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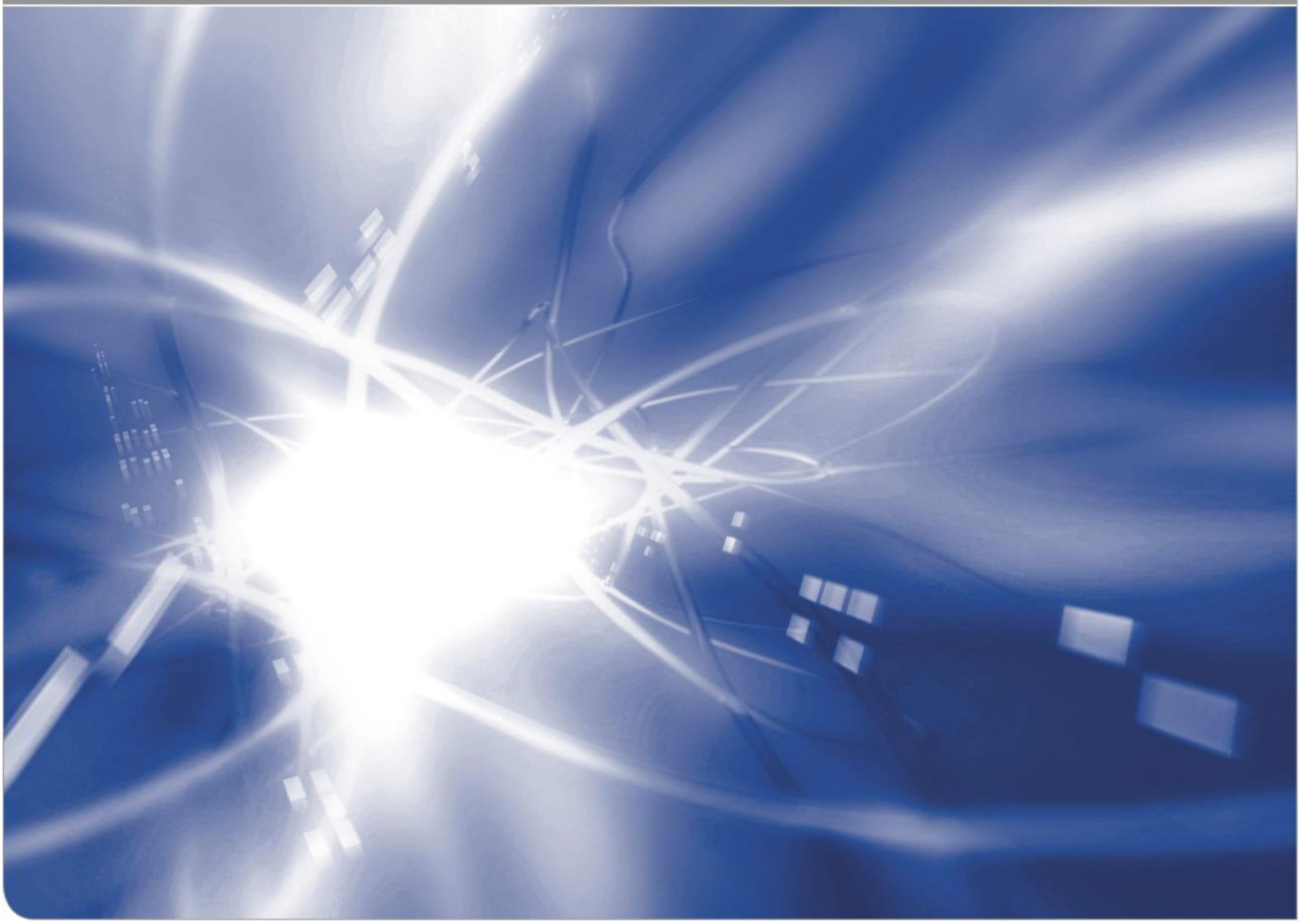

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# Preface

This volume contains selected extended abstracts from the Workshop on "Designing User Assistance in Intelligent Systems" of the 27th European Conference on Information Systems – held from June 8 to June 14 in Stockholm, Sweden.

