Slacking with the Bot: Programmable Social Bot in Virtual Team Interaction

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Nonhuman communicators are challenging the prevailing conceptualizations of technology-mediated team communication. Slackbot is a social bot that can be configured to respond to trigger words and, thus, take part in discussions on the platform. A set of 84 bot-related communication episodes were identified from a journalistic team's Slack messages (N = 45,940) and analyzed utilizing both qualitative content analysis and interaction process analysis (IPA). This integrated mixed-methods analysis revealed novel insights into the micro-level dynamics of human–machine communication in organizational teams. In response to Slackbot's greetings, acclamations, work-related messages, and relational messages, we identified how the team members respond to the bot, discuss it, and summon it to appear on the platform. Further, the IPA revealed that the bot-related communication episodes are shaped by the bot's responses toward more socioemotional and personal functions. Findings suggest that a team-configured social bot can manifest and facilitate relational team communication.

Lay Summary

New communication technologies not only support but also take part in organizational team communication, challenging how we see the agency of these technologies. This paper examines Slackbot, a bot that "participates" in team discussions based on the use of triggering words that are configured by the team members. We used integrated mixed methods to study a set of Slackbot interactions with team members. Specifically, we examined how team members summon, interact with, and discuss the bot based on the bot's greetings, acclamations, relational comments, and work-related messages. We found that Slackbot changes the nature of the team interaction. The analysis showed that when the bot participates in the discussion thread, it becomes more relational and less task focused. These findings suggest that a social bot can facilitate relational communication and provide assets that support organizational teamwork.

Keywords: Social Bots, Organizational Communication, Virtual Teams, Slackbot, Team Communication, Qualitative Analysis, Interaction Process Analysis

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Introduction

Technology has undoubtedly become an inseparable part of communication in organizations. Teams that use some form of communication technology to do their work are nowadays an extremely common way of organizing (Gilson, Maynard, Young, Vartiainen, & Hakonen, 2015). While older accounts looking at the role of technology in organizations and social life have explored them as tools that are adapted (or are not), some streams of research literature draw a more complex picture of the relationship between technology and social action. For instance, the computers as social actors (CASAs) paradigm proposes that technology has social agency, which manifests in various forms of anthropomorphism and human–computer interaction (Nass, Steuer, & Tauber, 1994). Additionally, in organizational studies, the sociomateriality approach highlights how technologies co-construct organizational activities interconnected with social action (e.g., Leonardi & Barley, 2010; Orlikowski, 2007). The advancement of algorithm-based, intelligent, and automated technologies has set the stage for a reconceptualization of the role of technology in human communication (Guzman & Lewis, 2020; Jones, 2014). Subsequently, an increasing number of studies have emerged to examine how these intelligent systems not just host or enable communication, but rather take part in and shape it (e.g., Edwards, Spence, & Westerman, 2016; Jones, 2014).

Different kinds of *online collaborative software* (OCS) are gaining popularity among work teams, not least in knowledge-intensive, creative fields such as journalism (Bunce, Wright, & Scott, 2017; Koivula, Villi, & Sivunen, 2020). These software not only facilitate collaboration among individuals but also introduce novel technological features in organizations. A rather recent form of communicative possibility offered by these platforms are *social bots* (or chatbots), small, automated programs that act in response to humans (e.g., Latzko-Toth, 2016). Social bots are defined as "automatic or semi-automatic computer programs that mimic humans and/or human behavior" (Wagner, Mitter, Korner, & Strohmaier, 2012, p. 41). They imitate a communicating human, at least in the sense that they similarly control an account in the OCS system and communicate in human language (Boshmaf, Muslukhov, Beznosov, & Ripeanu, 2011).

Social bots and their implications have been studied rather extensively when they act on public social media or in customer service (e.g., Graham & Ackland, 2016; Grimme, Preuss, Adam, & Trautmann, 2017; Gorwa & Guilbeault, 2020). However, studies of bots in organizational communication contexts are only starting to emerge (Meske & Amojo, 2020; Stoeckli, Dremel, Uebernickel, & Brenner, 2020). Although there are some studies about bots and artificial intelligence (AI) facilitating connection and socialization among coworkers (Hancock, Naaman, & Levy, 2020; Meske & Amojo, 2020), so far the attention given to the more micro-level examination of team's social interaction process with a social bot has been scarce. Additionally, cognitive responses and the perceptions of humanness as an indicator for engagement with a bot have been studied (Shin, 2021), but this, again, does not provide an understanding of the actual communication process with the bot.

In order to better understand the meaning of bots and their role in organizational teams, there is a need for empirical studies in naturally occurring micro-level team settings. This kind of work is needed to both expand the emerging field of human–machine communication (HMC) (Guzman & Lewis, 2020) as well as to provide novel insights that could drive the reconceptualizations of computer-mediated communication perspectives (e.g., Flanagin, 2020) and small group research (e.g., Reiter-Palmon, Sinha, Gevers, Odobez, & Volpe, 2017). This study contributes to the emerging

scientific discussion by examining the role of a social bot, Slackbot in virtual team interaction taking place on a popular OCS, Slack. As a framework, we accept the HMC perspective by being open to the idea of viewing communication as a technology-inclusive process rather than human-specific (Guzman, 2018). The ability to participate in team communication can be seen as one of the main ways in which intelligent technologies can participate in teamwork and collaboration (Seeber et al., 2020). Additionally, we utilize various perspectives of small group communication research to develop the understanding of team interaction with and about a machine (e.g., Bales, 1950; Wittenbaum et al., 2004; Keyton & Beck, 2009).

