: between insensitive and recognizing (12)
self-related experiences	Adaptation work of the user: between degrading oneself and making oneself available (6)
	Self-disclosing behavior of the user: between subjection and control (11)

A. System-related Experiences

Users differ in the wealth and depth of their reflections on both, the system and themselves. Across all of them, more system-related experiences are reported.

1) Nature of the System: Between Man and Machine

Ascriptions regarding system's nature are found in 22 initial narratives. These ascriptions oscillate between the poles 'machine' and 'human-like counterpart'. Descriptions are often made by comparing the experienced interaction to human-human interaction (HHI). Thereby, system aspects, which are far away from HHI (technical sound of system's voice, lack of reciprocity and of visible emotionality) and those associated with HHI (speech-based interaction style, personal communication contents) can get in conflict with each other (*"strange to talk about personal things with such a machine"*, MH [in order to ensure anonymity, initials of each user were used]). This mismatch can result in experiencing hybrid forms of the system, which combine both, human- as well as machine-like aspects (*"it isn't a real human being"*, SS). The hybrid is experienced as unfamiliar; it causes uncertainty and even uncanniness. This can result in continually searching for the real nature of the counterpart.

2) Capabilities of the System: Between Impressing and Frightening

Ascriptions regarding system's capabilities are found in 22 initial narratives. A lot of users are impressed and astonished by the capabilities and performances of the system. Comparing the performance of the system with that of other technical systems or with human capabilities leads to the ascription of communication abilities to the system (*"it looks simple but it can do more (…) not only yes or no (…) but even that it (…) is able to communicate somewhat"*,

BH). However, there are users, who do not appraise the experienced human-like characteristics as generally positive: A system which gives the impression of a machine but shows unexpected humanly performance seems scary. Feelings of discomfort, uncertainty and uneasy skepticism can appear. Furthermore, ambivalence regarding system's capabilities results, which is often related to the ascription of the ability to abuse confidence to the system.

3) Requirements by the System: Between Expectable and Strange

Ascriptions regarding the requirements by the system are found in 26 initial narratives. System's requests are mostly experienced as strange, unexpected and surprising. Emotional reactions vary from amusement and curious excitement regarding the further interaction, to shock, uncertainty, scepticism, distrust and discomfort. The latter are associated with the missing revelation of assumed aims of the system, which (possibly even on purpose) are expected to lie hidden in system's requests (*"there I'll be kept in the dark completely"*, SP). Furthermore, uncertainty emerges from doubts regarding the meaningfulness of system's demands (*"as it asked me I thought (…) that it really cobbles something individual-specific and when I see this retrospectively, I don't know why it needed this"*, CT) or ambiguity about system's expectations regarding content, demonstration and extent of user's answers. Nevertheless, system's requests are sometimes also described as ordinary or expectable (*"some kind of standard questions so I knew something like that would happen"*, TB).

4) Relational Offer of the System: Between Insensitive and Recognizing

Ascriptions regarding the relational offer of the system are found in 22 initial narratives. On the one hand, most users describe the system's information collection behavior as negative and insensitive: The system is experienced as nosy, it exceeds limits of privacy and intimacy and applies pressure and compulsion in terms of subjection to get user information (*"so if I didn't give the required information (…) it sort of refused to go on (…) there I felt very constrained (…) yes a little blackmail"*, SP). Thereby, it is not honestly interested in the user. Some users feel tested and assessed by the system, e.g., regarding intelligence. On the other hand, there are users experiencing the system as a supporting one, which tries to adapt to them. It is experienced as being really interested in personally recognizing the user and even represents a relational partner to one of the users (*"at some point you felt like someone is really interested in you (…) then little by little you built up such a bonding"*, FK).

B. Self-related Experiences

Besides reflections on self-disclosure choices, reflections on users' general contact to the system and implicit fundamental behavioral choices regarding the reaction to it appear.

