Designing Mika – A Participation Companion for Supporting Participation and Enhancing Motivation

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Abstract

The body of design knowledge surrounding information systems aimed at facilitating participation is presently limited and primarily focuses on top-down approaches. In response to this shortcoming, we propose a bottom-up methodology through the development of a Participation Companion that supports people in their participation process and could be a solution to motivate people to participate. Especially the lack of motivation plays an important role in participation, which is why in an earlier study, we followed a very creative, participatory, and user-centered approach to instantiate a prototype in three stages and then extracting five reflective design principles. Building on this foundation, we created Mika, our prototype, which aims to promote user engagement and participation.

Keywords: Virtual Companions, Participation, Human-Computer Interaction, Smart Cities, Conversational Agent

1. Introduction

Although cities are usually defined by geographical factors, it is the people that present an essential component of any city as they influence its appearance, identity and culture (Becker et al., 2022). The direct influence of citizens on the decision-making of the city, the participation in activities and the shaping of the city by its citizens is described as participation (Roberts, 2004; Viale Pereira et al., 2017).

Currently, the body of design knowledge regarding information systems for participation is limited, primarily focusing on top-down digital solutions (Becker et al., 2022). To address this gap, we propose a paradigm shift towards a bottom-up approach by developing a Participation Companion (PaCo) that utilizes the principles of artificial intelligence (AI) and draws upon the theoretical foundations of Virtual Companions (VCs). The PaCo serves as an innovative tool designed to facilitate individuals in finding opportunities for participation, such as redesigning a public space according to their needs or organizing social events to bring people together. The goal of PaCo is to motivate users, thereby promoting active engagement in the participation process.

VCs, known for their ability to establish collaborative partnerships with users, play a pivotal role in fostering enduring and meaningful human-machine relationships (Krämer et al., 2015; Strohmann et al., 2022). Current research in information systems often draws upon the social response theory, which posits that individuals tend to exhibit similar social behaviors with computers as they do with humans due to computer's resemblance to human social characteristics (Diederich et al., 2022; Nass & Moon, 2000; Siemon et al., 2022). Despite extensive research on chatbots and virtual assistants in fields such as health (Ahmad et al., 2022; Müller and Reuter-Oppermann, 2022), education (Gubareva & Lopes, 2020; Muid et al., 2021) and customer service (Følstad & Skjuve, 2019; van Doorn et al., 2016; Wirtz et al., 2018), there is a noticeable gap in scientifically grounded design knowledge concerning the application of VCs and other AI-based technologies specifically targeted at fostering and facilitating participation. For this reason, the following research question (RQ) is to be answered: *How can a VC be designed to encourage and support good and purposeful participation?*

We use a design science research paradigm based on Hevner et al. (2004) to answer our RQ. Therefore, we developed five design principles (DPs) in earlier studies, which are intended to provide design knowledge for a PaCo. These have now been instantiated and subsequently evaluated qualitatively. Our study relates to the organization "Sandkasten" at the TU Braunschweig, which aims to support students in creating a sustainable and livable campus. This organization offers various projects in which individuals can participate. Moreover, individuals can introduce their own ideas to initiate projects. The range

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of projects spans from the redesign of the campus to music events and bicycle repair services. By investigating participation dynamics within this context, we aim to generate insights that can be applied to foster engagement in cities and other communities.

2. Theoretical Background

2.1. Participation And Motivation

According to Simonefski et al. (2021), a Smart City is characterized as a city that collaborates with its residents and leverages technology to address the specific challenges of its region through innovative solutions. In this context, citizen participation plays a crucial role, and individuals need to be motivated, either intrinsically or extrinsically, to actively engage in the city's initiatives. Intrinsically motivated individuals are driven by their genuine interest and find satisfaction in participating in various activities (Alamri et al., 2020; Di Domenico & Ryan, 2017). In contrast, extrinsically motivated individuals participate with the expectation of attaining specific outcomes or rewards (Di Domenico & Ryan, 2017).