The aim of this study is to further understand the ways bots participate in team communication, how they are responded to by team members, and how team interaction processes are shaped by the bot's presence. These insights are gained through an integrated mixed-methods stance (Paoletti, Bisbey, Zajac, Waller, & Salas, 2021) combining qualitative content analysis and interaction process analysis (IPA) to provide a structured understanding of the bot shaping the micro-level dynamics of team communication (Bales, 1950). We conclude by illustrating how our findings contribute to the understanding of bot-related team communication. Most importantly, we highlight both practical implications and the overall relevance of making social interaction a key entry point in the study of social bots in organizational teams.

Communication in virtual teams

Teams that use some form of communication technology to do their work are nowadays extremely common in organizations (Gilson et al., 2015). These virtual teams can be defined as task-focused groups of individuals that are often somewhat distributed and utilize technology to accomplish their goals (Lipnack and Stamps, 2000). One common form of communication technology in team use is OCS. OCS are used in work teams to facilitate various team processes across temporal and physical boundaries, as well as to allow team members to get to know each other thus providing a shared platform for the team to socialize on (e.g., Stoeckli et al., 2020). These kinds of platforms, including the context of this study Slack, have been increasingly utilized in the context of knowledge work. Slack has become such a household name in journalistic teams that these applications have been even referred to as "newsrooms in the cloud" (Bunce et al., 2017). Koivula et al. (2020) note that Slack allowed journalists to chip in on story ideas by sharing personal anecdotes or information whereas Bunce et al. (2017) found that Slack helped create team identity by allowing "banter" among team members.

Technology-mediated collaboration in working life teams has been the focus of a vast set of literature, tackling matters such as trust, effectiveness, social presence, global teams, and team leadership (e.g., Ford, Piccolo, & Ford, 2017; Sedrine, Bouderbala, & Nasraoui, 2020; Sivunen & Nordbäck, 2015). As automated features, bots, and intelligent technologies become common parts of OCS, it is important to include these possibilities in studies focused on team communication. Not only because these new technologies have novel possibilities, but also because the implementation of social bots changes the perception of technology from merely as a mediator to being a non-human communicator in the collaborative system. This brings forth numerous conceptual and ontological dilemmas related to the inclusion of technology into human communication (see Guzman & Lewis, 2020).

Team communication processes can be examined from various theoretical and methodological perspectives (Poole, Hollingshead, McGrath, Moreland, & Rohrbaugh, 2004). The functional perspective proposes that social interaction functions crucially affect issues such as decision-making

effectiveness and team productivity (e.g., Wittenbaum, 2004). Team communication can be seen to have task-related and relational aspects, both of which are present in the interaction between members. One popular methodological avenue for small group researchers to study the balance between different communicative functions is Bales's (1950) IPA. IPA provides a 12-point taxonomy for systematic analysis of a team's task-related and relational communication. The practical framework around the method proposes that task-focused team interaction should have both socioemotional responses and task-related responses, but with a slight emphasis on task-messages (Bales, 1950; Keyton, 2003; Peña & Hancock, 2006). However, to accomplish the team's relational goals, for example, safe communication climate, social support, and relational cohesion, it is important to study and highlight the importance of relational messages (Keyton & Beck, 2009). Although often criticized for its simplistic dichotomy of human interaction and the mutually exclusive categories (see e.g., McGrath, 1984), IPA provides a widely applied (Paoletti et al., 2021) and relatively clear methodology for examining the balance between task-related and relational team interaction. In this study, IPA is utilized to examine how a social bot shapes the functional balance of the team's technology-mediated communication processes.

Social bots as communicative team members

Social bots can generally be seen as a part of the larger group of algorithm-based intelligent or semi-intelligent technologies. It is crucial to understand these kinds of novel technologies because of the applications they might have not only as mediators of communication (see Hancock et al., 2020) but also as artificial companions and social actors (e.g., Nass et al., 1994; Hepp, 2020). The key definitive characteristics of social bots are connected to their function as nonhuman communicators and their way of mimicking human behavior (Wagner et al., 2012). They are human-like in the sense that they communicate in natural language and have their own account in the collaborative system (Boshmaf et al., 2011). Because these technologies are not only supporting communication between humans but also take part in social interaction, they lead researchers toward being open to viewing communication as a human–machine process in addition to the more traditional human-to-human perspective (Guzman & Lewis, 2020; Jones, 2014).

