The Impact of Anthropomorphic and Functional Chatbot Design Features in Enterprise Collaboration Systems on User Acceptance

Tim Rietz[1], Ivo Benke[1] and Alexander Maedche[1]

[1] Karlsruhe Institute of Technology, Institute of Information Systems and Marketing, Karlsruhe, Germany
{tim.rietz,ivo.benke,alexander.maedche}@kit.edu

Abstract. Information technology is rapidly changing the way how people collaborate in enterprises. Chatbots integrated into enterprise collaboration systems can strengthen collaboration culture and help reduce work overload. In light of a growing usage of chatbots in enterprise collaboration systems, we examine the influence of anthropomorphic and functional chatbot design features on user acceptance. We conducted a survey with professionals familiar with interacting with chatbots in a work environment. The results show a significant effect of anthropomorphic design features on perceived usefulness, with a strength four times the size of the effect of functional chatbot features. We suggest that researchers and practitioners alike dedicate priorities to anthropomorphic design features with the same magnitude as common for functional design features in chatbot design and research.

Keywords: Acceptance, Anthropomorphism, Chatbot, Collaboration, Work

1 Introduction

Recently, the usage of chatbots for improving collaboration in the workplace has seen increasing interest [10]. Chatbots create new opportunities in digital work, potentially boosting collaboration culture [25]. Additionally, they have the potential of positively influencing the balance between the time allocated to work and private activities through digital interventions [5] and reducing work overload through supporting task management [45]. Major collaboration platforms in and outside the workplace include chatbots, such as Facebook, Slack, WhatsApp and Telegram. Slack has established itself as a successful platform used by thousands of companies, due to its capabilities for group collaboration and native integration of various productivity tools. Collaboration is commonly defined as making a joint effort toward a group goal, where joint effort encompasses acts of shared creation and/or discovery [3]. Collaboration systems used in the working context are referred to as enterprise collaboration systems, with Slack as a prime example. Airbnb, Autodesk, IBM and many others [40] frequently use the collaboration features of Slack and the possibility to access over 1000 chatbots developed by professionals and freelancers alike [34], alongside Slack's

14th International Conference on Wirtschaftsinformatik,
February 24-27, 2019, Siegen, Germany

natively integrated chatbot 'Slackbot'. As chatbots in enterprise collaboration systems are expected to become a substantial element of the modern workplace, there is a need to better understand the impact of chatbot design on user acceptance.

We observe a lack of user acceptance studies discussing overall chatbot design features in collaborative environments. In the face of limited resources, developers are required to make trade-off decisions regarding two essential aspects when designing chatbots: form vs. function. Traditionally, engineering-oriented disciplines tend to pay more attention to the functional dimension and dedicate less resources to the form dimension [7]. Form describes the relationship between design parameters and is primarily perceived as an aesthetic expression [36]. Due to its hedonic nature, form has a strong link to social presence of a bot and has been shown to positively affect perceived enjoyment and ease-of-use [17, 37]. This paper investigates the influence of anthropomorphic and functional chatbot design features in enterprise collaboration systems on user acceptance, on the basis of importance and frequency of usage of design features in Slack by practitioners. We formulate the following research question:

"How do anthropomorphic and functional chatbot design features in enterprise collaboration systems influence user acceptance of chatbots?"

In order to answer the research question, we follow a survey-based research approach and specifically investigate user acceptance of chatbots in the context of the enterprise collaboration system Slack. We contribute to the chatbot design body of knowledge by investigating how different design features influence user acceptance. At the same time, we provide a contribution for practitioners involved with chatbots in collaboration environments by providing input for the form vs. function trade-off decision in chatbot design.

2 Theoretical Background

2.1 Chatbots in Collaboration Systems

Chatbots are applicable for a large variety of situations, such as supporting collaborative learning [43], but are simpler in development and interaction compared to complex intelligent agents. Design decisions have to be made with regards to the 'chatting behavior' of the agent. Various configurations of chatbots are used in research and practice, such as agents that react dynamically to changing environments [51] or aid only on invocation (e.g. Slackbots /remind me functionality). Furthermore, seemingly small details of their conversational behavior, such as social cues, have a significant influence on the agents' effect on users [50]. Social cues are applied as an anthropomorphic feature of an agent, resulting in increased social presence [1]. In the example of MentorChat, a web-based agent for collaborative learning support, collaboration between individuals was enhanced by triggering discussions between students [43]. Furthermore, studies have shown that collaboration in a professional context suffers from a lack of group leaders, and that conversational agents can act as digital replacement for these roles [9].

2.2 Form and Function of Chatbots

Design science literature describes design features as concrete ways of integrating design principles into artifacts [28]. In the context of this paper, we use the term *design feature* as name for a group of functionalities that chatbots may provide. We refer to these individual functions as *items*. Chatbot design draws from two dimensions: form and function, the two fundamental components of design across domains [44], which definitions are displayed in table 1. Despite arguments for considering additional concepts in design [23], form and function are extensively considered as complete in forming the design dimensions [9].

