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Human-AI Collaboration in Group Creativity

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Résumé

La recherche sur la collaboration entre l'homme et l'IA s'est jusqu'à présent concentrée sur la compréhension des interactions entre un utilisateur unique et un outil d'IA, tel qu'un chatbot. Pourtant, la majorité des activités et des processus organisationnels, y compris le partage des connaissances, la créativité et l'innovation, sont basés sur le travail d'équipe. Par conséquent, le potentiel et l'intérêt des outils d'IA dans de tels contextes d'utilisation sur le lieu de travail sont en augmentation. Pour mieux comprendre ce phénomène, il est essentiel d'étudier le rôle des chatbots dans le travail d'équipe collaboratif. Dans la présente étude, nous explorons le rôle des chatbots basés en IA dans la facilitation ou l'encouragement dans la créativité collaborative. Une expérience en ligne 2x2 entre sujets est utilisée pour étudier l'impact des caractéristiques du chatbot, en particulier le style de conversation (machine ou humain) et le rôle du chatbot (facilitateur ou idéateur) sur la collaboration créative dans des environnements à distance. Cette étude permet de mieux comprendre la dynamique complexe entre les outils d'IA et la créativité dans des contextes de collaboration, avec des implications pour la théorisation de la créativité collaborative, la collaboration entre l'homme et l'IA et la conception des chatbots.

Mots clés : Créativité de groupe, Collaboration humain-IA, Chatbot, Interaction d'équipe, Télétravail, Idéation, Sérendipité.

Méthodes de recherche : Méthode expérimentale, Méthode d'enquête

Abstract

Human-AI collaboration research has hitherto focused on understanding interactions between a single user with an AI tool, like a chatbot. Yet, the majority of organizational activities and processes, including knowledge-sharing, creativity, and innovation, are team-based. Consequently, the potential for and interest in AI tools in such workplace contexts of use is growing. To advance our understanding of this potential, it is critical to investigate the role of chatbots in collaborative teamwork. In this study, we explore the role of AI-based chatbots in facilitating or fostering collaborative creativity. An online, 2x2 between-subjects experiment is used to investigate the impact of chatbot characteristics, specifically its conversational style (machine versus human) and its role (facilitator versus ideator) on creative collaboration in remote settings. This study yields insights into the intricate dynamics between AI tools and creativity within collaborative settings, with implications for theorizing about collaborative creativity, human-AI collaboration, and chatbot design.

Keywords : Group creativity, Human-AI collaboration, Chatbot, Team interaction, Hybrid Workplaces, Ideation, Serendipity.

Research methods : Experimental Method, Survey Method

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List of abbreviations and acronyms

AI : Artificial Intelligence

TOC : The theory of organizational creativity

CR : Chatbot role

CCS : Chatbot Conversational Style

WoO : Wizard of Oz

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Chapter 1: Introduction

Advances in Artificial Intelligence (AI) technology have led to an increasingly aggressive competition for developing and securing AI technologies. This competition is driven by the expansion of AI's commercial applications and the consequent boost in economic activity across multiple sectors including healthcare, education, manufacturing, financial services, transportation and logistics, among others (Mou, 2019). AI-enabled tools, such as chatbots, have already become popular in various industries, particularly in customer service and business operations (Caldarini et al., 2022). The potential for AI tools in workplace settings is growing and 73% of businesses currently use or plan to use AI-powered chatbots to support a wide range of business activities, from customer service to cybersecurity and from personal assistants to content production (Haan and Watts, 2023). The phenomenal surge in their interest has been coined “the chatbot tsunami” (Grudin & Jacques, 2019). Hence, the use of chatbots to provide business solutions is becoming ever more prevalent (Cain, 2021) and the growing attention to chatbots in both business and academia is thus hardly surprising.

The human-AI collaboration literature to date has focused largely on chatbots, which is in line with the dominance of chatbots in business settings. Similarly, the focus of the literature has been on investigating the use of chatbots primarily in customer service contexts (Rapp et al., 2021) and in one-to-one interactions between a single user and a chatbot. Limited research, however, exists at the group-level investigating collaborations between human teams and chatbots (Peng et al., 2019). Of the small number of studies to date that emphasized team collaboration, the focus remained on interactions of individual team members with the chatbot (Toxtli et al., 2018). Thus, a clear gap exists in the literature regarding the impact of using AI agents, such as chatbots, on collaborative teamwork.

Studying the use of chatbots in collaborative teamwork is an important area of investigation considering that organizations are the primary domain of application for AI agents, like chatbots, and that most activities and processes are inherently organized in teams in today’s process-based organizations (Forrester and Drexler, 1999). Hence, understanding the intricate dynamics between AI tools and team collaboration can have significant implications not just for our theorizing about

human-AI collaboration and team collaboration in the era of AI, but also for yielding important insights into the optimal design or role of AI agents in collaborative settings.

In this study, we focus on creative collaborations, i.e. team interactions focused on generating something novel or useful (adapted from Harvey, 2014). Creativity is the root cause of technological breakthroughs, new products, novel business ideas and thus the engine of innovation for organizations (Van Osch et al., 2023). Creativity is also an inherently collaborative activity involving interactions between members of a group around a topic (Boland Jr. & Tenkasi, 1995) where they engage in problem-solving on an impromptu task or sharing ideas on a project. Although creativity has received some attention in the chatbot literature, the focus has been on dyads - one human and one chatbot (Hwang & Won, 2021) and limited attention has been given to measuring the impact of the use of AI on creative outcomes (Lembcke et al., 2020).

1.1 Research Aims & Questions

Given the significance of the AI trend, this study seeks to provide a fresh perspective on how AI agents, specifically chatbots, can contribute to creative collaboration, a fundamental driver of innovation. Therefore, our research question asks: *What is the influence of text-based chatbots on group creativity within the context of remote teamwork, and how do these characteristics interact with underlying collaborative creativity mechanisms such as serendipity?*

To address the research question more comprehensively, this study will examine them through the following three underlying sub-questions:

1.1. How does the chatbot's conversational style influence group creativity in terms of idea quality, idea quantity and self-reported group creativity?

1.2. How does the chatbot's role influence group creativity in terms of idea quality, idea quantity and self-reported group creativity?

1.3. What is the mediating role of serendipity in the relationship between chatbot role and chatbot conversational style on group creativity?

1.4. How does the interaction of chatbot conversational style and chatbot role influence group creativity in terms of idea quality, idea quantity and self-reported group creativity?

To answer these research questions, we will use a scenario-based 2x2 between-subjects experimental design to investigate the impact of chatbot characteristics, looking at the conversational style (machine versus human) and the role (facilitator versus ideator) on creative collaboration in remote settings. That is, in this study, we used two manipulations in the chatbots, namely conversational style (CCS) and role (CR) as can be seen in the questions above. CCS had two categories: human and machine. The human style used longer sentences, encouraging language, emoticons, and personal pronouns to create a warm tone. The machine style used shorter, formal language with no emoticons or personal pronouns, resulting in a mechanical tone. CR was also divided into two categories: facilitator and ideator. The facilitator chatbot acted passively, managing time and giving instructions (i.e., orchestrating the team process). The ideator chatbot acted as an active team member (i.e., peer) by providing opinions, justifications, and slogan ideas, aiming to be perceived as proactive in addition to giving instructions. These categories will be elaborated on later in this paper.

The focus of studying AI-enabled mediated collaboration was motivated by the inherently digital and hybrid nature of today's workplaces. While conversational style has been a recurrent focus in previous research, it has yet to be studied in AI-powered collaborative contexts. Notably, in non-AI contexts, a study revealed that conversational styles significantly influence team dynamics and level of responsiveness, and as a result, performance (Craig & Kelly, 1999; Wang & Fussell, 2010). Consequently, exploring the impact of conversational style in an AI-enabled collaboration context becomes particularly intriguing and warrants further investigation. Furthermore, much less is known about the impact of the role of the chatbot during such interactions. In fact, one study found that chatbots playing the role of a peer accounted for only about 3% of studies in the literature. Chatbots were mostly acting as a facilitator (39%) or an expert (58%) (Janssen et al., 2020). In non-AI collaborative ideation, research indicates that diversity in teammates' roles and group composition plays a crucial role in fostering effective creativity (Paulus et al., 2018). Therefore, the aim of this study is to explore differences in the effect of the AI agent in the creative collaboration process, when serving as either a facilitator or an ideator. By exploring the effects of these two sets of chatbot manipulations, conversational style and role, this study holds the potential to yield valuable insights into the intricate dynamics between AI tools and creativity within distributed collaboration settings. Advancing this understanding will bear significant implications for theorizing about collaborative creativity, human-AI collaboration, and chatbot design.

1.2 Contribution

As this research project was the result of a collaborative effort, the below table summarizes my contributions and responsibilities. The below focuses on core aspects of this project relevant to this thesis, focusing on remote collaboration, chatbot characteristics and group creativity.

Table A: Personal contributions and responsibilities

Components	**Contribution**
Defining the Research Question	Identifying the gaps in the literature to define the main research problem - 60%. Defining the research project's general directions and the research objectives - 60%. My co-supervisors guided me in the process finalizing the dependent variables and mediator.
Theoretical Background	Conducting in-depth research on scientific articles related to the topic - 90% Identifying the conceptual frameworks to be used in the study - 90%

	My co-supervisors continuously provided feedback and guidance, enabling me to identify the foundational theories for my research model. Synthesizing the relevant literature and concepts for writing the articles - 90%
Experiment	Designing the procedure and tasks - 60% Designing the chatbot scripts - 75% Collaborative effort from the research team, including supervisors to revise and edit.
Ethics	Preparing documentation related to application submission to the REB - 80% Collaborative effort was needed by a teammate due to the collaborative nature of this application.

Recruitment	Recruiting participants for the study – 80% ▫ Participant screening, scheduling, and compensation management – 100% Managing participants compensations -70%. This last step was a collaborative effort with a teammate from the research project.
Data Collection	Conducting the experiment sessions and data collection – 70% This was a collaborative effort with teammates. In addition to conducting the experiment, I was in charge of overseeing & managing any issues that occurred daily.
Data analysis	Exporting and formatting data from Qualtrics – 100% Establishing test parameters – 50%

	Co-supervisors helped set parameters. Collaborative data analysis with supervisors – 80%
Drafting the thesis	Writing 75% Editing and improvements were done based on supervisors feedback.

Chapter 2: Literature review

2.1 AI and Chatbots

With advances in technology, there has been an increase in interest in artificial intelligence including chatbots - a phenomenon coined "the chatbot tsunami" by researchers Grudin & Jacque (2019). In fact, a recent eMarketer article reported that "53% of adults in the USA have interacted with chatbots for customer service in the past 12 months, Feb 22" (*US Adults Who Have Communicated with an AI Chatbot for Customer Service in the Past 12 Months, Feb 2022 (% of Respondents)*, 2022). Additionally, a Gartner survey recently reported that "41% of enterprises are using virtual assistants or plan to use them by next year, and 23% are using or planning to use conversational interfaces" (Gartner, 2021). Another market guide from Gartner highlights the growing interest in chatbots within the industry, evidenced by the projected revenue of $36 billion for conversational AI by 2032 (Gabriele Rigon et al., 2024). The use of chatbots to provide business solutions is becoming much more prevalent (Gartner, 2021). Hence, for the above reasons, we will focus on text-based chatbots as the specific AI application of interest.

Similarly, in business and academia, chatbots have become a subject of interest. Researchers have explored multiple facets of this AI solution, including the mechanism behind its interaction with humans. In the context of chatbots as an AI solution, human-chatbot interaction has been studied from a variety of theoretical perspectives such as social facilitation, distraction-conflict theory, grounded theory, uncanny valley effect, theories of emotional regulations, the Computers-Are-Social-Actors (CASA) Paradigm and theory of planned behaviour (Beattie et al., 2020; Ciechanowski et al., 2019; Hwang & Won, 2021; Nguyen et al., 2022; Peng et al., 2019). Additionally, studies have explored various applications of chatbots such as using these AI-driven intelligent agents for emotional regulation, persuasion, reducing workload, task assistance, facilitating meetings, and increasing productivity (Folstad et al., 2021; Gimpel et al., 2023; Hwang & Won, 2021; Luo et al., 2018; Peng et al., 2019; Toxtli et al., 2018). Overall, these studies aim to better understand the mechanisms of chatbot and user interactions in the broader domain of human-AI collaboration.

Underscoring the continued importance of this research topic, recent literature reviews have highlighted the many avenues that exist for future research exploring human-AI collaboration in

the context of using chatbots. For example, a recent literature review on text-based chatbots highlights the potential avenue of studying the use of collaborative chatbots through different lenses, such as the use of chatbots for teamwork, an area that has received limited attention given the dominant focus on individual users (Folstad et al., 2021). In Rapp and colleagues' paper (2021), the authors highlight that little is known about how humans react to human-chatbot collaboration. Although the authors delve into the different sub-topics and characterization of chatbots, again the paper focuses mostly on individual-level interaction, that is, the interaction between one human and one chatbot.

Taken together, it is evident that there is a void in theorizing about human-AI collaboration and the use of chatbots in collaborative settings involving teams of humans. This is particularly relevant as chatbots for collaboration have mainly been studied at an individual level (i.e., one user and one chatbot interacting) rather than the use of chatbots in group settings (i.e., a team and one chatbot interacting). Furthermore, existing literature has focused largely on customer service context (Adam et al., 2021; Brandtzaeg & Folstad, 2017; de Haan & Snijder, n.d.; Folstad et al., 2021; Folstad & Skjuve, 2019; Trivedi, 2019; Yen & Chiang, 2021) and there is limited exploration of other activities, especially truly collaborative activities such as creative collaboration.

2.1.a. Anthropomorphism

The use of anthropomorphism characteristics in AI has become increasingly important in the evolving technological landscape. Anthropomorphism characteristics are defined as adding human attributes to non-human entities such as artificial technology (Jang, 2023a; Lembcke et al., 2020). In this paper, the focus would be to add human characteristics to chatbots. In everyday life, conversational agents (thereafter, CA) are becoming more intelligent, enabling more human-like interactions with these systems (Fakhimi et al., 2023). For example, AI solutions utilizing large language models, such as ChatGPT or Google's Gemini, generate outputs using empathetic terms and first-person pronouns like "I understand" making the interaction appear more human-like (*Gartner*, 2023; Hwang & Won, 2021; Lembcke et al., 2020). From an enterprise perspective, this trend to add anthropomorphic traits to generative AI will continue to persist. In fact, a recent Gartner article predicted that by 2026, to drive customer loyalty, 80% of the top 100 consumer brands will be using anthropomorphic characteristics in their AI solution (*Gartner*, 2023).