This study focuses on the micro-level processes of organizational virtual teams utilizing a social bot. As previously reviewed, there is an extensive body of literature for social bots in the context of public social media and therapeutic use (e.g., de Gennaro, Krumhuber, & Lucas, 2020; Gorwa & Guilbeault, 2020; Grimme et al., 2017; Ho, Hancock, & Miner, 2018). However, in an organizational context, the studies are just starting to emerge. These studies have highlighted the role of bots as initiators of human social interaction (Meske & Amojo, 2020), and as facilitators of internal feedback processes (Lechler, Stöckli, Rietsche, & Uebernickel, 2020). Through their social role, chatbots are considered to transform traditional enterprise information systems into systems that afford more social behavior common to enterprise social media platforms (Stoeckli et al., 2020). In the realm of teamwork, the previous research has mostly focused on various applications of AI and issues related to technology, collaborative processes, and institutional design (Seeber et al., 2020). Overall, the applications of AI are often viewed as tools and their value is seen in increasing team performance or optimizing organizational processes. For instance, AI has been predicted to shape processes such as decision-making, data processing, and management (Raisch & Krakowski, 2021; Shrestha, Ben-Menahem, & von Krogh, 2019). Additionally, Hancock et al. (2020) have set a research agenda for

studies focusing on intelligent technologies as mediators in various computer-mediated communication processes.

The implications of different algorithm-based technologies are undoubtedly significant in terms of the effectiveness of organizational communication. Their participation in natural human communication also brings out social and relational possibilities attached to these technologies. This study aims to bring forth the micro-level dynamics of team communication with a bot. We focus on Slackbot participating in team discussions on Slack—provided that the team has programmed automated responses for the bot to use in the conversations. The current study aims to provide novel contributions (a) by studying actual, naturally occurred Slack communication, which is rarely present in previous empirical studies and (b) by examining the micro-level dynamics of human–machine team communication through the lens of IPA, thus providing information on how a social bot shapes the balance between task-related and relational interaction.

We aim to answer the following three research questions: (RQ1:) What kind of responses does the social bot use to participate in team discussion? (RQ2:) What type of group interaction characterizes bot-related communication episodes? (RQ3:) How do the bot's responses shape the team's interaction during the bot-related episodes?

Method

Data collection and preprocessing

Slack is an OCS that has gained increasing popularity during recent years. It is a multi-platform OCS that contains social-media-like features and facilitates both more formal collaborative processes, such as innovating, decision-making, and file sharing, as well as more relational aspects of teamwork (Koivula et al., 2020; Stoeckli et al., 2020). Slack works as an enterprise messenger, a chat tool for teams, and also has various automated features, including interfaces to other services and social bots. The Slackbot offers help for Slack users by reacting to certain keywords and by supporting a set of pre-programmed functionalities such as setting reminders. In addition, the platform allows its users to configure customized automated responses that are triggered by certain keywords. For example, the Slackbot can be configured to reply "Hello to you too" each time somebody says "hello." The bot, therefore, takes part in the group discussion via its messages—albeit without a more sophisticated understanding of the contextual cues or other natural language processing capabilities.

Data were collected from Slack conversations of a partially distributed journalistic team. The examined team consists of journalists working for a large Finnish media organization. Most of the time, the team consists of a producer, a graphic designer, and four journalists. However, the team memberships change dynamically during the lifespan of the team. In total, the studied thread includes messages from 18 different team members. Slack is not an official channel for the whole organization, but a shadow channel adopted by this particular team in August 2016. After the adoption of Slack, it quickly became an everyday communication channel for the team, a site where watercooler-type talk and work-related tasks (e.g., developing story ideas, finding interviewees, and sparring interview questions) merge in the #general channel which is open for all team members. Additionally, every journalist has their own channel for discussions on their story topics, ongoing projects, and feedback. First Slackbot's responses were configured by the team's producer. Over time, team members also contributed to the variety of trigger words and responses. Adding and deleting trigger words and bot responses took place organically. Responses were modified and deleted by members when it felt

necessary, for example, some of the profanities configured for the bot were removed when the #metoo movement broke out.

Data collection was executed in collaboration with the studied team. Access to the Slack workspace was negotiated with the team's supervisor and the third author spent four months (September–December 2018) on the platform with the journalists as a part of a larger research project that focuses on technology-aided innovation in newsrooms. The project included other forms of participatory observation and interviews with the team members. However, as that data have a significant focus on innovation in the newsroom rather than bots specifically, it is only used to contextualize the current study. Export of the team's Slack workspace was provided to the researchers by the team lead after all team members had agreed with the research use. The data were pseudonymized before analysis. In reporting the data, pseudonyms are used to protect the participants' privacy. The raw material for this study consists of all messages ($N = 45{,}940$) sent to the studied team's #general channel. The data range over two years (August 2016–October 2018) and include altogether 2,425 messages sent by the Slackbot.

