

What Do You Need Today? – An Empirical Systematization of Application Areas for Chatbots at Digital Workplaces

Completed Research

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Abstract

The application of chatbots in digital workplaces is currently on the rise. Especially in customer or employee support scenarios this kind of artificial intelligence and natural language-based human-computer interface is being used. However, the application of chatbots in real work scenarios is still considered barely and unknown. Therefore, we aim at surveying the current application of chatbots at workplaces. Thus, we conducted an empirical cross-section interview study. Our findings show that chatbots can perform five tasks, which have to be considered in seven application areas. Furthermore, we show generalized results for the combination of tasks and application areas in order to be reused by practice and science in the future.

Keywords

Chatbot, Digital Workplace, Empirical Interview Study, Task, Application Area.

Introduction

In recent years, a new trend for supporting employees in daily work scenarios emerged: the application of chatbots, an artificial intelligence and natural language-based human-computer interface (Følstad and Brandtzæg 2017; Reshmi and Balakrishnan 2016). As with the current progressing digitalization of established working practices and the redesign of the workplace, employees and the way they work are concerned. More and more innovative and private-known digital technologies are used to enhance the working quality (Byström et al. 2017; Köffer 2015; Lestarini et al. 2015; White 2012). Despite these advantages, the increasing use of information systems and necessary information sources leads to information as well as application overload. Regardless of the spread of new and smart systems, the information access is still a major problem at the workplace. Thus, the time for searching, editing, sharing of information increases, which affects the productivity negatively instead of improving it (Carayannopoulos 2018; Lebeuf et al. 2017; Russell 2012; White 2012).

Therefore, user-centric application systems, like chatbots, been used to assist or automate tasks as well as filter and provide only necessary information for work execution (Følstad and Brandtzæg 2017; Reshmi and Balakrishnan 2016; Richter et al. 2018). Besides the current common application in customer or employee support scenarios in practice, the scientific knowledge base is still limited as shown in (Meyer von Wolff et al. 2019). Especially the use at the workplace to support the daily tasks is barely considered. To survey this application of chatbots in workplace settings, the authors recommended research questions that we use as a starting point. Based on an empirical study with practitioners and experts, we survey tasks performed by chatbots and viable application areas at digital workplaces and address the following research questions:

RQ1: *Which tasks can be performed by chatbots at the digital workplace?*

RQ2: *What application areas are viable for chatbots at digital workplaces?*

To answer these questions, the remainder of the article is structured as follows. Next, we point out the theoretical foundations, chatbots as well as digital workplaces. After this, we describe our research design of the empirical study. Following, we present the results of our study and discuss them afterwards. We finish our article with a brief conclusion of the research results and an outlook.

Theoretical Foundations

Chatbots

A chatbot is a special kind of application system that uses artificial intelligence technologies to provide a natural language user interface. Since the first applications of conversational information systems, e.g., *ELIZA* (Weizenbaum 1966) or *ALICE* (Wallace 2009), different approaches were pursued. Independent of the technological advancements, the main characteristics have not changed. By text or audio the user can communicate in a natural and intuitive way via a dialog-based interface, e.g., to execute work tasks through messaging services (Lebeuf et al. 2018). Therefore, a chatbot allows access to various (knowledge) databases or APIs to other application systems or (web) services (Al-Zubaide and Issa 2011; Angga et al. 2015; Carayannopoulos 2018; Mallios and Bourbakis 2016). In addition, a chatbot can perform its actions reactively and proactively as well as autonomously based on environmental conditions. Also, a chatbot is to a certain extent adaptive and capable of (self) learning. Thus, a chatbot is an application system that provides a natural language-based user interface for the human-computer interaction. Therefore, chatbots use artificial intelligence and various application systems and databases to automate rote tasks and/or assist users in their daily work tasks (Meyer von Wolff et al. 2019).