This study will focus on two types of anthropomorphic characteristics in chatbots: conversational style (human and machine) and role (facilitator and ideator). These attributes are considered anthropomorphic because they impart human traits to the chatbot. Conversational style gives the chatbot a tone, making the AI potentially be perceived as more machine-like or more human-like. Similarly, a role provides the chatbot with a function that includes specific underlying human traits, such as proactiveness. Chatbot conversational style (thereafter CCS) was selected as an attribute because it has been studied previously, but not in interaction with the chatbot role (hereafter CR) or at the group level (Hwang & Won, 2021; Janssen et al., 2020; Lembcke et al., 2020). CR was selected because ideator-like roles where the chatbot has a proactive role during the user-system interaction have yet to be studied in the literature. In fact, chatbots having a proactive role counted for about 21% of studies (Hefny et al., 2021). Therefore, the interest in CR at these two levels (facilitator and ideator) stems from the expectation of observing differences between these dichotomous roles. The facilitator role has been extensively studied, providing a solid foundation upon which we built the ideator CR. The ideator role, in contrast, has not been extensively researched (Hefny et al., 2021). Given the rapid advancements in AI, anthropomorphism traits, such as proactiveness in chatbots, as investigated in this study, are likely to become increasingly important in the near future(*Gartner*, 2023; Lembcke et al., 2020; Rapp et al., 2021). Furthermore, with advances in Generative AI, it is likely that future AI tools and chatbots for the workplace, will be more proactive, especially in terms of providing ideas and suggestions.

2.2. Creative Collaboration

Creativity is the root cause of technological breakthroughs, new products, novel business ideas and thus the engine of innovation for organizations (Berchicci et al., 2016; Lin et al., 2023; Van Osch et al., 2023), underscoring the importance of studying creativity. Creativity is inherently a collaborative activity that involves interactions between teammates or groups of people focused on a topic to problem-solve tasks or share ideas (Boland Jr. & Tenkasi, 1995; Steffensen et al., 2016). This paper will focus on creative collaboration in remote team settings and defines creative collaboration as *team interactions focused on generating something novel or* useful (Harvey, 2014).

Remote work and online collaboration have become increasingly common since the pandemic, and it is forecasted that this trend will continue (Cain, 2021; Druta et al., 2021). As teams are increasingly remote, collaboration is happening largely through online channels. In the workplace, this can be seen with the incorporation of online communication through multiple chat channels and discussion boards, for example, the intensified usage of Microsoft Teams, Slack, discussion boards on companies' intranet, etc. Existing research has investigated the link between online collaboration and innovation (Berchicci et al., 2016; Lin et al., 2023; Ryzhkova, 2015; Van Osch et al., 2023; Zhao Yu & Zhinan Zhang, 2020) revealing that well-performing organizations that are using online collaborative and communication tools show a positive trend toward innovation (Ryzhkova, 2015) and that online collaboration has the potential to lead to innovation although improvement of online tools to support innovation is still needed (Zhao Yu & Zhinan Zhang, 2020). Considering the continuing trend towards remote workforces and the central role of technology in facilitating the innovation process, it is important to understand and promote new ways to creatively collaborate online.

2.2.a Theory Of Organization Creativity

This study draws on the theory of organization creativity (thereafter, TOC) by Woodman and colleagues (1993) as an overarching lens for understanding creative collaboration in remote teams interacting with a chatbot. The TOC is particularly useful for this context as it focuses on explaining the mechanisms behind creativity (Woodman et al., 1993). Hereto, TOC focuses on the interplay between various components to explain the creative process surrounding organizational creativity. In this study, specific attention is given to part of the TOC model, specifically to four components: individual characteristics (contextualized as chatbot characteristics), group characteristics, creative behaviour and the creative situation (see Figure 1).

These facets of TOC were specifically selected as they relate to individual and group interactions and their effect on group creativity. We align the following TOC's facets with those investigated in our current research. First, individual characteristics was linked, mostly, to unique attributes given to the chatbots and participants prior experience with creative collaboration. Second, group characteristics were contextualized as group size and the group task (i.e., creative collaboration). Third, situational context was linked to environmental factors such as serendipity through the

exposure to additional ideas from the chatbot. Fourth and last, organizational creativity as defined in this theory as the collaborative effort toward the creation of an idea and the creative activity output: the slogans. Therefore, the connection between the current study and these selected facets of TOC is highly relevant, which is why they were chosen for this research (see Figure 1).

Furthermore, the interactionist perspective underpinning TOC, which emphasizes how the creative situation is influenced by both the individual and situational context (Woodman et al., 1993), lends itself particularly well to exploring human-AI collaboration, that is, untangling the interactions among team members and between members of the team and the AI tool in the context of collaborative creativity.

In the TOC, various mechanisms affect teamwork and group creativity. Besides the four components mentioned above (i.e., individual characteristics, group characteristics, organizational creativity, and the creative situation), the theory identifies other mechanisms less relevant to the scope of this study. These additional mechanisms related to organizational creativity or individual creative behavior include organizational characteristics and creative behavior. Organizational characteristics, which encompass an organization's culture, structure, and resources, were not the focus of this study due to the context not being that of an actual enterprise. Similarly, creative behavior, describing individual actions towards creating a product, was not emphasized as this study aimed to highlight collaborative behavior rather than individual behavior. See Figure 1.1 for a visual of the whole TOC including the mechanism that were eliminated for the purpose of this study (marked in red). Mechanisms that affect teamwork and group creativity include serendipity which will be further explained below.

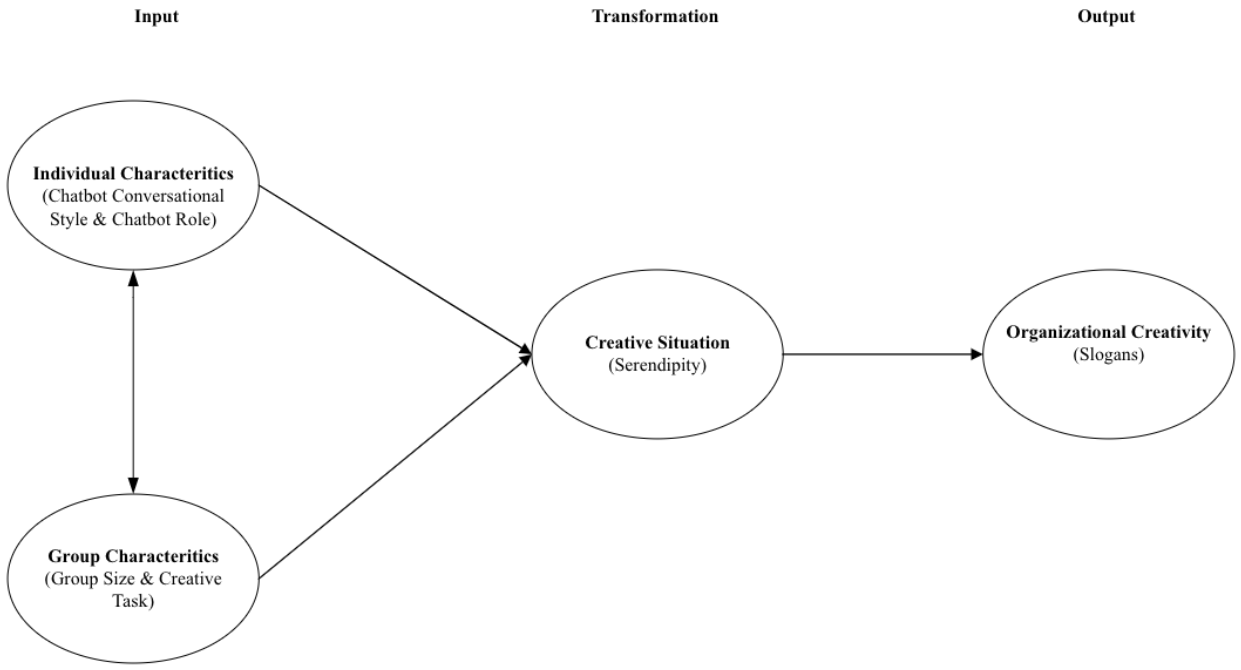

Figure 1: Theory of organizational behaviour linked to this paper's focus.

Figure 1 illustrates the four key components related to the TOC, which are the focus of this paper. The figure highlights the specific theoretical linkages between these components as proposed in the TOC. The TOC component titles are presented in bold, with the related variables used in this study indicated in parentheses underneath.

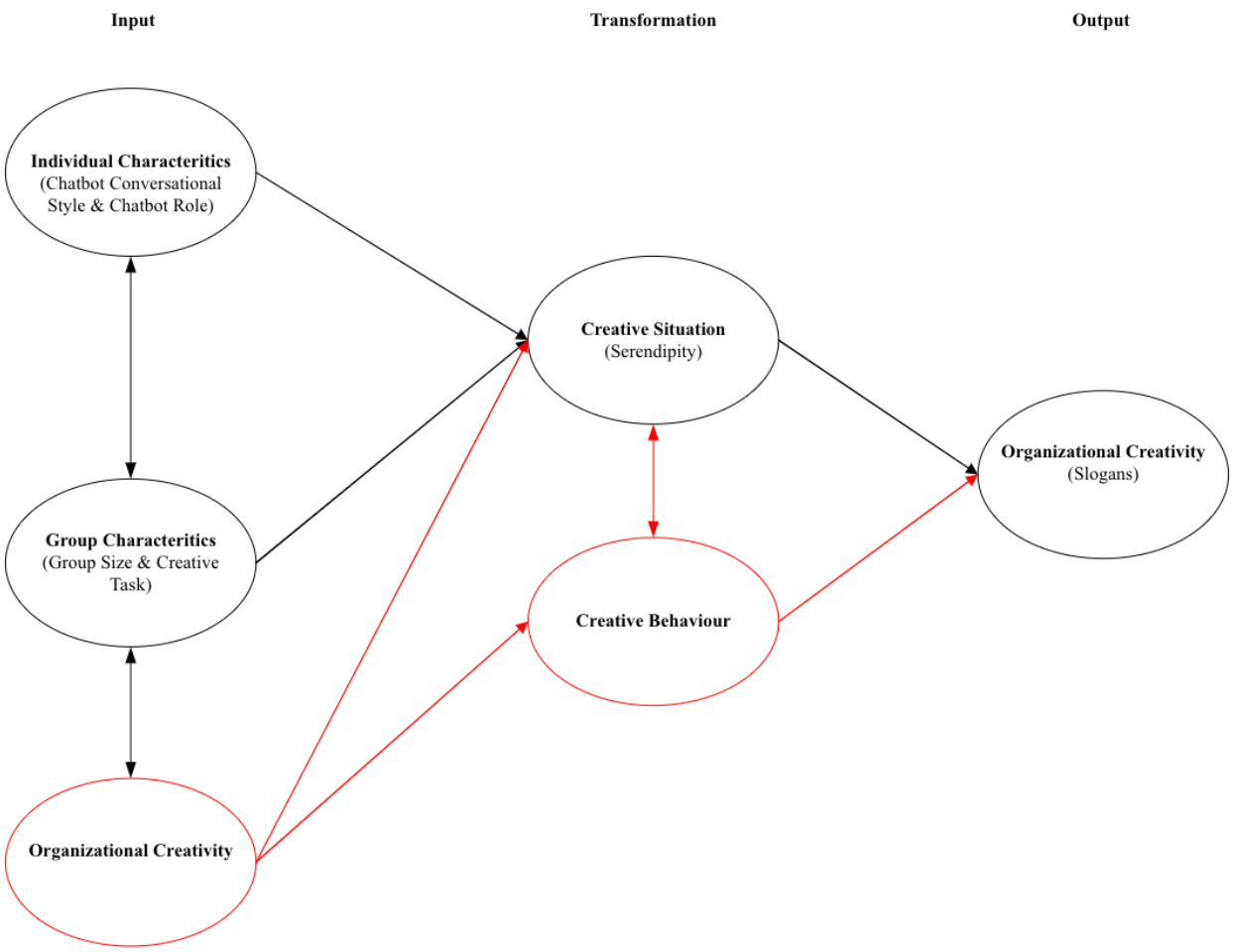

Figure 1.1: The complete TOC model with mechanisms not focused on in this paper highlighted in red.

2.2.b. Creativity & Serendipity

Serendipity is defined as an unexpected "aha" moment when one makes impromptu connections based on a trigger (McCay-Peet et al., 2015). This trigger(s) can happen through multiple types of interaction for example, while communicating with another individual or when being faced with new information (Chen et al., 2019; Foster & Ford, 2003; McCay-Peet et al., 2015). For organizations serendipitous moments can be increased by creating suitable environmental conditions to promote such phenomenon, for example, this can be done during the creative processes or team collaboration (Malmelin & Virta, 2017; Ross & Vallée-Tourangeau, 2021). This could also be done, for example, by using suitable digital environments to encourage serendipitous

occurrences through online interactions (Afridi & Olsson, 2023; McCay-Peet et al., 2015). Thus, leveraging a team's creative process to promote serendipitous moments could potentially lead to innovative ideas (Kennedy et al., 2022; Malmelin & Virta, 2017; McCay-Peet et al., 2015; Steffensen et al., 2016). In fact, a study done by cognitive psychologists found that serendipity is an integral part of the creative process; through a problem-solving experiment, researchers observed that participants creatively solve tasks based on insights not directly related to the tasks at hand. In other words, the participants had "aha" moments which allowed them to come up with a solution for the tasks during the experiment (Steffensen et al., 2016). Another paper referred to using serendipity to stimulate researchers' creativity by optimizing one's environment and implementing best practices to promote such occurrences during collaboration and ultimately increase the potential for scientific discoveries, or innovation (Kennedy et al., 2022). Thus, serendipity is important for innovation, by the by-product of one's environment and ability to encounter new pieces of information that can result in unexpected ideas (Foster & Ford, 2003; Malmelin & Virta, 2017; Ross & Vallée-Tourangeau, 2021).