In order to answer RQ2 and RQ3, we filtered the data to include only *bot-related communication episodes*. These episodes were identified following three criteria. First, messages mentioning the bot explicitly, coded by mentions of "bot" or "slackbot" and their abbreviations, as well as indirectly. Second, messages directly following the bot's responses that answered or reacted to the prevailing bot message. Third, messages directly after the bot's responses that manifested a change in topic triggered by the bot message in the discussion feed. The episodes consisted of the messages fitting these criteria and the bot messages embedded into the episode at hand. In order to include the whole episode, we also used the message topics and timestamps as cues to identify temporal and topical communication episodes, with an aim to include the entire conversation in each episode. The identification resulted in 84 bot-related communication episodes with 486 individual messages both from the Slackbot ($n = 130$) and human members ($n = 356$). The average length of an episode was 5.77 messages. As we were interested in examining the bot's role in the team's Slack interaction, each of these episodes was further coded into two parts: Part A (pre-bot) which included all messages sent in an episode before the bot's initial response and part B (post-bot) which included interaction after the bot's first message in a given episode.

Data analysis

The data analysis consisted of forms of qualitative and quantitative content analysis as well as an application of Bales's (1950, 1953) IPA. Hence, this study contributes to a recently promoted methodological avenue for studying small group communication, *integrated mixed methods* (Paoletti et al., 2021). This methodological approach suggests that "methods defined by an interconnected mix of quantitative and qualitative characteristics" (Paoletti et al., 2021, p. 1) are especially suitable for addressing some previous methodological shortcomings of group communication studies and providing rich and contextualized results. The methods highlighted in the integrated mixed-methods approach include, for instance, content analysis and interaction analysis, both of which are applied in the current study.

Content analysis

The content analysis was conducted in two distinctive phases in order to inductively seek answers for research questions RQ1 and RQ2 by (a) classifying the bot's response types (RQ1) and (b) categorizing team members' discussions with and about the bot (RQ2).

In the first phase (1) all Slackbot responses configured by the team members (79 different response types in total, 52 of which were available in the filtered data) were identified and qualitatively categorized into three response type categories (see Table 1). The categorizations were formed by examining both the content of the actual response as well as the trigger words activating the response. The classification was done by the first author but discussed and refined by all authors, thus following the peer-debriefing principles common for qualitative content analysis (e.g., Lincoln & Guba, 1985). Consequently, we examined the frequency of each type, thus gaining more quantitative information about the forms of bot's participation in the team discussion.

In the second (2) phase of the content analysis, we qualitatively coded the team members' message functions in the bot-related communication episodes. This mainly data-driven analysis was conducted following the principles of *phronetic iterative analysis* (Tracy, 2018) that consisted of three rounds of coding. Following the principles of iterative examination, the coding was executed by both looking into the concepts emerging from the data itself, as well as sporadically going back to the research questions and existing literature to gain a framework for the analysis. The first round of qualitative coding was a round of data-based inductive open coding of the communication episodes regarding the bot, commenting on the bot, or impacted by the bot. This round was conducted by all authors on separate parts of the analyzed data. Second, a round of systematic coding of all individual messages that were part of the bot-related communication episodes was completed to bring out the second-level analytic codes. Third, the previous message-specific codes were compared and combined to reach the main result categories. Both second and third rounds of coding were conducted by the first author but regularly discussed among all authors to achieve credibility through peer-debriefing practices (Lincoln & Guba, 1985).

Interaction process analysis

In order to gain further understanding of the functions of the team's Slack interaction and bot's relation to team communication, we conducted an IPA for the bot-related communication episodes. IPA is designed to examine the interaction processes of a task-focused small group, such as a work team, and identify the *task* and *relational* (or socioemotional) elements of group communication (Bales, 1950, 1953; Keyton, 2003) . Through IPA we were able to identify and quantify the group communication functions and changes in them. Thus, adding to the more explorative content analysis.

The utilized IPA classification was drawn mostly from the original 12-point taxonomy (Bales, 1950), which includes four functional areas of group interaction, 1) *positive socioemotional responses*, 2) *task responses: information sharing*, 3) *task responses: questions*, and 4) *negative socioemotional responses* (Keyton, 2003; Löfstrand & Zakrisson, 2014). These broader areas are further divided into 12 mutually exclusive coding categories (Bales, 1950) which provide more specific operationalizations (see Table 2). As IPA stems from a long tradition of studying recorded face-to-face team discussions

Table 1 Frequencies of Slackbot's Response Types in the Empirical Data

Response type	Full data *n*	Filtered data *n*
Greetings and acclamations	1,033	56
Work-related messages	905	35
Relational messages	487	39
Total	2,425	130

Table 2 IPA Coding Categories (applied from Bales, 1950; Keyton, 2003; Löfstrand & Zakrisson, 2014; Peña & Hancock, 2006)

Functional area	Coding category	Example message
Positive socioemotional	Shows solidarity, seems friendly	"Thank you Slackbot!"
	Shows tension release, dramatizes, jokes	"Lol, that's funny"
	Shows agreement, agrees	"Yeah, I agree"
Personal	Shares personal information	"I used to live in Chicago"
	Asks for personal information	"Where are you going for holidays?"
Task	Gives suggestions relevant to the task	"I could call Norman about this"
	Gives opinions relevant to the task	"The photos look good"
	Gives information relevant to the task	"This is due tomorrow"
	Asks for information relevant to the task	"What is her last name?"
	Asks for opinions relevant to the task	"What do you think?"
	Asks for suggestions relevant to the task	"Should I tell them?"
Negative socioemotional	Shows disagreement, disagrees	"That's not right"
	Shows tension	"This is so annoying!"
	Shows antagonism, seems unfriendly	"Screw you!"
Technical/other	Summons, greetings and partings	"Hello!"
	Repairs	"Thnks" "I mean *thanks"
	Unclassifiable messages	"User1234 has started a Google Meet"

