
Creating Positive Experiences with Digital Companions

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ABSTRACT¹

Over the last decade, advances in machine learning have multiplied the possibilities for applications of artificial intelligence. One of these applications are digital companions that assist their users in tasks and activities. In this study, we wanted to evaluate whether digital companions can be designed to create possibilities for positive experiences in work contexts and also be perceived as such using a Wizard-of-Oz prototype of a companion that supports workshop planning.

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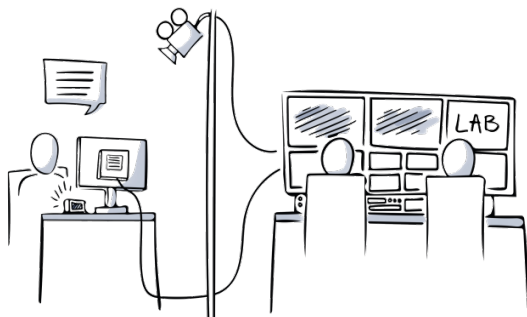


Figure 1: Sketch of the Wizard of Oz prototypes

We find that the work is perceived as more positive, more natural, and the content that is presented as more positive after the interaction with a companion that has been designed for positive experience compared to a neutral companion with the same functionality.

1 INTRODUCTION

This research aims to address two major current trends in HCI. First, this is use of artificial intelligence (AI) for assisting users in simple routine tasks and more complex tasks [1]. The second point is on user experience. Here the focus on how to design for positive emotional experiences is of special interest. [e.g. 2].

1.1 Artificial intelligence

Artificial intelligence has become a trend due to the advances in machine learning [3] which increased possibilities for application of AI. When interacting with artificial intelligence there are several differences to traditional interfaces. AI follows a mixed initiative approach. The user can initiate activities with the AI system and also the AI can start interactions with the user [4]. Interaction becomes more a notion of cooperation between human and AI. During the interaction, AI can build up new knowledge on the user and on task relevant aspects. This leads to a situation that the system is not stable and changes [5], which means that the ISO dialogue principles of ‘conformity with user expectations’ and ‘controllability’ are less pronounced [6]. As a companion AI is used to assist human users in their tasks and activities [7].

1.2 User Experience

Over the last 20 years there has been vital discussion on what user experience (UX) is, how it could be defined, and on how to design for it [e.g. 3, 4, 7]. An important step forward was that emotions experienced during product use are important to form the user experience. Donald Norman’s ‘emotional design’ describes different levels of processing and the associated affects, which can be used as basis for design [11]. Hassenzahl [12] pointed out that the valence dimension of emotions (from negative to positive) is relevant for experiences of users interacting with a product or service. A very important part of his model is the clarification that positive emotions occur, when psychological needs are fulfilled. Therefore, design must address the fulfillment of psychological needs such as autonomy, relatedness, stimulation, competence, popularity, security [2], [12], [13].

1.3 Positive User Experience at Work

Up to now there is not much research on UX and work contexts [e.g. 15]. Some first studies showed that work can be experienced more positive, when users get detailed feedback on what they achieve (need of feeling competent), which leads to more concentrated work [15]. Lu and Roto showed that it is possible to design software for the positive emotion pride [16] and for the

Hugo was designed to address the following positive experience categories and needs:

Security

Hugo reminds the user that tasks have not been completed (e.g. including the innovation group or writing the social media invitation).

Receiving feedback

Hugo comments on the participant's plans and says that he likes ideas.

Remembering

Hugo asks about previous experiences.

Creating something together

Hugo also suggests workshop methods and can brainstorm together with the participant.

Hugo can add methods, so the participant can plan not only with suggested methods but also their own. Hugo has an opinion on the methods and notes and comments when he finds an idea new or interesting.

Finishing a task/Rising to a challenge

After planning a workshop phase, it is ticked off on the overview screen. This gives the participant an overview of their progress. Once the whole workshop has been planned, Hugo points out that the plan is complete and saved so that the participant or their colleagues can use it in the future.

experience of meaningful work [17]. Tuch and colleagues compared user experience in leisure and work contexts. They found that the psychological needs for competence, security, and popularity are rated rather prominent for work contexts and relatedness, pleasure/stimulation, and beauty are more relevant in leisure domain [18]. Even the demanding work of field sales personnel can be improved by designing for positive social relationships with their customers (relatedness in combination with competence). Furthermore, the team experience (relatedness) could be more positive e.g. by providing the possibility of expressing and receiving gratitude for contributions in a customer relationship management system [19]. As a next step, we investigated positive work contexts. We identified 17 positive experience categories [20] which can be used in software design processes [21].