In the literature, serendipitous moments have been associated with creativity, but not much interest has been given to this topic in the context of IT usage or system interactions, specifically using chatbots (Afridi & Olsson, 2023). The literature showcases multiple studies related to engineering serendipitous moments using various interfaces, specifically by manipulating the information being presented to participants visually (Bach et al., n.d.; Calero Valdez et al., 2015; Cleverley & Burnett, 2015; Kleiner et al., 2013). Although these various studies, including a literature review, explored serendipity with different artifacts, none of these appear to focus on the use of a chatbot as a means to engineer serendipity, highlighting a gap in the literature (Afridi & Olsson, 2023).

Mechanisms that affect teamwork and group creativity include serendipity. Serendipity was chosen as it is associated with the situational context (from TOC) in this current study. We explored this mechanism for two main reasons. First, as aforementioned, this phenomenon has yet to be studied with the use of a chatbot. Second, serendipity was particularly relevant in this study because of the manipulation of chatbot role, specifically the exposure to the ideator chatbot. The primary purpose of the ideator chatbot was to provide new ideas to the team, presenting ofte unexpected information, distinct from the flow of the human participants' conversation, such as slogan details. Hence, by design, the ideator role was designed to increase serendipitous input.

Given these reasons and the inherent importance of serendipity in the creative process, we decided to focus solely on serendipity as an explanatory mechanism.

In short then, in this study, we aim to explore the impact of various chatbot characteristics on group creativity, particularly focusing on the underlying mechanism of serendipity. We will next discuss how anthropomorphism is conceptualized in this study, examine the hypothesized relationships, and conclude with the presentation of the proposed research model.

Chapter 3: Theory and Hypotheses Development

We will begin by integrating the literature on chatbots, and specifically the importance of anthropomorphism, with the literature on creativity to examine how chatbot characteristics are conceptualized in the context of online creative collaboration.

As teams increasingly shift to remote work, collaboration is predominantly facilitated through online channels. Collaboration in an online setting may elicit similar effects or involve similar explanatory mechanisms to those observed during in-person creative collaborations.

Research has begun to explore the effects of anthropomorphic features in AI solutions specifically within the context of creative activities (Jang, 2023a; Lembcke et al., 2020; Savery et al., 2021). Jang (2023) discovered that anthropomorphic features help users accept AI, with this effect being particularly prominent during creative activities where the AI generates creative solutions. Another study found that human attributes in AI are positively associated with inclusivity and intrinsic motivation in users (Lembcke et al., 2020). Using a chatbot with human attributes during creative tasks makes users perceive the chatbot as more capable (Zheng et al., 2023). Overall, using AI with anthropomorphic features during creative activities appears to have a positive impact on the interaction (Hwang & Won, 2021; Jang, 2023b; Lembcke et al., 2020; Savery et al., 2021; Zheng et al., 2023). In this paper, we focus on two anthropomorphism attributes, namely chatbot conversation style and chatbot role, which will be further explored below.

3.1 Chatbot Conversation Style (CCS)

CCS is an anthropomorphism characteristic previously studied in the literature (Hwang & Won, 2021; Lembcke et al., 2020; Rapp et al., 2021; Roy & Naidoo, 2021). Lembcke and colleagues

(2020) examined different levels of anthropomorphism in chatbots during individual user-chatbot interactions in a persona-building activity. In this study, they described CCS as human and machine, where each condition used different verbal and non-verbal cues to represent their respective conditions. Examples of verbal cues and human-like attributes included praise, greetings, and human-like names (e.g., Laura) in the dialogue. Non-verbal cues in dialogue included response time and the use of emoticons. Lembcke and colleagues (2020) study focused on the effects of anthropomorphic traits on motivation and inclusiveness. Although the experiment involved a creative activity, this study did not measure or examine creative variables. This highlights a gap that the current paper aims to address.

Hwang & Won (2021) also studied CCS during an idea generation activity, defining CCS in two levels: bot-like and human-like, using predefined scripts for both conversational types. Their study focused on individual-level interaction during a creative activity and assessed creativity by measuring the number and originality of ideas generated, as well as self-evaluation of creative self-efficacy. A notable gap in Hwang & Won (2021) that this paper addresses is the evaluation of chatbot-human interactions at the group level.

3.2 Chatbot Role (CR)

CR is another anthropomorphic attribute of chatbots that this study focused on through two roles: a facilitator and an ideator. Most current research has focused on using chatbots with a facilitator-like role (Følstad & Halvorsrud, 2021, Hefny et al., 2021). Facilitator chatbots are defined as AI that engage in reactive behaviour, i.e., the chatbot's main function is to respond to user's input thus giving users more control over the conversation (Følstad & Halvorsrud, 2021). This can look like chatbots providing options to its users based on users' specific questions or search queries. In fact, 79% of studies on chatbots focus on reactive chatbots (Hefny et al., 2021).

In contrast, an ideator role in a chatbot, as defined in this study, involves more (pro-)active participation in the conversation by acting like a peer and providing inputs, feedback, or ideas without being prompted. These peer-like, proactive chatbots have been less studied, and the outcomes of using proactive chatbots seem conflicting (Folstad et al., 2021; Hefny et al., 2021; Rapp et al., 2021; Zhu et al., 2021). Proactive dialogue can help streamline task achievement and help users (Zhu et al., 2021) thus underscoring the potential relevance of proactive chatbots. That being said, some past research has shown that proactive behaviour can be perceived negatively if

not contextually appropriate (Følstad & Halvorsrud, 2021). However, as our chatbot was designed to be contextually appropriate–i.e., to provide input relevant to the creative task at hand–it is anticipated that the proactive role of our ideator bot would have a positive impact on the creative outcome of the remote teams in the study. By empirically exploring the effect of chatbot's role on serendipity and on the creative outcomes of the team, this study might further help to shed light on this equivocality in the literature on proactive chatbots.

The use of chatbots for collaboration especially in the context of group-level interactions has been less studied, hence this paper seeks to fill that gap by uncovering the mechanisms interlinking different anthropomorphism features (CCS and CR) and its effect on group creativity. The importance of anthropomorphism in chatbots lies in the fact that users' perceptions of chatbots influence their interactions. This, in turn, can impact business outcomes by enhancing customer retention, streamlining services through increased loyalty, and reducing expenses (*Gartner*, 2023). To further unpack the effect of these two anthropomorphism attributes of chatbots—CCS and CR—on collaborative creativity as well as the mechanisms of serendipity from a theoretical perspective, the following will propose a set of hypotheses and explain the underlying theoretical rationale.

3.3 Creative collaboration & chatbots characteristics

The TOC suggests that individual characteristics influence overall creativity and the contextual situation. Because of the focus on chatbots in this study, we have adapted the TOC and contextualized individual characteristics to refer to the characteristics of the chatbot. Specifically, in line with the above, we focus on two characteristics of chatbots, CCS and CR, and how these will influence the group and creative situation.

3.3.1 Chatbot conversation style (CSS) and group creativity

Previous research has tackled building chatbots with different characteristics (Hwang & Won, 2021; Lembcke et al., 2020). This holds particular significance because the perception of chatbots directly shapes human interactions with them.

Anthropomorphic features, such as a human conversational style in conversational agents, have been found to influence human perceptions and other factors. For example, Lembcke (2020) found

that human-like qualities in chatbots can boost motivation by creating a safer environment for individuals to interact within. Therefore, human attributes in chatbots, such as human CCS, could increase individual motivation to engage in creative tasks, potentially enhancing creative outputs in terms of idea quality, idea quantity, and self-reported creativity.

Furthermore, specific chatbot characteristics could significantly impact creative outputs during creative tasks (Hwang and Won, 2021). Specifically, chatbots with a human conversational style were associated with higher idea quality. This improvement in idea quality may be due to the increased exposure to words based on the CCS through longer sentences, non-verbal cues like emojis, and positive reinforcement in the language, all of which contribute to a more welcoming and safer environment in online group chats. By creating this supportive environment, team members may feel more confident and motivated, leading to the generation of higher-quality ideas.

Hwang and Won (2021) found that—inversely—the number of ideas is greater with a machine conversational style in chatbots, attributing this to social facilitation theory. They suggested that in one-on-one interactions between a human and a chatbot, participants might experience less social anxiety, as they feel less judged when communicating with a machine. However, this explanation may not apply in our study's group setting. In a group context, collaborative synergy and the fully online environment may reduce the influence of social anxiety, potentially enhancing human collaboration. With multiple participants involved, the additional human cues provided by both the chatbot and other team members may lead to an increased quantity of slogans, outweighing any potential judgment associated with the human conversational style.

Although, Hwang & Won (2021) found that the number of ideas is greater with machine conversational style in chatbots (Hwang & Won, 2021), this study thus explores an alternative rationale, suggesting that exposure to human conversational style may lead individuals to generate more ideas. Thus, the human CCS encourages team members to share more ideas and more original ideas. Exposure to a human conversational style may encourage participants to generate more ideas by fostering positive group interaction, enhancing individual motivation, and creating a safe space. This, in turn, could lead to higher quantities and quality of ideas, as well as increased self-reported creativity.

In exploring the impact of conversational style on self-reported creativity during creative tasks, we find that higher self-reported creativity is often observed at the individual level when interacting with a chatbot using machine CCS (Hwang & Won, 2021). This may be due to individuals feeling safer, more comfortable and less judged engaging with a chatbot. However, since this study examines group interactions involving multiple humans, and considering that self-reported creativity often depends on overall group performance, we believe this effect may not fully apply. Instead, the overwhelming evidence that people hold more positive perceptions toward human CCS in chatbots in general, leads us to hypothesize better team performance, in terms of self-reported creativity (Jang, 2023), for groups exposed to a chatbot using human conversational style.

Thus, based on the foundation of previous research, we hypothesize the following:

H1: Teams engaging with a chatbot that adopts a human conversational style will display higher group creativity compared to teams engaging with a chatbot that adopts a machine conversational style.

- **H1a**: Teams engaging with a chatbot that adopts a human conversational style will display higher quantity of ideas compared to teams engaging with a chatbot that adopts a machine conversational style.
- **H1b**: Teams engaging with a chatbot that adopts a human conversational style will display higher quality of ideas compared to teams engaging with a chatbot that adopts a machine conversational style.
- **H1c**: Teams engaging with a chatbot that adopts a human conversational style will display higher self-reported creativity compared to teams engaging with a chatbot that adopts a machine conversational style.

3.3.2 Chatbot role (CR) and group creativity

Past research has only offered limited insights into the effect of chatbot role during human-machine interactions; primarily as there are very few studies having explored a peer-like role compared to a facilitator role (Janssen et al., 2020). With that in mind, our approach to hypothesizing about the ideator role takes a slightly exploratory scope and touches upon broader literature. The ideator CR is considered more human-like as the goal is for the chatbot to be perceived as an autonomous entity with its own ideas and suggestions that are contextually relevant to the task at hand. Additionally, in this context, the ideator chatbot may be perceived as an expert or authority figure in the domain, given that its suggestions are contextually relevant and drawn from a vast amount of background information accessible to the AI (Araujo et al., 2020). Thus, considering that ideator CR in this study is inherently creative (i.e., proposing ideas and suggestions for slogans), individuals may perceive those chatbot characteristics as more positive resulting in individuals being more accepting toward CR ideator inputs (Jang, 2023b; Lembcke et al., 2020). This positive perspective of ideator CR could result in higher engagement during the creative tasks resulting in higher idea quantity.

Given that the chatbots in this study are context-specific and the ideator chatbot plays a proactive role, we hypothesize that the contextual proactivity of the ideator chatbot will positively influence group creativity (Folstad et al., 2021). By guiding and focusing the team towards relevant slogans, the chatbot is expected to also enhance the quality of the slogans produced by the teams (Zheng et al., 2023). The ideator chatbots might stimulate more dynamic group interactions, pushing the team to think more creatively and critically about the task at hand. This study posits that the mere perception of the chatbot as an engaged group member—demonstrated through its ideator CR by proposing ideas and slogans—will lead teams to perceive themselves as more creative. Thus, influencing individuals' perception of self-reported creativity. Therefore, the proactive dialogue facilitated by the chatbot will help both the group and individuals perceive their creative contributions as streamlined and valuable (Zhu et al., 2021).

Building on these insights, we propose the following hypothesis:

H2: Teams working with a chatbot acting as an Ideator will display higher group creativity compared to teams working with a chatbot acting as a Facilitator

- **H2a:** Teams working with a chatbot acting as an Ideator will display higher quantity of ideas compared to teams working with a chatbot acting as a Facilitator.

- **H2b**: Teams working with a chatbot acting as an Ideator will display higher quality of ideas compared to teams working with a chatbot acting as a Facilitator.

- **H2c**: Teams working with a chatbot acting as an Ideator will display higher self-reported creativity compared to teams working with a chatbot acting as a Facilitator.

3.4 Creative collaboration and serendipity

The TOC emphasizes how group processes such as the social context and problem-solving strategies (e.g. brainstorming) influence creative behaviour. Additionally, social information, that is verbal and non-verbal cues one perceives from the environment can influence perception and ultimately creativity. This brings us to the concept of serendipity , an important characteristic of the creative situation, which is defined as an accidental valuable finding, an "aha" moment (Malmelin & Virta, 2017). In the digital environment, serendipity can occur when people are confronted with unexpected information. In the context of AI-human collaboration, where the chatbot's role is to ideate, that is the AI agent will actively contribute written ideas to the group, there is a heightened chance for facilitating serendipitous moments during the creative task at hand. When individuals engage with human CCS characterized by more verbiage (e.g. longer sentences) and non-verbal cues (e.g. emojis), the increased exposure to these elements may heighten the likelihood of serendipitous moments during the interaction.

Given that human CCS and ideator CR in this study will provide participants with additional information through lengthier, more human-like sentences, visual cues such as emojis, and contextually relevant new slogan ideas, it is likely that these enriched interactions will increase the likelihood of serendipitous moments occurring with the most human-like chatbots (Chen et al., 2019; Foster & Ford, 2003; McCay-Peet et al., 2015). The ideator chatbot was specifically designed to provide contextually relevant suggestions, (from pre-developed prompts) not tailored to each group's specific progress, but rather relevant to the overall task. Because of this, the chatbot may introduce elements that are relevant to the task at hand but not necessarily align with the participants' current progress, potentially increasing the likelihood of unexpected moments of insight. These serendipitous moments, generated as a byproduct of the group's interaction with the

human CCS and ideator CR, could lead to the creation of new ideas (Kennedy et al., 2022; Malmelin & Virta, 2017; McCay-Peet et al., 2015; Steffensen et al., 2016).

