Under Pressure? - The Effect of Conversational Agents on Task Pressure and Social Relatedness in Digital Labor

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Completed Research Paper

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Abstract

Digital labor platforms (and many other digital workplaces) can be anonymous, isolated, and lacking social interaction. In this context, implementing conversational agents (CAs) to provide social presence and relatedness could be a remedy. However, based on research in the context of human-to-human interaction, two counteracting effects of CAs' social presence can be derived. First, social presence and social relatedness induce enjoyment. Second, social presence can lead to a perception of task pressure, which reduces enjoyment. We conducted a three-condition online experiment with 269 participants from a commercial digital labor platform to investigate these effects. Our results show that social presence directly leads to social relatedness and enjoyment, and indirectly to task pressure. However, this perceived task pressure does not reduce enjoyment and only positively effects performance. Thus, it appears that introducing CAs as part of digital labor platforms is a win-win situation for users and work.

Keywords: Conversational Agents, Social Presence, Digital Labor, Task Pressure, Enjoyment, Performance

Introduction

Workplaces and working are becoming increasingly digital (Dery et al., 2017; Mousavi Baygi et al., 2021). New types of working environments and self-employment have developed through digitalization, such as online freelancing (e.g., via Upwork or Fiverr) or digital labor/crowd working (e.g., via MTurk or Clickworker), which have changed how many people work and earn wages (Durward et al., 2020; Ilo, 2020). For instance, workers on digital labor platforms can browse work offers, such as labeling a set of images, from many different clients and select the tasks they prefer to do for the offered reimbursement (Brawley & Pury, 2016; Deng et al., 2016). Instead of long-term employer and employee relationships, working together with co-workers, or earning pay rises based on good work (Backes-Gellner & Tuor, 2010), digital labor is characterized by individualism, anonymity, short-term interactions, and reimbursement based on supply and demand (i.e., when many workers are available and capable of doing a task, the reimbursement rate will be relatively low (Berg, 2016; De Stefano, 2015)).

In this context, interest in conversational agents (CAs), such as voice assistants and chatbots, has developed as part of the digital work environment (Meyer von Wolff et al., 2019). CAs are referred to as "software-based systems designed to interact with humans using natural language" (Feine et al., 2019, p. 1). CAs have been applied for many tasks in the digital workplace, including onboarding (Zumstein & Hundertmark, 2017), learning (Mikic et al., 2009), and information acquisition (Reshmi & Balakrishnan, 2016). One key feature of CA, distinguishing them from traditional graphical interfaces, CAs can be designed to appear humanlike by equipping them with so-called social cues (e.g., human name, greeting users, and using emoticons (Feine et al., 2019)). This humanlike design induces a perception of social presence, which can be understood as the perception of interacting or being in the presence of a social agent (commonly another human) (Nass et al., 1994), which has been reported to have various benefits (Diederich et al., 2022), such as increasing users' enjoyment (i.e., increasing perceived fun during an interaction) (De Cicco et al., 2020) and intention to use the CA (Chung et al., 2018). In the context of digital labor being characterized by anonymity and social isolation (Marsh et al., 2022), implementing a CA could be a potential remedy by offering a means of social relatedness (i.e., by establishing an "interpersonal" interaction).

However, based on existing research in the human-to-human context, the social presence of others can also have effects that counteract the positive effects of feeling social relatedness and subsequent enjoyment. As outlined above, on the one hand, people enjoy social interaction (Cacioppo & Patrick, 2008) and desire social relatedness (Baumeister & Leary, 1995). On the other hand, especially in work environments, the presence of others can also lead to a perception of pressure (i.e., perceived expectations to complete tasks, perform, and/or work well), which has been shown to reduce enjoyment (Wallace et al., 2009) but increase performance[1] (Hetland et al., 2022). However, research lacks empirical evidence on this potential paradoxical effect (increasing and also decreasing enjoyment at the same time), although research on this phenomenon would provide important theoretical implications regarding human-CA interactions on digital labor platforms. Against this background, we formulate the following research question:

> **RQ:** *How does a conversational agent's social presence influence users' enjoyment and performance?*

To answer this research question, we conducted a three-condition online experiment with 269 participants from a commercial digital labor platform (Clickworker). The experiment emulated an image labeling task. The three treatments were: (1) interacting with a humanlike designed chatbot, (2) interacting with a non-humanlike designed chatbot, and (3) interacting with no chatbot during the task completion process.

Based on CASA (computers are social actors, i.e., the tendency of individuals to treat computers as social actors) (Nass et al., 1994) and Social Response Theory (Nass & Moon, 2000), we derive a research model that entails how social presence influence enjoyment and performance via a pro-user and pro-task route. Regarding the pro-user route, we hypothesize that social presence leads to social relatedness and enjoyment. For the pro-task route, we hypothesize that social presence induces task pressure, facilitating performance (e.g., completing more tasks than required). Furthermore, regarding the interrelations of both routes, we hypothesize a positive effect of social relatedness on task pressure, a negative effect of task pressure on enjoyment, and a positive effect of enjoyment on performance.

In this context, our results support our theorizing that social presence simultaneously leads to pro-users and pro-task effects. Specifically, social presence leads to social relatedness, which leads to enjoyment. However, social presence does not directly lead to task pressure, but via social relatedness it does. Furthermore, task pressure leads to higher performance but does not reduce enjoyment. Lastly, enjoyment appears not to increase performance. Overall, our results reveal that humanlike designed CAs as part of digital labor platforms could be win-win situation: it leads to pro-task (increased performance) and pro-user outcomes (higher enjoyment), without any counteracting effects.