This workshop is the successor of three other workshops on "Designing User Assistance" held at ECIS 2018 in Portsmouth, UK, ECIS 2017 in Guimarães, Portugal, and at the WI (Wirtschaftsinformatik) conference 2017 in St. Gallen, Switzerland. The workshop has a focus on the design of systems providing user assistance.
We define user assistance as a specific capability of interactive intelligent systems that help users perform their tasks better. Thereby, user assistance is a human-, task-, and context-dependent augmentation of task performance bridging the gap between the system's functionalities and the human's individual capabilities with the goal of positively influencing task outcomes. User assistance can be classified along two dimensions: (1) the degree of interaction enabled by user assistance, and (2) the degree of intelligence of user assistance. The degree of interaction characterizes the assistance systems capability to support humans in an ongoing reciprocal and activating dialog using, potentially, different channels. The degree of intelligence describes the capability to provide assistance based on the human, the context, and the current activity.
We received five submissions for the workshop and we were able to accept all submissions as extended abstracts. Each of the submissions was reviewed in a double-blinded process by two reviewers of the program committee and the workshop organizers. In total, this volume now contains five extended abstracts.

We would like to thank all authors who submitted their papers to our ECIS 2019 Workshop on "Designing User Assistance in Intelligent Systems". We trust that the readers will find them as interesting and informative as we do. We would like to thank all members of the program committee as well as the additional reviewers who took their time to provide detailed and constructive critiques for the authors. Furthermore, we would like to thank the Karlsruhe Institute of Technology (KIT), which made the publication of this volume possible. We believe the papers in these proceedings provide many interesting and valuable insights into the research on user assistance systems. They open up new and exciting possibilities for future research in the discipline.

June 2019
Stefan Morana
Jella Pfeiffer

Program Committee



# Table of Content

# TOWARDS DESIGNING AN ANTHROPOMORPHIC CONVERSATIONAL AGENT FOR ASSISTING JOB INTERVIEW PREPARATION

*Extended Abstract*

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Currently, conversational agents (CAs) attract strong interest in research and practice alike (Luger and Sellen 2016). While the idea of natural language interaction with computers dates back to the 1960s (Weizenbaum 1966), significantly enhanced capabilities through developments in machine learning and natural language processing have led to a renewed interest in recent years (Knijnenburg and Willemsen 2016). However, many CA could not fulfill the high user expectations and were often discontinued (Ben Mimoun et al. 2012). This gap between user expectations and system capabilities can be better understood by drawing on the Social Response Theory (Nass and Moon 2000). The human-like characteristics of CAs, such as the communication via natural language, being named, or sharing artificial thoughts and emotions, trigger social responses by the users. While these social responses offer interesting design opportunities, such as the design of persuasive CAs (Adler et al. 2016) or empathetic CAs (Hu et al. 2018), they can lead users to similar expectations of the systems as they have towards humans (Seeger et al. 2017), which are often not in line with the system's actual capabilities (Luger and Sellen 2016). In sum, successful design of CAs remains a practical challenge and an interesting phenomenon to study.

Different studies that address this challenge have recently emerged in IS research, providing prescriptive knowledge for the design of CAs with conceptual frameworks (e.g. Seeger et al. (2018)), initial design principles (e.g. Gnewuch et al. (2017)) or situated implementations (e.g. Vaccaro et al. (2018)). With our study, we contribute to this growing knowledge base in three ways: First, we present a novel artifact, that is an anthropomorphic CA in the context of recruiting. The artifact will be designed and evaluated over a span of around seven months in a DSR project in collaboration with an international professional services firm with over 2,500 employees. The project aims to offer a simulated job interview for interested candidates to prepare for the actual recruiting process. Second, we plan to summarize the prescriptive knowledge generated in the DSR project in a nascent design theory. Third, we pave the way for distancing from situated implementations to more general design knowledge for text-based CA in a professional context through contrasting our results with extant DSR studies on CA.

Our research project is based on the DSR framework suggested by Kuechler and Vaishnavi (2008). We conducted the project in three design cycles over a span of seven months. As of now, we are implementing the adapted design principles in the prototype. Afterwards, we plan the evaluation of the adapted artifact by means of an online experiment, which we describe in more detail in the final section of this article. The motivation for our DSR project stemmed from the idea to provide a new tool that supports the applicants in their interview preparation at the professional services company. As the job interviews are for the most part standardized and case-study based, which is common for companies of that size, applicants can prepare themselves through practicing online case studies. These cases involve the structuring of a specific business problem, estimating and calculating numbers and presenting, as well as defending the solution. Existing online training systems typically consist of Q&A forms with a transparent structure and given answer options. While those systems can be helpful to understand the basic course of interviews, they lack realism due to their obvious structure and given answer options, which is not the case in the actual job interviews. Against this background, we considered a CA that simulates a more realistic job interview as a promising opportunity to improve the existing solutions in this application domain (Gregor and Hevner 2013).