In our study, we have developed an advanced prototype that incorporates real-time interaction to explore user engagement and motivation in relation to participation. Our prototype is built upon five design principles (DPs) that are based on two kernel theories (KT) (Kuechler & Vaishnavi, 2008): **KT1:** The Self-Determination Theory (SDT) by Ryan and Deci (2000) which highlights three fundamental psychological needs that influence motivation: competence, autonomy, and relatedness. *Competence* refers to the need for mastery and control over the outcome of a challenge. *Autonomy* represents the need to tackle a challenge using one's own abilities and power. *Relatedness* entails the need to feel connected and socially engaged with others (Birk et al., 2016; Ryan & Deci, 2000). **KT2:** The theory of self-efficacy by Bandura (1977) states that a person's belief in their ability directly impacts their performance perception and motivates them to engage in tasks. Intrinsic motivation and the perception of achievable success are essential to perform a task (Bandura, 1977).

2.2. Conversational Agents and Virtual Companions

Conversational agents are software applications that engage in human-like dialogs, for example in the form of chatbots. Applications today range from customer service automation (Feine et al., 2019), to mental health support (Fitzpatrick et al., 2017), to educational purposes (Winkler & Söllner, 2018).

The evolution of AI has driven the development of statistical methods, with recent advances in machine learning, deep learning, and NLP contributing significantly to the sophistication of these agents (Brown et al., 2020). The advent of models such as GPT-3 (OpenAI, 2020) has dramatically improved the ability of conversational agents to generate human-like text, taking a significant step toward more natural and engaging conversations. This formed the basis for further developments such as the ChatGPT series, a derivative of the GPT models that focuses specifically on creating coherent and contextual dialogues (Radford et al., 2021).

To develop a VC supporting participation, another relevant KT is introduced: **KT3:** The Social Response Theory is fundamental to understanding interaction between humans and non-human actors. It states that despite the obvious recognition of the non-human nature of the system, people establish a social connection when the system exhibits social behaviors (Nass et al., 1994; Nass & Moon, 2000).

This theory serves as the foundation for the Virtual Companion approach, a distinct class of conversational agents that focus on building a relationship between humans and machines in order to enable richer and more long-term relationships between humans and machines (Nißen et al., 2021; Strohmann et al., 2022).

2.3. Related Work

A growing interest in AI applications that support participation processes is emerging, although the work is still in the early stages of exploration. We identified several studies that used AI technologies to facilitate participation or otherwise support the process (Begen, 2020; Debowski et al., 2021; Haqbeen et al., 2021; Lieven et al., 2021; Tavanapour et al., 2019). A common feature of these studies was the use of AI chatbots that acted as conversational agents (Tavanapoor, 2019; Lieven et al., 2021; Haqbeen, 2021). It has been found that AI-powered chatbots can lead to more sophisticated ideas and facilitate a deeper participatory process, demonstrating the potential benefits of AI in participatory contexts.

However, the literature also shows a diversity of AI applications and implementations. Tavanapoor (2019) suggested that AI systems should offer conversational capabilities and provide socio-emotional cues to enhance the user experience. Begen (2020), on the other hand, focused on using natural language processing (NLP) techniques to classify citizens' messages on their e-participation platform to improve user experience and increase engagement.

While these studies provide valuable insights into the applications of AI in participation scenarios, they focus mainly on short-term interactions. The literature is silent on the application of AI technologies to support individual users in their participation efforts over a longer period of time or to build a deeper, lasting relationship between humans and AI, such as a virtual companion (Strohmann et al., 2022). There is also a lack of concrete prescriptions regarding motivational design for participation support.