Research Background

In this study, digital workplaces are understood as work arrangements where employees perform their work not onsite (e.g., working in an office building that is rented or owned by the employer), instead, it can be completed from anywhere. Common examples are mobile work (i.e., working from anywhere (Chatterjee et al., 2017)) and freelancing on digital platforms (Watson et al., 2021). In this context, increasing importance can be attributed to digital labor – often also called crowd working (Durward et al., 2020; Ilo, 2020). In crowd working, companies, institutions, or individuals can outsource task requests to a crowd (i.e., an undefined body of individuals, teams, or companies) on an online platform (Howe, 2006; Morschheuser et al., 2018). These requests can be completed by individuals from the crowd (crowd workers) for a predefined

[1] Performance in this study is understood as the number of completed tasks.

payment. Although this type of work promotes flexibility, it lacks social interaction with others, appreciation (e.g., positive feedback or pay raises), or communication with decision-makers in case of uncertainties (Brawley & Pury, 2016). In this context, the application of CAs could be seen as a valuable means to provide workers with the desired social interaction.

CAs are IS that allow interaction between humans and machines in natural language (Diederich et al., 2022). Commonly, CAs in business contexts are applied as customer interfaces, providing customer support and helping with information acquisition (Meyer von Wolff et al., 2019). For instance, they are used in processes of returning goods, answering FAQ, or general service requests, such as signing new contracts or opening new bank accounts (Adam et al., 2021). The advantage of this technology is cost and time saving by automating processes or responding to a flood of requests that otherwise could not be handled (Zumstein & Hundertmark, 2017).

In the digital workplace, CAs are primarily used to gather information or outsource tasks (e.g., a CA forwards questions to Google and displays the results in the dialog) (Meyer von Wolff et al., 2019). Using CAs to directly support employees, such as in training them or freeing up personnel for other tasks (Mikic-Fonte et al., 2009), happens only rarely (Meyer von Wolff et al., 2019). Another emerging example is that in performing tasks, instead of using a complex graphical interface, employees can retrieve data from the internet/databases by interacting with a CA (Meyer von Wolff et al., 2019). Further, CAs can take over the communication of appointments in planning meetings, or help with task assignment in groups, thereby ultimately leading to higher productivity (Toxtli et al., 2018).

Regardless of the application areas, CAs have the ability to induce a perception of social presence (i.e., CAs can be perceived as social actors, similar to a human (Diederich et al., 2022; Nass et al., 1994)). This perception is prompted in users by equipping CAs with social cues (i.e., the capability "of sensing and expressing several multimodal verbal and nonverbal characteristics usually associated with humans" (Feine et al., 2019, p. 1)), including giving them a humanlike name and avatar, or using emoticons. These social cues trigger anthropomorphism in humans, i.e. the perception of social presence in a CA (Dacey, 2017). In this context, CASA paradigm (Nass et al., 1994) and the social response theory (Nass & Moon, 2000) explain that the perception of a social presence leads users to react to the CA as they would to another human, which includes affective responses. For instance, current research has found that CAs can increase enjoyment (Lee & Choi, 2017) or satisfaction with training (Diederich et al., 2020), which in the digital workplace. Research on this application area remains scarce, and first studies on this topic have only recently emerged. For instance, Sadeghian & Hassenzahl (2022) work on increased work satisfaction when accompanied by an artificial colleague. Similarly, Dennis et al. (2023) studied the influence of CA team members on the satisfaction, conflicts, trustworthiness, and willingness to work with.

Research Model and Hypotheses

In this study, we distinguish between pro-users and pro-task effects. Pro-user effects are positive regarding users' cognition, emotions, and behavior (similar to Benbasat (2010) understanding of agenda-driven IS). For instance, users experience higher enjoyment, their needs are fulfilled, or they are motivated to take care of themselves (e.g., exercising more to get healthier). Examples are Apple's fitness app or Duolingo for learning (Huynh et al., 2016) with the primary aim to support ones goal achievement. In contrast, pro-task effects are related to the task, work, and the overall goal behind it (e.g., working to produce profits for the company) (similar to Benbasat (2010) understanding of neutral IS). For instance, workers produce higher quality results, complete more task per hour, or are more creative. An everyday example is Microsoft's Excel, which enables workers to generate and calculate spreadsheets faster. In this context, it is important to note that pro-user and pro-task effects are highly intertwined, for instance, feeling enjoyment during a task leads to higher motivation and related task performance (e.g., providing gamification elements as part of a work environment (Warmelink et al., 2020)).

Against this background, this study's aim is to understand how the social presence of CA influences users regarding pro-user (feeling social relatedness and enjoyment) and pro-task (feeling task pressure and increasing performance) effects in digital labor. We formulate a set of hypotheses based on CASA (Nass et al., 1994) and Social Response Theory (Nass & Moon, 2000). Figure 1 illustrates and summarizes the included constructs, their relations, and the set of derived hypotheses. The postulated relations of the constructs will be derived based on recent literature and analyzed regarding the impact of our treatment conditions throughout the whole model (e.g., social presence influence relatedness which influences task pressure). In the following paragraphs, we provide the reasoning behind our research model.

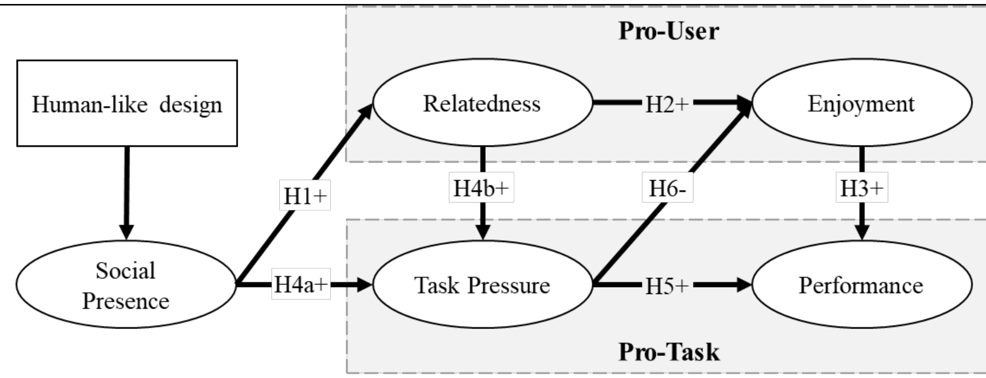


Figure 1. Research Model

Social Presence

CAs can be equipped with social cues to appear more humanlike (Feine et al., 2019). Social cues can be divided into three categories: human identity as in a name and gender (Cowell & Stanney, 2005; Gong, 2008; Nunamaker et al., 2011), verbal communication as in greeting and self-disclosure (Cafaro et al., 2016; Schuetzler et al., 2018), and non-verbal communication as in dynamic response delay (Gnewuch et al., 2018). These social cues trigger the inherent human tendency to perceive humanness in objects and animals, called anthropomorphism (Dacey, 2017). Following CASA (Nass et al., 1994) and the social response theory (Nass & Moon, 2000), the perception of humanness also leads to a perception of social presence in computers, including CAs. In general, social presence is understood as an individual's degree of perceiving other social entities around them (Biocca & Harms, 2002). In summary, equipping a CA with social cues leads users to perceive a CA as a social actor, to which they behave similar to another human (Nass & Moon, 2000).