Table 1. Literature definitions of the form and function design dimension

Design Dim.	*Definitions in Literature*	*Source*
Form	[…] while form refers to certain customer interface characteristics and is often addressed from the perspective of visual aesthetics.	[2]
	We define form as structural product characteristics that provide the architecture through which functional product features are delivered. Product form embodies the hedonic component of design.	[44]
	The form of the object as a whole can then be represented as the collection of components and a description of the interaction among components.	[36]
	[…] alternatively, design has been equated to product form, focusing on its esthetic characteristics. This approach has generally found that these attributes are related to hedonic value.	[23]
Function	Function refers to certain product function characteristics and their perceived performance […]	[2]
	Product function refers to product specifications and standard architectures - essentially the utilitarian aspect of product design. Functional design is defined by the factors, benefits, characteristics, and features that are combined to provide utility.	[44]
	[…] functional requirements which describe performance. There are many designs which satisfy any one set of functional requirements, therefore there cannot be a unique relationship between the function and the form of a product.	[36]

Form. The form of a product or service on the other hand refers to the arrangement of individual design components [36]. It is primarily perceived as an aesthetic expression [9] and can be interpreted as a user's perception of non-utilitarian aspects. Form features mostly are hedonic in nature and characterized through pleasure derived from the appearance of a product / service [33]. Historically, form features of design are investigated in marketing and product development literature [25], and comprise a multitude of elements, such as usage of lines, curves, proportions and symmetry. In the domain of websites and software, research regularly focuses on visual aesthetics when discussing form features [24]. In the design of chatbots however, another form feature becomes a relevant research topic: anthropomorphic presentation of the virtual agent [38], (cf. chapter 4.2). Anthropomorphism is considered part of the form design dimension, as its items change the visual presentation of an agent and the interaction

between components. Although the most commonly used variant of anthropomorphic virtual agents are embodied conversational agents [8], chatbots as well can incorporate anthropomorphic features. Despite a chatbot being limited in the range of applicable visual cues to appear more human-like, it may still rely on language that is enriched by emotional semantics or expression of emotions through emojis [42].

Function. The function of a product or service refers to parameters related to its general performance [36]. Historically, the function is dominated by principles from engineering [9]. The focus lies on providing utilitarian value, through addressing the practical needs of users. These can appear in simple functionalities, such as being able to communicate with an agent in natural language, or in more complex desires, e.g. safety or maintainability. Therefore, improving functional design features of a product/service pays consideration to how objects can be arranged in a way for users to interact with them efficiently and comfortably [44].

2.3 User Acceptance of Chatbots

We rely on a variation of the technology acceptance model (TAM) to investigate the impact of chatbot design features. Instead of utilizing the original TAM from Davis (1989), or its extensions, e.g. TAM2 [49], we decided for a model that includes perceived enjoyment (PE) as a core antecedent of behavioral intention [17]. The focus on chatbots in a work context stresses the interplay of hedonic and utilitarian aspects of a system [17]. Utilizing chatbots for improving company-internal collaboration might still be perceived as a novel application by employees [32]. This may introduce an hedonic component into work processes, potentially contributing to user acceptance of information systems (IS) normally perceived as utilitarian [17]. Besides PE, we do not include further concepts into our TAM evaluation, such as social presence or trust, as it is not in the scope of our evaluation. The study is intended to use a lean research model with a limited number of concepts. We are aware of concerns with the TAM methodology regarding its generalizability [4], the inclusion of factors external from the technology, or the models capabilities for predicting IT adoption [26]. Consequently, we evaluated the applicability of TAM as basis of the proposed research model against other common models used in IS research, such as UTAUT [47] or Task-Technology Fit [13]. The simplicity of the model, a broad range of research on its primary constructs alongside the inclusion of PE provides us with an appropriate model for this initial assessment. The traditional measures PEoU, focusing on the degree of peoples believe that using an IS is free of effort, and PU, focusing on the expected increase in job performance through using an IS [48], allow us to explore the utilitarian antecedents of behavioral intention. PE, the degree to which fun can be derived from using the IS, on the other hand explores the hedonic antecedents of it [17].

3 Research Model

Anthropomorphic form features influence users' perceptions of social presence, which in turn has been shown to positively affect PE [1, 33]. We expect the same relationship

to be demonstrated in the context of chatbots in Slack. Furthermore, previous studies on TAM showed the close linkage between PEoU and hedonic values [17, 37]. As the form feature of design primarily induces hedonic value, we expect a positive relation between anthropomorphic chatbot design features and PE and PEoU.

H1: Anthropomorphic chatbot design features positively influence the perceived enjoyment of chatbots in enterprise collaboration systems.

H2: Anthropomorphic chatbot design features positively influence the perceived ease-of-use of chatbots in enterprise collaboration systems.

As we observe work context, the conceptual distinction between hedonic and utilitarian concepts may blur, since hedonic systems would more naturally occur in home environments [17]. As such, we expect to observe effects of the anthropomorphic design feature on PU.