(Keyton, 2003), we made additions to the original taxonomy to better consider text-based computer-mediated interaction. Following Peña and Hancock (2006) as well as (Rice and Love, 1987), we added five additional coding categories. First, we added two categories to make a distinction between sharing and asking for *professional information* versus sharing and asking for *personal information* (Peña & Hancock, 2006; Rice & Love, 1987). These kinds of personal message categories have previously been connected with positive socioemotional interaction (Peña & Hancock, 2006) and differ from information sharing that strictly connects to the team's core task. Second, in order to be able to sufficiently code all messages in the subset, we added three categories related to the technological context (Peña & Hancock, 2006): *summons*, *greetings*, *and partings* (i.e., notifying others of entering or leaving the platform), *repairs* (i.e., fixing an error in a previous message), as well as *unclassifiable* (i.e., system notifications and shared files).

The final IPA included 17 coding categories (see Table 2). The analysis unit was one *message*. The data at hand were organized in a message-per-row order, which made the unitization relatively simple. There could be several messages from the same user in a row, but each was coded as an independent analysis unit. Using a message or an utterance is a common practice when applying IPA (e.g., Keyton, 2003). The analysis was conducted for all bot-related messages ($n = 486$), including Slackbot's responses, but the bot's messages were excluded from the final reporting. This decision was based on the notion that IPA, arguably, is not a suitable tool for analyzing the responses of a bot that does not have the required metacognitive and communicative skills considered as the main theoretical premises of IPA (Bales, 1950).

The coding of the data was executed by three trained coders. To validate the classification, intercoder reliability was tested using an approximately 10% random subset of the sample consisting of full episodes. The reliability was calculated using Krippendorff's alpha (see Krippendorff, 2004). After the first two rounds of testing, coders improved the codebook by clarifying the descriptions for each code in a joint discussion by all the coders and subsequently coded a new 10% test sample. For the final third round, the three coders reached an overall reliability score of 0.797, which is close to the commonly required $\alpha \geq .800$ and considered acceptable with caution (Krippendorff, 2004). In communication research, especially regarding IPA method, a .700 reliability score is often deemed as the acceptable minimum (Keyton, 2003).

After the coding, we calculated the relative frequential share of each IPA class in the data set, as well as in messages categorized as part A of the communication episode versus part B. This practice is according to the IPA tradition in which relative frequencies and other nonparametric statistics are often used to bring forth the balance (or imbalance) between task-related and relational interaction. In this analysis, the cross-tabulation was utilized to illustrate how the bot's responses shape the team's communicative functions regarding task-related and relational interaction (RQ3). In the following sections, we present the findings in the order of the research questions.

Findings

Slackbot's responses

The qualitative categorization of the pre-programmed bot responses revealed three main response types: *greetings and acclamations*, *work-related messages*, and *relational messages* (see Table 1). These response types define the bot's contribution to the team discussion. Additionally, the categories reflect the role the team members assigned to the bot as they configure its responses. Each response type consisted of multiple individual responses that are explained in further detail in this section.

The majority of the bot's actualized (visible in the team discussion feed) responses were greetings and acclamations ($n = 1{,}033$). The next most frequent response type was work-related messages ($n = 905$) and, finally, the least frequently appearing responses were different kinds of relational messages ($n = 487$). However, in our filtered dataset, the relative frequency of relational messages was higher than in the full data set, implying that the team members more frequently acknowledge or respond to bot messages that are greetings or relational in nature. Fifty-two out of the possible 79 response types were visible in the bot-related episodes.

The overall most frequent response type included *greetings and acclamations*. The bot's preprogrammed greetings were both different forms of general greetings ("hello," "hi") and time-of-the-day specific greetings ("good morning"). The response activating trigger words were three common forms of a greeting. These three trigger words activated altogether approximately 20

different greetings from the bot. The responses programmed for the bot also manifested in the form of cursing and seemingly random or humoristic acclamations. These messages were triggered either by curse words or general forms of greetings.

The *work-related responses* included messages about the core task of the team, that is, developing story ideas, messages about coordination of the work, and suggestions for a work-related action. The responses related to developing story ideas consisted of both presenting ideas ("next we should make a piece about Chicago[1]") and giving feedback ("can't you come up with a better headline?"). The bot also had some responses dedicated to coordinating or distributing work tasks. These responses included person-specific comments ("Ken will do this") and more general remarks ("could it be that we actually get this week's paper done?"). Finally, the last form of work-related responses was different kinds of proposals for a work-related action ("somebody read the piece immediately!"). The work-related responses were triggered by multiple different task-related trigger words as well as some curse words and town names.