We built the artifact and instantiated the design principles using Google Dialogflow and a custom-built web interface. Dialogflow provided the basic natural language processing capabilities to implement the CA, while the web interface was developed to provide convenient access for users, along with the website's integration of the professional service company. In order to simulate the interview as realistic as possible, we closely collaborated with the HR department to better understand a typical interview structure, employing existing material provided by recruiting experts of the company to design the conversation. To evaluate our artifact and demonstrate its usefulness in the field, we currently prepare an online experiment that compares the performance of the conversational agent to the performance of an extant online training system for job interview preparation. The professional services company will provide access to their talent pool which contains potential applicants. These job candidates will be asked to participate in an online experiment in which we randomly assign each participant to either the extant training system or the conversational agent (between-subjects design). At the moment, we estimate to have a sample size of around 100-120 participants from the talent pool. After completion of the training, participants will complete a survey. In the survey, we will use established measurement instruments to assess the perceived usefulness (Davis 1989), perceived enjoyment (Koufaris 2002), perceived human-likeness (Holtgraves and Han 2007), and social presence (Gefen and Straub 1997) as well as collect demographic information and prior experience with digital assistants and chatbots. After the collection of the survey data, we will test the hypotheses by means of t-tests for independent samples to understand whether the CA does indeed make an improvement on the state of existing training systems. After the evaluation of the artifact, we plan to summarize our contributions in the form of a nascent design theory (Gregor and Jones 2007) comprising the purpose and scope of the artefact (support applications in their job interview preparation), constructs (perceived usefulness, perceived enjoyment, perceived human-likeness, social presence), principles of form and function, artifact mutability, testable propositions, justificatory knowledge (Social Response theory, theory of Uncanny Valley), principles of implementation and expository instantiation.

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# INTRODUCING THE VIRTUAL COMPANION CANVAS – TOWARDS DESIGNING COLLABORATIVE AGENTS

*Extended Abstract*

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Due to a significant technological progress in the field of artificial intelligence (AI), a number of new services and products emerged (Gnewuch et al., 2017; Maedche et al., 2016; Seeber et al., 2018). In addition to specific applications in the form of virtual assistants (VA), such as Apple's Siri or Amazon's Alexa, companies are increasingly developing chatbots and enterprise bots for the interaction with customers. Besides these practical uses of AI, many scientific articles in this field are published, including design principles and lists of tips on how to design and implement specific AI applications (McTear, 2017). Due to the overarching research endeavor of AI, various definitions and theories from different research areas exist, are combined and used, which additionally makes it hard to understand the comprehensive perceptions of AI. Terms, such as VA, chatbot, virtual agent and conversational interface are often used synonymously, whereby differences can be found in the applied technology, the implemented functions and the different tasks addressed (Gnewuch et al., 2017; McTear, 2017; Schuetzler et al., 2014). While there is a variety of terms, all have one thing in common, they allow their users to interact with them using natural language. Therefore, these systems can be summarized using the term conversational agent (Gnewuch et al., 2017; McTear et al., 2016).