H3: Anthropomorphic chatbot design features positively influence perceived usefulness of chatbots in enterprise collaboration systems.

A product design study identified PEoU as the most cited benefit (40%) of the utilitarian design [23]. Another study, investigating the role of function in utilitarian design of mobile data services, found a significant effect of function on user satisfaction, positively affecting PEoU and PU [2]. Thus, we formulate the following hypothesis for the effect of function features on TAM constructs:

H4: Functional chatbot design features positively influence perceived ease-of-use of chatbots in enterprise collaboration systems.

H5: Functional chatbot design features positively influence perceived usefulness of chatbots in enterprise collaboration systems.

Finally, in accordance with H1, hedonic and utilitarian concepts may blur at work and so we expect to observe effects of functional design features on PE.

H6: Functional chatbot design features positively influence perceived enjoyment of chatbots in enterprise collaboration systems.

Additionally, we investigate the effects of selected control variables – age, gender, experience (with Slack, with Slackbots, general developing experience, and chatbot developing experience in Slack) and education level of the participants. Figure 1 depicts the resulting research model.

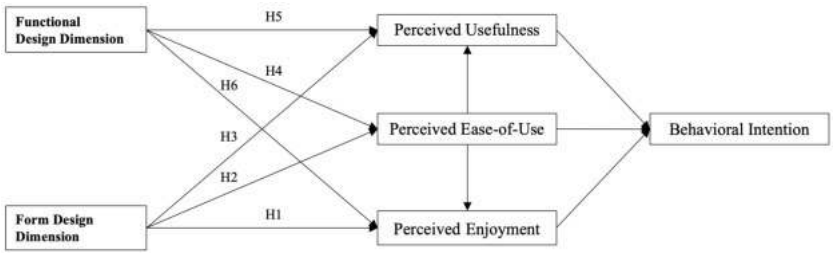

Figure 1. Research Model

4 Empirical study

4.1 Context: Enterprise Collaboration System Slack

As the experiment investigates design features of chatbots, the form of communication is text-based and the common technology for interacting with chatbots is instant messaging. Because we explicitly want to explore the effect of different design features on technology acceptance in a work context, we chose Slack as platform for our study. Slack is widely used in international enterprises and therefore provides a suitable solution for conducting a study. Slack has integrated a default chatbot, called "Slackbot". This default bot is approachable within every conversation. It can be enhanced by individually implemented commands. This function makes Slack particular interesting for this experiment. Besides its application in the work context, the natural integration of self-deployed chatbots by providing an interface API is necessary for providing custom designed solutions.

4.2 Selected Chatbot Design Features of Function and Form in Slack

Relevant design features are selected through a multi-stage process. Initially, a list of possible interactions, functionalities and behaviors available to bots in Slack is extracted from the Slack API documentation [41]. From the complete set of bot capabilities in Slack, we select five distinct groups of capabilities, whose effect on behavioral beliefs we attempt to measure. The five groups refer to design features of chatbots in Slack, that are commonly observable in bot implementations. The features are categorized according to the definitions of design features and its dimensions provided in table 1. Design features where pre-tested for importance and completeness with eight doctoral candidates familiar with using Slack in a work context and interacting with chatbots. During the pre-test the participants were confronted with the feature instantiations and the questionnaire. Their feedback was collected, evaluated and merged in order to develop the final survey. The following features are used as instantiations of the **functional dimension**:

Invocation. Usually, there are two ways of engaging in a conversation with a chatbot: either it is invoked by a command or it reacts by activating autonomously. In Slack, the user may activate the 'reminder' functionality of a chatbot by invoking the /remind command. At the same time, when pasting links into a conversation, e.g. from Google drive, the Slackbot will recognize the link and autonomously suggest a specific reaction to every subsequent link.

Intention-type. When interacting with a chatbot, the interaction can revolve around two intentions, seeking information or delegating a task [45]. A user may ask the bot for an update on the weather or to write an apology message to another user. More advanced chatbots may also provide a combination of both tasks, such as Google Assistant making a reservation with a service provider while sending information back to the user [27].

Question-type. The more sophisticated the interaction with a chatbot becomes, the more natural and simpler may the conversation feel. However, a sophisticated

interaction increases the bot's complexity [18]. In order to keep complexity low, a chatbot will ask closed questions (such as Yes/No questions). This form of interaction allows the chatbot to dictate the flow of the conversation. Open questions on the other hand allow the user to communicate in a natural, unrestricted way.

Reaction-type. Finally, chatbots have various strategies of handling failure. When a bot struggles to understand or act on a command, it may react with an error notification and ask the user to retry or provide additional information. Other fallback mechanisms may include forwarding a user query to a common search machine or asking for more information. This behavior could be characterized as an attempt of the chatbot to satisfy the user in a fallback scenario by relying on outside sources and providing links [39].