As the chatbot induces more 'aha' moments, these could enhance idea quality by presenting more relevant, contextually appropriate slogans through the CR as well as facilitating out-of-the box thinking, and further increase idea quantity by making such moments more frequent. Consequently, self-reported creativity is likely to be rated higher, as the serendipitous moments facilitated by the chatbot's characteristics will lead participants to perceive the brainstorming session as more diverse and creative due to the team's increased creative output. This process of group creativity is expected to positively influence the quantity, quality, and self-reported creativity of the ideas produced. Considering the ideator chatbot role and the human conversational style which will include exposure to more information (through longer sentences, emojis and ideas) we formulate the following hypotheses:

H3: Serendipity mediates the relationship between Chatbot Role and Group Creativity, such that an ideator Chatbot Role increases the level of Serendipity experienced by the group, which in turn leads to higher group creativity.

- **H3a**: Serendipity mediates the relationship between Chatbot Role and Group Creativity, such that an ideator Chatbot Role increases the level of Serendipity experienced by the group, which in turn leads to higher quantity of ideas.

- **H3b**: Serendipity mediates the relationship between Chatbot Role and Group Creativity, such that an ideator Chatbot Role increases the level of Serendipity experienced by the group, which in turn leads to higher quality of ideas.

- **H3c**: Serendipity mediates the relationship between Chatbot Role and Group Creativity, such that an ideator Chatbot Role increases the level of Serendipity experienced by the group, which in turn leads to higher self-reported creativity.

H4: Serendipity mediates the relationship between Chatbot Conversational Style and Group creativity, such that a human Conversational Style increases the level of Serendipity experienced by the group, which in turn leads to higher group creativity.

- **H4a**: Serendipity mediates the relationship between Chatbot Conversational Style and Group Generativity, such that a human Conversational Style increases the level of Serendipity experienced by the group, which in turn leads to higher quantity of ideas.
- **H4b**: Serendipity mediates the relationship between Chatbot Conversational Style and Group Generativity, such that a human Conversational Style increases the level of Serendipity experienced by the group, which in turn leads to higher quality of ideas.
- **H4c**: Serendipity mediates the relationship between Chatbot Conversational Style and Group Generativity, such that a human Conversational Style increases the level of Serendipity experienced by the group, which in turn leads to higher self-reported creativity.

The overall research framework is presented in Figure 2.

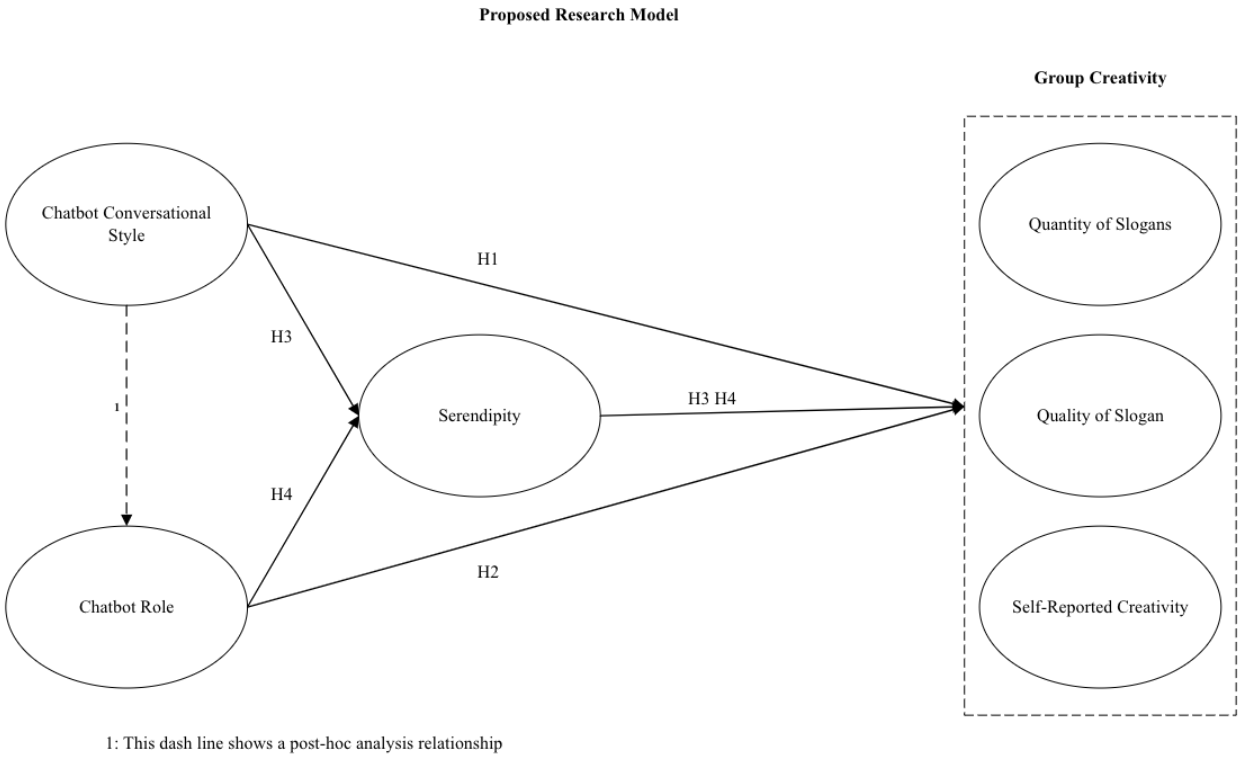

Figure 2: Proposed research model

Chapter 4: Methodology

4.1 Research Design

In this study, an online 2x2 between-subject experiment was conducted where participants were required to do a creative activity (See Figure 3). The first factor manipulated was the chatbot's conversational style via two levels: human-like and machine-like. The second factor manipulated was the chatbot's role during the experiment which was defined as the chatbot acting as either a facilitator or an ideator (i.e., an active participant). Participants were randomly assigned to one of these four conditions. Group creativity was measured as an output of the team's activity along three dimensions, specifically by measuring self-reported creativity as well as two unobtrusive measures, namely the quantity of ideas and the quality of the ideas generated. The quality of ideas was assessed by a domain expert using Tierney and Farmer's (2002) three-dimensional scale (Shin & Zhou, 2007). The main underlying creative mechanism that was measured for this study was serendipity. This construct was measured through a survey using scales validated in existing literature (Edmondson, 1999; McCay-Peet & Toms, 2011; Salisbury et al., 2006).

4.2 Wizard of Oz (approach)

This study employed a Wizard of Oz (hereafter, WoO) technique for the experiment. This technique is defined by the use of a human to play the system during the experiment (Avula & Arguello, 2020; Bittner & Shoury, 2019). This technique was selected to streamline the experiment process as the research team did not have the technical abilities to create multiple different chatbots from scratch while maintaining the experimental (i.e., controlled) nature of this project (i.e., ensuring exposure to identical messages at consistent time intervals). In other words, the Wizard of Oz technique was selected to ensure the controlled nature of an experimental design and to implement the chatbot without the need to code it. Additionally, this technique has been used in prior studies with conversational agents, including studies using chatbots, making it an ideal framework for this study (Avula & Arguello, 2020; Maria Rosala & Sara Paul, 2024; Rapp et al., 2021). This follows best practices and enables this study to test the chatbots in specific conditions at a low cost (Maria Rosala & Sara Paul, 2024).

In the context of this specific study, the human or research assistant was trained to play the chatbot in specific conditions. While playing the chatbot, each research assistant was given specific rules

and conditions to follow. To make sure the experiment setting was consistent across all four conditions, each research assistant playing a chatbot followed a script, which included specific instructions regarding the timing of prompts to be sent to the minute (time-based rules) and some additional condition-based rules describing the nature of the interaction between human and chatbot.

First, time (in minutes) was used as a rule for prompting the chatbot. Time was used because this was a collaborative experiment including multiple people and with strict timeframes to complete each of the experimental tasks. For example, 10 minutes was used for the divergent creative activity and 5 minutes for the convergent creative activity (see Appendix 1). Additionally, the time-based rule prompting was selected because the research team wanted to make sure that the effect of the exposure to the independent variable, that is, the chatbot was sufficient to observe an effect.

Secondly, condition-based rules that were used throughout the experiment gave the research assistant playing the chatbot additional flexibility to make sure the participants followed the instructions. Those condition-based rules were only displayed under, as per the name, specific conditions. In this experiment, this meant two main points. First, if any participants made an inquiry by referencing the chatbot by typing “bot” or “chatbot” or “@Ideabot”. For example, if a participant asked a question directly to the chatbot, the human playing the chatbot could answer, based on the script, “Please only insert the password enclosed within the brackets.” (see Appendix 2 for more examples). This was implemented to make sure the participants got an idea regarding the chatbot’s limitations and would continue the experiment without additional hurdles. Second, to make sure that all the participants were present for all experimental tasks, the chatbot could request the participants in the room (i.e., the active group chat) to wait or start the activities. This was implemented based on the participant's active presence and participation in the chat. Examples of messages the chatbot could send were “Hey there! Please wait for the rest of our team before starting the task” (see Appendix 2 for a breakdown of prompts per conditions).

The WoO technique enabled streamlining of the implementation of the experiment without having to actually develop the code for the chatbot from scratch allowing the research team to gain research insight without spending an important amount of time and money on chatbot creation

resources. Like all techniques, the WoO does have limitations. In this study, one major downside of this technique was the less-than-flexible output of the chatbot which could make the chatbot sound odd because of the pre-established timing of messages. In other words, users could notice a "clear" limitation of the chatbot during the experiment depending on the pace of their conversation. Another limitation comes from the nature of the technique in the context of an experiment. Given that this study involved synchronous group participants and four different experimental conditions, each condition was designed to ensure similar exposure to the independent variables (i.e., the chatbot and its responses). Consequently, the chatbot was limited in its ability to provide personalized recommendations based on participants' outputs (Maria Rosala & Sara Paul, 2024) thus limiting the ecological validity of the scenario. The research team recognized this limitation, however, greater personalization in the messaging by the chatbot would have increased human error and undermined the experimental (i.e., controlled) nature of the study.

4.3 Script

This study used four scripts, one per condition, to support the WoO technique and make sure each participating team followed a specific structure for the creative activities. Each script was used by the research assistant to copy/paste the prompt in the group chat when playing the chatbot. This means that the chatbot operated on two main layers according to the script: first, as a moderator (regardless of the experimental condition), and second, as a personalized chatbot (i.e., the independent variable). The moderator role was limited to giving specific instructions for the smooth process of the online experiment (see Appendix 1).

The script development for each condition was generated using ChatGPT[1] to make it as realistic as possible and increase ecological validity. The process for script creation was as follows: First, ChatGPT was asked to develop a script outline while adhering to specific conditions, such as a 10-minute activity involving three participants. Second, the research team reviewed the script and made edits. Then, ChatGPT was asked to refine the script based on the team's feedback. This iterative process continued until a satisfactory script meeting all the experimental conditions was created.

[1] https://chat.openai.com/

Once a strong outline for the script based on timing and participant number was reached, we used chatGPT again to fine-tune the script per conditions. This means that ChatGPT was used for additional minor edits based on the persona of the chatbot for each condition. This is described in detail in the independent variable section, later in this paper. Once the fine-tuning of the script was completed, the research team reviewed the scripts and added final minor edits as needed, for example, by editing emojis or personal pronouns. See Appendix 3 for an outline of the iterative process for script development using ChatGPT.

4.4 Dependent Variables

To measure the dependent variable, group creativity, three methods were used to have a comprehensive understanding of the variable. Firstly, this study assessed team creativity through self-reported team creativity responses of each participant on a questionnaire. Secondly, group creativity was quantified by calculating the number of slogans generated by each group during the first part of the experiment; the divergent ideation session where participants were required to brainstorm slogans in team. Finally, an expert evaluation was conducted to assess the quality of ideas each group generated. The assessment for the quality of the group's creativity was based on the final slogan chosen by each team during the second part of the experiment (convergent ideation).

4.5 Independent Variables

Two variables were manipulated to evaluate chatbot characteristics: chatbot conversational style and chatbot role (see Figure 3). Each independent variable had 2 sub-factors.

Chatbot conversational style (CCS) was defined as the style of speech the chatbot used. There were two types of speech used in the experiment: human and machine conversational style. The human conversation style had various characteristics to distinguish it from its counterpart: the machine style. Human conversational style included, overall, the use of longer sentences, verbiage that encouraged teams this was to increase the perception of "warmness" of the chatbot, the usage of emoticons, and the usage of personal pronouns to increase the perception of the chatbot as human. Some examples of personal pronouns used by the chatbot to help create a conversation and inclusive tone were: I, we, you, it, your and our. This can be seen in context in the scripts (Appendix 1). Alternatively, the machine conversational style was intended to sound bot-like. This was done to distinctly highlight the differences between the two conversational styles during the

experiment, enhancing the likelihood of observing significant results. Thus, the machine conversational style in the chatbot excluded the components that can be found in the human conversational style chatbot. Instead, the machine conversational style chatbot used shorter verbiage, formal and mechanical language including repetitive words and notification prompts, no emoticons, and no personal pronouns. The goal of the machine conversational style was to be perceived as a bot lacking personalization and emotional engagement, characterized by an overall detached and mechanical tone.

The chatbot role (CS) was also defined into two sub-factors: facilitator and ideator (or peer-like) role. The facilitator role was defined as a chatbot who had as a primary role to orchestrate the team's activities by acting in a passive manner. This was demonstrated by the chatbot's role, which focused on managing time and giving specific instructions to guide participants through the tasks to be executed, i.e., orchestrating the team activities. The chatbot's prompts avoided phrases like 'our' and 'my team,' reinforcing the perception that the bot was not part of the team and instead referred to it as "your" or "your team". Alternatively, the other chatbot role, that of ideator, was designed to actively participate and be perceived as a peer or an active team member during the execution of the experimental tasks. A specific characteristic of the ideator bots, in addition to giving instructions and managing time (similar to the facilitator condition) was that it proposed opinions, suggestions, and ideas of its own. This additional behaviour in the ideator chatbot aimed to add to the perception of the chatbot as a proactive team member, an intelligent AI solution.