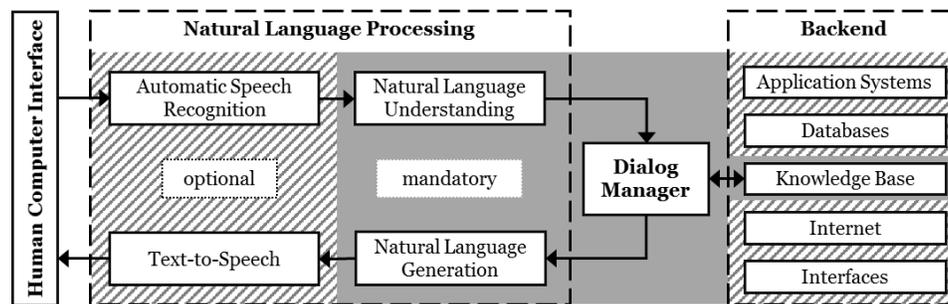


Figure 1. Chatbot architecture

Chatbots usually consist of three components that are used via a *human-computer interface* (see Figure 1) (Berg 2014; Mallios and Bourbakis 2016). In the *natural language processing* component, the user input is transformed in machine-readable form. Hereto, the text is analyzed, dismantled and patterns are extracted. Also, the natural language processing generates a natural language output (e.g., audio or text) based on the results of the dialog manager. The *dialog manager* is responsible for the matching of the user input with the backend, by extracting content or executing functions. The *backend* consists of databases, application systems or APIs. In this research, we focus on tasks and application areas of chatbots. Therefore, we do not focus on specific component design.

Digital Workplace

To enable research studies for chatbots at workplaces, it is necessary to define the application area of a digital workplace. The design of workplaces already has a long tradition in human-oriented computer science (Richter et al. 2018). A digital workplace is not limited to a physical location. Rather, it is a combination of work duties, information-related tasks, e.g., searching, transforming or documenting and the required application systems. In addition, it is location-independent and sometimes mobile. The mentioned information-centric work is nowadays also referred to as knowledge work (Lestarini et al. 2015; White 2012). We differentiate our digital workplace and the work with information from physical work, e.g., production processes or maintenance tasks. Thus, a digital workplace is a combination of (IT-)technologies, processes and information that helps employees to carry out their daily tasks. The focus lies on information, high communication afford as well as collaboration between the involved people and/or application systems in and between enterprises (Meyer von Wolff et al. 2019).

Research Design

To identify performed tasks (*RQ1*) and application areas (*RQ2*) of chatbots at digital workplaces, we conducted a qualitative empirical interview study based on (Myers 2013; Döring and Bortz 2016). Therefore, we interviewed experts who deal with current topics and trends of digitalization, especially chatbots or natural-language user interfaces. To ensure the quality, every expert of our interview study had at least a few years of working practice in workplace design. In addition, experts should work in companies, which plan or already use chatbots, or in software firms, which develop chatbots for workplaces. This group is capable of assessing the influence of the technology and how chatbots redesign the workplace of the future. Hereto, our study followed a three-step process:

First, we selected potential interview partners based on personal contacts from projects or fairs and on an internet search. To ensure heterogeneity and to achieve a comprehensive cross-section for the research domain, we include experts independently of the industry sector. Hereby, we want to achieve results that can be applied in general workplace settings and are not biased for a specific industry or workplace. We contacted the identified potential experts by e-mail and sent them a leaflet about our research project. Overall, of all 68 experts contacted, 29 have agreed to participate in the study (43 %; see Table 1). The high participation rate already points out the relevance for the research area as explained in the introduction.

ID		Position	ID		Position
Into1	Exp01	Project Leader	Int15	Exp16	CEO
Into2	Exp02	CEO	Int16	Exp17	Head of Controlling & ICT
Into3	Exp03	Product Owner	Int17	Exp18	Major Account Executive CE
Into4	Exp04	Subject Specialist	Int18	Exp19	Director Information Management
Into5	Exp05	Online Editor / Consultant	Int19	Exp20	Divisional Management
Into6	Exp06	Senior Manager	Int20	Exp21	Business Development Manager
Into7	Exp07	Head of Department	Int21	Exp22	Executive Board
Into8	Exp08	Team Leader / Consultant	Int22	Exp23	CEO
Into9	Exp09	Consultant	Int23	Exp24	Expert Sales Manager
Into10	Exp10	Digital Engineer	Int24	Exp25	Account Manager
Int11	Exp11	CEO		Exp26	Senior Consultant
Int12	Exp12	Leading AI-Architect	Int25	Exp27	Technology Manager
Int13	Exp13	IT Service Manager	Int26	Exp28	Head of Workplace Services
	Exp14	IT Service Manager	Int27	Exp29	Project Manager / Service Developer
Int14	Exp15	Lead IT Architect			