In CA research, various studies support relating humanlike design to users' perception of social presence. For instance, assigning a humanlike name to a CA gives it a human identity (Feine et al., 2019). Similarly, Gnewuch et al. (2018) find that CAs with response delays similar to the time humans needs to process and respond to speech, increase perceived social presence. Also, Diederich et al. (2019) show that chatbots responding empathically, as in differently tailored responses if users expressing anger, increased the perception of humanness. Thus, we utilize two alternative CA designs to elicit various levels of social presence to test our theory and hypotheses yet focusing on the social presence our participants experience and its influence on pro-task and pro-user outcomes.

Pro-User Route

Based on the CASA paradigm (Nass et al., 1994) and social response theory (Nass & Moon, 2000), users tend to respond to the perception of a social presence of a CA similarly to their interaction with a human, so that they apply related cognitive and behavioral patterns, such as saying "thank you" to a CA (Burton & Gaskin, 2019). Regarding the work experience of an individual and a CA collaborating, the presence of a social actor should lead users to experience a more supportive and friendly environment (Love et al., 2007). This experience could bring fulfillment of the human's need for relatedness, which is defined as the human desire for interacting, connecting, and experiencing other humans (Deci & Vansteenkiste, 2003).

Current literature provides related evidence. For example, individuals feel more related to a CA (during task completion) when the CA is designed with a social presence (i.e., humanlike) (Sadeghian & Hassenzahl, 2022). Another example is "Boomer", a robot designed to detonate explosives. Smids et al. (2020) report that soldiers working with the robot related to it due to their shared work environment. They also attributed a personality to it, which led them to give it a funeral after being destroyed (Carpenter, 2016). However, all examples above give a small indication what could be achieved with a CA during a short interaction in a digital work environment. Thus, we hypothesize:

H1: Perceived social presence increases relatedness.

Enjoyment is generally understood as perceiving an activity as fun (Ryan & Deci, 2000). Individuals tend to experience more fun together with others, for instance, because the received feedback and feel relatedness (Csikszentmihalyi & Csikzentmihaly, 1990; Puca & Schmalt, 1999). Hence, we propose that fulfilling the human need for relatedness via a CA can drive enjoyment (Balakrishnan & Dwivedi, 2021; Deci & Ryan, 2000; Högberg et al., 2019). Literature supports this assumption. Forest et al., (2011) conducted a study to analyze the relation between relatedness and enjoyment in work activities. They reported that satisfying the need for relatedness mediates the perceived enjoyment of working. Further, Van den Broeck et al., (2009) questioned employees to validate the urgency of satisfying individuals' needs to achieve (among other things) enjoyment. They found that satisfying relatedness fosters well-being and marks an essential aspect of increasing enjoyment and commitment. Against this background, we formulate the following hypothesis:

H2: Relatedness increases enjoyment.

For crowd working/digital labor platforms, performance can be understood as the total number of successfully completed tasks (Lichtenberg & Brendel, 2020). Regarding how performance and enjoyment are related, enjoyment has been shown to drive behavior (Ryan & Deci, 2000). Enjoying something is a strong predictor of doing it repeatedly (Deci & Ryan, 2000). For instance, Kuvaas (2006) surveyed bank employees and found that work enjoyment increases work performance. Hence, in the context of our study, enjoyment can be expected to increase performance. In context of CA research, Fasola & Matarić (2010) showed how introducing a "socially assistive robot" to support task performance, increased the interacting individual's enjoyment, which ultimately led to increased performance. Thus, we hypothesize:

H3: Enjoyment increases performance

Pro-Task Route

Completing tasks while other people are present feels different to completing tasks alone (Todorova et al., 2008). For instance, when working with others, one can feel the pressure to perform, meaning that one is aware that others are watching and expecting completion of the task in an effective and efficient manor (Aiello & Douthitt, 2001). This effect has various names, such as work (Hetland et al., 2022) or performance (Gardner, 2012) pressure, depending on the context (e.g., the terms work or performance pressure are commonly used to describe the general perceived pressure as a worker in a company (Gardner, 2012)). In this paper, we speak of task pressure to distinguish the pressure felt during completing a task (i.e., a contained short-term event) from long-term pressure (i.e., the daily felt pressure to work and perform well); because a task is what is completed on crowdworking platforms and, therefore, task pressure describes the pressure workers perceive during that single task (i.e., the pressure to complete that single task well).

In literature, some studies report on the effect of the presence of others on task perception and performance. For examples, Markus (1978) reported that mere presence of another person while competing tasks (even when the persons solved tasks themselves) led to improved performance on well-learned tasks and hindered performance on transfer tasks. Similarly, Ukezono et al., (2015) found that the mere presence of others during a task is sufficient to enhance task performance. However, no such evidence exists for the context of CAs. Nonetheless, because CAs can be perceived as social actors similar to human agents (Nass et al., 1994), we expect the CA's presence to lead to a similar effect. Against this background, we formulate the following hypotheses:

H4a: Social presence increases task pressure.

H4b: Relatedness increases task pressure.

In general, humans want to fulfill the expectations of others (Goffman, 1956). Feeling task pressure is a strong driver of human behavior (Graves et al., 2012) because the individuals want to fulfill the perceived expectations of others. Various studies report on this relation in the context of human-to-human interactions. For instance, Chen & Klimoski (2003) find that performance expectations (i.e., of new team members) and expectations of others (i.e., existing team members) have a positive impact on performance.