Especially, networked AI systems provide many possibilities to design for positive user experience [22]. With that it is possible to give feedback how work results are used by others in order to provide an experience of meaningful work. Algorithms can collect information on the further work results and feedback what has been achieved during a chunk of time, say during the last week [22].

2 TWO COMPANIONS

2.1 Method

In this study, we were interested in whether digital companions could create positive experiences. We decided to test in how far this is possible by designing two prototypes for digital companions – one that merely supports the user and one that has exactly the same functionality but was also designed to create possibilities for positive experiences using experience categories [20], [21]. Participants were instructed to plan a workshop with the companion. In order to create a realistic situation, the participants had to deal also with negative experiences (their workshop was cancelled in an email). Afterwards they were interviewed about their experience with the companion and filled out a series of questionnaires. For the experiment participants were seated in front of a table with a screen and a speaker (see Figure 1). We used module II of the MeCUE questionnaire [23] which measures the emotional response to a product in addition to the qualitative questions to evaluate how the companions were perceived. Note that the majority of the more detailed description of the experiment was placed in the sidebar.

2.2 Design

The overall design goal was to create two prototypes for digital companions that support the user while planning a workshop with an agenda, different phases and moderation methods. As such both shared several features but also differed in how much they were designed to create positive experiences.

Companion 1: Neutral

The neutral companion has no name. It can read out workshop methods, but does not suggest them independently, it logs ideas but does not provide feedback, reminds the participant of tasks but does not ask about previous experiences in workshops.

Task

At the beginning, participants were given the task of planning a workshop on the subject of "communication in teams" and setting up a workshop plan. The workshop is going to be supported by an innovation group with a high level of expertise on this topic. Participants were told they should plan the workshop and integrate the innovation group in the workshop. In addition, participants had to write an invitation for social media channels that encourages as many people as possible to sign up for the workshop.

While planning the workshop, participants could collaborate with the companion. How close this cooperation was up to the participants themselves. They also had the opportunity to plan the workshop with pen and paper – though, all participants used the companion for at least some part of the planning process.

Klassen eines Workshops > 2. Konkretisierung des Problems > Methoden > Kreativitätstechniken

Regeln für Kreativitätstechniken

- **Keine Kritik** an anderen Beiträgen, Ideen und Lösungsvorschlägen
- Auch **unmögliche Ideen** aussprechen oder aufschreiben
- Ideen anderer aufgreifen
- Befangenheit verdrängen
- Je **kühner und phantasievoller** die Ideen desto besser
- Keine Angst vor Blamage

Figure 2: Screenshot of the prototype

Companion 2: Hugo

The "empathic" companion is called Hugo. It introduces itself to the users and tells them about its functions. Hugo can read out moderation methods or suggests them independently, logs agenda topics with the related moderation methods, notices if the participant has interesting ideas (e.g. methods which are not in the database of the companion) and points out that it will remember them. It reminds the user of tasks, as well as asking about previous experiences in workshops. It also gives the user feedback about the planned steps. At the end of the planning process, Hugo saves the workshop plan so that it can be used by the user themselves or by colleagues. With these aspects, this companion addresses different experience categories ([20], [21]) (security, receiving feedback, remembering, creating something together, finishing a task) and thus addresses the needs of the users. See sidebar for more details.

2.3 Prototypes

The two companions were developed as Wizard-of-Oz prototypes [e.g. 23]. This means the AI is simulated. With Wizard of Oz prototypes intelligent systems can be simulated by the experimenters. The human agents simulating the companion follow a decision tree and so the prototype reacts to the user like a realistic AI system. Thus, very early on studies on design issues for human-AI interaction can be performed. These findings can then be used later in the design of real AI systems. In our case the participant was shown Power Point slides on a screen which were then updated from a control room during the session (see Figures 1 and 2). This means the companion could write down what the participant wanted to record. The prototype also used a pre-recorded selection of text-to-speech responses that allowed the prototype/experimenter to interact with the participant as a realistic voice user interface. The combination of screen output and voice interaction was the same between the prototypes of the two companions.