1) Adaptation Work of the User: Between Degrading Oneself and Making Oneself Available

Reflections upon adaptation towards the system are found in 18 initial narratives. The users search for an adequate reaction to the nature, requirements, capabilities and relational offer ascribed to the system. Here, a global focus of adapting to the system to ensure a successful interaction can be made out. There are users who doubt or even accuse themselves of deficient cognitive abilities or failures in anticipating system's capabilities (*"you're really stupid, you just could've told everything first"*, GA) resulting in an insufficient adaptation to the system and an unsuccessful interaction in turn. Others describe to (passively) get accustomed to the specific characteristics of the system or (more actively) invest cognitive and time resources for this purpose. Finally, some go to great lengths to adapt to the system because they anticipated or recognized system deficits. They make their own capabilities available to the system and thereby support it to ensure a successful interaction, e.g., by adapting content and way of answering to the anticipated system's capabilities (*"first of all I thought what I could tell, like what understands this machine"*, UK).

2) Self-Disclosing Behavior of the User: Between Subjection and Control

Reflections upon self-disclosing behavior in the interaction are found in 26 initial narratives. Self-disclosing experiences range between conscious or even unconscious subjection and feeling independent from the system, i.e., having control over self-disclosure. There are users who do not reflect upon their disclosure (*"I've just told this (…) and I actually didn't think about it"*, AS). They work off the system's questions obediently or answer them despite doubting their meaningfulness. Others answer reluctantly, e.g., because they feel pushed, feel personal limits exceeded or experience nonspecific aims of the system (*„I found it hard to give this information because I didn't really recognize the meaning"*, SP). A few users reduce breadth and depth of their answers, e.g., because of distrust regarding possible information abuse or absent familiarity with the system. In contrast, others answer unhesitatingly, e.g., motivated by the imagination of the system as a pleasant long-term dialog partner (*"well, I could have gabbed with it"*, SB).

IV. DISCUSSION

In the following, the findings are compiled and discussed according to theories from diverse disciplines. Two human needs, which seem to fuel users' ascriptions in UCI are referred to: the need for safety and the need to belong.

A. Need for Safety as a Motivation for Users' Ascriptions

Users' emotional reactions regarding the experience of the system mainly range from uncertainty, discomfort and irritation to skepticism, fear, feelings of strangeness and weirdness. The experienced misfit and ambiguity of ascriptions regarding different system aspects seem to be the reason: The system is experienced as an unsettling counterpart, neither human nor machine. When specifying it with regard to the interplay of system aspects, this finding seems to fit in what is described as the *Uncanny Valley effect*

 ISBN: 978-1-61208-440-4

in robotics: People's acceptance of anthropomorphic robots increases up to a certain point in which the robot is highly realistic but not perfect, than decreases abruptly (the robot 'is stuck in the Uncanny Valley'), and increases again when the robot is indistinguishable from reality [30]. The inability to merge nature, capabilities and requirements of the system into a coherent picture causes lots of negative emotions, including first and foremost uncertainty. Negative ascriptions and skepticism, discomfort and fear are fueled, when difficult relational offers by the system, e.g., pressure and enforcement of information disclosure, are experienced additionally.

Because *safety needs*, including the preference of the known over the unknown, are inherent in humans (already [31]), users strive to handle these ambiguities and *regain certainty* for interacting effectively and successful with the system. By ascribing especially human-like mental states (motives, aims, emotions, etc.) known from HHI to their unsettling counterpart, they try to make sense of its nature and behavior and turn it into a certain, predictable one. This can be understood in line with the aforementioned *Intentional Stance* [16]: The user is confronted with a highly complex system and (suffering from lack of alternative useful explanations) anthropomorphizes it to make its behavior predictable and explainable. Thereby, he constructs a common interaction situation, namely one comparable to HHI, which allows choosing confidently adequate reactions to the system. This is in line with a psychological theory of anthropomorphism [32]: People tend to see nonhuman objects as human-like ones for interacting effectively in their environment. This *'effectance motivation'* triggers access and application of anthropocentric knowledge and leads to anthropomorphism.

B. *Need to Belong as a Motivation for Users' Ascriptions and Users' Self-disclosure in UCI*

In their theoretical contribution regarding the design of robot companions, [33] consider another human need when thinking about the user interacting with such robots – the *need to belong* [34]. It describes the immanent desire in humans to establish and sustain relationships. Regarding anthropomorphism, [32] describe the wish for social contact and affiliation in humans (*'sociality motivation'*), which – besides the effectance motivation (cf. Section IV-A) – facilitates the application of anthropocentric knowledge, too.

This need to form relationships provides another possible explanation for occurring anthropomorphic ascriptions in all of the four dimensions worked out in this study: The user unconsciously aims at constructing a potential relational and therefore at least social, if not human-like partner in the system. Thus, he interacts with the system by applying an *'as-if-mode'*, as if it would be a social, human-like counterpart that is able to get in contact with him.