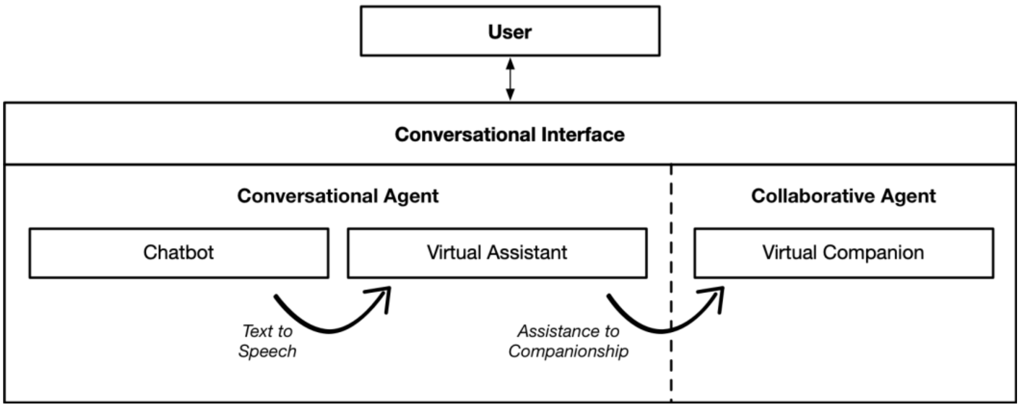


*Figure 1. From conversation to collaboration*

The front-end for the conversational agent is then called a conversational interface (see Figure 1), which allows the user to interact with the agent using speech, text, touch or other input and output options (McTear, 2017). While the term conversational agent limits the interaction between the system and the user to a conversation, a system that proactively contributes to a given task and autonomously creates content would thus not just be conversational, but rather collaborative. We therefore propose the collaborative agent as an evolution of the conversational agent (see Figure 1). We introduce the virtual companion (VC) as a first instance of a collaborative agent. We chose the name VC, as it represents a more comprehensive view on existing and especially future applications of AI and by forming a companionship between a human and a machine a collaborative scenario might be achieved. We define the VC as follows: A VC is a conversational, personalized, helpful, learning, social, emotional, cognitive and collaborative agent, that interacts with its user proactively and autonomously to build a long-term relationship (Danilava et al., 2012; McTear, 2017; Strohmann et al., 2018; Wilks, 2006).

The difficulty to decide what functionalities to use is furthermore strengthened by the confusing terminology, different frameworks, the plethora of tools and the extensive documentations (McTear, 2018). Therefore, it is necessary to create special tools which are useful for practical developments and applications of AI as well as for design-oriented research in the field of AI. In order to make these design challenges possible, we are proposing a so-called Virtual Companion Canvas (VCC), which is a tool that shows in an easily understandable and transparent way which design characteristics an VC can have. The VCC should be helpful in the design process as well as in the analysis, classification and understanding of existing AI applications. We opted for a canvas approach because of the advantage of visualization (Swaab et al., 2002), allowing users to not only follow lists and design guidelines, but conceptually design AI without considering specific technologies. For the development of the VCC we followed a systematic and iterative Design Science Research (DSR) approach (Hevner et al., 2004). The VCC is successive and iteratively developed based on two different DSR projects, containing three design cycles (Strohmann et al., 2019, 2018, 2017). This continuous development insures a rigorous process in order to create the VCC artifact. We followed the adapted process model proposed by Kuechler and Vaishnavi (2008), that emphasizes the contribution and knowledge generation of DSR.