Furthermore, Kierein & Gold (2000) find that leader expectations implicitly induces task expectations of oneself and thus increase performance. Similarly, Bond and Titus (1983) report that perceived pressure increases performance for simple tasks. Thus, we formulate the following hypothesis:

H5: Task pressure increases performance.

Feeling pressure is generally a negative state of mind (Svenson & Maule, 1993). The thought of being not able to fulfill the felt expectations of others (i.e., feeling task pressure but not being able to perform accordingly) leads to negative emotions because of the perception to have failed (Schlenker & Leary, 1982). In context of this study, the implemented task is easy to do but the system does not provide any concreate feedback on how well the labeling task was completed (e.g., how many pictures were labeled correctly). Hence, there is no explicit way to tell if someone is failing or not, which is normal for labeling tasks; images are labeled because it is not clear what is depicted (for instance, to train an algorithm (Durward et al., 2020)). Hence, this ambiguity and inability to assess the own performance can be expected to lead to negative emotions. Furthermore, Eisenberger & Aselage (2009) found that individuals with jobs that are concerned with innovations and creativity are positively impacted by task pressure. In contrast, their results suggest that for individuals that perform a mondain and rather boring task, pressure should have negative effects. Because we implemented a task that is simple and repetitive, it should lead to lower levels of enjoyment, when perceiving task pressure. Following both argumentations, we formulate the following hypothesis:

H6: Task pressure reduces enjoyment.

Methodology

Participants

In total 259 people took part in our experiment (ten had to be removed due to failing attention checks). The participants were recruited via clickworker. Females make up 46.22% of the sample. The participants' ages ranged from 18 to 69 years old (mean 35.89). 40% were residing in the US and 60% in Germany. We designed the task to take 15 minutes and compensated the participants with $2.50 each (generally compensation is based on time with $0.15 per minute required to complete a task (Lovett et al., 2018)). On average, the entire experiment took participants 12:40 minutes.

Task and Procedure

As the experimental task, we selected an image classification task, as it is an common task on crowdworking platforms (Durward et al., 2020). In our experiment, four images had to be classified to fulfill one task (i.e., they images were presented, and a drop-down menu added to click the correct animal category) (see Figure 2). Before categorizing an image, all drop-down menus read "choose" so the participant could not proceed until each picture has been matched with a category. To proceed to the questionnaire, the participants had to complete five tasks (i.e., classify 20 images) but they could complete up to 30 tasks (i.e., classify 120 images).

Before stating the experiment, we provided every participant with exactly the same briefing information explaining the experiment (Alan R. Dennis & Valacich, 2001); however, the CA treatment groups received further information explaining how to interact (see Treatments section). At the end of the briefing document, we explicitly explained that participants had only to complete five tasks to proceed to the questionnaire, and that after finishing the questionnaire they received their payment. Further, we added three comprehension questions, including one asking how many tasks must be completed to receive the previously agreed payment. This was made to ensure that the participant had attended to the instructions. Participants who failed this test were excluded from the experiment.

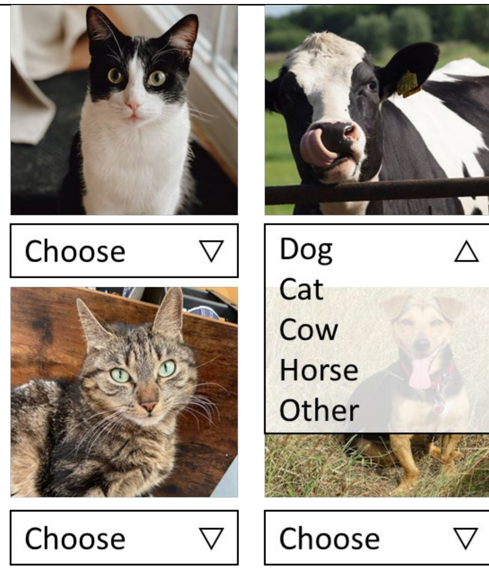
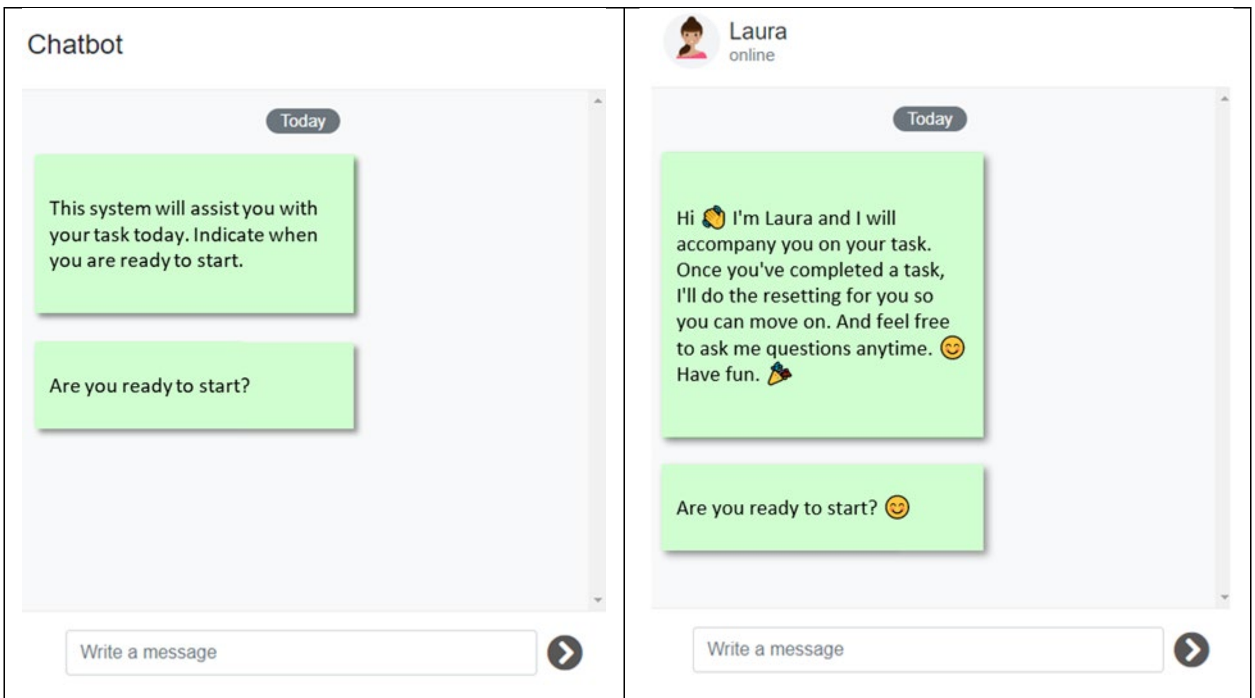