3. Design Science Research

The Design Science Research (DSR) paradigm supports a problem-solving process whereby knowledge and understanding about a problem domain and the potential solutions are enhanced through the design and application of DSR artifacts (Hevner et al., 2004). The goal is to develop design knowledge on how to effectively create innovative solutions to important problems. Vom Brocke et al. (2020) describes that knowledge about a problem in a certain context as well as knowledge about possible solutions can exist independently of each other. According to this, design knowledge arises from the fact that the context and quality criteria dependent on it (problem space) as well as the representations of possible solutions and their development process (solution space) are related to each other via the evaluation of artifacts.

The central contribution of DSR is design knowledge, which can be either in the form of theoretically abstract knowledge (design theory), such as design principles, or in the form of instantiated artifacts (design entities) (Brocke et al., 2020).

In the DSR, there are different strategic approaches to arrive at the design theoretical knowledge (Iivari, 2015; Möller et al., 2020). Möller et al. (2020) propose two possible approaches in their method for design principles development: either the instantiation takes place first and design knowledge is extracted from it (reflective) or design theoretical knowledge is first identified and synthesized from the knowledge base and then instantiated (supportive).

In our research approach, we want to use the advantages of both approaches. In the first design cycle, we focus on a very creative, participatory and user-centered approach and therefore choose the reflective approach to instantiate prototypes in three stages. After instantiation we reflected a set of design principles. We then iterated this again by enriching it with theoretical knowledge from the knowledge base. We published the first prototypes and the resulting reflective set of design principles as meta-design (Wittholz, 2023). In the second design cycle in this study, we have now used this meta-design to instantiate and evaluate the software artifact Mika.

4. Design Process

In our previous research, we developed design principles (DP) that serve as the foundation for a Participation Companion aimed at supporting and motivating individuals in their participation process (see table 1). To develop the DPs, we initially conducted a structured literature research and interviews to fully understand the problem space. Based on this, an artifact was created in the form of a

#	Reflective Design Principle (DP)	Related KT
DP1	For designers and developers to design a Participation Companion (PaCo) that promotes transparency and purposefulness, clear information must be given about the goal, the time required, and the content of the participation opportunity.	KT1, KT2
DP2	For designers and developers to design a PaCo that promotes autonomy, relatedness and competence, a matching algorithm can be integrated that suggests different participation opportunities based on interests, skills, and available time.	KT1
DP3	For designers and developers to design a PaCo that supports self-efficacy and autonomy, participation tasks need to be divided into sub-steps that are clearly defined and explained in order to make participation understandable and accessible.	KT1, KT2
DP4	For designers and developers to design a PaCo that introduces the participation scenario to the user the conversation must be designed systematically, logically and intuitively by explaining the functions and contents of the PaCo, introducing the participation project and then asking about the user's interests and skills.	KT1, KT2
DP5	For designers and developers to design a PaCo that enhances the value and motivation for participation, goals must be articulated clearly, incentives (e.g., community, commitment, certificates) must be created and a unique value proposition compared to traditional internet research must be offered.	KT2

Table 1. Design Principles.

prototype. Subsequently, an explorative study was conducted to gather feedback and promote participatory design with stakeholders. Initial results revealed that the aspect of motivation for participation is particularly critical. Building on this, the first prototype was designed to assist users in finding opportunities to participate by querying their interests and then suggesting a suitable task. The descriptive data indicated that the task assignment by the PaCo is generally perceived positively. The PaCo also facilitated the onboarding process for the respective project, and users could identify with their matched task (Wittholz, 2023).

These results, combined with the two kernel theories from motivation theory (see 2.1), led to the formulation of the five DPs that were then utilized to develop a prototype, which is subsequently evaluated through qualitative methods. In addition, the Virtual Companion Canvas (Strohmann et al., 2019) was utilized to design the PaCo itself. We framed the PaCo's behavior and appearance as friendly and courteous, with a neutral humanlike avatar. In addition, we chose the gender-neutral name “Mika”.