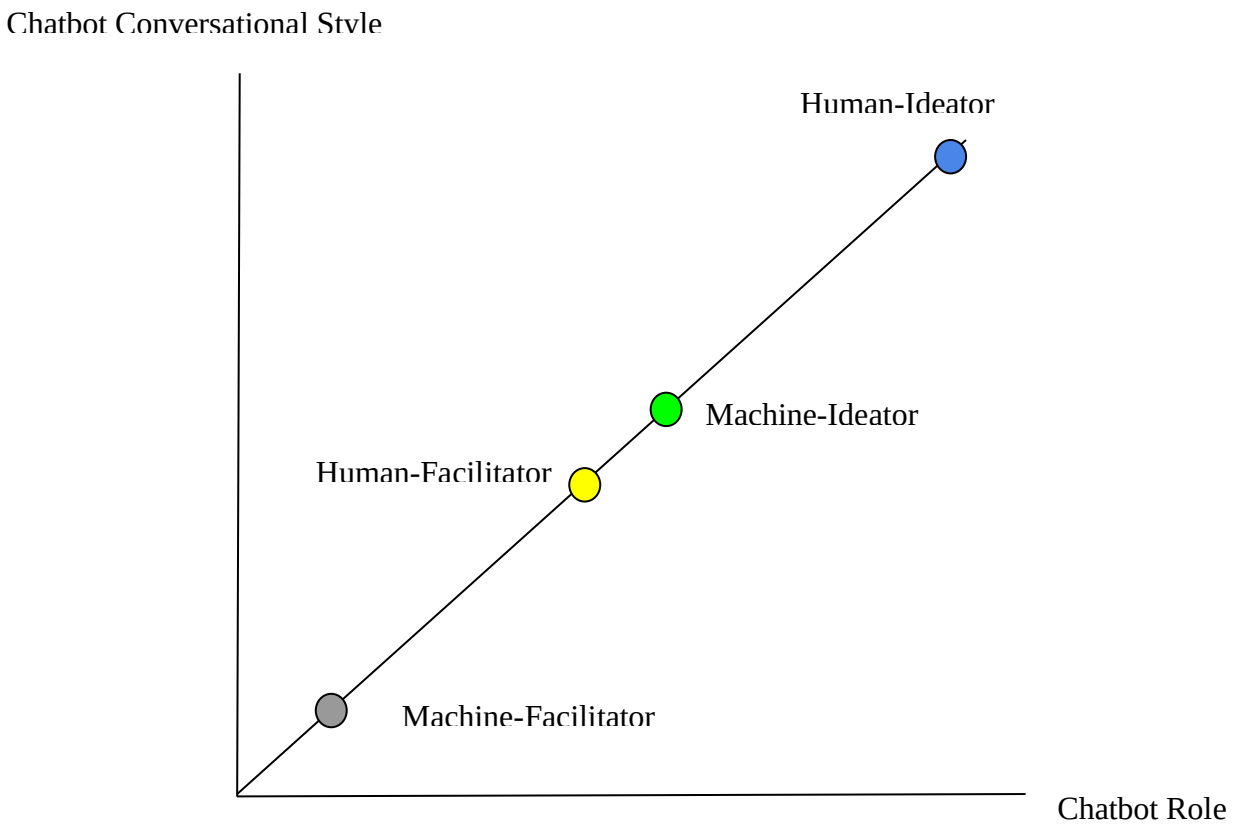

Figure 3 : Level of characterization per condition

4.6 Confounding & Control Variables

To minimize confounding variables and to have good internal validity this study tried to randomize each participant for each group. This was done in multiple ways. First, each participant was randomly assigned to a condition. Secondly, each group was scheduled between 1 to 6 PM Eastern time across all conditions to rule out timing variations between conditions. Third, each moderator had a practice session to understand their role and requirements when playing the chatbot. All of these were kept consistent to minimize external influences.

Furthermore, relevant control variables were gathered using a demographic questionnaire. First, sex was collected in three categories: male, female, and non-binary. Second, age was collected in brackets, from 18-24 years old to 65 and more years old. Third, a question regarding participants' comfort with technology was asked due to the nature of this experiment (synchronous online collaboration). Last, prior experience with chatbots was also collected. Control variables were not

found to have a significant effect and no significant differences in any of the control variables were found between conditions.

4.7 Participants

For this controlled experiment, to have statistical power we estimated an initial sample amounted to 384 participants (see Table 1 for a breakdown of conditions). This number was estimated using a G*Power analysis. After each round of recruitment (each round lasting about 1.5 weeks) some preliminary analyses were conducted using means to assess the trend of the research model and variables of interest. Based on these preliminary analyses, the feasibility of group recruitment and timeline had to be re-assessed and it was decided that the final sample would be reduced to 15 groups per condition (see Table 2 for exact breakdown), each group having on average of 3 (human) participants in addition to the chatbot. It is worth noting that due to the group nature of the experiment and the complexities of scheduling group sessions, there was a tendency for participants not to show up. Hence, an over-sampling strategy was employed, which resulted in some groups having 4 human participants (see Table 3 for breakdown).

Text-based chatbot	Human conversation style	Machine conversational style
Facilitator role	n=96	n=96
Ideator role	n=96	n=96

Table 1: Initial experimental design

Text-based chatbot	Human conversation style	Machine conversational style
Facilitator role	n=15	n=16
Ideator role	n=15	n=15

Table 2: Final group breakdown (groups had between 2 to 4 participants with the majority having 3 participants).

Number of participants per group	Number of groups
2 participants	2
3 participants	48

4 participants	11
Total number of groups	61

Table 3: Breakdown of the number of participants per group

In this study, participants were selected based on criteria such as individuals with collaborative experience, and individuals who spoke English. Hence, participants' inclusion criteria included proficiency in the English language and having obtained a graduate degree at a minimum. Those criteria ensured that participants had experience with group collaboration which was relevant for this study's research objectives.

The final participant count was a total of 190 participants with each of the four conditions having around 50 participants (see Table 4 for an accurate number). The variation in number of participants per condition is due to the final group size varying slightly between conditions during the experiment. Specifically, some no-shows and unexpected dropouts during the actual group experiment were external conditions the experimenters could not control or foresee. In terms of age, 19.5% (n=37) participants were between 18 to 24 years old, 38.9% (n=74) participants were between 25 to 34 years old, 28.9% (n=55) participants were between 35 to 44 years old, 10% (n=19) participants were between 45 to 54 years old, 1.6% (n=3) participants were between 55 to 64 years old, and 1.1% (n=2) participants were 65 years old or more. In terms of sex, 52.1% (n=99) participants identified as male, 45.8% (n=87) identified as female and 2.1% (n=4) identified as non-binary. Most participants in this study were comfortable with using technology, specifically, 80% (n=152) of participants described themselves as extremely comfortable, 16.3% (n=31) of participants were somewhat comfortable, 0.5% (n=1) of participants were neither comfortable nor uncomfortable, 1.1% (n=2) of participants were somewhat uncomfortable, and 2.1% (n=4) of participants were extremely uncomfortable. Lastly, most participants had prior experience interacting with a chatbot for assistance or information in the past (such as using a chatbot for customer service inquiries on websites or getting assistance from ChatGPT). Specifically, 90% (n=171) of participants said to have previously used or interacted with a chatbot and 10% (n=19) said to not have used a chatbot in the past.

Text-based chatbot	Human conversation style	Machine conversational style
Facilitator role	n=45	n=51
Ideator role	n=48	n=46

Table 4: Final experimental design

4.8 Procedure

Participants were recruited through Prolific[2]. Prolific was selected because of the online nature of the platform, its recruitment cost and its use by other researchers in different studies(Palan & Schitter, 2018). Once a participant expressed interest via the Prolific platform, they were sent to a Calendry link to make an appointment for the group study. On Calendry, slots of time were made available between the hours of 1 PM EST and 6 PM EST. Those were selected based on the research team's availability and to avoid confounding effects based on time across conditions and groups. Once a participant chose a slot of time, a member of the research team sent a confirmation message as soon as possible (see Appendix 6). Additionally, a reminder message was sent about 15 minutes before the start of the session to each participant (see Appendix 7). This was done to decrease no-shows. For a visual representation of the different websites used in this study, see Appendix 5.

Participants were assigned to groups of 3 or 4 people for this experiment. Each group had 45 minutes to complete the online group activity; they were instructed to work together to generate as many creative slogans as possible to promote public transportation among university students to contribute to a better environment and a sustainable society.

In the first part, each participant had to fill up a consent form and spend 5 minutes doing an individual brainwriting activity. This technique will allow participants to come up with some individual ideas without communicating with each other (Kohn & Smith, 2011; Paulus et al., 2011); this will also allow participants to contribute meaningfully to the subsequent group activity. A timer was put on through the survey to make sure each participant spent the same amount of time individually brainstorming.

[2] https://www.prolific.com/

In the second part, each group came together and brainstormed slogans. This was done on an online plate called Chatzy (https://www.chatzy.com/). Chatzy was selected rather than other popular chats because it allowed participants to enter a private online chat room without the need to sign up or use their email addresses. This allowed more flexibility and streamlined the process for each session. The goal of this divergent group creative activity is to allow each group to come up with as many ideas for slogans as possible.

In the third part and final part, each group were asked to discuss and come to a consensus to select their most creative slogan from the brainstorming activity. This was the convergent group creative activity. See Appendix 4 for a visual overview of the design procedure.

After the experiment, each participant was compensated about $10CAN (following the deduction of Prolific fees). In addition, three groups were selected based on the best final slogans and the amount of slogans outputted during the brainstorming session. Each of these groups got an extra $45CAN cash bonus on the prolific platform.

4.9 Measurement

Following the completion of the group experiment individuals were asked to complete a survey. Surveys were distributed electronically via Qualtrics to facilitate efficient data collection from a geographically diverse group of participants. Validated scales from existing literature were used to measure serendipity and self-reported creative performance, which are further discussed below (Edmondson, 1999; McCay-Peet & Toms, 2011; Salisbury et al., 2006; Shin & Zhou, 2007). In addition, group creativity was measured as an output of the team's activity, specifically the quantity and quality of the ideas generated, with quality being assessed by experts using Tierney & Farmer's (2002) three-dimensional scale.

4.9.1 Serendipity

The serendipity in digital environment scale was used to measure serendipity(McCay-Peet & Toms, 2011). This validated 16-item questionnaire includes 5 factors of serendipity: enabling connections, introducing the unexpected, presenting variety, triggering divergence & inducing curiosity. Participants rated each item on a 5-point Likert scale from 'strongly disagree' (1) to 'strongly agree' (5). Items were slightly edited to fit the context of the experiment regarding chatbot interaction. Here is an example of a contextualized item "The chatbot enabled me to make

connections between different ideas". See Appendix 8 for the complete scale. For this study, a total score was calculated across all items. A higher score indicated a higher occurrence of serendipity. The serendipity scale demonstrated good internal consistency with a high Cronbatch alpha ($\alpha = .902$) in this study.

4.9.2 Group Creativity

Group creativity was measured through 3 dimensions: (1) self-reported team creativity, (2) Number of slogan and (3) expert rating of group performance.

Self-reported creativity was measured through a 2-items questionnaire (Shin & Zhou, 2007; Tierney & Farmer, 2002). Participants rated each item on a 7-point likert scale from 'poorly' (1) to 'very much' (7). The questions "how well did your team produce new ideas?" and "how useful did you find these ideas?" were used. For this study, a total score was calculated across all items. A higher score indicated a higher self-reported team creativity. The self-reported creativity scale demonstrated a good internal consistency with a high Cronbatch alpha ($\alpha = .954$) in this study.

Number of slogans was calculated based on team performance during the divergent ideation activity. For each group activity, there was a script available. At the end of the experiment, researchers calculated the number of new slogans each group came up with, not including any slogans the chatbot inputted in the chat. A total score was used to evaluate the number of slogans. This score was standardized depending on the number of participants in each group session considering the slight variations (3-4 members) that emerged due to the oversampling strategy employed.

Expert rating was intended to be evaluated by a total of three experts, but responses were not received in time. Thus, for the purpose of this research project and due to time constraints, we decided to proceed with the use of one creativity expert evaluation. Specifically, one expert in social media was used to evaluate team performance based on the final slogan each team selected during the second activity, the convergent ideation activity. The expert rated 61 final slogans. Each slogan was evaluated for how creative it was (Gillier & Bayus, 2022; Goncalo & Staw, 2006). Specifically, two criteria were evaluated: novelty and usefulness. Usefulness represented the degree to which the slogan solves the underlying problem and creates value (i.e., to promote public transportation use among university students). Novelty referred to the originality of the slogan.

The item asked was “How creative do you find the slogan below?”. The expert rated each slogan from “Extremely creative” (5) to “very uncreative” (1).

4.9.3 Qualitative items

Aiming to enrich the study’s data collection and subsequent analysis with qualitative data on participants’ perceptions of the chatbot, three (3) open-ended questions were included as part of the survey. Each open-ended question was optional. Participants were asked their opinion on their interaction with the chatbot. At the midpoint of the experiment, participants were asked to “Name two things that you particularly liked about the chatbot” and “Name two things that could be improved about the chatbot”. At the end of the survey, participants were asked “Is there anything else you would like to share about your experience?”.

Chapter 5: Data Analysis & Results

To begin with, we used IBM SPSS Statistical for Macintosh version 28.0 to clean up the data by screening for missing data, unengaged responses, and outliers. Any participants that did not answer the survey or did not participate in the activity were removed. We investigated outliers by verifying the overhaul variability of the survey response using kurtosis analysis to assess unexpected scores. Based on that analysis, we determined that there were no outliers in the dataset. Then, we performed an exploratory factor analysis and used a frequency table with all the variables to highlight odd items. Those items were flagged as potential issues to pay attention to during the next steps in the analysis.

Using Smart PLS 4.1.0.2, we then conducted a confirmatory factor and structural equation model analysis of 190 participants across 61 groups (i.e., with 15 groups for each of the four conditions). The decision to use individual-level data for the analysis was made because we did not have a large enough sample size to analyze the data using the group-level dataset. This is partly due to the difficulties encountered during recruitment and the restricted timeline for this study.