Figure 2. Illustration of Classification Task

Treatment

We implemented three treatments in our experiment: no CA (control treatment), a non-humanlike (see Figure 3A), and a humanlike designed CA (see Figure 3B).



A: Non-Human CA | **B**: Humanlike CA

Figure 3. CA Treatments

The design of the humanlike CA (i.e., having a name, avatar, greeting, emoticons and typing indication) is based on Feine et al., (2019) and reportedly increases social presence (Gnewuch et al., 2018). The participants were randomly assigned to one of the experimental conditions (between-subjects design). The

CAs were created using Google's natural language processing platform Dialogflow. The CAs were given the identical training words (examples of what users might say during an encounter) to help them comprehend the user's intent and respond appropriately. Thus, they were able to evaluate several variations of the same statement with the same meaning and extract factors, such as whether the user intended to start the next task or finish the experiment and could respond appropriately. Further, a custom-built web interface to make the CAs accessible, assuring device independence, and reducing distraction was designed (see Figure 3). The main purpose of the CAs were to navigate the experiment (i.e., no help or assistance was provided). Specifically, they started the first task and after the participants finished it, they confirm that the participants wanted to start the consecutive task (e.g., humanlike: "Do you want me to start the new task for you? 😊"; non-human: "continue?"). As the participants had to complete a minimum of five tasks to proceed to the questionnaire, a fallback message was introduced if an individual wanted to exit the experiment before fulfilling this requirement (e.g., humanlike: "You completed below five tasks. Thus, you cannot proceed to the questionnaire, sorry. 😔 So may I start the new round? 😊"; non-human: "Complete at least five tasks to finish."). After finishing the mandatory five tasks, the participants could proceed to the questionnaire by telling the CAs to finish, which the CAs commented differently (e.g., humanlike: "Okay, thank you very much. 😊 You will now be forwarded to the survey."; non-human: "You will now be forwarded to the survey").

Measures

All participants received the same questionnaire. We adapted measurement instruments established in the literature, namely, social presence (Gefen & Straub, 1997), task pressure (Eisenberger & Aselage, 2009), relatedness (Van den Broeck et al., 2009), and enjoyment (Teo et al., 1999).

Constructs and Items	TP	E	R	SP	Source
Task Pressure (a = .743, CR = .851, AVE = .658)					Adapted from (Eisenberger & Aselage, 2009)
I had to perform well	**.841**	.369	.427	.309	
I felt that I had to complete tasks	**.905**	.379	.401	.323	
I felt pressure to do well	**.670**	.145	.269	.231	
Enjoyment (a = .928, CR = .948, AVE = .822)					Adapted from (Teo et al., 1999)
I liked the task	.337	**.908**	.453	.187	
I enjoyed doing the task	.371	**.916**	.471	.217	
I found the task entertaining	.339	**.883**	.445	.343	
I enjoyed the task	.369	**.919**	.499	.356	
Relatedness (a= .901, CR = .938, AVE .835)					Adapted from (Van den Broeck et al., 2009)
During the task completion, I felt supported	.376	.445	**.923**	.438	
I felt understood during the completion of the task	.399	.424	**.914**	.452	
I felt appreciated while performing the task	.480	.534	**.903**	.486	
The system was personal relevant for me	.438	.339	**.627**	.481	
Social Presence (a = .900, CR = .931, AVE = .770)					Adapted from (Gefen & Straub, 1997)
I felt a sense of...					
...human contact with the system	.291	.234	.444	**.889**	
...personal relationship with the system	.297	.255	.452	**.896**	
...sociability from the system	.332	.310	.424	**.843**	
...human warmth from the system	.336	.261	.448	**.882**	

Note: that all items were translated to German for the experiment.
SP = Social Presence, TP = Task Pressure, R = Relatedness, E = Enjoyment

Table 1. Measures

Each item was measured on a 7-point Likert scale. We measured the outcome variable 'performance' as the number of completed tasks (i.e., the number of completed tasks equals how many times a participant categorized four images). We conducted a confirmatory factor analysis (CFA) to check the factor loadings of the items for each construct, to validate that the items had been selected appropriately. For our following analyses, we only considered items with a factor loading above .60 (Streiner, 2003). To be considered, a construct was required to have a value above .70 for Cronbach's α (a) and composite reliability (CR) (Cortina, 1993). Lastly, we calculated the average variance extracted (AVE), requiring a value larger than .50 (Urbach & Ahlemann, 2010). Table 1 summarizes the constructs with their corresponding items and the CFA factor loadings. The dependent variable performance is not depicted in the table because it was measured by counting the number of completed tasks per participant.

The measurement model includes manifest variables in terms of the experimentally manipulated variables, the performance, and reflective constructs (Table 2). We assessed the reflective measurement model of the variables for individual item reliability, convergent validity, and discriminant validity. The model displays sufficient measurement properties: all factor loadings are meaningful and significant, the CR is above .7, the AVE is above .5, and the Fornell–Larker criterion is satisfied.