The Rasa framework was used for our implementation. The Rasa natural language understanding pipeline is responsible for extracting intents and entities from user input (Bocklisch et al., 2017). To collect user's responses to questions, we use entity extraction via buttons. Mika relies on custom actions and "forms" to manage quests and implement specific logic, which depends on the DPs, such as the matching algorithm. To store the extracted user characteristics like interests, competence, and time availability for DP2, we utilize "slots," which act as the brain of Mika. The communication channel between the user and Mika is facilitated through the messaging tool "Slack," enabling direct interaction and the option to use buttons or freely write messages.

Figure 1 illustrates excerpts from the conversation with Mika, demonstrating the integration of the different DPs into our Prototype. Concerning *DP1*, Mika ensures transparency and promotes purposefulness by providing users with clear information about the goals of different projects while respecting their time availability. Additionally, it provides information about the tasks involved in each suitable participation opportunity. Regarding *DP2*, users have the autonomy to share their interests, competencies, and time availability. Mika then collects and analyzes this information, promoting autonomy, relatedness, and competence by determining the most suitable opportunities for user participation. With *DP3*, Mika supports self-efficacy and autonomy by concisely describing the projects available for user participation.

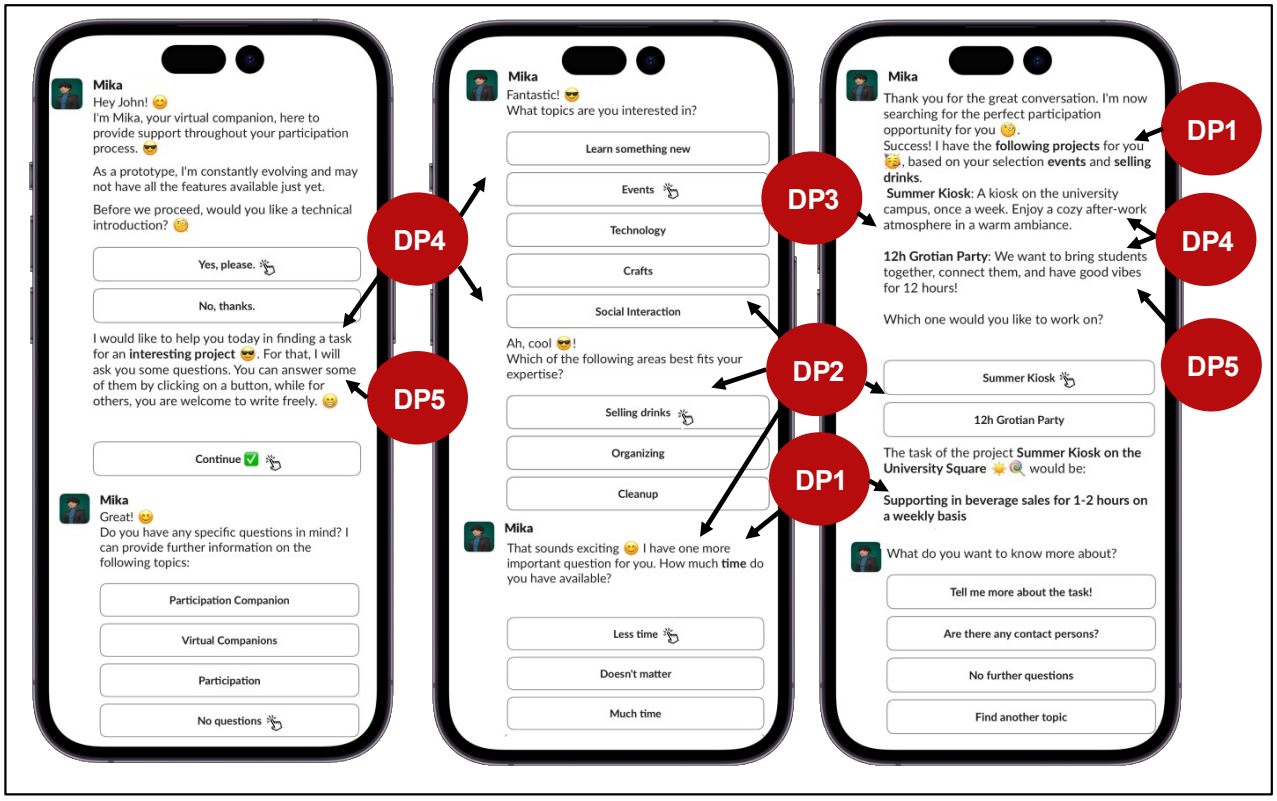

Figure 1: Excerpts of the Conversation Related to DP.