Table 1. Expert description

Second, in preparation for the interviews, we sent a pre-questionnaire with selected questions on the topic in preparation for the interviews as well as a privacy policy to all experts. In the following, we conducted the interviews face-to-face or via phone from July to October 2018. These lasted from 31 to 94 minutes (mean: 54:07 min.; median: 51:50 min.). In order to leave the interviewees enough room to express their own ideas, we used a semi-structured interview guideline to conduct the interviews. Therefore, we used the following leading questions as a basic structure: *Do you use or plan to use chatbots in your company? For which tasks or application areas are chatbots applied? Which tasks are supported by a chatbot? What are the characteristics of a chatbot task? For which scenarios can a chatbot not be used? What are potential future application scenarios?* We stopped the survey, as no new insights were revealed in the last interview according to the theoretical saturation by (Glaser and Strauss 2006). The interviews were recorded on tape, if the privacy policy was accepted, and afterwards transcribed.

Third, we analyzed and coded our transcripts by using a structured content analysis approach. To obtain more detailed insights in the application areas of chatbots at digital workplaces, we have done our coding and analysis two folded. First, we analyzed mentioned tasks performed by chatbots to determine necessary functions (*RQ1*). Second, we looked for the mentioned application areas related to chatbots to whom we assigned the aforementioned tasks to identify the needed functional scope (*RQ2*). The coding was done by two researchers independently using continuous analysis of the transcripts followed by an assignment of the codes to the core topics (Mayring 2014). Since the analysis was conducted in German, we translated the final coding into English while preserving the meaning.

Results

Our expert sample consists of a cross-section of different industries (see Figure 2). However, the ICT-industry is overrepresented. This might be explained as experts from outsourced IT-departments or (exclusive) IT-business partners, e.g., for insurance or automotive, are contacted. Also, experts from many different company sizes, measured in number of employees, participated.

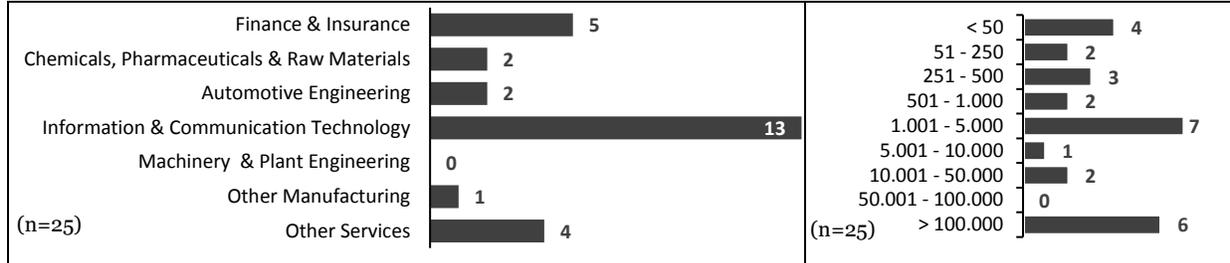


Figure 2. Sample description

Tasks

As the first step in the analysis, we aimed at identifying mentioned tasks a chatbot can perform (RQ1) at the digital workplace. By doing this, our analysis revealed five tasks or rather functions of a chatbot.

T1	Provision of content	n=27
Quotes	static, predefined information	n=25
	"[...] relieve the workload by building such a service bot, which provides advice and support for all questions relating to minor technical problems and how to handle things that are really simple [...]."	(Exp5)
	"[...] e.g., Service Desk Q&A just as it is with such a FAQ. Frequently asked questions that run through a service desk, which you could do with a chatbot."	(Exp10)
	"No, only standard questions, responsibilities, contact persons, maybe something like cost centers or something like that. So first of all classic FAQ."	(Exp20)
	dynamic, unstructured information	n=19
	"In my opinion, it could change the future [...] if unstructured data is prepared in a structured way. So what I just meant was, that you ask for system information via a chatbot e.g., Please give me the nightly disturbances from the system."	(Exp4)
	"That you can quickly retrieve information via input, e.g. [...] retrieve specific information about customer [...] because implementing a higher-level system that can immediately provide the information via the corresponding logics, regardless of where it is located."	(Exp17)
	"The Chatbot is also a relatively good contact point, for everything like information procurement with Intranet [...] currently we have tried out Chatbots to optimize something like Intranet searches."	(Exp29)
	files or documents	n=5
	"Or maybe [the employees] also need forms or documents or don't know which forms or documents they need. Such things."	(Exp2)
"[...] also internally there is a lot of interest to make with [chatbots]. e.g., from the accounting that one places there any inquiries and documents or excerpts from documents be returned."	(Exp10)	
"[...] that you are only redirected to the search path of the PDF. Then you can download the PDF via the bot and then you can print it out."	(Exp21)	