(Latent) Variable	**1**	**2**	**3**	**4**	**5**	**6**
1. Task Pressure	**.811**					
2. Enjoyment	.392	**.906**				
3. Relatedness	.520	.537	**.825**			
4. Social Presence	.358	.305	.567	**.878**		
5. Performance	.175	.139	.065	.051	**n.a.**	
6. Humanlike design	.063	-.034	.096	.272	.055	**n.a.**

Table 2. Inter-Construct Correlations

Results

Treatment Validation

Before we tested our hypotheses, we did validation checks (one-way ANOVA to compare significant differences on the means of the constructs) and calculated the descriptive statistics for perceived social presence, performance and a manipulation check (*"I perceived the system as humanlike",* 7-point Likert scale) (see Table 3). First, a Levene test was conducted to test variance homogeneity (i.e., to test if all groups have the same variance) which was assured for social presence (F (2, 256) = 1.51, p = .224) and quality (F (2, 256) = 2.113, p = .123) but not for performance (F (2, 256) = 6.49, p = .002) and the manipulation check (F (2, 256) = 4.359, p = .014)). To further analyze performance and the manipulation check, a Welch test was conducted enabling a further analysis (performance: F (2, 168.533) = 4.677, p = .011; manipulation check: F (2, 168.533) = 4.677, p = .011). Based on both preconditions an ANOVA for social presence (F (2, 256) = 165.100, p < .001) and quality (F (2, 256) =1.257, p = .286), and a Welch-ANOVA for performance (F (2, 256) = 4.89, p = .008) and the manipulation check (F (2, 256) = 27.829, p < .001) were conducted. A Tukey HSD post-hoc test was conducted for all significant ANOVAs (i.e., all but quality) to compare the variables regarding their differences of means based on the assigned treatment. We find that the social presence is perceived the lowest for the control group (mean = 2.18), whereas the non-human treatment is significantly higher than the control group (mean = 2.80, p = .008) but significantly lower compared to the human treatment (mean = 3.6, p < .001). In contrast, the control group completed significantly more tasks (mean 18.44) compared to the non-human treatment (mean 13.74) – between the CA treatments, the performances did not differ significantly. Further, the means of the manipulation check was significantly different between all treatments (control group: 4.41, non-human treatment: 5.33, human treatment: 5.83). Lastly, we report more information about the participants per treatment group, namely: occupation, gender and age.

		Treatments				Statistical Analysis		
		All (N=259)	C (N=81)	NH (N=89)	H (N=89)	ANOVA	post-hoc comparison	
Manipulation Check	Mean SD	5,21 1.38	4.41 1.45	5.33 1.25	5.83 1.05	F (2, 256) = 27.829 p < .001***	C -> NH NH -> H	p < .001*** p = .021**
Social Presence	Mean SD	2.88 1.47	2.18 1.19	2.80 1.39	3.60 1.45	F (2, 256) = 23.621 p < .001***	C -> NH NH -> H	p = .008** p < .001***
Performance	Mean SD	15.59 10.34	18.44 10.81	13.74 9.53	14.83 10.24	F (2, 168.533) = 4.677 p < .001***	C -> NH	p = .008**
Quality (%)	Mean SD	99,16 3.12	99.03 3.01	99.52 1.14	99.32 1.76	no significant differences		
Occupation (%)	Student Employed Unemployed	15.9 65.9 18.2	14.1 68.5 17.4	17.0 59.6 23.4	16.8 69.5 13.7	-		
Gender (%)	Female	46	47	43	49			
Age	Mean SD	35.89 11.57	34.94 10.71	36.21 14.68	36.39 12.38			

*SD = Standard Deviation, C = Control Treatment, NH = Non-Human Treatment, H = Human CA Treatment; Significance levels: *p ≤ .05; **p ≤ .01, ***p≤ .001;*

Table 3. Descriptive Statistics of Task Performance

Structural Equation Modeling and Hypotheses Testing

We applied partial least squares (PLS) to evaluate the measurement model and estimate the structural model. In experimental research designs with latent variables, SEM is preferable to other methods because it can account for measurement errors and multidimensional structures of theoretical constructs (Bagozzi & Yi, 1989; Bagozzi et al., 1991) if latent variables are used. As the PLS estimator offers advantages in terms of fewer restrictive assumptions (Bagozzi et al., 1991), it finds broad application in experimental research designs (Fombelle et al., 2016).

For our structural model, we dummy-coded the treatments to compare the individuals that had a non-human-like CA interaction with the individuals that interacted with a human-like CA. As our analysis includes latent variables, we applied a structural equation approach. We used partial least squares path modelling and employed SmartPLS 4.0.8. In the following sections, we first inspect the measurement models and then estimate and interpret the structural model. Based on these results, we answer our hypotheses. We applied a bootstrap resampling procedure (with 5,000 samples) to test the relationships (see Figure 4). We found support for our first hypotheses, confirming that social presence increases relatedness (**H1**: β= .567, t= 10.709, p<.001), while task pressure is not influenced (**H4a**: β= .093, t= 1.118, p=.264). Additionally, we find a significant effect of relatedness on enjoyment (**H2**: β= .456, t= 6.584, p<.001) and task pressure (**H4b**: β= .467, t= 5.665, p<.001). However, task pressure has no influence on enjoyment (**H6**: β= .155, t= 1.931, p=.054). Next, the impact of task pressure on performance was analyzed supporting our hypothesis 5 (**H5**: β= .178, t= 2.008, p=.045). Lastly, we found no support for the impact of enjoyment on performance (**H3**: β= .103, t= 1.214, p=.225). The R^2 values were .074 for social presence, .064 for performance, .276 for task pressure, and .305 for enjoyment and .322 for relatedness. All values are above the threshold of (Cohen, 2013), indicating sufficient explanatory power of our model for all constructs.