During the analysis, we extrapolated group-level data points to serve as individual-level data points. For example, variables such as slogan quality and quantity, which are inherently group-level metrics, were used as individual scores for each member of the group. This was done to enable the research team to use individual-level data in Smart PLS. Lastly, we built our model in Smart PLS and evaluated it using the significance level structural equation modelling (PLS-SEM) and bootstrapping. See Figure 4 for the research model demonstrating path coefficient.

5.1 Direct Effects

A significant effect was also observed between chatbot conversation style (CCS) and idea quality, where the human conversation style seems to produce higher idea quality ($p=0.001$). Therefore, Hypothesis H1b is supported. Additionally, CCS significantly affected the quantity of ideas produced; the machine CCS was found to produce significantly more ideas than the human CCS ($p=0.034$). Thus, H1a is not supported. There was no statistically significant result on the relationship between CCS and self-reported creativity ($p>0.1$), hence H1c is not supported.

A significant effect can be seen between the chatbot role (CR) and the number of ideas generated, where the facilitator role seemed to produce more ideas, in other words, a higher number of slogans was generated ($p=0.000$). Thus, not supporting H2a. Additionally, the chatbot role was observed to have a positive effect on idea quality, yet, this relationship was inverse indicating that overall groups in the ideator condition produced higher idea quality ($p=0.024$). Hence, providing support for H2b. There was no statistically significant result on the relationship between CR and self-reported creativity ($p>0.1$), hence H2c is not supported.

5.2 Mediation Effect

The CR has been positively associated with serendipity meaning that the ideator role in the chatbot increased serendipity occurrence compared to the facilitator role ($p=0.034$). Additionally, a significant positive relationship was found between serendipity and self-reported creativity ($p=0.036$). Therefore, Hypothesis 3c is supported, i.e., there is a mediating effect of serendipity on the relationship between CR and creativity. Considering that there is also a direct positive effect of CR on self-reported creativity, we can conclude there is partial mediation by serendipity. There was no statistically significant result indicating a mediating relationship between CR and group creativity on serendipity ($p>0.1$), hence the remaining hypotheses (i.e., H3a, and H3b) are not supported ($p>0.1$).

Marginal significant results can be found between CCS and serendipity, where human CCS influences serendipity occurrence in a positive manner ($p=0.057$; see Figure 4). However, no statistically significant results were found supporting serendipity mediating the relationship between CCS and group creativity, thus H4 and its sub-hypotheses (i.e., H4a, H4b, and H4c) are not supported. No further mediation tests were performed.

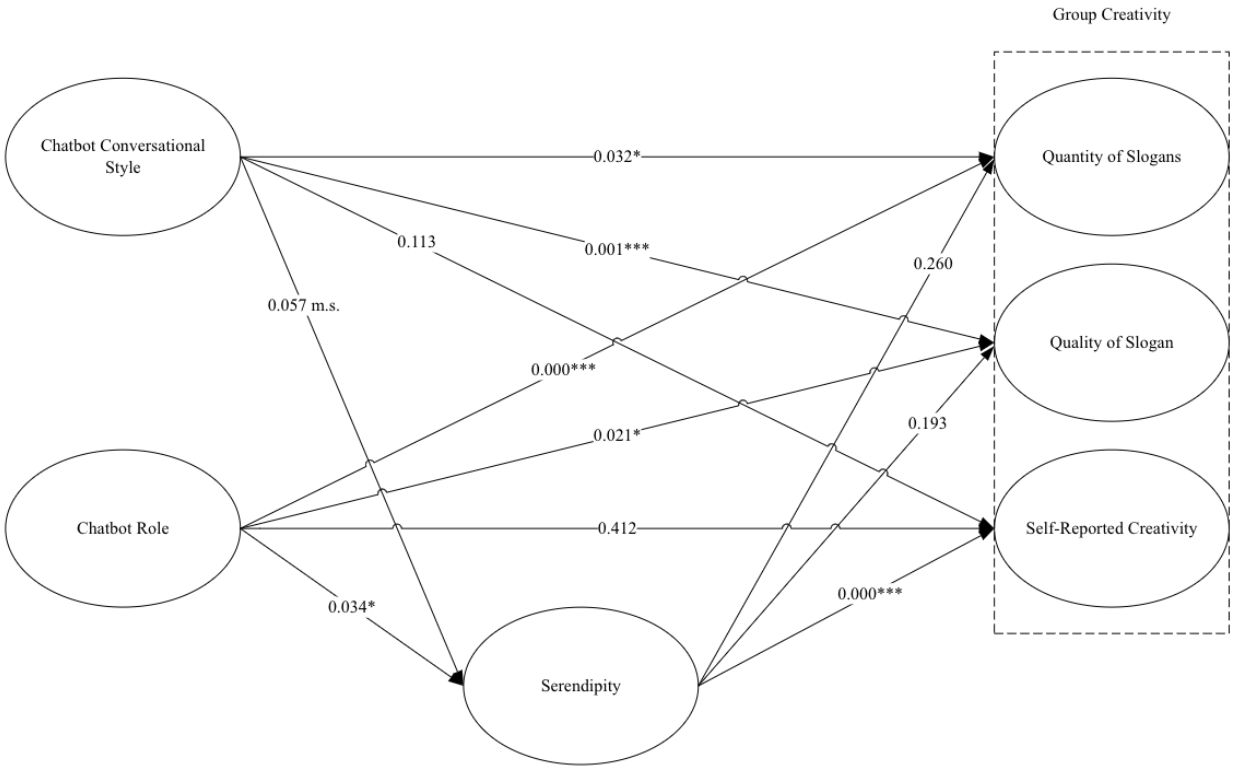

Figure 4: Research Model Demonstrating Path Coefficient

Notes: Asterisks indicates the p-value attained
m.s. (marginally significant) = ≤ 0.1;
* = ≤ 0.05;
** = ≤ 0.01;
*** = ≤ 0.001.

5.3 Post-hoc Moderation Analysis

Although this study did not hypothesize a moderation effect between chatbot role and chatbot conversation style, a post-hoc analysis of moderation was performed to obtain additional insights into the potential interaction effect of these two anthropomorphism characteristics. The results showed us that the effect of CR was statistically significant with group creativity when the relationship was moderated by CCS. Specifically, the facilitator condition produced a greater number of ideas especially when the CCS was machine-like (p=0.001; see Figure 5).

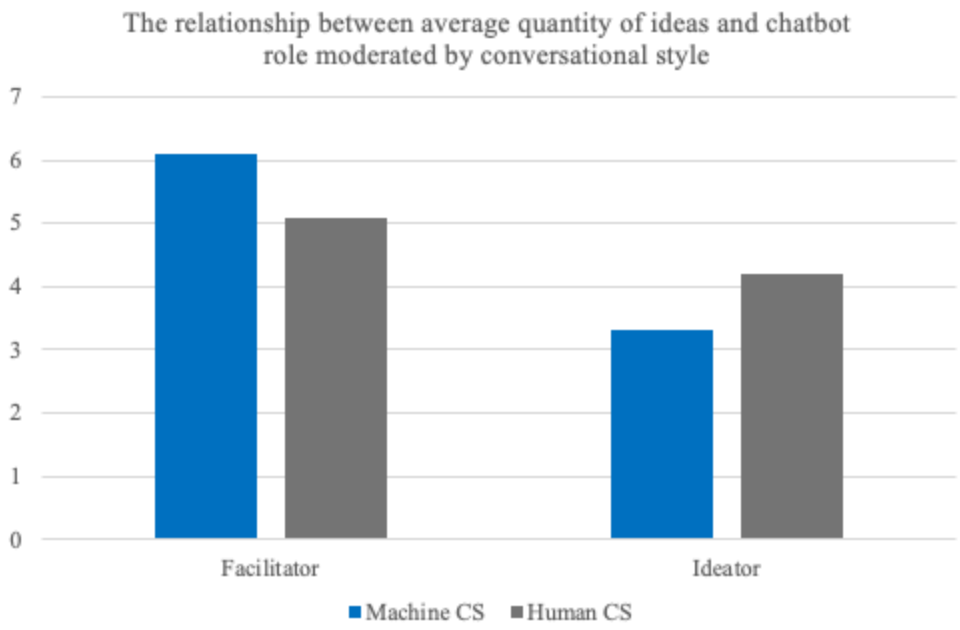

Figure 5: The moderating relationship of chatbot conversational style on the quantity of ideas

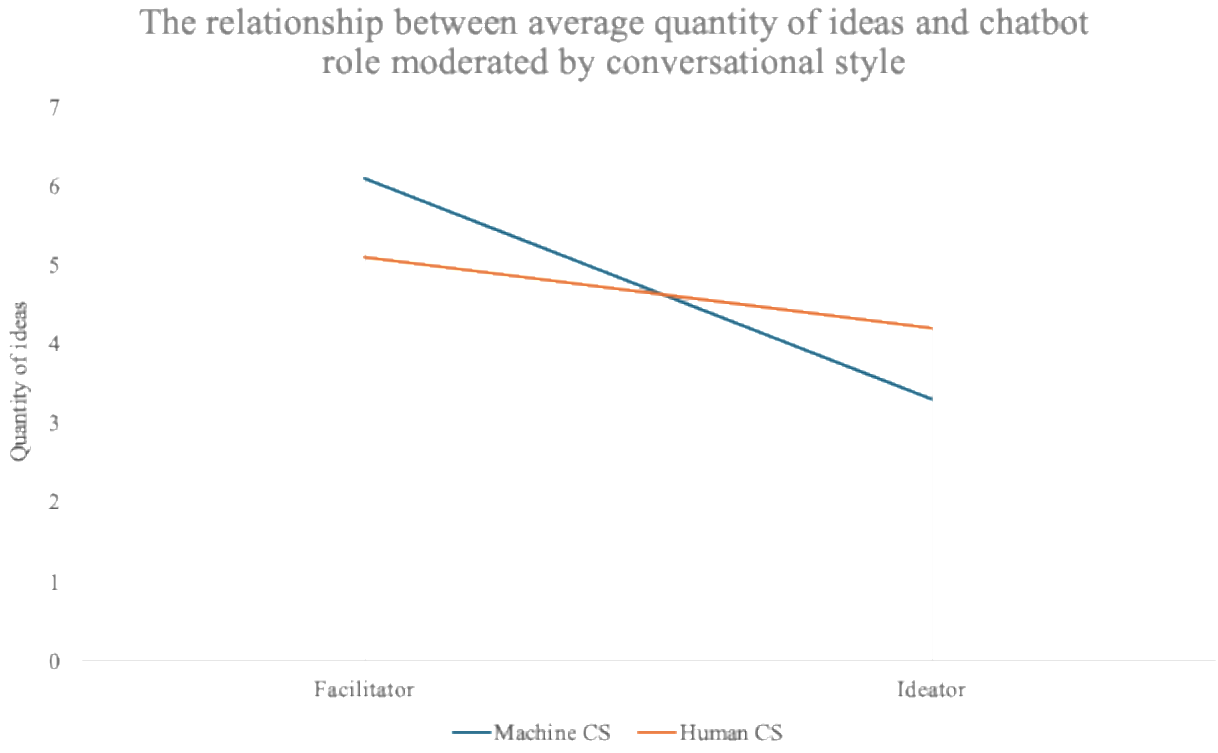

Figure 5.1: The interaction plot of the moderating effect chatbot conversational style on the quantity of ideas.

The results further revealed that although overall the ideator CR, compared to the facilitator CR, significantly increased the quality of ideas produced by a remote team, when considering the interaction effect of the two manipulations–CR and CCS–the quality of ideas was highest for teams interacting with the facilitator CR using human rather than machine language (p=0.001; see Figure 6).

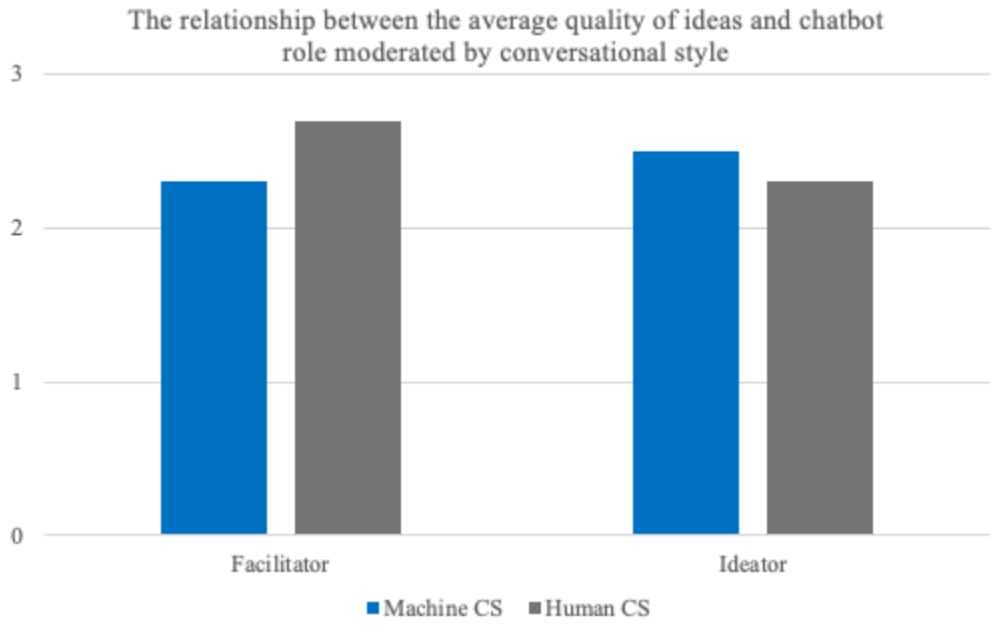

Figure 6: The moderating relationship of chatbot conversational style on the quality of ideas