This ensures that users clearly understand the participation process and enables them to make informed decisions autonomously. In relation to *DP4*, Mika provides a concise introduction to its functionality and explains how users can interact with the system. Furthermore, it offers information about the available projects for participation and collects data on user interests and skills. Regarding *DP5*, Mika creates a unique value proposition by engaging in personalized interactions with the user to identify a project that aligns best with their interests. In this process, the Companion specifically highlights and explains the goals of each project that are most suitable for the user.

The study required approximately 30 minutes to complete. During this time, the participants in the test group engaged in a conversation with our prototype and subsequently filled out the research survey. There were eight projects available for participation, reflecting 34 tasks. At the beginning of the conversation, the participant had a selection of five different areas of interest (Learn something new, Events, Technology, Crafts, and Social Interaction). After choosing one, the prototype presented them with a selection of specific areas. The participant was to choose the area that best suited them. Then, they were asked how much time they had available. Based on this data, projects were suggested, from which they could choose. Once they decided on a project, they were given the opportunity to gather further information about it, such as contact persons.

While the test group tested the "Mika" prototype, the control group received a presentation created with PowerPoint. This contained exactly the same projects and tasks, as well as the respective time slots, contacts, and additional links that were also implemented in the prototype. The design was kept simple and structured with one project with its time slots and tasks per slide. In contrast to the prototype, the presentation included an image relevant to the project on each slide. The participants in the control group were then presented with this presentation on a tablet for independent review. The task for the control group was: Find a task that suits you using the presentation provided.

5. Qualitative Evaluation

The explorative evaluation of the prototype was aimed at gathering feedback on the instantiated design principles. For this purpose, participants were instructed to verbalize their thoughts while interacting with the prototype. The interactions were recorded, transcribed and coded to ensure a complete evaluation of everything that has been said.

We employed MAXQDA, a text analysis software, for assessing the interviews. This software provides the option of assigning a code to individual text segments (coded segments). The codes were derived inductively and were grounded in data after examining the interview transcripts, leading to the subsequent formation of categories (Kuckartz & Rädiker, 2019).

5.1. Study Structure

In total, 60 participants took part in the user test, with half of them testing Mika and the other half testing the presentation.

The test group consisted of 31.82% employees and 68.18% students from the TU Braunschweig. The age range was from 19 to 37, with an average age of 26.09 years. 36.36% of the participants were female and 63.64% were male. The control group consisted of 19.05% employees and 80.95% students from the same university. The age range in this group was from 20 to 35, with an average age of 24.04 years. In this group, 35% of the participants were female and 65% were male. Throughout the analysis of the transcribed interviews using MAXQDA, we coded 14 hours and 42 minutes of transcript. Of these, 5 hours and 46 minutes were coded for the test group. The shortest speaking duration was 2 minutes and 59 seconds, while the longest was 36 minutes and 35 seconds, with an average of 12 minutes and 21 seconds. The speaking portions of the control group lasted a total of 8 hours and 56 minutes, with an average duration of 16 minutes and 45 seconds.

5.2. Results

During the evaluation, the statements from the participants were assigned to a total of eight categories. Subsequently, the DPs were allocated to the items of the test group. In every category, positive and negative comments were identified in both groups. Furthermore, some additional points were noted that could not be evaluated in both of the groups. The main findings can be found in table 2.