Table 2. Task 1 - Provision of content

In all of our interviews (n=27), the **provision of content [T1]** (see Table 2) was named as a task for chatbots at digital workplaces. In detail, the kind of information differs and can be subdivided into three subtasks: *provision of static, predefined information* (n= 25), *provision of dynamic, unstructured information* (n=19) and *provision of files* (n=5). For the subtask of **static, predefined information** it was mentioned that chatbots are capable of answering simple questions, e.g., technical problems or daily work-related questions (Exp5). Chatbots should help by answering how to handle or solve these problems. Also, often mentioned was the provision of frequently ask questions (FAQ) content via the dialog of a chatbot (Exp10). These predefined and often regularly returning questions, like if someone asks for "question Q?" give him "answer A!", are typical questions handled by first-level service desk employees. Besides this, chatbots are capable for inquire other workplace related information for the daily work, e.g.,

contact persons, responsibilities and so on (Exp20). In case of **dynamical, unstructured information**, chatbots should provide an interface to retrieve unstructured data in a structured way. In opposite to static or predefined information, chatbots can provide actual information, e.g., system status (Exp4). Necessary for this is a logic as well as interfaces to databases, application systems or (web) services, which enable the provision of all kind of information regardless of the location in a timely manner (Exp17). This allows chatbots to optimize the current state of internet or intranet searches through a new natural language-based interface (Exp29). In doing so, present access rights must be taken into account. As a third subtask, five participants stated that chatbots can **provide files or documents**. So, a chatbot is capable to providing the documents or files directly in the dialogue and a user does not have to search for them manually in their (local) directories (Exp21). As (Exp2) mentioned, often employees do not know which documents they need for a specific task, so a chatbot can provide them as a response. Also, for example in the case of accounting, chatbots not only can provide complete documents, instead they deliver only the relevant snippets (Exp10).

T2 Execution of processes		n=23
Quotes	standardized; single actors	n=22
	“Of course, such a scenario is a goal of chatbots. [...] to support workflow-based processes in which employees, run through a workflow or just fill out a form, in which fields build on each other [...].”	(Exp3)
	“[...] e.g., if someone needs a reset of their SAP password, [...] they could say “I need a new SAP password.” Then the chatbot asks back on which SAP systems the reset should take place and then, if [the chatbot] is integrated, it could reset the password and tell the user the new password.”	(Exp13)
	“For us, the focus is on ensuring that everything that can be displayed in a process-oriented manner can be sensibly displayed via a chatbot.”	(Exp25)
	rule-based; multiple actors	n=7
“What you would otherwise try by mail back and forth, the bot then actually takes over and controls the whole thing among all participants. [...] every one of them has a personal dialogue and the bot puts the information together, manages it and finally sets the appointment.”	(Exp16)	
“[...] the request prefilled via this channel is then digitally passed on to the approver, who can then very easily say “Released.” and the request will be processed further.”	(Exp28)	

Table 3. Task 2 - Execution of processes

The second most named kind of tasks in our interviews (n=23) was the **execution of processes [T2]** (see Table 3). As with [T1], this group could be further subdivided by the complexity and the amount of involved actors into: *standardized processes with single actors* (n=22) and *rule-based processes with multiple actors* (n=7). For the **first subgroup**, chatbots should support employees in the execution of workflow-based processes. Employees control or execute the whole workflow in the dialog, fill out necessary fields or execute corresponding actions (Exp3). Hereto, the users only have to speak in a natural manner with the chatbot. The chatbot processes and executes the corresponding actions, e.g., resetting the password for application systems (Exp13). Thus, every work task that can be mapped as a process could be carried out via chatbot dialogs (Exp25). For the **second subgroup** our participants stated that chatbots can handle or rather manage complex rule-based processes. This extends our first group to some extent. Here chatbots can support tasks involving multiple actors, e.g. meeting planning, where each actor gets its own dialog and the chatbot finally sets up an appointment (Exp16). In addition, processes in which approvals from supervisors or other departments are necessary, e.g., business trips or procurement of work materials, can be addressed as well (Exp15). In this case, a chatbot manages between all involved actors and responds accordingly, so that the process is executed correctly and no steps are forgotten or skipped.