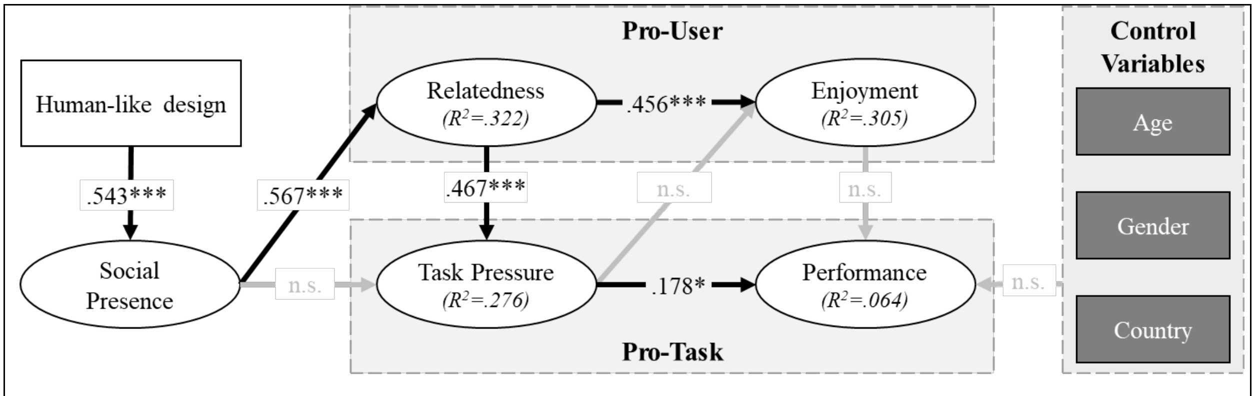


Figure 4. PLS Structural Model

The effect of the humanlike treatment on the outcome variables enjoyment (β = -.004, p < .974) and performance (β = .161, p < .265) was insignificant. Regarding the mediation of social presence on the outcome variables, the total effect on enjoyment (β = .304, p < .001) and performance (β = .304, p < .001) was significant (Both direct effects were insignificant (social presence on performance (β = -.055, p = .476); social presence on enjoyment (β = -.014, p = .841)). Then, the indirect effects of social presence via relatedness on enjoyment (β = .263, p < .001) was significant, making it fully mediated. In contrast, the relation of social presence on relatedness on task pressure on performance (β = .052, p = .065) was not significant.

Discussion

In general, many digital workplaces (e.g., digital labor platforms) can be described as anonymous and highly individualized, lacking the social component many traditional work environments have, such as social interaction with co-workers (Moussawi & Koufaris, 2015). To counteract this, introducing CAs as interfaces in work-related tasks provides a potential remedy (Sadeghian & Hassenzahl, 2022). However, it remained unclear what influence CAs have on workers. Potentially, social presence could lead to social relatedness, which increases enjoyment, and task pressure, which decreases enjoyment. Against this background, we examined how the perceived social presence of a CAs influences the perceived social relatedness and perceived task pressure of users. Furthermore, we examined how both perception influence users' enjoyment and performance.

In summary, our results suggest that introducing a humanlike CA to digital work environments leads to pro-user (feeling social relatedness and enjoyment) and pro-task (higher performance) without any counteracting effects. On the one hand, it functions as a pro-user element, improving workers' experience, fulfilling their need for relatedness and leading to feelings of enjoyment. On the other hand, the perception of social relatedness also leads to a feeling of task pressure, which increases performance (i.e., participants completed more tasks then necessary). However, task pressure does not reduce enjoyment, which goes against indications that the social presence might have paradoxical effects – increasing and decreasing enjoyment simultaneously.

Implications for Theory and Future Research

First of all, we would like to highlight that we find an indirect effect of social presence on enjoyment via relatedness, supporting our expected pro-user pathway of social presence. Hence, social presence appears to have the desired effect to provide social relatedness, which is enjoyable, at the digital workplace that is characterized by isolation and anonymity (Jiang et al., 2013; Wood et al., 2019). This result opens up new avenues for future research. Specifically, we see value in investigating how specific social cues and the portraying of certain personalities influence users' perception of social relatedness. For instance, CAs portraying an empathetic personality have shown to influence users' cognition, emotion, and behavior (Diederich et al., 2019; Seitz & Bekmeier-Feuerhahn, 2021). Such a personality would provide emotional support, which should lead to even greater perception of social relatedness. However, designing CA to display empathy is challenging (Diederich et al., 2019), therefore, it is necessary for future research to investigate different ways to equip a CA with social cues that express empathy and feel genuine, providing the desired social relatedness.

Our results do not show an effect of enjoyment on performance, which goes against our prior hypothesizing. Specifically, we build upon the results of various studies (Graves et al., 2012; Puca & Schmalt, 1999) that show that enjoying a task is a great predictor of behavior (i.e., doing more task, completing them quicker, and spending more effort to provide them in high quality). In our study, we measure performance as the number of completed task (we required participants to complete 5 tasks and they could complete up to 25 tasks more) and enjoyment did not significantly increase the number of completed task. Against this background, we would like to propose the following explanation: the enjoyment of the task was driven by the social relatedness and other reasons for enjoyment were not present (e.g., the task was too simple to induce a perception of mastery, which lead to enjoyment (Deci & Ryan, 2000)). Thus, enjoyment derived from social interaction with a CA appears to be different from other forms of enjoyment. Specifically, it was "fun" to interact with the CA and not to complete the task. In this context, future research should engage in testing our explanation. For instance, future research could implement more difficult tasks (e.g., labeling picture that are difficult to decipherer) or tasks that are very boring (e.g., slider tasks (Charness et al., 2018)) in a similar experimental setup as applied in this study to investigate how the relation of enjoyment and performance changes depending on the humanlike design of a CA and the characteristics of the task.

We find that social presence does not lead to increased task pressure but social relatedness does. This goes against parts of our prior theorizing. We theorized that social presence and social relatedness lead to task pressure because users will feel similar to a human-to-human interaction. In human-to-human interactions, the presence of others changes drastically how individuals feel and behave (Aiello & Douthitt, 2001). In essence, they perceive that others are watching and evaluating one's performance, which leads to a pressure to achieve a positive evaluation. Comparing the different effects of social presence and social relatedness, we would like to propose the following explanation: social relatedness contains an aspect that related to the context of the interaction – i.e., feeling supported by the CA needs something the CA can support. In contrast, the effect of social presence is not specific to a task and be perceive even when a CA is totally passive and not engaging (Biocca & Harms, 2002). Against this background, we see potential for future research to investigate different types social relationships. For instance, a CA that is actively praising users could lead to a perception similar to bounding between co-workers or friends, which could lead to even more enjoyment but also task pressure.