The following feature is used to instantiate the **form dimension**:

Anthropomorphism. In presenting the bot to its users, a common approach is the humanization of the conversational agent, especially present in embodied conversational agents. For chatbots, the possibilities for making the bot appear as a human-like actor are limited. Common approaches are the inclusion of social cues in conversations, such as including short pauses before giving an answer [23], or making the bot include emojis in their conversational behavior [42]. The underlying idea of making agents more human-like stems from the CASA paradigm – computers are social actors [31, 35]. The paradigm states that social attributes are ascribed to computer technology during interaction, similar to another human, and was proven with sets of studies testing e.g. mindless responses in detail and the depth of social responses to computer's personality [31]. This can result in the development of social and emotional bonds with the agent [22] Social presence was identified as an antecedent of behavioral intention through affecting the PE of users [20]. Furthermore, the principle serves as a possible explanation for the observation that group allow agents to take on social roles, such as group leader, and viewing a machine as an embodied entity by referring to the agent as "him" and not "it" [8]. In Slack, chatbots can have a user profile, providing the same information as the profile of a human user. For explanatory reasons this aspect of anthropomorphic design features is displayed in figure 2.

Figure 2: Picture and Name of Chatbot as Example of Anthropomorphic Design Feature

4.3 Procedure & Participants

This study is conducted as a confirmatory survey study. The study is set up using Limesurvey, a web application for creating and distributing research surveys. The survey language is English. At the end of the survey, participants have the opportunity

to participate in a lottery for the chance of receiving rewards. For the purpose of eliminating survey replies not completed truthfully, we included two reverse coded and two trap questions. Trap questions ask participants to select specific answers to ensure reading the questions properly. For the evaluation procedure, the finalized survey is sent out to enterprises using Slack by posting the survey with an introduction text into relevant Slack workspaces. For this purpose, we have access to Slack workspaces of three international companies in the area of consulting, eCommerce & fashion and IT industry. Additionally, Slack has invitation only workspaces for professional chatbots, where the survey is distributed as well. We record a total of 71 answers. From those answers, 14 are not fully completed out or failed to provide the appropriate answer to included trap questions and therefore are excluded. In consequence the study sample contains 57 participants (N=57), whereby 48 are male (84,3%) and 9 are female (15,7%).

4.4 Measurement Approach

The structural model consists of two parts, the hedonic TAM and function and form dimensions. The constructs of TAM are derived from [17]. All items of TAM are measured on a seven-point Likert scale ranging from “Highly disagree” to “Highly agree”. The question and answer forms are individually composed according to [46]. The design dimensions of chatbots in Slack are measured utilizing the design features introduced in section 4.2. Each feature is represented by two or more items, representing specific instantiations of the feature. To assess the influence of each item, the questionnaire applies a two-question characteristic, measuring importance and frequency of usage for each item. Both Importance and Frequency of usage are measured on a seven-point Likert scale. The measurement scales are derived from [46]. The two question characteristic is adopted from [30], who applied the design to study the relationship between features of a game and we-intentions. We adopt a reflective path model, suggesting that both importance and frequency of usage are a sample of the possible indicators for the respective latent construct. For the calculation of the two latent constructs, functional and form design dimension, we additively combined the two characteristics, importance and frequency of usage, for each item. We controlled for age, gender, education and experience. Experience is measured on four levels: Slack experience, chatbot experience, chatbot experience in Slack and general coding and development experience, on a seven-point Likert scale ranging from “Not at all experienced” to “Extremely experienced”, as derived from [46]. An exemplary set of questions is depicted in table 2.

Table 2. Exemplary question set for one item from the Invocation design feature

Measurement characteristic	*Question*
Importance	How important is it to you, that the chatbot can be tagged in conversations like human users?
Frequency of usage	How often do you invoke the chatbot via a user command to perform some action?

5 Results

To evaluate the collected survey data, we apply partial least squares (PLS), a structural equation modelling (SEM) technique [7]. Specifically, we use the tool SmartPLS 3.2.7. As we try to explore relationships and the proposed research model, traditional common factor based PLS-SEM is chosen over component-based SEM [12, 14]. This approach is particular suitable for our model, as it is applicable for smaller sample sizes [14]. Moreover, we apply the bootstrapping method to calculate the significances of path coefficients.

5.1 Measurement Model

In a first step, we evaluate the measurement model. We apply a reflective instead of a formative modeling approach as the measurement items are representatives of the latent variable rather than a composition [14]. To assure the quality of our data, we determine the items' loadings and assure indicator reliability and validity (see table 3). All items of the measurement model load above 0.6 on their construct, which is an sign for indicator reliability [6]. Composite reliability (CR) is chosen to overcome limitations of Cronbach's α for measuring internal consistency. It reveals values at least between 0.7 and 0.8 for five out of six, a reliable indicator for an adequate confirmatory model and values higher than 0.8 for four of six constructs, indicating a good fit for confirmatory research for these constructs [14]. However, Cronbach's α for PE indicates almost no inter-item correlation, while CR for PE indicates correlation, but only at levels adequate for exploratory research [14]. The convergent validity was measured by average variance extracted (AVE). Except for one (AVE = 0.471), AVE shows values for all constructs higher than 0.5, which is sufficient [14]. However, as this represents only a small discrepancy from the accepted value for this one value, it is a minor limitation of the model but the analysis can be continued and is still valid [15]. Further, we assess discriminant validity by running the Fornell-Larcker criterion, confirming that the square root of the AVE exceeds the respective constructs correlation with other variables in the model [11].