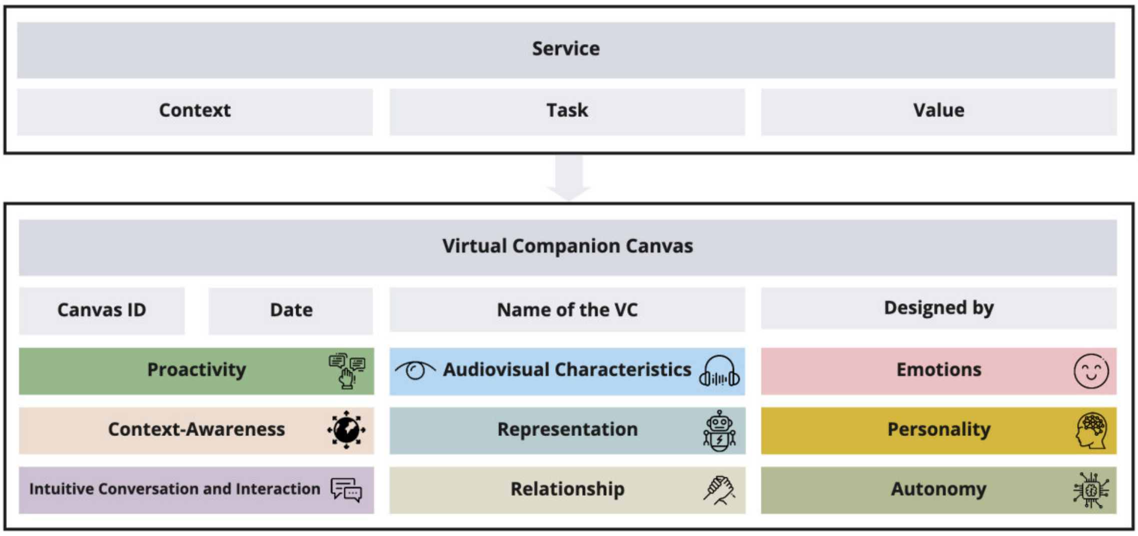


*Figure 2. Reduced Version of the Virtual Companion Canvas*

Figure 2 presents a reduced version of the canvas, whereas a full version of the VCC can be found here: bit.ly/ecisvcc. It is divided into two parts: the service concept of the VC and the canvas itself in the form of the VC's dimension with its individual design features and characteristics. With the development of the VCC, we not only aim to introduce tool support for the design of VCs, but additionally follow the overarching objective to contribute a design theory giving explicit prescriptions for the design of VCs (Gregor, 2006; Gregor and Hevner, 2013).

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# TOWARDS THE CONCEPTION OF A VIRTUAL COLLABORATOR

*Extended Abstract*

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Digitization and an increasingly interconnected world confronts companies with immense challenges and complex problems, that require teamwork and collaboration (Finkbeiner and Morner, 2015; Dulebohn and Hoch, 2017). With the help of information and communication technology (ICT), collaboration can be conducted time- and location-independent, resulting in virtual teamwork. Virtual teamwork is a setting that nowadays is part of the daily business of many knowledge workers, where different team members collaborate by using specific information technology for communication, information exchange and an overall collective value creation (Driskell et al., 2003; Fiol and O'Connor, 2005; Dulebohn and Hoch, 2017). The interdisciplinary endeavour of computer-supported collaborative work (or collaboration technology), examined the different mechanisms that are required to successfully collaborate via information systems (Grudin, 1994; Borghoff and Schlichter, 2000). Guidelines and design principles propose various features, that support interaction and group dynamics in order to decrease negative cognitive or social group effects, like production blocking, evaluation apprehension or social loafing (Diehl and Stroebe, 1987; Voigt and Bergener, 2013). With the rise of artificial intelligence (AI), new forms of collaboration need to be considered, that involve AI as an active partner within a collaboration setting (Seeber et al., 2018). Theories and design guidelines that support collaboration, considering cognitive and social group effects, need to be revised when team members are not solely human any more.

Recent research tries to address this or similar questions by focusing on specific mechanisms and phenomena, like trust, politeness, reciprocity, mindlessness or anthropomorphism (Nass and Moon, 2000; Gnewuch et al., 2017; Saffarizadeh et al., 2017; Elson et al., 2018; Schroeder and Schroeder, 2018). Especially trust and reliance are frequently covered topics, as well as privacy concerns and data security when interacting with intelligent systems (Saffarizadeh et al., 2017). Studies show that trust in intelligent systems is an important aspect that has a major influence on the willingness to share information (Schroeder and Schroeder) and how users rely upon recommendations from intelligent systems (Elson et al., 2018). When interacting with computers, data security additionally impacts privacy concerns and overall trust (Saffarizadeh et al., 2017). In summary, the studies underline the importance of trust in computers and subsequently the necessity to consider trust as a major factor within human-machine collaboration.

Commonly known applications of AI like Apple's Siri or Google Assistant are personal assistants fulfilling everyday tasks for their user (McTear et al., 2016a; Pearl, 2016). They can carry out tasks and give various information concerning topics like weather, traffic, restaurant information or even make appointments at the user's favourite hairdresser (see Google Duplex) (Zhao, 2006; McTear et al., 2016a).

Hence, these systems are already able to understand natural human language and interact with humans in a social way (Zhao, 2006; Skalski and Tamborini, 2007b). According to Maedche et al. (2016), we speak of Advanced User Assistance Systems when amongst other things, the user's context and activities are considered while performing a particular task. They suggest that so-called Anticipating User Assistance Systems are the highest form of user assistance, which include a proactive behavior and self-learning capabilities, adapting to certain contexts and to the user's needs. Maedche et al. (2016) draw attention on this topic and demand future research in this field (Maedche et al., 2016). Seeber et al. (2018) coincide with that and state that technology has the potential to be our smart collaboration partner in the future (Seeber et al., 2018). This assumption includes, that the support by a smart machine is not solely an assistance, but a coequal value creation between humans and AI. Based on these various definitions of AI that support the user, combined with the theoretical background on collaboration, we define the **Virtual Collaborator (VC)**, a coequal virtual teammate in a collaboration setting.