Furthermore, we find no support for our hypothesis that task pressure reduces users' enjoyment. We developed this hypothesis based on the assumption that task pressure reduces enjoyment because to resolve task pressure one has to perform well. However, the task does not provide any indications of what "well" is. There is no direct feedback on the quality of the labeled task (i.e., how many images were labeled correctly). In this context, we would like to explain the effect by the characteristics of the task: it was relatively easy to do and participants could be (to some degree) certain about their good performance. However, there is still some ambiguity and uncertainness, which leads to task pressure having no effect on enjoyment. Against this background, we see value in investigating the interaction of social presence, task pressure, and feedback. For example, based on our previous elaborations, a CA that is providing positive feedback (e.g., "You are doing great and nearly all images were labeled correctly) should lead to a vastly different relation between task pressure and enjoyment compared to providing negative feedback (e.g., "You should try harder. The images are not all labeled correctly.").

Interfering with employee's ability to think freely should be done with caution and awareness of ethical implications. In our case, participants were given the option to voluntarily complete more task then required and necessary. Overall, all treatments (including the control treatment) completed more task then the mandatory five – i.e., they "overperformed" without any compensation to do so. In this context, designing a CA to be humanlike with the aim of achieving an outcome lucrative to the organization, can be considered a kind of "digital nudging" (i.e., using digital design elements to influence decisions) (Lembcke et al., 2019). Lembcke et al. (2019) propose that digital nudges should be evaluated regarding how they preserve freedom of choice, transparency, and goal justification (pro-self, pro-environment, or pro-society goals). Without such consideration, using CAs to "manipulate" individuals (e.g., workers) can be unethical. Our finding that the non-human designed chatbot leads to the lowest performance indicates avenues for future research. Specifically, the question of *why* a non-humanlike CA reduces overperformance is of interested. For instance, we would highlight the concept of situational normality – i.e., the belief that within a specific situation things are normal (Baer et al., 2018; Garfinkel, 1963; Misztal, 2001). In this context, a humanlike CA and its presence feels normal (the understanding that humans lead to a felt task pressure is normal) and does not lead users to actively think about "what they are doing" (meaning overperformance). In contrast, a non-humanlike designed CA is not normal (the felt pressure feels alien), which leads users to actively thinking about the situation and their behavior. In consequence, many users become aware that the system somehow induces a drive to overperform, which they are actively denying (they stop earlier). However, this explanation needs to be tested by future research, but any results will deepen our theoretical understanding of the interrelation of CA design and user behavior.

Lastly, we specifically addressed the role of humanlike design and how it leads to users feeling relatedness. We would like to highlight specific implications drawn from the example of "Boomer," the explosive-detonation-bot (Smids et al., 2020). The bot itself had no specific humanlike design; yet its users developed a relation with it because of their long-term shared work experience. With this in mind, we suggest longitudinal studies of CA in the digital workplace would be highly valuable. Specifically, we expect humanlike design to function as a catalyst for forming a relation, but such an effect has to be verified via future research.

Implications for Practice

Our results imply that digital work environments, such as digital labor platforms, which are characterized by anonymity, individualism, and an overall lack of social interaction (Wood et al., 2019), should be augmented by CAs. Specifically, in the context of digital labor, the humanlike design has been shown to greatly improve workers' overall experience, leading to task enjoyment. Furthermore, feeling social relatedness also leads to higher performance via task pressure. Task pressure does not reduce enjoyment and only to higher performance, which can be considered a win-win situation: social presence leads to enjoyment and increased performance. However, digital labor tasks do not offer the opportunity to do more work without being paid, but they provide the opportunity to select and complete many tasks for little pay, which can be seen as equivalent. Similarly, "traditional" working from home (e.g., home office) commonly does allow for working more without compensation (e.g., checking and answering e-mails at the weekend). Therefore, compulsive working behavior should be checked. In summary, a CA as a task interface has the potential to satisfy social needs, which can ultimately improve workers' well-being, but extensive pro-task outcomes need to be considered.

Limitations

Our study is not without limitations. It is limited by the experiment-based approach. Participants were not required to partake in a real-world commercially task – i.e., labeling the pictures was not work for a company, interested in the results. Hence, our experiment traded some realism for controllability (Alan R. Dennis & Valacich, 2001). However, other parameters were highly realistic (e.g., real worker of a commercial digital labor platform participated). Nonetheless, future research should investigate the presented theoretical model in real-world situation. Therefore, future research should replicate ours with other populations, such as workers working from home for an organization (Goodman et al., 2013; Paolacci & Chandler, 2014), and digital employees in other countries. In addition, further contexts should also be considered where no organizational goal (e.g., performance goals) is to be achieved, but a personal one (e.g., sports or education). Furthermore, the humanlike design of one of the CAs was based on common designs from other studies (Diederich et al., 2019) but it limits the results to the specific set of social cues. For instance, the avatar and name were female, which leads to the question if our results can be replicated for a male avatar and name. We are confident that our results are robust, but different CAs designs might lead to a deeper understanding of the border conditions of our reported effects.

Conclusion

The digitalization of work has led many individuals to work from home, reducing social interaction. In such a context, CAs could partly fill the socialization void, leading to an improvement of workers' perceptions and emotions. Against this background, we investigated how the social presence of a CA leads to pro user- (e.g., feeling social relatedness and enjoyment) and pro-task outcomes (e.g., completing more tasks). Based on prior research, social presence was expected to have a paradoxical effect: increasing enjoyment via social relatedness but, at the same time, reducing enjoyment via task pressure. Our results indicate that a CA's social presence fulfills workers' need for relatedness, which leads to enjoyment. Furthermore, social relatedness also leads to a perception of task pressure, which increases users' performance (completing more tasks then necessary) but has not influence on users' enjoyment. Thus, adding CAs to digital work environments appears to be a win-win situation: increasing users' enjoyment and performance.

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