The *relational bot messages* consisted of responses that did not clearly indicate any work-related topic but instead included messages that had functions for team building and social value. These messages included inside jokes, moral commentary, and suggestions for a recreational activity. The inside jokes were both about towns or other general topics ("you can eat a hot dog in Chicago") as well as non-work-related comments about team members ("Ken is the king"). The moral commentary by the bot was mainly focused on responses that reprimanded team members' frequent use of curse words ("I hurt my feelings because you used such foul language"). The majority of the suggestions for recreational actions were related to breaking habits and beverages ("somebody make coffee!"). The relational responses were triggered by multiple different kinds of trigger words ranging from people's names to curse words.

Bot-related team communication

The analysis of the bot-related communication episodes resulted in three forms of bot-focused messages. These characterizations reflect the way the bot was spoken to and spoken about. The team members were *responding*, *discussing*, and *summoning* the bot (see Table 3). The coding was not mutually exclusive and thus the recognized forms of bot-focused interaction were present in multiple episodes. These forms of bot-related communication allow us to reflect on both the team interaction with the bot as well as the ways team members view and make sense of the bot. We illustrate and further explain these categories throughout this section.

Table 3 The Forms of Bot-Related Team Communication (n = episodes)

Responding ($n = 49$)	(1) Neutral • Answering • Greeting • Apologizing	(2) Positive • Praising • Thanking • Joking with	(3) Negative • Teasing • Reprimanding • Commanding
Discussing ($n = 47$)	(1) Talking about the bot's actions and functions	(2) Making fun of the bot	(3) Comparing the bot to a human member
Summoning ($n = 11$)	(1) Playing with the bot's responses	(2) Testing trigger words	(3) Inviting the bot to join the chat

First, the team members responded to the bot's messages in various ways. The responding category illustrates the messages oriented toward the bot (see discussing for comparison). The responses can be divided into generally neutral responses including *answering* the bot's question, *greeting* the bot and *apologizing* to the bot, generally positive responses such as *praising* the bot, *thanking* the bot, and *joking* together with the bot, and finally, generally negative responses consisting of *teasing* the bot, *reprimanding* the bot, and *commanding* the bot.

Many customized responses are questions. Although there are several instances where these questions seem to be purely rhetorical as they receive no response from the team, occasionally someone answers. The answers are typically related to phatic questions (e.g., "how are you doing?") but also some work-related questions were answered. The following example illustrates a bot-related communication episode with an answer directed to the bot:

TM: Good morning
Slackbot: Ouch, what day is it?
TM: How should I know @Slackbot

The bot's greetings were often part of longer conversation chains where team members greeted each other, typically at the start of a new work day. In these greeting chains, the bot acted as a part of the team as it reciprocated other member's greetings. Apologies to the bot appeared usually as a response to the bot's moral commentary. This commentary included the bot reprimanding the members, usually about their choice of words. These instances were not extremely frequent as these reprimanding comments by the bot were often disregarded. The positive responses to the bot included some instances where the bot was praised for its response. The bot was sometimes also thanked, especially when it contributed to the discussion with a motivational statement or praise of its own. These kinds of positive remarks sometimes stimulated the team members to voice agreement with the bot's statement:

TM1: Yes, I got them. Ken mailed those yesterday - -
Slackbot: Ken is the king
TM2: Yeah. Bot knows what is up.

The team members occasionally included the bot in humoristic discussions as they joked with the bot. This joking usually took place in the form of well-meant banter and teasing or was sometimes connected to the bot's word choices. Some team members even adopted the bot's phrases or words into their own vocabulary as a form of humorous team interaction. The negative responses to the bot's messages, however, were often connected to occasions where the bot's responses failed to match the context of the discussion or if the bot repeated similar responses multiple times in a short timeframe. These characteristics of the bot's pre-programmed responses seemed to aggravate the human members, which led to them teasing, reprimanding, and commanding the bot, as shown in the excerpt below:

TM2: I have marked down [dates]
Slackbot: Ouch, what a feedback
TM1: According to the list you have [dates]
Slackbot: Ouch, what a feedback
TM2: But I could exchange those dates with Will
TM3: Damn you bot
Slackbot: I hurt my feelings because you used such foul language

Second, the bot is an object of team interaction and discussion. The discussion about the bot includes three kinds of messages from the team members: *talk about the bot's actions and functions*, *making fun of the bot*, and *comparing the bot to a human team member.* This positioning manifests as the team members talk about the bot and its functions in the third person as if the bot was not part of the conversation. The team members talked about the bot and its actions and functions often as a reaction to the bot's messages. This kind of discussion consisted of the team members talking about configuring the bot's responses, more generally about the functions the bot has or could have, as well as comments on the bot's messages and word choices. In the following example, the team members talk about the bot's actions:

Slackbot: Well [curse word]!
TM1: What has the bot learned?
TM2: Curse words
TM1: Have you programmed those?
TM2: Ken programs, I do not know how
TM1: Ken has crafted them on his holiday
TM2: Yeah, every morning in Argentina he just codes Slackbot

The team members made fun of the bot and its answers regularly. The interaction about the bot included both humoristic characteristics of the bot as a "person" and remarks that highlighted its machine nature. For instance, the team members often made fun of the bot's word choices or its out-of-context comments. The team members also compared the bot with a human team member by statements such as "Matt has finally found himself an equal conversation partner [the bot]."