Table 3. Reliability Measures of the Measurement Model

Latent Variable	***α***	***CR***	***AVE***	***Fornell-Larcker Criterion***					
				FuDD	*BI*	*FoDD*	*PEoU*	*PE*	*PU*
Functional Design Dimension (FuDD)	0.675	0.823	0.608	**0.780**					
Behavioral Intention (BI)	0.944	0.964	0.899	0.578	**0.948**				
Form Design Dimension (FoDD)	0.786	0.842	0.437	0.444	0.341	**0.661**			
Perceived Ease of Use (PEoU)	0.677	0.797	0.505	0.471	0.630	0.432	**0.711**		
Perceived Enjoyment (PE)	-0.094	0.617	0.639	0.488	0.535	0.255	0.662	**0.799**	
Perceived Usefulness (PU)	0.950	0.960	0.802	0.720	0.598	0.410	0.630	0.669	**0.895**

5.2 Structural Model

After evaluating the measurement model validity, we assess the structural model according to [17]. Figure 2 shows the structural model with the results of the PLS bootstrapping analysis with 5000 samples displaying the coefficient of determination (R2) for all endogenous constructs. The figure contains path coefficients, significance levels and effect sizes (f^2) of the paths.

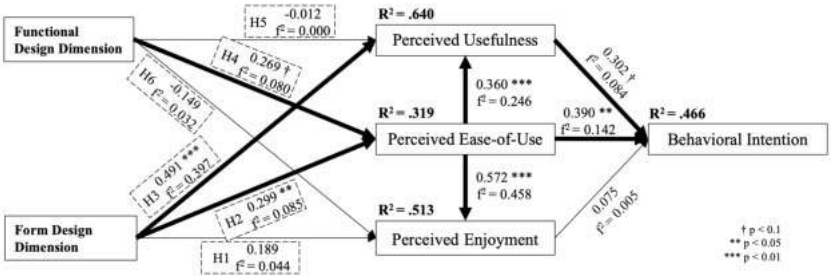

Figure 3. Structural Equation Model

We report significance on the following significance levels: $p < 0.01$, $p < 0.05$, $p < 0.1$. We explicitly allow for significances at the 10% level, as this study aims to identify promising correlations for future research to explore with more detailed and strict criteria, rather than minimizing false positives. For H1 our evaluation shows a significant effect of functional → PEoU ($p < 0.1$, $f^2 = 0.08$). H2 and H6 are not supported by the results as there is no significance measurable, whereas H4 and H5 are supported by the evaluation with significance at level $p < 0.05$ and $p < 0.01$, respectively. H3 is rejected as well, showing no significance. The constructs PU, PEoU and PE have positive loadings on BI. The paths from PEoU → PU and PEoU → PE also show a significant effect. Besides the path PE → BI, all of them are significant at least at the $p < 0.05$ level while only one is at the level of $p < 0.1$. The three outgoing paths from the anthropomorphic design features have a positive effect while the path to PU has a very strong path coefficient. The path to PEoU loads weaker. The effect size of anthropomorphic → PEoU (H4) counts for $f^2 = 0.085$, the value for anthropomorphic → PU (H5) for $f^2 = 0.397$. It can be concluded, that most of the paths have effect sizes $> f^2 = 0.02$, which at least accounts for small effects [16]. Only for PE → BI, the effect size is neglectable ($f^2 = 0.02$). The coefficient of determination for all constructs was medium up to high [7], with values between 0.319 and 0.64. Additionally, we test for the moderating effects of experience with developing, chatbots and Slack, but do not identify any significant effects.

6 Discussion

In contradiction to our initial hypothesis, anthropomorphic design features show no significant effect on PE. This rejects H3 and contradicts the assumption that form features have direct effect on the hedonic character of the acceptance of chatbots. Originating from the point of view that higher anthropomorphism is leading to higher