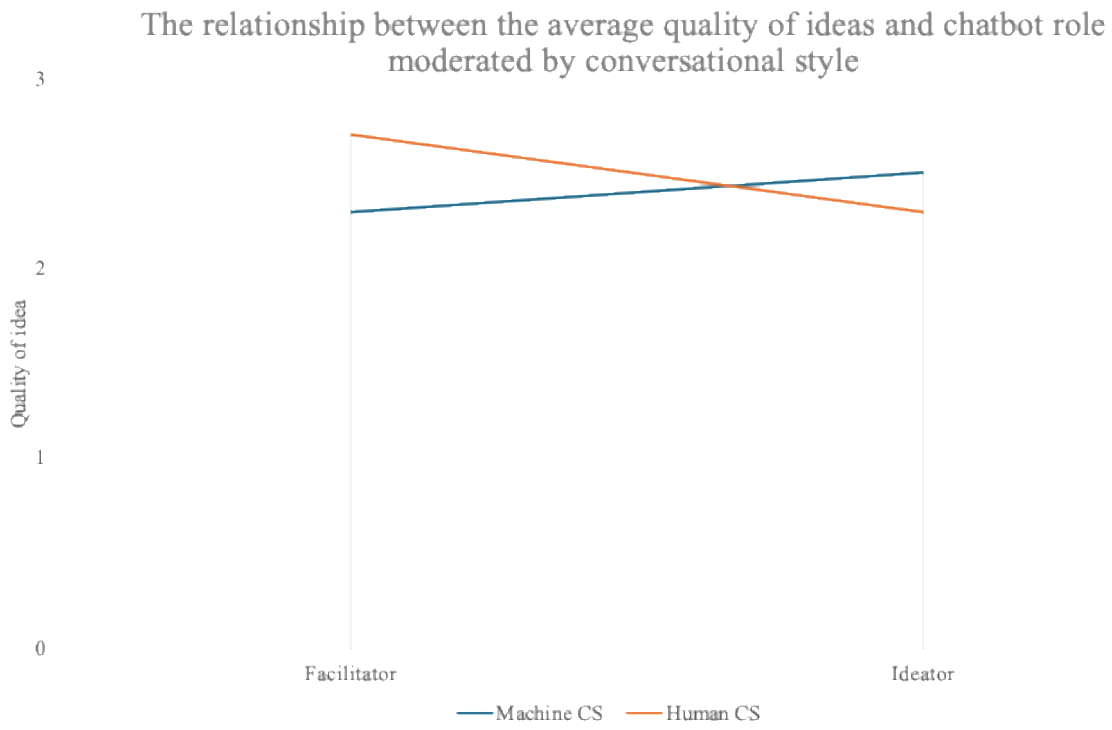

Figure 6.1: The interaction plot of the moderating relationship of chatbot conversational style on the quality of ideas

Chapter 6: Discussion

This study aimed to shed light on human-AI collaboration in team creativity, a crucial activity in today's organizations. By examining CCS and CR, this research sought to better understand the design considerations of chatbots in the context of collaborative creativity in remote teams as well as explore the possible mediating role of serendipity, thus offering insights into the intricate interplay between AI tools and creativity. Hereto, this study set out to answer the main underlying research question, namely: What is the influence of text-based chatbots on group creativity within the context of remote teamwork, and how do these characteristics interact with underlying collaborative creativity mechanisms such as serendipity? In this section, we will answer the above by discussing each of the underlying sub-questions and interpreting the related results.

The first sub-question explored the effect of chatbot CCS on creativity, by asking: how chatbot conversational style influences group creativity. Our study found significant relationships between CCS and idea quality and idea quantity. First, we found that human conversational style resulted in greater idea quality, in line with the hypothesized relationship. This finding is also in line with previous studies (Hwang & Won, 2021) even though these results were obtained in the context of individual-level chatbot-human interaction. Idea quality being positively affected by human CCS may be because it gives humans more exposure to words through lengthier sentences and non-verbal cues such as emojis, as well as implicit encouragement. This, in turn, could encourage individuals in teams to share more original ideas as it may give the online group chat a friendlier and safer environment. Second, looking at the number of ideas, we found that groups exposed to machine CCS generated more ideas than ones in the human CCS. Although this finding is in line with previous findings from Hwang & Won (2021) who found that the number of ideas being generated greater with machine conversational style in chatbots during individual idea generation interactions., it was contrary to our hypothesis focused on the team context. The machine CCS could have resulted in a higher quantity of ideas generated because it gave individuals more time to think and type ideas compared to the human CCS. Individuals with machine CCS are exposed to shorter sentences with fewer non-verbal distractions such as emojis and thus require less time to process messages, being able to focus more on producing and recording ideas especially

considering the relatively short time allotted to the experimental brainstorming task (10 minutes). No significant results were found regarding CCS and self-reported creativity.

Concerning the second sub-question, how chatbot role influences group creativity in terms of idea quality, idea quantity and self-reported group creativity, the findings of our study showed that different chatbot roles produce different results when looking at the main effects alone. First, when the chatbot had a facilitator role, teams produced more slogans rather than when the chatbot had an ideator role. This was contrary to our expectation, which anticipated more positive outcomes for the ideator role in terms of all creative outcomes. Although future research needs to explore these surprising findings in more detail, we believe this effect could be due to the chatbot being less "interruptive" by using shorter messages in the facilitator condition compared to the ideator condition. Less lengthy interruptions may decrease participants' cognitive load and give each team member more time to brainstorm, thus allowing participants more time to focus on the creative task at hand, that is, to propose ideas and type those in the chat rather than spending the time processing messages from the chatbot (Nguyen et al., 2022). Inversely, when looking at the effect of chatbot role on the quality of ideas generated by remote teams, we found that the ideator chatbot role resulted in higher-quality ideas being generated by the team compared to teams exposed to a facilitator role. This finding suggests that the ideator role potentially could have focused the group's idea in a more relevant direction to answer the problem at hand. Therefore, giving slogan ideas more substance, and resulting in better ideas quality for the final slogan chosen compared to the facilitator role. It is worth noting that even during the ideator condition, the chatbot itself gave no "right" answer, but its main purpose was to give slogan ideas to streamline the brainstorming process. The slogans given by the chatbot were also not known by the expert evaluator who evaluated the final slogan selected by the team. These points are highlighted to emphasize that this effect was not due to confounding variables. Third, no significant effects were found when looking at self-reported creativity and CR.

With respect to the third sub-question; what is the mediating role of serendipity in the relationship between chatbot role and chatbot conversational style on group creativity, we found that serendipity played an important mediator role, however, only for the relationship between CR and self-reported group creativity, i.e., perceptions of creativity rather than for actual creativity (in terms of quantity and quality of ideas generated). A possible explanation for this phenomenon

could be that individuals in the ideator condition, as they were exposed to more ideas, opinions and feedback from the chatbot, created the perception of exposure to more unexpected information (Cleverley & Burnett, 2015; McCay-Peet & Toms, 2011). Yet, considering the short timeframe of the experimental sessions and task, the perceptions of greater serendipity might not have resulted in any tangible effect on the output produced by the team. Especially for non-usual ideas, members might have needed more time to fully develop and type out these new slogan ideas in the chat, which is in line with prior research showing the need for extensive and ongoing engagement with non-usual ideas (Harvey, 2014). Given the time limit of the experiment, this could explain why the effect on perceptions of creativity is significant, while the actual quantity and quality of slogans remained unaffected. The fact that serendipity did not mediate the relationship between CCS and creativity will be further discussed in the limitations section below.

Lastly, with respect to the fourth and final sub-question; how does the interaction of chatbot conversational style and chatbot role influence group creativity; we found significant effects for both quantity and quality of ideas, but not on self-reported creativity. Specifically, we found that the interaction of the facilitator CR and machine CCS had a greater effect on the number of ideas, reinforcing our previous theorizing regarding the positive main effects for idea quantity, namely that less interruption—i.e., shorter messages—provide teams with the opportunity to allocate their (inherently limited) time to the creative task at hand rather than processing chatbot input.

Furthermore, unlike our main effects—where ideator CR was associated with greater idea quality—the interaction models showed that idea quality was increased significantly when the facilitator CR used a human CCS. Whereas in isolation, the ideator CR's positive impact on idea quality seemed to stem from the chatbot's active contribution of relevant slogan, the combination of facilitator CR with a human CCS performed even better. This might stem from a similar explanatory logic that the facilitator CR allowed the group to focus their attention and time towards the creative task at hand—with minimal side-tracking—while retaining a sense of humanness through the greater encouragement offered by the chatbot. This greater encouragement and positive reinforcement would have increased perceptions of psychological safety where the team felt more comfortable taking risks and sharing innovative and original ideas, thereby increasing idea quality.

Finally, the lack of a significant effect on self-reported creativity from the interaction of CCS and CR may be attributed to the between-subjects design of this experiment, where each participant experienced only one condition. This design might have limited their ability to perceive subtle differences in the chatbot's characteristics.

In conclusion, findings suggest that the chatbot's role, such as acting as an ideator, positively influences serendipity, a critical antecedent to creativity, in addition to enhancing the outcome of the creative process, including idea quality, whereas the facilitator role in a chatbot (i.e., where the chatbot does not actively input ideas) enables the group to generate a higher quantity of ideas. This may be the case because the chatbot was less disruptive to the flow of the team. However, it is worth noting that although the facilitator CR does not necessarily produce higher-quality in isolation, adding a human CCS can significantly increase the quality of ideas generated by the remote team, further underscoring the intricate interactions that exist between various chatbot design element.

All in all, the findings from this study highlight how human-AI collaboration is a complex phenomenon where different chatbot roles and characteristics interact in intricate ways to affect the creative process. Although overall chatbots with an inherently more generative (i.e., ideator) role positively affect the ability of teams to be creative, the interaction of chatbot role and conversational style produces unexpected interplays that affect discovery in unusual ways. Considering that creativity is the root cause of innovation, the trend of hybrid and remote work, as well as the increasing adoption of AI tools in workplace settings, this study has the potential to generate important implications for today’s hybrid organizations and collaborative workplaces.

6.1 Industry implications

From an industry perspective, the findings of this study offer practical implications for the design and implementation of chatbot solutions aimed at enhancing creativity in the workplace. By leveraging the potential of chatbots to increase serendipitous moments—those triggers that can result in unexpected connections leading to innovative breakthroughs—organizations can optimize their use of AI to foster a more creative and innovative environment (Kennedy et al., 2022; McCay-Peet & Toms, 2011). For instance, utilizing anthropomorphism traits in chatbots optimally can significantly boost different dimensions of creativity within teams. As businesses increasingly adopt AI-driven tools, understanding the optimal design and implementation strategies for chatbots

in group settings will be crucial. Chatbots can be used to support and enhance the creative capabilities of teams. Yet, practitioners need to be aware of the trade-offs in chatbot design that exist when considering different creative goals, such as the quantity versus quality of ideas. These design trade-offs can be strategically leveraged in various contexts and challenges, supporting both incremental and radical innovation. Thus, this research highlights the importance of designing chatbots that can function seamlessly within group dynamics, particularly in the context of remote online collaboration, which is increasingly becoming the norm in today's workplaces. In this context, it also highlights an inherent challenge for designer; although ideator chatbots might provide greater opportunities for serendipity—a demonstrated root cause of creativity—its greater interruption of the creative flow of teams might undermine this positive effect. Therefore, designers should carefully balance the ability of chatbots to offer unique and surprising suggestions with a minimally invasive design to respect the ongoing interactions and flow of the team (Nakamura & Csikszentmihalyi, 2014). By leveraging this study's insights, companies can foster collaborative creativity through serendipitous moments and ultimately drive innovation to achieve better business outcomes

6.2 Academic implications

This study contributes significantly to the academic understanding of group-level interactions involving chatbots, addressing a notable gap in the existing literature. Prior research has predominantly focused on individual-level interactions with chatbots, leaving a void in our knowledge about how these interactions function within group settings. By exploring group-level interactions, this study adds valuable insights into the dynamics of multiple participants engaging with a chatbot, a notably underexplored topic. In fact, statistics reveal that only 4% of chatbots are designed for multiple participants (Janssen et al., 2020), however, considering the emphasis of organizations on teams this is likely to increase in the years to come.

Additionally, this study highlights the trade-offs in chatbot design, particularly the balance between quantity and quality of ideas. These theoretical insights demonstrate how different human-AI collaborations can be optimized for specific creative outcomes. This research thus provides critical knowledge on potential design considerations for chatbots intended for group use, which will become increasingly relevant with the advancement of large language model solutions and their applications in the workplace.

Moreover, this study adds to the literature on the use of chatbots for creativity purposes and the potential to leverage serendipitous moments to enhance such processes. It introduces an intriguing perspective that, while serendipity may not influence the actual quality and quantity of creative output, it significantly impacts individuals' perception of their creativity, which could be an important antecedent to people's confidence in their future creative performance. This finding opens the door to further exploration of this mechanism and its adaptation in the context of human-AI collaboration. By examining how chatbots can facilitate creative processes in group interactions, this research fills a specific gap and lays the groundwork for future studies on the intersection of AI, creativity, and collaborative work.

6.3 Limitations

Although this study attempted to mitigate limitations, some are still worth noting. First, the use of the WoO method in this study introduced several inherent limitations. One significant drawback was that the experiment was not driven by an actual coded chatbot, which affected response times and accuracy. Additionally, using the WoO method required humans to play the role of the chatbot, which introduced human errors during the experiment, affecting the consistency and reliability of the interactions. Second, the utilization of a predefined script for the chatbot interactions reduced the level of personalization possible during the interaction. With today's technology and the normalized use of large language models, this issue could be mitigated. A coded chatbot using a large language model would provide a more accurate representation of a chatbot's behaviour, potentially reducing out-of-context prompts and improving the overall user experience. Third, the synchronous online group nature of this experiment resulted in a small sample size due to recruitment difficulties and a high rate of no-shows or last-minute dropouts. This led to wasted time and financial resources. The limited timeframe of this project, being part of a thesis project, required us to stop recruitment earlier than desired to proceed to subsequent project stages. Lastly, another limitation of this study was during the analysis, specifically, that group-level (aggregated) data was used as individual-level data points. This approach was taken to allow flexibility and to compensate for the low sample size in terms of group data (approximately 15 groups per condition). Although this method allowed the research team to have flexibility and detailed insight from an individual-level perspective, not using group-level data does bring some limitations to this

study. Specifically, it may have obscured relevant nuances arising from group dynamics and increased the risk of ecological fallacy by disregarding individual differences within the group(Croon & Van Veldhoven, 2007; Hoyle & Crawford, 1994). Having highlighted the limitations of this study, let's discuss the potential direction for future studies.