To shed light on the newly established term of a Virtual Collaborator, we conducted an exploratory study for a phenomenon that has not been studied before (Babbie, 2015). In order to understand the conception and in order to identify the influencing factors of team workers towards virtual collaborators, a questionnaire was developed and carried out. A study with 144 participants was carried out to provide valuable information about collaboration principles, conceptual implementations and requirements.

The results reveal that a substantial part of the participants is not using any VAs in their daily life (42%), because of mistrust. Overall, the study reveals a somewhat inconclusive opinion about VCs. Participants can imagine working with a VC, but only when a VC is subject to stricter rules and works on less complex tasks and do agree on the fact that a VC should not work as a team leader. This leads to the conclusion, that participants do perceive a VC as unequal to other team members, don't conceive a collaboration with a VC the same as with solely human partners, do not completely trust in a VC and would not accept instructions from a VC in equal measure as from a human person. Tasks mentioned by the participants that VCs should not take are executive activities, critical decision making, vital tasks or creative tasks. When it comes to completely replacing human-made work with a VC, only 39% of the participants agree and comment that especially easy tasks can be done by VCs, but "there must always be a last means of human control." Participants name tasks like "Organize appointments", "Write summaries of lecture scripts", "Conduct systematic literature reviews", "Help writing mid-term paper", "Write emails and communicate with clients" or "Secretarial duties" that should and can be done by VCs. Some participants did not answer this question, as they could not imagine any relevant tasks a VC can adopt. The participants state that the workload can be reduced significantly and that a VC can be beneficial in the professional environment as well as in the private sphere. Overall, the conception of a VC is unclear and participants are primarily sceptical towards VCs in a coequal manner. Participants expect a VC to comply to rules of collaboration, e.g. a VC should be reciprocal, trustworthy, respectful, have commitment and work benevolently with all team members towards a common goal. This is backed by comments, that a VC should not take tasks involving empathy, personal conflicts or social relationships.

The conception of the participants that VAs and possible VCs still don't work as satisfying as required, should challenge practice to further develop AI and especially consider collaboration features within their services. Current VAs are limited to features that solely assist the user, like chatbots that are implemented in support or voice assistants like Apple's Siri. In summary, it can be said, that the novel research endeavour of AI, actively collaborating with humans and working in teams is still in its infancy. With our study, we provided a foundation for future research that can lead to new collaboration theories, mechanisms, artefacts and guidelines.

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# IMPROVING IT-BASED USER ASSISTANCE FOR EARLY PRODUCT-COST OPTIMIZATION: EVALUATION OF A SOLUTION DESIGN

*Extended Abstract*

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In today's globalized market, product manufacturers are increasingly exposed to competitive pressure due to shortened product life cycles, increased product diversity, and rapidly changing customer requirements, among other phenomena. In response, manufacturers increasingly need to optimize their product costs at an early stage in order to maintain long-term economic viability. That need has become particularly important since up to 90% of total product costs are determined during product development, and thus before start of production (Mörtl and Schmied, 2015). Our collaborative research with the discrete manufacturing industry has revealed that, despite enormous competitive potential of product development to optimize product costs, existing information systems (IS) do not yet sufficiently support early product-cost optimization. The lack of support is due to not only a lack of functionality in existing IS (Schicker et al., 2008) but also the characteristics of product development, including information uncertainty (Vosough et al., 2017) and process emergence (Markus et al., 2002). To counteract that situation by designing a suitable solution to improve information technology (IT)-based user assistance for early cost optimization, we initiated a long-term research project following the methods of design science research (DSR; Peffers et al., 2007). In a problem-centered initiation with close collaboration with the discrete manufacturing industry (Walter and Leyh, 2017), we elaborated major challenges in designing a potential solution and evaluated its requirements (Walter et al., 2018). Considering the information system design theory (ISDT) for emergent knowledge processes (EKPs), we proposed a potential solution design involving extensive user assistance in early product-cost optimization that can support the management and implementation of a variety of optimization cases, such as optimization of material prices, investments in production machinery, or make-or-buy decisions. To ensure the flexibility needed to support such a variety of optimization cases, our solution design offers dedicated user assistance to cultivate specific optimization measures from their initial idea (Measure identification, Fig. 1) through their elaboration and evaluation to their final implementation, as described in Walter et al. (2018). The proposed approach was instantiated as a prototype in Walter (2019).