Results regarding users' self-related experiences underline the role of the need to belong in this study. Surprisingly, a lot of users disclose requested information cooperatively although their ascriptions to the system are mostly negative ones. They do not consider terminating the communication prematurely and often do not even think about dropping cooperativeness. Instead, they reveal information despite uncertainty, doubts, skepticism and discomfort, rate themselves rather than the system as inadequate, and adapt to anticipated system's expectations and capabilities.

This may be interpreted as the users' attempt to get and stay in contact with the system. They want to understand it as well as being understood by it. Occurring ambivalence between readily providing information (although this exceeds privacy limits) on the one hand and hesitating to provide information (because of an unsettling and unpredictable counterpart) on the other hand is decided in favor of the relationship. In order to apply the calculus perspective on privacy decision making (e.g., [35]), this could be understood as the user's acceptance of the costs of intimate self-disclosure (including endurance of ambivalence and uncertainty) for the benefit of gaining a *relational partner*.

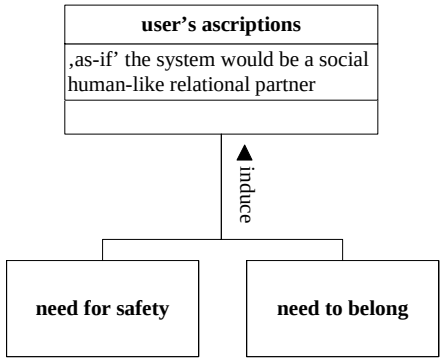

Figure 1. Grafical summary.

Figure 1 summarizes users' tendency to ascribe even human-like mental states to a Companion-system, which is based on users' inherent need for safety and need to belong.

V. CONCLUSION AND FUTURE WORK

This study examined users' individual ascriptions to a WOz-simulated speech-based interactive dialog system representing a preliminary stage of visionary Companion-systems as well as users' experiences of themselves in reaction to it. By referring to users' need for safety and need to belong, the surprisingly high user cooperativeness despite often negative ascriptions seem to be explainable. The numerous ascriptions of social skills and mental states can be interpreted as users' efforts to transform the system from an unsettling into a social, anthropomorphic counterpart representing a potential relational partner.

The presented work represents fundamental research on users' experiences in UCI. However, regarding the application-oriented perspective it can be emphasized that users tend to disclose even private and intimate information if they (independently from specific negative ascriptions to it) are enabled to see a relational partner in the Companion-system. Currently, we are conducting a supplementary study on identifying patterns in the variety of users' ascriptions and self-related experiences worked out in this study, which base

 ISBN: 978-1-61208-440-4

on the concept of 'ideal types' (cf. [36][37]). After building up this typology and assigning each individual user to exactly one of the ideal types, information about type-specific accumulations of characteristics from individual users' background profiles will be taken into account (e.g., age, sex, educational level, usage behavior and experiences regarding technical devices) to enrich the discussion of explanations for the identified patterns. The typology may be applicable to the design of Companion-systems, e.g., by deriving type-specific dialog strategies, which can foster positive ascriptions as well as reduce negative ones.

Additionally, limitations of this study indicate potentials for future research: The work was based on an experimentally simulated initial system contact for the purpose of individualization. Longitudinal studies are needed to show how users' ascriptions may change in different situations during even long term interactions. By applying quantitative and mixed methods, influences of ascriptions on observable user behavior (here with regard to self-disclosure) could be taken into account, too. Furthermore, experiments were run with volunteers. Thus, questions of ecological validity arise. In fact, motives of system use as well as downstream questions, e.g., regarding costs and benefits of self-disclosure, will become more important when considering real life UCI scenarios like, e.g., in E-Health. It could be hypothesized that being dependent on a Companion-system may increase users' tendency to ascribe in order to form a predictable, relational counterpart, as well as enhance self-disclosure in the interaction.

ACKNOWLEDGMENT

The presented study is performed in the framework of the Transregional Collaborative Research Centre SFB/TRR 62 "A Companion-Technology for Cognitive Technical Systems" funded by the German Research Foundation (DFG). The responsibility for the content of this paper lies with the authors.

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 ISBN: 978-1-61208-440-4