perceived enjoyment of the user, this result is especially valuable. Drawing implications from this, it shows that a stronger humanization of chatbots does not necessarily result in higher user enjoyment. Additionally, no effects of significance involving PE, other than PEoU on PE, were observed in the study. A significant relationship between PE and BI, observed by previous studies (29), did not occur. Alongside the insignificant effects of form and function design features on PE, this may hint at the questionnaire failing to capture PE of participants. Cronbach's α for PE indicates no inter-item correlation, while CR appears at the lower end of the acceptable range. Consequently, the underlying construct items might not have measured the construct appropriately. On the other hand, the results may also be interpreted as PE not being a relevant factor to influence users' behavioral intentions, stressing the importance of the utilitarian character of chatbots in work environments. Taking a deeper look, all the more interesting are the further results of the anthropomorphic design features. They show the most significant effect of outgoing paths to PU. In addition, the path loading is strongest, and effect size is highest ($f^2 = 0.397$) of all evaluated paths. This means that the effect of anthropomorphic design features on PU is the strongest across all results. The finding is supporting H5. This result comes together with a significant path loading from anthropomorphic design features to PEoU, which supports H4. Although the effect is not as strong as to PU, it still is significant with a positive path loading and effect size considered as meaningful ($f^2 = 0.085$). Comparing the two paths - anthropomorphic design features → PU and → PEoU, we see the former one has almost twice the loading and effect size, showing a strong prominence of effect on PU.

Accompanying these results and contrasting them to the first discussion point mentioned above spawns a valuable implication. Instead of influencing the hedonic share of technology acceptance, anthropomorphic design features have the strongest and most significant effect on utilitarian aspects of chatbot acceptance. This was contrary to the initial assumption about humanization of chatbots and may therefore be seen as the main contribution of this research work. Further elaborating this idea, it means that Slack users accept a anthropomorphic chatbot more for utilitarian reasons than for joy and hedonic perception. As possible explanation, we call on the argument of context influence raised by van der Heijden [29]. It imposes that work environments are mainly associated with utilitarian values. The influence of anthropomorphic design features, which are assumed to be hedonic, seem to be controversial in this context. Our results suggest that they impact the utilitarian character of acceptance which goes hand in hand with the implication of [29], suggesting that hedonic features add acceptance to utilitarian systems and thereby usefulness, especially in the working context. Furthermore, we may theorize that user satisfaction is increased when interacting with chatbots that utilize anthropomorphic design features, thus benefiting PU and PEoU, similar to the effects that Botzenhardt et al. observed for functional design features [2].

Looking at the functional features of design characteristics, the only significant connection is pointing at PEoU. This supports H1. Therefore, we can report a positive effect of functional features on the ease-of-use of the chatbots technology and see the support of utilitarian aspects by functions in the design of a chatbot. On the other hand, H2 was not supported. This is interesting as well, suggesting that functional features may make usage easier but not necessarily make the chatbot more useful. Overall, we

still document much higher loading, significance and effect size on the outgoing paths from anthropomorphic features than functional ones. Moreover, it is worth mentioning that H6 is rejected as well, stating no confirmative effect on PE. Mirroring the hypothesis about functional features (H1, H2, H6), our results at least suggest, that they are more likely to contribute to utilitarian aspects than to hedonic aspects, as we cannot confirm any significant relationships with PE.

Finally, aggregating our findings, they stress the importance of anthropomorphism in order to increase acceptance. This is valuable for both researchers and practitioners, giving a clear guideline for chatbot design and research. Observing this implication, it poses the questions if more anthropomorphism directly leads to higher acceptance. For answering this question, we want to mention the phenomenon of "uncanny valley" [29]. It compares human likeness of an entity with human affinity to this entity and states that the relationship is increasing, but only until reaching a specific point, the uncanny valley. Simultaneously, the raised equation is finally likely to fail, as humans are feeling rather unfamiliar when a technical system reaches this specific point of anthropomorphism.

6.1 Implications

"The aesthetics of your product speaks out for you just as much as the functionality, because if the functionality is no longer unique, guess what steps in? The beauty." [21]

We urge researchers and practitioners alike to pay attention to the importance of anthropomorphism for chatbot adoption. The results of this study show strong and significant effects on the utilitarian aspects of acceptance of the users. Moreover, taking up on findings on chatbots, they possibly serve as leaders in groups, the results gain even more significance as replacing a human being might demand for serving different social and hedonic facets. The importance of functional features goes without saying and the relevance of function features for PEoU could be demonstrated for the Slack in the work context. However, function and form features need to go hand in hand to achieve the best possible outcome. While function and form serve separate causes in the design of an agent, both are relevant for behavioral intentions of users. Tailoring both features to the individual task of a chatbot can significantly improve its acceptance amongst users.

6.2 Limitations

Some limitations apply to this study. The selected design characteristics for function may be perceived not as functionalities provided by a chatbot, but rather as characteristics of the agent's interaction with a user. As such, they may provide both utilitarian and non-utilitarian value. Furthermore, a specific chatbot task may affect the perception of function and form features. However, the selected function characteristics are present in chatbots fulfilling a large spectrum of tasks and purposes. Choosing distinct functions for this study might limit the findings of this study to specific fields of application. Regardless of these considerations, we suggest the evaluation of our results with chatbots dedicated to discrete tasks and purposes.