T3 Forwarding to application systems/sources		n=3
Quotes	“And if it is only a URL call or such things. I also imagine that the chatbot can do that at the end, but not further trigger or perform [a function] [...].”	(Exp14)
	“I see a chatbot rather as an access channel, as a navigator, as a search engine, which then brings me to a corresponding function.”	(Exp15)

Table 4. Task 3 - Forwarding to systems/sources

Instead of executing processes directly through the dialog as described in [T2], it was noted that sometimes chatbots should only **forward to application systems or services [T3]** (see Table 4). However, this was mentioned by only three experts. They state that a chatbot should only forward to systems or services but not encompass a process logic (Exp14). As (Exp15) mentioned, chatbots are just a new access channel or portal to existing data sources, application systems or (web) services, which can be used for daily workplace tasks.

T4	Capture of data/information	n=9
Quotes	"[...] to introduce a chatbot, which you can invite into the chat as a participant and this bot can then record by commands [...], please note as a resolution on the subject that we now want to proceed as follows [...]"	(Exp11)
	"You could also use this, e.g., for a requirement analysis, if you now want to query requirements from several users, then they can all do their requirements and this query [...] can then be supported by a virtual assistant."	(Exp24)
	"[...] currently it is a running pilot on how to make this work time recording based on telephone calls with an automatic dialog. [...] To get data input by speech or dialog into such a semi-structured form, which otherwise have to be submitted by tablet or by Excel or in any other way."	(Exp27)

Table 5. Task 4 - Capture of data/information

Further, we determined also indications that chatbots can be used for the **capturing of data or information [T4]** at workplaces (see Table 5). Corresponding quotes were stated by nine participants. First, it was mentioned that a chatbot – invited as an participant in a normal dialog between employees or in project teams – can be used to save decisions made in discussions, e.g., by saving the whole dialog or the relevant excerpts (Exp11). Second, chatbots can be used to generate or capture content belonging workplace relevant topics. For example a chatbot can be used for capturing requirements in software engineering in a dialog form (Exp24). In addition, a chatbot is capable of processing data input via text or speech in a simple semi-structured form where the chatbot inquires intelligently only the necessary inputs, e.g., like a digital secretary (Exp27).

T5	Setting up reminders	n=2
Quotes	"Then the chatbot [...] would either automatically create an activity or ask, "Should I set a reminder for you again? Should I create an activity for you? [...] that you should ask again, so just a follow-up appointment."	(Exp16)
	"I have a number of Chatbot mechanisms that just help me be more productive, remind me to do things and so on."	(Exp23)

Table 6. Task 5 - Setting up reminders

Even though it is the least named group of tasks (n=2), it is to state that chatbots are capable for **setting up reminders [T5]** (see Table 6). Both experts stated that chatbots been used for different reminders in their daily work, so nothing will be forgotten (Exp23). Also, with their proactive capability, they can suggest automatically corresponding actions on current work tasks, like the mentioned reminders (Exp16).

Application Areas

As the next step in the analysis, we aimed at identifying mentioned application areas at the digital workplace that are viable for chatbots (RQ2). In addition to the plain identification of these, we wanted to link our identified tasks (RQ1) with them. Hereby, we wanted to identify necessary tasks, as requirement areas, when designing and implementing chatbots for particular application areas. As a result, our analysis revealed seven potential application areas for chatbots at digital workplaces, which can be further subdivided into divisional and cross-divisional application areas (see Table 7).

Firstly, the participants mentioned potential application areas of chatbots in **internal and/or external support [A1]**, e.g. service help desks in companies or customer service. This was mentioned by 22 experts. As they state, a chatbot is a new medium for answering questions in the daily work. Thus, employees can get easily solutions for their suffered problems or answers to their questions without asking and disturbing other employees (Exp3). Besides this internal scenario, a chatbot can also enhance the external support with customers or other departments (Exp7). In this case, the goal is to reduce interruptions in service centers through the automation of answering employee as well as customer questions. Thus, the first-level support can be relieved and they can focus on complex or major concerns. As (Exp23) noted, most of the first-level questions are like "How do I do ...?", which can all be answered by a chatbot. Therefore, a chatbot must provide information and corresponding content to aid in the task of support in companies [T1].