In addition to responding to the bot and talking about the bot, the team members *summon* the bot into the discussion feed, either intentionally or by accident. These episodes included multiple instances where the bot was either *played with*, *tested*, or *invited* to the chat. The game-like use of the bot had team members playing with known trigger words to intentionally receive a reaction from the bot. Team members also tested the bot's responses through the use of the trigger words, but these sequences tended to be more neutral or serious in nature and often connected to talking about the possibilities to configure new responses for the bot. Additionally, they invited the bot to the discussion either by calling it by its name or tagging it. The following example illustrates team members testing and playing with the bot:

Slackbot: Go Hank!
TM2: coffee Hank
Slackbot: I would listen to what Hank has to say about this
TM1: Why does not this guy [bot] talk about coffee anymore?
TM2: Coffee, do you have something to say about that Slackbot?
Slackbot: Do we need to buy more coffee?
TM1: make
TM2: coffee
Slackbot: Do we need to buy more coffee?

Through qualitatively exploring the versatile ways human members interact with the bot in these bot-related communication episodes, we have been able to gain further insights on the forms of interaction between the bot and the team. The team members are responding and reacting to the bot's messages, discussing the bot and its actions, as well as summoning the bot to appear.

Team interaction process in the bot-related episodes

IPA lens on team communication allows researchers to examine individual and/or group-level processes with nonparametric statistics (e.g., Löfstrand & Zakrisson, 2014). In this study, the statistical examination focused on the team-level process, since that provides data to gain an understanding of the bot's role in shaping the team's communication (vs. examining individual-level frequencies). The examination of all 356 individual team member messages in the bot-related episodes revealed the team's interaction being relatively evenly distributed between *task-related messages* (28.09%), *positive socioemotional messages* (25.56%), and *personal information sharing* (22.47%). Technical and other responses, as well as negative socioemotional responses were more sparsely present in the interaction (see Table 4).

Bales's framework for IPA suggests that task-focused teams should have the majority of their interaction task-related instead of socioemotional responses (Bales, 1953; Keyton, 2003; Paoletti *et al.*, 2021). However, positive socioemotional responses and personal information sharing (which has been previously connected to positive socioemotional functions, see Peña & Hancock, 2006) are seen as essential in terms of building effective team cohesion and relationships (Keyton & Beck, 2009). Negative socioemotional responses, albeit often present, should not have major significance among the interaction process as they generally portray disruptions among the team (e.g., Keyton, 2003). This is also the case with the studied team as negative socioemotional responses manifested the least in the overall bot-related discussion (8.43%). Technical and other messages were 15.45% of the conversation, however, mostly consisting of the category *summons*, *greetings*, and *partings*. Overall, the conducted IPA analysis shows that bot-related communication episodes were generally relational (positive socioemotional and personal sharing) in nature with a moderate balance of task-related interaction.

To examine Slackbot's role in shaping the team communication, we conducted cross-tabulations between the team interaction process before the bot joins the discussion (part A) and the interaction process after the bot's first response (part B). The difference in IPA class distribution between the two partitions shows that the bot's participation moves team communication toward more relational communication, that is, socioemotional and personal functions (see Table 4). The messages posted after the bot's initial response have significantly higher frequencies of socioemotional (both positive and negative) and personal functions compared with the episodes before the bot ($\chi^2 = 53.597$, df = 4, $p <$

Table 4 Frequencies of IPA Functions among Bot-Related Communication Episodes (n = messages)

	Episode part A		Episode part B		Total	
IPA	*n*	%	*n*	%	*n*	%
Positive socioemotional	14	11.38	77	33.05	91	25.56
Personal	21	17.07	59	25.32	80	22.47
Task	56	45.53	44	18.88	100	28.09
Negative socioemotional	3	2.44	27	11.59	30	8.43
Technical/other	29	23.58	26	11.16	55	15.45
Total	123	100.00	233	100.00	356	100.00

.001). Therefore, a shift in the balance between task-related and relational team communication functions is evident whenever the bot joins the discussion. Thisfurther explains not only the team's bot-related interaction processes but also how the bot's responses reorient the discussions. During the qualitative analysis, we observed that the activation of the bot repeatedly invited the team members to initiate a discussion on a topic related to the bot's message, or a discussion of the bot itself.

Discussion and conclusions

This paper examined a social bot as a part of a journalistic team's Slack. The analysis revealed three types of bot responses, three categorizations that illustrate the content of the bot-focused team member messages, and quantification of bot's responses effect on the balance of task-related and relational team interaction on Slack. Thus, our findings give three-dimensional insights into how team communication can be shaped by a social bot. Based on our analysis, we propose that this kind of team-configured social bot *manifests* and *facilitates* the team's relational communication; that is, the bot brings forth the team's internal communication culture through the team-configured responses and team member's interactions with and about the bot. Furthermore, it shapes the team discussion toward socioemotional and personal interaction.