In the design category, only DP3 and DP4 were identified. These related to the additional links provided to enhance the explanation of sub-steps and to structure the conversation. Although both groups had access to these links, only the test group positively noted them as a helpful feature, while the control group did not notice them at all. Nevertheless, some participants from the test group pointed out that the links to the project pages or additional information might inadvertently lead users to other sites, diverting their attention and potentially causing them not to

return to the interaction with the companion. Since Mika was integrated into Slack, the design was dictated by the messenger platform itself. The presentation's design was kept simple to ensure that the visual element remained in the background. 3.33% of the test group mentioned that the design was too minimalist

Category	Control group - presentation	%	Test group - Mika	%	Related DP
Design	(+) Picture	10,00%	(+) Picture	/	-
	(+) Additional links	0,00%	(+) Additional links	23,33%	3, 4
	(-) Design too minimalistic	40,00%	(-) Design too minimalistic	3,33%	-
	(-) More (suitable) pictures	53,33%	(-) More (suitable) pictures	10,00%	-
		/	(+) Buttons instead of typing, preset topics	13,33%	-
		/	(+) Keywords highlighted in bold	10,00%	-
		/	(+) Neutral name	6,67%	-
		/	(+) Appearance of Mika (Humanoid)	6,67%	-
		/	(-) Simulate typing/slower chat	33,33%	-
Information	(+) Gaining an overview	40,00%	(+) Gaining an overview	30,00%	3-5
	(+) Information is sufficient	13,33%	(+) Information is sufficient	43,33%	3, 4
	(-) Tasks too general	20,00%	(-) Tasks too general	6,67%	1, 3
	(-) Information seems too general	50,00%	(-) Information seems too general	6,67%	1, 3, 4
	(-) More information is needed	93,33%	(-) More information is needed	13,33%	1, 3
Matching	(+) Hours required/Time specification	6,67%	(+) Hours required/Time specification	50,00%	2, 3
	(+) Topic selection	0,00%	(+) Topic selection	26,67%	2, 3
		/	(+) Matching is good	20,00%	2
		/	(-) Add more topics/headings and levels; be able to select multiple topics	40,00%	3, 4
Structure	(+) Summary/structuring of information	16,67%	(+) Summary/structuring of information	56,67%	3-5
	(-) Lack of structure	13,33%	(-) Lack of structure	0,00%	3-5
Value	(-) Unclear goal/task	33,33%	(-) Unclear goal/task	6,67%	1, 3, 5
	(-) Unclear value/functions	13,33%	(-) Unclear value/functions	16,67%	3-5
	(-) No value compared to internet research	20,00%	(-) No value compared to internet research	6,67%	5
		/	(+) Email with summary	20,00%	3
		/	(+) Time saving through Mika	16,67%	3, 5
Language	(-) Texts do not motivate	23,33%	(-) Texts do not motivate	0,00%	-
		/	(+) Emojis	20,00%	-
Technology	(-) Presentation is an unsuitable medium	26,67%	(-) Slack is an unsuitable medium	6,67%	-
		/	(-) Technical problems	33,33%	-
		/	(-) Back button for individual layers	23,33%	-
Behavior	(-) Personal component missing	20,00%	(-) Personal component missing	3,33%	-
		/	(+) friendly behavior	16,67%	-
		/	(+) Personal interaction/human behavior	33,33%	-

Table 2: Summary of the Evaluation.

compared to 40% in the control group. Even though Mika did not present any images, notably fewer of the participants from the test group, in comparison to the control group, expressed a desire for more pictures. Furthermore, one-third of the test group expressed a preference for a slower chat, simulating a scenario where Mika appears to be thinking before responding.

Regarding the provided information, all DPs were identified. 43.33% of the test group indicated that the information provided was sufficient, and only 13.33% expressed a desire for more information. In contrast, the proportion in the control group who found the information adequate was lower at 13.33%. However, almost all participants in the control group desired additional information.

In terms of the matching category, DP2, DP3, and DP5 were notably identified. Half of the test group particularly liked the specific time indication or the number of hours required for the assigned task. Although this information was also provided to the control group, the proportion appreciating it was significantly lower in that group. It is also worth noting that 40% of the test group negatively commented on the need for more topics and subcategories to enhance the matching process.