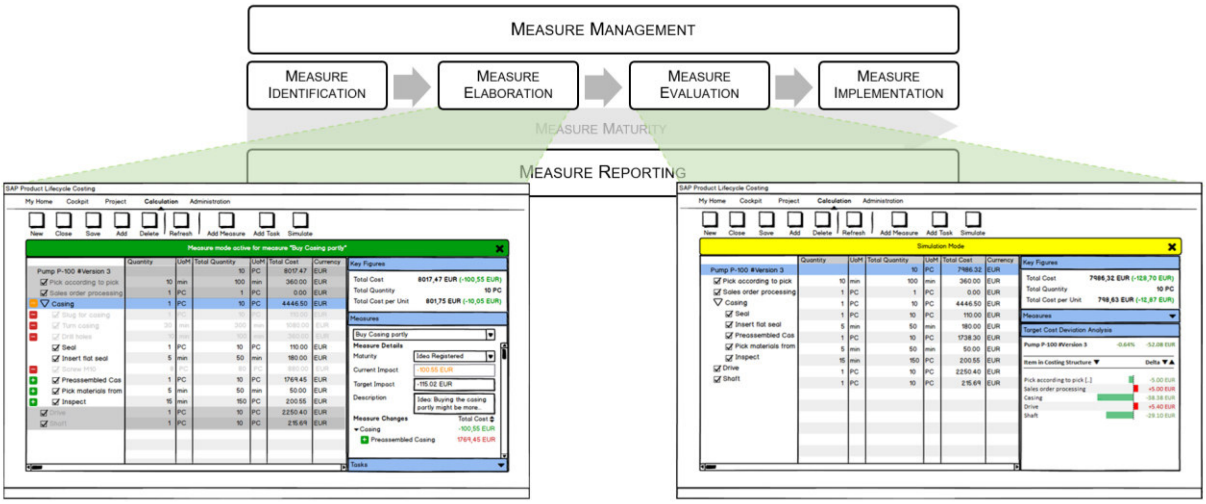


*Figure 1. Approach to early product-cost optimization with prototype interface mockups*

In that context, this paper resumes the evaluation of the instantiated prototype. Due to the singularity of EKPs, as underscored by Marin et al. (2016), and the consequent necessity for an in-depth evaluation of the solution design, we first developed a suitable strategy for such evaluation that combines artifact evaluation patterns recommend for DSR (Peffers et al., 2007; Venable et al., 2016; Sonnenberg and vom Brocke, 2012) with the specific needs of our research project respective to its domain. The resulting two-staged evaluation strategy aimed to assess whether and, if so, then to what extent our solution design can improve IT-based user assistance for early product-cost optimization and thereby overcome challenges with implementing the solution design as well as address requirements outlined in prior research (Walter et al., 2018).

| **Evaluation criterion** | **Ø** | **σ** |
|---|---|---|
| The scenario of the prototype test was realistic. | 4.2 | 0.6 |
| The prototype is useful for supporting product costing. | 4.3 | 0.7 |
| The prototype enhances productivity in product costing. | 4.0 | 0.8 |
| The prototype enhances transparency in product costing. | 4.1 | 0.8 |
| The approach enhances the quality of product costing. | 4.0 | 0.8 |
| The approach is able to cover optimization use cases in my organization very well. | 3.4 | 1.2 |

*Table 1. Extract of the results of the evaluation of the instantiated prototype from the second step of evaluation on a 5-point scale (1 =* strongly disagree*, 5 =* strongly agree*).*

Overall, the results of the evaluation (Table 1) revealed the significant potential of the proposed solution design for broad industrial application. The developed approach can increase the productivity, transparency, and quality of early cost-optimization processes for the evaluated scenario of application. Major reasons for the positive results of the evaluation are attributable to the underlying ISDT and its design principles for EKPs (Markus et al., 2002). Nevertheless, since our research domain does not perfectly align with all EKP characteristics, the ISDT's design principles were mapped to design-related features of the instantiated prototype and discussed in terms of their adequacy for and relevance to the results in the respective research domain. For example, the prototype's design features that link relationships of optimization measures to different types of entities within the prototype (e.g., personal responsibilities, products, maturity phases, and tasks), a specific component supporting the parallel elaboration of conflicting optimization measures, and the loosely coupled collaboration management to assist in evolving knowledge structures over a measure's maturity can be expected to benefit productivity, transparency, and quality.