Secondly, for the case of **human resources [A2]**, four of our participants mentioned that chatbots may support the process of job offering, e.g., to provide information of open vacancies or about the company to applicants (Exp1). Also, they can be used to map the whole job application process (Exp5). In this application area, we assume that it has to be possible to retrieve application relevant information [T1] and map the whole process, so an application can be made entirely via a chatbot [T2].

Another identified application scenario is **purchase and sales [A3]** (n=9). Hereby, our study participants added the potentials that chatbots can be used to retrieve product information, e.g., for customer acquisition (Exp2). Besides the information provision as well as recording of made sales, the chatbot can manage the sales or purchase process. As mentioned by (Exp17), offers can be made, which can further be transformed into real production orders by simple chatting with the bot. In summary, a chatbot has to be capable of delivering different kind of content [T1] as well as guiding through the process [T2]. Also it should be possible to capture emerged data and information, e.g. offers or customer data [T4].

Application Area		Task					Σ
		T1	T2	T3	T4	T5	
<i>divisional</i>							
A1	(internal/external) Support	X					22
Quotes	“One [chatbot] is for our [self-service portal], which is available to every employee to answer questions about the working day, not only of a technical nature.” (Exp3) “With the chatbot, simple customer inquiries are answered in the Service Center and customer inquiries that would otherwise end up in the Service Center are answered there.” (Exp7) “I used to work in one organization which probably had 150 people [...] working in a call center to help employees through their HR questions. You know, 70 percent of those questions were, “how do I do ...?” and actually, a chatbot is absolutely capable of responding to those questions.” (Exp23)						
A2	Human resources	X	X		X		4
Quotes	“[...] job offering: What is [company name]? Which jobs does [company name] offer? Who are the contact persons? Such questions are answered here.” (Exp1) “There is also a similar form that this [a chatbot] simplify the application process.” (Exp5)						
A3	Purchase and sales	X	X		X		9
Quotes	“On the subject of sales support or in general: “How do our products actually work?” This only applies to our sales staff, which is looking for the best arguments for the (potential) customer.” (Exp2) “Preparing an offer [...], but of course I can also continue this afterwards very well, if the offer becomes an order, I could also save myself a lot again. Perhaps by saying: “Offer XYZ has become an order”.” (Exp17)						
A4	Maintenance	X	X				2
Quotes	“[...] in the area of maintenance, [...] because specific information are needed and it would be advantageous to have your hands free. [...] So, if I can just query the [required information] by voice [...].” (Exp17) “[...] machine maintenance, where a user has to process checklists which are connected to the [...] [backend]. There, the chatbot can guide the employee through the process and say: “Do this and that”.” (Exp24)						
<i>cross-divisional</i>							
A5	(Employee) Self-service	X	X	X	X	X	21
Quotes	“Things like making appointments and coordinating appointments for groups.” (Exp2) “[...] e.g., making room bookings via chatbots, that you can ask what's in the canteen today, that I can change my (private) address [...]. That if I need any forms, like duration of employment or pay slips [...] things like that.” (Exp9) “[...] IT Service Desks, where I can, for example, request a token for remote access or a new [employee card] etc., [...] and not only “Where can I find the holiday request?” but also cover such processes automatically [...].” (Exp16)						
A6	Education and training	X	X				9
Quotes	“[...] for example to let lectures run over the chatbot again. Not by a monologue, but that participants have a chatbots for repetition as a tutor, whether terms are understood correctly for example.” (Exp21) “[...] chatbots for employee training, that the employees can conduct such dialogs from the perspective of the provider or the customer in order to get a feeling for what the right answers are and at the same time the knowledge can be made available to the employee in a supportive way.” (Exp27)						
A7	Knowledge and information management	X			X		12
Quotes	“Where one has deposited relatively much information in a knowledge portal, where then the chatbot could navigate through it or refer to corresponding functionalities [...].” (Exp15) “What we find quite interesting is the component of the chat, which at some point is learning in a certain way [...]. This then develops from a pure knowledge machine to a dynamic knowledge store, which is also better maintained than classic knowledge management systems.” (Exp27)						