Concerning the structure, we identified DP3, DP4, and DP5, as these specifically address the division of sub-steps and the structure of the conversation. The structuring and summarizing of information were rated positively by 56.67% of the test group. In the control group, only 16.67% of the participants noted this point. On the other hand, 13.33% of the control group pointed out the lack of structure.

In the value category, all DPs were identified since each targets the value and use. In terms of value, at the end of the user test, 6.67% of the test group were not clear on the exact goal or task of the assigned project. In the control group, this was 33.33%. Positively, the test group noted that using Mika can save time when searching for a suitable project in comparison with searching on the internet.

The last three categories are not covered specifically by the DPs. Regarding language, 23.33% of the control group noted that the texts did not motivate them to participate in projects because they lacked a personal address and merely listed the tasks. This was not the case in the test group.

During the user test, one third of the test group encountered technical problems with the internet, as well as with the Slack platform, which the participants considered negative. Since the presentation was also usable offline, there were no issues with that. Nevertheless, only 6.67% found Slack to be an unsuitable medium, while 26.67% considered the presentation as an unsuitable medium.

From the test group, 3.33% noted that the personal component is missing in the interaction with Mika. Furthermore, one third of the test group found the interaction with Mika to be personal and positively noted the human-like behavior of the companion. In the control group, 20% noted the absence of the personal component, especially because it is considered important for the participation process.

6. Discussion

The provided results offer insights into the applicability of the design principles developed in previous research. DP1 emphasizes the need for transparency and purposefulness, requiring the clear articulation of the participation opportunity's goal, the time needed, and the content involved. This principle particularly emerged in the category "information". In this study, a dramatic difference was observed between the test group and the control group. While only a small portion of the test group expressed a desire for more information, almost all participants in the control group wanted more details regarding the participation opportunity. However, the difference between the two groups concerning the adequacy of the information provided was much less pronounced. This can likely be attributed to the fact that the test group received information incrementally, slowing down the information dissemination process, while the control group had all the information at once and therefore knew directly that it was limited. In summary, Mika performed significantly better in this area compared to the presentation. This implies that although some participants would like more information, the issue is much less prominent in the context of Mika than when using the comparison system. Since the desire for more information and a clear goal has been identified as essential for the motivation to participate, DP1 can be considered relevant.

DP2 suggests integrating a matching algorithm to promote autonomy, relatedness, and competence, recommending different participation opportunities based on the users' interests, skills, and available time. In the area of matching, the aspect of time was positively rated by half of the test group. Although the time specification was also present in the presentation, it was much less noticed there. The reason for this might be that Mika suggests a specific subtask at the end, making the aspect of time appear significantly more important. In the presentation, the user searches for a task themselves, which is why the time expenditure relative to the content of the task becomes less prominent. The same applies to the suggested overarching topics of the individual projects. In addition, some of the participants even found and

described the matching as directly suitable. This shows that the prototypical matching performed by Mika is already producing good results and users are reacting positively to the allocation, which means that DP2 is considered to be relevant for designing a PaCo.

DP3 proposes the breakdown of participation tasks into understandable and accessible sub-steps to enhance self-efficacy and autonomy. This principle was addressed by the participants most frequently. In the areas of information, structure, and matching, there was positive feedback, which shows that the participants basically have all the information and functions available to independently decide which task suits them. However, in the prototypical implementation, it was not possible to switch between individual levels of the conversation. This created a feeling of loss of control among the participants, which negatively affects self-efficacy and autonomy. For this reason, it is imperative that the user be given more control over the progression of the conversation, which is also associated with DP4.