The study is framed as especially focused on the workplace. We assume this focus reveals different aspects than it does in private life. Though, there might be concerns that the tool Slack as well induce private mindset into the survey's results. We did not especially check for this in the questionnaire as we think it would not have fully covered the limitation. Regardless of these considerations, we suggest the evaluation of our results with chatbots dedicated to discrete tasks and purposes. Furthermore, we did not evaluate potential effects of the participants' PEoU, PU and PE on the design features proposed. As such, we cannot exclude reverse effects. Finally, despite applying PLS-SEM as evaluation method due to the small sample size, and adhering to the rule of thumb of 10 participants per [14], repeating the evaluation with a larger sample size may be advised to further solidify the results.

7 Conclusion

With this study, we evaluate the impact of anthropomorphic and functional chatbot design features on user acceptance in Slack, an enterprise collaboration system. We conduct an online survey, asking users of the common collaboration and messaging tool Slack about function and form features of chatbots. Contrary to our hypotheses formulated against the backdrop of previous studies on conversational agents, we identify anthropomorphism to have a highly significant effect on PU. The effect size of anthropomorphism on PU was four times the size of other significant effects identified. On these bases, we reject our initial hypothesis which predicted a strongly positive effect of form features on PE. These findings highlight the importance of form features, in the form of anthropomorphism, in achieving a high PU and consequently strengthening the BI of users. The results have implications for developers of chatbots in collaborative work environments. We urge researchers and practitioners alike to dedicate resources to form features in the same magnitude as dedicated to function features during chatbot development. At the same time, we encourage further research on the effect of function and form features of design in the context of specific chatbot tasks or specific collaboration environments, as well as other collaboration setups.

References

1. Al-Natour, S., Benbasat, I.: The Adoption and Use of IT Artifacts: A New Interaction-Centric Model for the Study of User-Artifact Relationships. J. Assoc. Inf. Syst. 10, 9, 661–685 (2009).
2. Botzenhardt, A. et al.: The Roles of Form and Function in Utilitarian Mobile Data Service Design. J. Electron. Commer. Res. 17, 3, 220–238 (2016).
3. Boughzala, I. et al.: Special Issue Team Collaboration in Virtual Worlds: Editorial to the Special Issue Team Collaboration in Virtual Worlds: Editorial to the Special Issue. J. Assoc. Inf. Syst. 13, 10, 714–734 (2012).
4. Bouwman, H., van de Wijngaert, L.: Coppers context, and conjoints: a reassessment of TAM. J. Inf. Technol. 24, 2, 186–201 (2009).
5. Cameron, G. et al.: Towards a chatbot for digital counselling. Br. HCI Conf. 2017. 1–7 (2017).

6. Chin, W.W. et al.: Advancing the theory of adaptive structuration: The development of a scale to measure faithfulness of appropriation. Inf. Syst. Res. 8, 4, (1997).
7. Chin, W.W.: The Partial Least Squares Approach to Structural Equation Modeling. Presented at the (1998).
8. Derrick, D.C. et al.: Automated group facilitation for gathering wide audience end-user requirements. In: Proceedings of the Annual Hawaii International Conference on System Sciences. pp. 195–204 (2013).
9. Domermuth, D.: The Pedagogy of Form versus Function for Industrial Design. (2009).
10. Frommert, C. et al.: Using Chatbots to Assist Communication in Collaborative Networks Christian. In: IFIP Advances in Information and Communication Technology. (2018).
11. Fuller, M.A. et al.: Efficacy in Technology-Mediated Distributed Teams. J. Manag. Inf. Syst. 23, 3, 209–235 (2007).
12. Gefen et al.: Editor's Comments: An Update and Extension to SEM Guidelines for Administrative and Social Science Research. MIS Q. 35, 2, iii (2011).
13. Goodhue, D.L., Thompson, R.L.: Task-Technology Fit and Individual-Performance. MIS Q. 19, 2, 213–236 (1995).
14. Hair, J.F. et al.: A primer on partial least squares structural equation modeling (PLS-SEM). Sage Publ. 2, (2016).
15. Hair, J.F. et al.: Multivariate Data Analysis. Pearson Education Inc., New Jersey (2009).
16. Hair Jr, J.F.: A primer on partial least squares structural equation modeling (PLS-SEM), https://www.amazon.com/Partial-Squares-Structural-Equation-Modeling-ebook/dp/B01DT3F33I/ref=sr_1_1?s=books&ie=UTF8&qid=1495311972&sr=1-1&keywords=9781483377469, (2013).
17. van der Heijden, H.: User Acceptance of Hedonic Information Systems. MIS Q. 28, 4, 695 (2004).
18. Hill, J. et al.: Real conversations with artificial intelligence: A comparison between human-human online conversations and human-chatbot conversations. Comput. Human Behav. 49, 245–250 (2015).
19. Hong, J.H. et al.: ConaMSN: A context-aware messenger using dynamic Bayesian networks with wearable sensors. Expert Syst. Appl. 37, 6, 4680–4686 (2010).
20. Jin, S.-A.A.A.: The effects of incorporating a virtual agent in a computer-aided test designed for stress management education: The mediating role of enjoyment. Comput. Human Behav. 26, 3, 443–451 (2010).
21. Kim, M.: Beautiful and functional interfaces – UX Planet.
22. Komiak, Benbasat: The Effects of Personalization and Familiarity on Trust and Adoption of Recommendation Agents. MIS Q. 30, 4, 941 (2006).
23. Kumar, M., Noble, C.H.: Beyond form and function: Why do consumers value product design? J. Bus. Res. 69, 2, 613–620 (2016).
24. Lavie, T., Tractinsky, N.: Assessing dimensions of perceived visual aesthetics of web sites. Int. J. Hum. Comput. Stud. 60, 3, 269–298 (2004).
25. Lebeuf, C. et al.: How Software Developers Mitigate Collaboration Friction with Chatbots. (2017).
26. Legris, P. et al.: Why do people use information technology? A critical review of the technology acceptance model. Inf. Manag. 40, 3, 191–204 (2003).
27. Leviathan, Y., Matias, Y.: Google AI Blog: Google Duplex: An AI System for Accomplishing Real-World Tasks Over the Phone, https://ai.googleblog.com/2018/05/duplex-ai-system-for-natural-conversation.html.
28. Meth, H. et al.: Designing a requirement mining system. J. Assoc. Inf. Syst. 16, 9, 799–837 (2015).