Table 7. Application areas of chatbot at digital workplaces

In addition, two experts mentioned the application of chatbots for **maintenance [A4]**, e.g. production facilities or office supplies. Critical to mention is that this corresponds strongly with physical work, which

was not the focus of this research. However, as it was stated by some experts, it should be considered as a field of application, especially for the case of maintenance of office supplies at workplaces. In this case, necessary information can be retrieved through audio in-/output while carrying out maintenance tasks (Exp17). Furthermore, the chatbot ensures that the maintenance process is executed correctly and no steps will be forgotten (Exp24). As derived from the statements, a chatbot must map the whole maintenance process [T2] and has to provide necessary information during the tasks [T1].

Also, we determined the application area of **(employee) self-service [A5]** in our coding. 21 participants noted application areas for this group of workplace duties. One stated application area are typical tasks for the personal organization for daily work, e.g., chatbots for meeting assignments, where the participants can chat with the bot to find a common date (Exp3). But all other (minor) tasks, e.g., room bookings, request of documents as well as master data changes, which are typical addressed by self-service portals in companies, represent potential applications areas for chatbots (Exp7, Exp23). Necessary for a chatbot to be used in this scenario is that all of our identified tasks are addressed [T1-T5]. Thus, employees can retrieve requested information, which corresponds to [A1]. They also should execute the processes (Exp23) as well as have the option to capture or change data. Besides this, chatbots should forward to systems, if they cannot carry out the work directly or set up reminders, e.g., for upcoming tasks or appointments.

Furthermore, some attendees (n=9) noted that they see chatbots as a new tool to support **education and training [A6]** at workplaces. Hereby, chatbots should provide the learning content, so that it can be retrieved in the dialog. For example, after a product training, employees can retrieve information after the training again (Exp21). This corresponds narrow to the process of information provision [A1] as it is only about getting information. Another option for employee training is to map the optimal dialog, e.g. a customer support conversation, so employees can learn how to react optimally by taking up the different roles (Exp27). Even if the experts did not mentioned it directly, the whole learning can be seen as a process where information will gradually be provided depending on the individual progress or ability to learn. Therefore, a chatbot has to provide information [T1] and carry out the (adaptive) processes [T2].

In addition, we found evidence in 12 interviews that chatbots are a viable tool for **knowledge or information management [A7]**. Most of the mentions belong to the already outlined provision of information or knowledge, which are stored in large databases (Exp15). Additionally, some experts mentioned that chatbots can be used as a source of a dynamic knowledge store, where dialogs or their results are stored and been reused later, e.g., for training of employees or documentation (Exp27). To be capable of supporting knowledge and information management a chatbot has to deliver requested information [T1] as well as collect new information to expand and enhance the current state for the future [T4]. As in total, this application area corresponds nearly with the provision of information [A1], as most of the tasks also to provide an employee with requested/necessary information for their daily work tasks.

Extending this examination and based on our sent pre-questionnaire (n=25), we surveyed the deployment scenario of chatbots with an 11-step slider (see Figure 3). As shown, the application is suitable for both internal and external use cases. What is to mention, some respondents note that an employee, e.g., from a different department, can also be regarded as external.

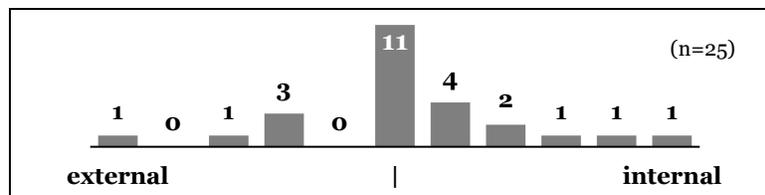


Figure 3. Deployment scenario

Discussion and Implication

Our findings imply that chatbots can carry out some tasks, which are necessary for application areas of chatbots at digital workplaces. Overall, we identified five relevant tasks for chatbots. Although, of course all tasks are relevant, the distribution of mentions differs. Mostly, chatbots should *provide information in different kinds* [T1] (n=27) as well as *execute processes* [T2] (n=23). In addition, we surveyed specific application areas mentioned by our participants and identified seven potential application areas for