The bot manifests the team's communication style by responding to the message thread with the responses configured by the team. In our analysis, we recognized three types of responses configured for the bot: forms of greetings, work-related messages, and relational messages. The majority of the configured responses were different forms of greetings and acclamations triggered by greetings or curse words. Furthermore, relational bot messages and greetings were the most frequent types of bot messages whenever the team members reacted to the bot. The human team members interacted with the bot by responding to it, discussing it, and summoning it through tagging and toying with the trigger words.

The Slackbot facilitates relational team communication by shaping the balance between task-related and socioemotional interaction. The bot's responses shift the overall distribution of interaction functions toward relational functions. The analysis (see Table 4) comparing IPA scores before and after the bot joins the discussion shows clear growth in positive and negative socioemotional messages, as well as personal information sharing. Whereas task functions seem to decrease. This illustrates the bot's role in encouraging discussions outside the core task. These are discussions where the team members joke with and about the bot, repeat inside jokes, and share information about themselves. Indeed, there is an inherent playfulness in this; the team members respond to the bot, discuss it, and summon it by testing its functions. In addition, the Slackbot's messages occasionally changed the topic of the discussion as the bot's appearance in the discussion either turned the conversation to the bot itself or to the topic it brought up.

Team communication, from the functional perspective, has task-related and relational properties that relate to team effectiveness (Hirokawa & Salazar, 1999; Wittenbaum et al., 2004). Relational team communication is crucial for building and maintaining relationships inside the team (Keyton & Beck, 2009) which, in turn, reinforce trust and other essential interpersonal aspects that relate to team performance (Costa et al., 2018; Henttonen and Blomqvist, 2005) . However, the extent of relational team interaction in online work settings has been previously questioned and social information is noted to be processed slower than in face-to-face settings (Henttonen & Blomqvist, 2005; Järvenpää & Leidner, 1998; Walther, 1992). Our findings suggest that a team-configured social bot could potentially support a team's interpersonal functions on an OCS, as it fosters workplace humor, facilitates

personal discussions among the team members, and thus overall shapes the discussion toward more socioemotional and personal talk.

The findings contribute to the understanding of a nonhuman communicator as a part of a team interaction process. There is some existing evidence that social bots can induce socializing among coworkers (Meske & Amojo, 2020). Additionally, our findings are in line with studies of therapy bots and other social bots designed for socioemotional needs, since they also seem to indicate that nonhuman communicators have relational and emotional impact (Ho et al., 2018; De Gennaro et al., 2020). However, the notion that the bot nudges the team towards socioemotional and personal talk contrasts the thinking that algorithm-based technologies should be utilized to optimize organizational processes and straightforwardly induce effectiveness (Shrestha et al., 2019).

Interestingly, the rise in the relational functions is not visible only regarding positive socioemotional and personal interaction, but also regarding negative socioemotional talk, such as unfriendliness. The qualitative analysis revealed some explanations. When analyzing how the team members talk about and to the bot, we found multiple instances where the bot's limited features sparked negative messages from the team members. In particular, the bot's repetitive communication seems to emphasize its technological and configurable nature. Our findings provide a communication process perspective to the previous findings on how cognitive processing of *perceived humanness* can predict interaction with the bot in a journalistic setting (Shin, 2021). Repetitive responses and limited understanding of the social context could be issues that restrict perceptions of humanness regarding this bot. These issues should be considered when designing social bots to provide ideal support for relational team communication.

In addition to the bot's nature, the task-socioemotional dichotomy presented by Bales (1950) causes reason for critical evaluation. It has been understandably criticized over the years and these two forms of team interaction are often seen as inherently intertwined rather than as two ends of a spectrum (e.g., Dillard, 1997; Keyton & Beck, 2009). However, IPA is still one of the most used forms of quantitative interaction analysis for groups (Paoletti et al., 2021), and as such, provides a framework of observing team communication. In this study, an extended IPA method was utilized to build on top of the more exploratory qualitative methodology that was a necessary first step, as this kind of naturally occurring team data has not been previously examined with a focus on bot-related communication. Thus, this study adopted an integrated mixed-methods stance that has been recently recommended for small group studies (Paoletti et al., 2021).

In dispersed journalistic teams, communication technologies have been reported to lend themselves specifically to creative work, such as sharing story ideas and developing working practices (Koivula et al., 2020; Bunce et al., 2017). Studies have found that this is much due to OCS platforms' ability to facilitate lateral communication between team members. Previous studies highlight the importance of a supportive and open group culture for (creative) work. As the Slackbot, in this study, facilitates relational communication in the team and thus participates in building and enhancing group culture, it could be argued that the bot is, indeed, valuable for the team's ability to conduct creative work. This notion provides a fruitful avenue for further studies, but some suggestions can already be made. Namely, utilizing the social aspects of the Slackbot (human-like responses) is recommended to generate relational benefits. However, the programmed responses should be carefully designed; relational messages seem to induce relational communication, but repetitive and context-blind responses might lead toward more negative socioemotional interaction.

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Endnotes

1. All data excerpts have been translated into English and the names have been replaced with pseudonyms.

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