3 RESULTS AND DISCUSSION

3.1 Qualitative Results

The positive and negative aspects about the prototypes mentioned by the participants are listed in Table 1. While the functionality of the two companions was comparable they were perceived very differently. Most strikingly the voice was perceived as very different even though the same text-to-speech generator was used for both and they shared about 75% of their sound files. This was also mirrored by the ratings of the interaction with the companions – the interaction with Hugo was described as natural nearly 3 times as often as the interaction with the neutral companion. As experimenters, we noticed this difference as well. With Hugo participants would thank the companion for doing something for them or even ask for the companion's advice on things such as the workshop structure. Two negative aspects were mentioned more often for the Hugo than for Neutral prototype. The participants preferred more control over the system and disliked the simple screens (see figure 2) more often when interacting with the Hugo prototype than with the neutral one.

Pilot Study

Initially, a pilot study was conducted to test both versions of the companion and the research design. A total of 6 participants took part in the pilot study. New findings (e.g. on the structure of the test) were incorporated directly into the concepts and the moderation guide after each test and checked during the next study. The functions of the companion were extended iteratively. Amongst other issues, the pilot study addressed the following:

At the beginning, it turned out that the possible reactions of the companion were not yet versatile enough. In some situations, the companion could not respond properly because we had not included audio files that matched the needed response. Therefore, the available responses were expanded.

We also noticed the need for sentences to bridge possible breaks or incorrect inputs. Therefore, apologies and the request to wait briefly were integrated.

Participants

A total of 40 students and staff at Stuttgart Media University participated in this study. They were alternately assigned to one of the two prototypes.

- Age: \bar{x} 24.4 (20 to 35 years)
- Gender: 28 female, 12 male
- Education: 28 x High School Diploma, 6 x Bachelor, 4 x Master, 2 x unspecified

Most participants did not have much experience in workshop planning and generally rated the task as rather difficult to extremely difficult.

Table 1: Positive & Negative Aspects About Interaction with Prototypes Mentioned by Participants

Positive Aspects	Hugo	Neutral
Rated working with the companion as positive	78.6%*	50%**
Participants rated the interaction with Hugo as natural	66.7%***	21.4%****
Participants mentioned the methods & their presentation as positive	86.7%	75%
The companion had supported them through the various workshop phases (by suggesting the different phases and giving guidance)	80%	66.7%
Mentioned the voice control as positive	46.7	50%
Mentioned the flexibility that this way of planning provided as positive	26.7%	16.7%
Negative Aspects	Hugo	Neutral
Would have preferred more control over the system (e.g. through a keyboard or the addition to other visuals)	57.2%	35.7%
Perceived the companions voice as negative	14.3%	42.9%
Mentioned disliking the overall design of the slides (which was black font on a white screen, see figure 2)	35.7%	21.4%
Did not like the content (e.g. available methods and their explanation)	28.6%	35.7%

*(Hugo: neutral: 7.1%; negative: 14.3%); **(Neutral: neutral: 42.9%; negative: 7.2%)

*** (Hugo: mixed: 13.3%; unnatural: 20%); ****(Neutral: mixed: 35.7%; unnatural: 35.7%)

3.2 Quantitative Results

MeCUE: Module II of the MeCUE assesses positive and negative emotions in response to a product. While participant's positive were higher and negative emotions were lower for those who had worked with Hugo as opposed to the neutral companion, this difference was not significant (Hugo: pos. emotions: \bar{x} =3.90, SD=1.19; neg. emotions: \bar{x} =3.02, SD=1.19; Neutral: pos emotions: \bar{x} =3.75, SD=1.23; neg. emotions: \bar{x} =3.28, SD=1.37; MANOVA: F=0.20; p=0.70).

4 DISCUSSION AND CONCLUSIONS

In summary, our results show that we might, indeed, be able to design digital companions with a focus on positive experiences for white-collar tasks. By simply changing the experience quality of a companion (by using the positive experience categories) the user's perception can be altered quite dramatically. The simple screens (see Figure 2) were more often disliked in the Hugo prototype. An interpretation might be that the screens are perceived as a contrast to the positive impression of Hugo. The fact that the difference of negative and positive emotions between the companions is not significant, might be caused by a recency effect [25], i.e. just the experiences at the end of the sessions are rated. A concurrent sampling of the emotions might be more appropriate. We believe a digital companion such as Hugo show new potentials for positive experiences in work contexts extended by artificial intelligence. Studies like this allow us to generate guidelines or patterns that support the design of positive experiences with digital companions.

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