DP4 underscores the systematic, logical, and intuitive design of conversation, which helps introduce the participation scenario by explaining the functions, contents, project details, and inquiring about the user's interests and skills. The structuring of the conversation was perceived as very positive. Compared to the control group, it was observed that the participants showed significantly less confusion when using Mika and asked fewer questions during the user tests. As mentioned before, the participants felt a loss of control over the conversation as it was not possible to switch between layers or edit answers. For this reason, DP4 should be supplemented to increase the effectiveness of this principle. We suggest the following refined DP4: *For designers and developers to design a PaCo that introduces the participation scenario to the user the conversation must be designed systematically, logically and intuitively by explaining the functions and contents of the PaCo, introducing the participation project and then asking about the user's interests and skills as well as granting the user full control over the conversation.*

DP5 encourages clear articulation of goals, creation of incentives like community, commitment, and certificates, and offering a unique value proposition over traditional internet research to enhance value and motivation for participation. The value creation through Mika was achieved by structuring the information, simplifying the process of searching for a suitable project. When providing a general overview, the difference between the test group and the control group was relatively small, with more positive remarks from the control group. It was especially noted that the presentation displayed all available information on a single slide, providing a good overview. However, for a majority of the control group, the precise objective or value of the task remained unclear by the end. In comparison, Mika performed significantly better, and its structuring of information was evaluated positively. Additionally, some of the participants mentioned the time savings gained through Mika, which represents a solution with respect to the general problem (no participation due to lack of time). In summary, Mika was able to provide added value, facilitating an entry into the project and simplifying the search process compared to internet research and therefore considering DP5 as relevant.

When reviewing the existing DPs, it is noticeable that the area of the character of the PaCo has not been part of the principles so far. Although there is already much research and design knowledge regarding the design of companions (Seeger et al., 2021; Strohmann et al., 2022) and the influence of emotions on VC design (Meyer & Strohmann, 2019), and this is generally applied as a basis in design, for a true PaCo, which enters into as real and valuable a relationship as possible with the user, an additional DP needs to be added. This should specify the appearance, behavior, and language of the PaCo while considering the understanding and showing of emotions by the PaCo. Based on our evaluation, we therefore suggest DP6: *For designers and developers to design a PaCo that that enters into a valuable and friendly relationship with the user must base the design of language, behavior, and appearance on fundamental design knowledge regarding virtual companions in order to promote a sustainable relationship, increase the use and value of the companion, and thereby support and encourage participation.*

There are some limitations that need to be considered. Since Mika could only receive and use predefined responses, the conversation was limited and lacked user control. Furthermore, the matching process could be enhanced by querying more of the users' needs to identify even more appropriate tasks for the participating individual. Both aspects could be improved through the targeted use of AI. This AI could, for example, utilize a database containing all participation opportunities, including their tasks, time requirements, and contact persons. In this way, much more information could be conveyed freely, eliminating the need for a predefined conversational path. The application context of the study is the campus. Although one can assume that the fundamental drives and needs concerning participation are generally similar, it needs to be verified whether the PaCo can also establish itself in larger contexts, such as participation in cities. The most crucial point is the design of the PaCo itself. The current findings mainly relate to the content of the conversation and the

content-related aspects that promote motivation. The aspect of forming a friendship with the Companion to foster sustainable participation has not been investigated. Further studies should also explore the impact of trust in the PaCo on participation.

7. Conclusion

In addressing the existing gap in design knowledge for Virtual Companions that facilitate bottom-up participation, our prior research led to the derivation of five reflective design principles. These principles were instantiated in a prototype and subjected to a qualitative evaluation. Our findings revealed that the principle including the conversation structure (DP4) needs to be supplemented with the aspect of control to enable true autonomy. In addition, another principle must be added, which specifies the behavior, appearance, and language of the PaCo in order to achieve a real and valuable relationship. In summary, the DPs could thus be improved and expanded and therefore provide a design foundation for further implementations. Future work should encompass an implementation phase that transcends the prototype stage, enabling the execution of longitudinal studies. It is also imperative to investigate the applicability of the acquired design knowledge across various domains, with particular emphasis on its relevance to civil participation.

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