Particularly remarkable among the positive results of our evaluation was that potential users of a future IS implementation have evaluated the prototype for different organizational contexts in discrete manufacturing. Such collaborative diversity facilitated valuable feedback due to the speak-aloud evaluation procedure addressing further improvements to the solution (e.g., to support additional optimization cases). The next step is thus to incorporate the collected feedback and pursue the chosen evaluation path "Human Risk & Effectiveness" (Venable et al., 2016), and ultimately perform a naturalistic evaluation (Sonnenberg and vom Brocke, 2012) that can rigorously underpin broad effectiveness of the solution design to improve the status quo toward IS support for early product-cost optimization.

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# DESIGN PRINCIPLES FOR HUMAN-COMPUTER COLLABORATION

*Extended Abstract*

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User assistance systems are information systems that help humans perform tasks better (Maedche et al. 2016). Enabled by emerging technologies like artificial intelligence, the widespread adoption of these increasingly sophisticated systems is radically transforming the way humans work. Advanced user assistance systems can relieve employees from mundane or repetitive work and allow them to focus on more complex work (Maedche et al. 2016). As the field of artificial intelligence is advancing quickly, computers can perform an increasing number of tasks which were previously performed by humans. However, in a vast number of cases, computers still need the help of humans to achieve acceptable levels of performance. The interplay between such systems and humans remains a challenge. In many cases, the capabilities and functionalities of user assistance systems have increased rapidly in the last decade, while the ability of humans to comprehend and utilize these systems has not kept pace (Gorecky et al. 2014, Kagermann 2015). There is evidence that these emerging systems will eventually shift the majority of tasks from humans to computers (Manyika 2017, Leopold et al. 2018). However, today there are still many problems that computers cannot solve alone (Kamar 2016). That is the case, for instance, with complex planning problems where companies rely on the tacit knowledge of their employees. As this circumstance will not change in the foreseeable future, there is a need for systems that complement and augment human capabilities instead of aiming to replace them. Hence, we argue that information systems need to be designed to support human-computer collaboration. We explore design principles for these "human-in-the-loop" systems that facilitate the collaboration of humans and computers (Holzinger 2016).

To take advantage of human-computer collaboration companies must understand how humans can effectively augment computers, how computers can enhance what humans do best, and how business processes have to be designed to support this partnership (Wilson & Daugherty 2018). We study human-computer collaboration in the context of user assistance systems by instantiating various machine learning artifacts in an industrial application context. In particular, we explore interactivity as an essential design aspect of user assistance systems and examine its influence on the trust of users in the system as well as the accuracy of the joint predictions.

We conduct a field study in the context of personnel planning in system catering restaurants—and more specifically focus on the forecasting of revenue as an essential prerequisite of personnel planning. In the gastronomy sector, wages account for one-third of all costs. Accordingly, restaurateurs try to optimize the utilization of their employees by creating suitable work schedules. To do so, restaurateurs have to forecast the daily and weekly revenue of their restaurants to assign employees to shifts. Estimating the fluctuating revenue is a difficult task that requires weighting multiple factors (e.g., historical revenue, weather, events). While computers are skilled at modeling general tendencies of time series (i.e., trend and seasonality), we know that restaurateurs rely on a variety of factors that are complicated to incorporate into traditional forecasting methods due to their rarity and uniqueness (e.g., events). These complementary capabilities of humans and computers combined with the concreteness of the task (i.e., forecasting revenue) provide a promising opportunity to study human-computer collaboration. Following the design science research paradigm (Sonnenberg 2012), we develop a software artifact with a case company to empirically answer our research question.

Our contribution is fourfold: First, we address a crucial real-world issue in personnel planning, namely the need for predicting revenue as a prerequisite for assigning employees to shifts. Based on design requirements derived through expert interviews, we develop prototypes that incorporate the expertise of users in the revisioning of automated forecasts. We further conduct a focus group with domain experts to refine the prototypes before developing software artifacts. Second, we conduct a comprehensive evaluation of the software artifacts through a field experiment with high external validity. Third, we gain insights on the influence of interactivity on trust and accuracy as proxies for human-computer collaboration. Forth, we refine and discuss two design principles for the facilitation of human-computer collaboration in advanced user assistance systems.

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