chatbots at digital workplaces. As with the tasks, all application areas can be relevant, but the distribution differs as well. Mostly, our experts see chatbots in the areas of (*internal/external*) support [A1] (n=22) as well as supporting the (*employee*) self-service [A5] (n=21). Furthermore, we could combine our identified tasks with the application areas, based on the mentions of the experts as well as on argumentative deductive conclusions made by us. By doing this, we could highlight necessary tasks or rather requirement areas for chatbots in each of our application area. It is to mention that [A1] is the most specific use case, as only tasks of content provision are required. On the opposite, [A5] is the most diversified one, as all tasks can be relevant for specific use cases. Also, independent of the application area, chatbots always operate as a medium to provide relevant information. As we point out all relevant tasks, it is to mention that the actual selection of addressed tasks within an application area depends on the intended use case. For example for self-service [A5], if a company plans a chatbot just for providing information on regulations of business trips, probably only the information provision [T1] is relevant but not the execution of processes [T2] or the collection of data [T4]. However, based on our findings we can argue that chatbots can mostly be used for information provision along with the execution of corresponding processes, as these combinations were nearly found in all application areas. Critical to mention on our final results is that the identified application areas might not be complete selective. As shown, dependencies between the application areas exist. For example, the process of learning starts with querying of learning content, which can be seen as information management [A7]. Same can be seen for maintenance, where sometimes meetings have to be scheduled [A5] or necessary knowledge has to be retrieved [A1, A7]. In comparison to the state of art based on (Meyer von Wolff et al. 2019), we could verify some of the results and extend them: Practitioners also mentioned the information acquisition [T1] as a task for chatbots. We also verify the customer support [A1] as an application area. However, our results differ from the research as well, for instance we identified the Self-Service [A5] as a high relevant application area, which was not named in the research so far. Therefore, we could answer some of the open research questions and survey relevant tasks and application areas for chatbots at workplaces in a comprehensive way.

As with every qualitative study, there exist some potential limitations, which need to be pointed out. Firstly, the findings of our study are dependent mainly on the selection of interviewees and their willingness to participate. Therefore, we selected carefully a suitable amount of experts (n=29) for (future) workplace design under consideration of chatbots. We have not limited the industry sector, to survey a cross-section in the research area. However, not from all sectors interviewees could be acquired, e.g., machinery and plant engineering. Despite this, our sample is still suitable to identify and survey the application of chatbots at digital workplaces. Secondly, it could still be possible that we have not identified all tasks or application areas as well as all combinations. Thirdly, different researchers might interpret the coding differently. To reduce the subjective influence during the analysis, we reconciled the individual findings and merged them in common based on discussions between the researchers.

Even though, our study focused on the application of chatbots and may have some limitations, our results seem to be generalizable and transferable to specific application areas. Based on our combination of tasks and application areas, we derived potential requirement areas. As shown in (Meyer von Wolff et al. 2019) specific requirements are still missing. Our results can be used for this as a starting point for specific future implementations. Nonetheless, our combination of tasks and application areas still has to be verified and may be extended in future research. Furthermore, as some experts mentioned the objectives and aspects of the usefulness of chatbots in specific application areas, these should be addressed in detail in further research. Hereto, objectives and requirements for specific application scenarios should be analyzed in the future. Also, supporting and hindering factors, e. g., challenges and their solutions, should be a subject in future research. Corresponding to (Meyer von Wolff et al. 2019), these are the still open research questions as we are only addressed application scenarios of chatbots at digital workplaces.

Conclusion

In this research paper, we aimed at surveying relevant tasks chatbots have to address at the digital workplace (RQ1). Furthermore, we surveyed application areas in companies in which chatbots can be used beneficial (RQ2). To extend our contributions, we linked both of our results to determine the necessary tasks for each of our identified application scenario. As a result of our 27 interviews, five tasks and seven application areas – along with 17 combinations – for chatbots at digital workplaces were identified. Our study will contribute to both, research and practice: First, the study will contribute to the knowledge and

understanding of chatbots for workplaces. Thus, this can be used for further investigations in the research area. Second, we regard our tasks as a good starting point for a requirement analysis for chatbot projects at digital workplaces. Therefore, we think that the results may help to implement chatbots as we highlight the potentials and requirements on a generalizable level, which can be refined for respective cases.

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