29. Mori, M. et al.: The uncanny valley. IEEE Robot. Autom. Mag. 19, 2, 98–100 (2012).
30. Morschheuser, B. et al.: Gamified crowdsourcing: Conceptualization, literature review, and future agenda. Int. J. Hum. Comput. Stud. 106, May, 26–43 (2017).
31. Nass, C., Moon, Y.: Machines and Mindlessness: Social Responses to Computers. J. Soc. Issues. 56, 1, 81–103 (2000).
32. Pickard, M.D. et al.: Revealing sensitive information in personal interviews: Is self-disclosure easier with humans or avatars and under what conditions? Comput. Human Behav. 65, 23–30 (2016).
33. Qiu, L., Benbasat, I.: Evaluating Anthropomorphic Product Recommendation Agents: A Social Relationship Perspective to Designing Information Systems. J. Manag. Inf. Syst. 25, 4, 145–182 (2009).
34. Recast.ai: (Almost) Every Slack and Facebook Messenger Bot - Universe, https://airtable.com/universe/expJrvnYEz5BooYKk/almost-every-slack-and-facebook-messenger-bot?explore=true.
35. Reeves, B., Nass, C.: The Media Equation: How People Treat Computers, Television and New Media Like Real People and Places. (1996).
36. Rinderle, J., Hoover, S.P.: Function and form relationships : strategies for preliminary design. (1990).
37. Rodrigues, L.F. et al.: Does ease-of-use contributes to the perception of enjoyment? A case of gamification in e-banking. Comput. Human Behav. 61, 114–126 (2016).
38. Seeger, A.-M. et al.: When Do We Need a Human? Anthropomorphic Design and Trustworthiness of Conversational Agents. Spec. Interes. Gr. Human-Computer Interact. 15, 1–6 (2017).
39. Segura, C. et al.: Chatbol , a chatbot for the Spanish “La Liga.” In: International Workshop on Spoken Dialog System Technology 2018 (IWSDS). pp. 1–12 (2018).
40. Slack: Customer Stories | Slack.
41. Slack: Enabling Interactions with Bots | Slack, https://api.slack.com/bot-users.
42. Stoeckli, E. et al.: Exploring Affordances of Slack Integrations and Their Actualization Within Enterprises – Towards an Understanding of How Chatbots Create Value. In: Hawaii International Conference on System Sciences 2018 (HICSS-51). pp. 2016–2025 (2018).
43. Tegos, S. et al.: MentorChat: Introducing a Configurable Conversational Agent as a Tool for Adaptive Online Collaboration Support. In: 2011 15th Panhellenic Conference on Informatics. pp. 13–17 IEEE (2011).
44. Townsend, J.D. et al.: Form and function: A matter of perspective. J. Prod. Innov. Manag. 28, 3, 374–377 (2011).
45. Toxtli, C. et al.: Understanding Chatbot-mediated Task Management. (2018).
46. Vagias, W.: Likert-type scale response anchors, (2006).
47. Venkatesh, V. et al.: User acceptance of information technology: Toward a unified view. MIS Q. 27, 3, 425–478 (2003).
48. Venkatesh, V., Bala, H.: Technology acceptance model 3 and a research agenda on interventions. Decis. Sci. 39, 2, 273–315 (2008).
49. Venkatesh, V., Davis, F.D.: A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field. Manage. Sci. 46, 2, 186–204 (2000).
50. Wang, W. et al.: Effects of Emoticons on the Acceptance of Negative Feedback in Computer-Mediated Communication. J. Assoc. Inf. Syst. 15, 8, 454–483 (2014).
51. Wünderlich, N. V., Paluch, S.: A Nice and Friendly Chat With a Bot: User Perceptions of AI-based Service Agents. Proc. Int. Conf. Inf. Syst. 1, 1–11 (2017).