6.4 Future studies

This study opens the door to a plethora of future research opportunities. First, future studies could use a programmed chatbot on a popular chat group software (e.g. Microsoft Team or Slack) to increase accuracy and ecological validity. Second, future studies should leverage the use of large language models to enhance user experience and personalized chatbot inputs to be more context-specific, keeping in mind that this would limit the ability to conduct experiments that emphasize a controlled environment. Third, potential replication could be made with a bigger sample size to increase accuracy and possibly use true group or aggregated-level analysis to highlight the nuances of group dynamics. Finally, replication of this study in the wild, that is, in real organizational teams and settings, could further enhance the ecological validity and explore the boundary conditions of the validated research model. Overall, these improvements could significantly advance research in group-level human-chatbot interaction while building upon the preliminary and novel findings of this study.

Chapter 7: Conclusion

In conclusion, this study seeks to better understand the role of collaborative chatbots and creativity. By delving into the nuanced dynamics of chatbot characteristics and their interaction with collaborative mechanisms like serendipity this research aspires to shed light on uncharted territory, offering insights into the intricate interplay between technology and creativity in remote collaborative settings. The findings from our research suggest that an ideator chatbot positively influences serendipity and enhances the quality of ideas generated in the creative process. Alternatively, a facilitator chatbot leads to a higher quantity of ideas, yet, this facilitator role—in and of its own—does not necessarily improve idea quality. However, combining a human conversational style with a facilitator role can amplify the quality of ideas produced even beyond that produced by a chatbot functioning as a peer. Considering the importance of creativity for innovation, the trend towards remote workplaces, and the increasing adoption of AI tools in contemporary workplaces, this study will have important implications for today's organizations and digital workplaces.

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Appendixes

Appendix 1.Procedure: Scripts per condition

Timing	**Human-Ideator**	**Human-Facilitator**	**Machine-Ideator**	**Machine-facilitator**
OPEN CHATZY at the start time - GENERAL INSTRUCTIONS	Welcome team! I'm Ideabot. Quick heads up: We will start the activity in 5 minutes. We are waiting for 3 or 4 group members to log in the chat, so we can start. Make sure you've intitiated the survey before coming to the chat as instructed. If that is done, don't forget to text "Hi" 😊	Welcome team! I'm Ideabot. Quick heads up: The activity will start in 5 minutes. Please wait for all 3 or 4 group members to log in the chat before the activity starts. Make sure you've intitiated the survey before coming to the chat as instructed. If that is done, don't forget to text "Hi" 😊	Greetings. This is Ideabot. Notification: The activity will start in 5 minutes. Wait for all 3 or 4 group members to log in the chat before the activity starts. Make sure you've intitiated the survey before coming to the chat as instructed. If that is done, text "Hi".	Greeting. This is Ideabot. Notification: The activity will start in 5 minutes. Wait for all 3 or 4 group members to log in the chat before the activity starts. Make sure you've intitiated the survey before coming to the chat as instructed. If that is done, text "Hi".
~ 5 min (IF 1 or 2 participants only are active) terminating this session	Hi team, unfortunatly due to the low amount of people in the group we will have to cancel the session. The research team will send you a re-booking link through prolific, so you get another chance to participate & be compensated. Sorry & thank you for showing up! 😔	Hi team, unfortunatly due to the low amount of people in the group we will have to cancel the session. The research team will send you a re-booking link through prolific, so you get another chance to participate & be compensated. Sorry & thank you for	Hi team, unfortunatly due to the low amount of people in the group we will have to cancel the session. The research team will send you a re-booking link through prolific, so you get another chance to participate & be compensated. Sorry & thank you for	Hi team, unfortunatly due to the low amount of people in the group we will have to cancel the session. The research team will send you a re-booking link through prolific, so you get another chance to participate & be compensated. Sorry & thank you for

		showing up! 😔	showing up!	showing up!
	[Start Group Ideation Activity]			
5 min in (3-4 members are log in/active)	Hey team! I'm Ideabot. I'm just as excited as you are about this brainstorming adventure. How about we kick things off by coming up with slogans that really get students pumped about using public transport? 🚍💚 Our goal is to BRAINSTORM AS MANY CATCHY AND CREATIVE SLOGANS that we can that'll encourage university students to hop on board and contribute to a better environment and a more sustainable society. Let's unleash our creativity! 😊	Hello team! I'm Ideabot, thrilled to guide you through this brainstorming adventure. Your goal: BRAINSTORM AS MANY CATCHY AND CREATIVE SLOGANS that'll excite students about using public transport to foster a culture of sustainable transportation on campus 🚍💚. Your creativity is key, dive in as a team and contribute to a better environment and a more sustainable society! 😊	Team, this is Ideabot. Today's objective: BRAINSTORM AS MANY CATCHY AND CREATIVE SLOGANS together promoting public transport among university students for a better environment and sustainable society. Team, start brainstorming.	Team, this is Ideabot. Your objective: BRAINSTORM AS MANY CATCHY AND CREATIVE SLOGANS as possible promoting public transport among university students for a sustainable society. Team, start brainstorming.
INSTRUCTIONS START THE TIMER AFTER THIS	Let's start the timer and kick off our brainstorm for 10 minutes. Remember, there are no bad ideas, so feel free to suggest anything that comes to	Team, I'll start a 10-minute timer to kick off your brainstorming. I'm Ideabot, and remember, no bad ideas – suggest	The 10 minute timer for brainstorming starts now. No limitations on ideas. Suggest any thoughts. Ideabot will	Your 10 minute timer for brainstorming starts now. No limitations on ideas. Share any thoughts. Ideabot will monitor the

MESSAGE!	mind. I'll keep track of the time.😄	anything that comes to mind. I'll keep track of time.😄	monitor the time.	time.
	[Start the timer for 10 minutes]			
2	I would suggest a catchy slogan like "Ride to Tomorrow, Today!"? 🚆🌎 What do you think?	What could be a catchy slogan to encourage university students to use public transport ?🚆🌎	What about "Journey to Tomorrow, Today!" Discussion encouraged.	Please share your ideas.
3	Our ideas are fantastic! 😄 How about this one: "Eco-Journeys for Brighter Tomorrows"? 🌟🌱	Great ideas! Keep them coming. What's another slogan that comes to mind? 🌟🌱	Good ideas. Consider the following: "Eco-Journeys for Brighter Tomorrows."	Thank you for your input. Please continue.
4	Wow, our ideas are gold! 💰 What do you think about "Transit for a Greener Campus Life"? 🏫🌿	I think these ideas are awesome🤩! Does anybody in the group have more ideas ?	Another option: "Transit for a Greener Campus Life." What are your thoughts?	Good. Please share your next slogan idea.
5	We're doing fantastic! Let's keep 'em coming! I have another cool slogan here😎 "Ride Green, Live Clean" what do you all think?	You're doing fantastic!😎 Keep the creativity flowing. What's the next slogan that could resonate with university students?	Team, moving forward. Proposed slogan: "Ride Green, Live Clean". Input appreciated.	Please continue. Share another slogan idea.
6	These are top-notch ideas, team! 😎 Let's keep our ideas rolling! How about "Join the Green Commute Revolution"? ♻️🚌	Awesome job, everyone! Keep those ideas rolling. 😎 What's another slogan that captures the spirit of sustainable transportation?♻️🚌	Consider "Join the Green Commute Revolution." Thoughts appreciated.	Keep going. What's your next idea?

7	Great stuff, folks! What do you think of "Sustainability Starts with Us: Choose Transit!" to inspire students to take public transportation for a greener future? 🌎🚌	I love your ideas. Share your next slogan to inspire students to choose public transport for a greener future.🌎🚌	How about "Sustainability Starts with Us: Choose Transit!". Input appreciated.	Thanks for your contributions. Share another slogan idea.
8	We have 2 minutes left! 🔥	You have 2 minutes left! 🔥	Team: 2 minutes left	2 minutes left
8	We're on fire with these ideas! My final idea: "Get on Board: The Greener Way to Campus"? 🚌🍃 Any final ideas to share as a team?	You're on fire with these ideas! Any final ideas to share? 🚌🍃	Consider: "Get on Board: The Greener Way to Campus." Final ideas appreciated	Final ideas?
	[Timer goes off after 10 minutes]			
TASK 2				
10	Time's up! 🕒 We've generated some fantastic slogans during this brainstorming session. Our next goal is for OUR TEAM to select ONE winning slogan that we want to submit to the contest. 🌟 Once our team has dicuss and chosen one slogan, ONE PERSON please drop the slogan in the chat in this format: FINAL = "the slogan chosen". Then the whole team needs to show their agreement to the final answer by typing 'YES' after it.	Time's up! 🕒 Your team has done an incredible job brainstorming these slogans. Your TEAM's next goal is to select ONE winning slogan to submit to the contest.🌟 Once your team has dicuss and chosen one slogan, ONE PERSON please drop the slogan in the chat in this format: FINAL = "the slogan chosen". Then the whole team needs to show their agreement to the final answer by typing 'YES' after it.	Time's up. Great slogans generated. Team, the next goal: as a TEAM select ONE winning slogan for contest submission. Ideabot and team will dicuss and chose one slogan. Then ONE PERSON drop the chosen slogan in the format: FINAL = "the slogan chosen". Then, everyone type 'YES' to show your agreement to the final answer.	Time's up. Slogans generated. Next goal: as a TEAM select ONE winning slogan for contest submission. Team: dicuss and chose one slogan. Then ONE PERSON drop the chosen slogan in the format: FINAL = "the slogan chosen". Then, everyone type 'YES' to show your agreement to the final answer.
	Let's take a moment to review our slogans and share the ones we find most novel and effective	Now team, take a moment to review your slogans and share the ones you find most	Team, start the slogan review. Share the ones you find most novel and effective for the	Team: Pause to review the slogans. Share the ones you finds most novel and effective for

	for the contest. I'm curious to hear your choices! 😊	novel and effective for the contest. 😊	contest.	the contest.
11	My favorite slogan is "Join the Green Commute Revolution" 😊	Now, each of you take a moment to share your chosen slogans with the group! 😊	Ideabot's favorite: "Join the Green Commute Revolution"	Please share slogans.
12	Great picks, everyone! Now, let's dive into it. What do you think makes the slogans stand out? Let's share our thoughts!😊	Fantastic selections, team! Now, your team will dive into each one. What makes the slogans stand out? Share your thoughts! 😊	Good selection. Now, thoughts on the slogans ?	Good. Share your thoughts on the slogans.
13	I like the slogan "Join the Green Commute Revolution" because it taps into the power of inclusivity and empowerment, inviting students to be part of a positive change for a sustainable future while aligning perfectly with the university's progressive culture. 🌟	Brilliant contributions, everyone! Any final thoughts on your selections? Your reflections are pivotal as you finalize the decision! 🌟	Selected preference: "Join the Green Commute Revolution". It is inclusivity and empowering.	Great. Final thoughts on the slogans?
14	Awesome insights, team! We have 2 minutes left to choose our final most novel and effective slogan. 🕑 Once chosen, drop the final slogan in the chat in this format: FINAL = "the slogan chosen". The rest of the team please confirm the answer by replying "YES" to the slogan.	Excellent contributions, team! You have 2 minutes left to choose your final most novel and effective slogan. 🕑 Once decided, drop the final slogan in the chat in this format: FINAL = "the slogan chosen". The rest of the team please confirm the answer by replying "YES" to the slogan.	Time: 2 minutes left. Team select the most effective and unique slogan for the contest. Once chosen, drop the final slogan in the chat in this format: FINAL = "the slogan chosen". Team confirm the slogan by replying "YES".	Time: 2 minutes left. Please select the most effective and unique slogan for the contest. Once decided, drop the final slogan in the chat in this format: FINAL = "the slogan chosen". Team confirm the slogan by replying "YES".
16 min [Potential backup message if TEAM have not chosen the final slogan in the	Team, we need to make our selection now.	You need to make your selection now.	Team, select the final slogan now.	Make your selection now.

formal FINAL="X"]				
17 OR **as soon as you get the message FINAL SLOGAN ="the chosen slogan" AND the yes confirming it END OF TASK 2**	Awesome teamwork, everyone! We've nailed down our winning slogan. 🍓	Awesome teamwork, everyone! Your team has selected the winning slogan 🍓	Great. The winning slogan has been identified.	Great. Winning slogan selected.
INSTRUCTIONS after END of T2	Team, could you please return to the survey to share your awesome answers to some additional questions before we roll into our next task. COPY/PASTE the password [NHC2024] to access the next part of the survey. Don't close the chat. Keep going! 🚀	Team, could you please return to the survey to share your awesome answers to some additional questions before we roll into your next task. COPY/PASTE the password [NHC2024] to access the next part of the surveyDon't close the chat. Keep going! 🚀	Please return to the survey and COPY/PASTE the password [NHC2024] to access additional questions before our next task. Don't close the chat. Thanks.	Please return to the survey and COPY/PASTE the password [NHC2024] to access additional questions before your next task. Don't close the chat. Thanks.
	END OF PART 1 (ideation exercise) / START TASK 3			
INSTRUCTIONS 0	👏 Hello again! 🌟 Now, let's figure out together the most effective platform to spread the word about public transportation to Canadian university students aged 18-24. Get ready to rank order the following platforms: Facebook, Twitter(X), Instagram, YouTube, TikTok, and LinkedIn. 🚌💬 Once we've made up our mind, drop the final ranking in the chat in this	👏 Hello again! 🌟! Now, as a team dive into a vibrant discussion to rank order the following platforms—Facebook, Twitter(X), Instagram, YouTube, TikTok, and LinkedIn—for promoting public transportation to Canadian university students aged 18-24 based on their effectiveness 🚌💬. Once you've made up	Hello again! Now as a team rank order the following platforms—Facebook, Twitter(X), Instagram, YouTube, TikTok, and LinkedIn—based on their effectiveness for promoting public transportation to Canadian university students aged 18-24. When you decided please insert your final ranking in the chat in	Hello again! Please rank order the following platforms—Facebook, Twitter(X), Instagram, YouTube, TikTok, and LinkedIn—based on their effectiveness for promoting public transportation to Canadian university students aged 18-24. When you decided please insert your final ranking in the chat in

	format: (FINAL RANKING= 1: Most Effective, 2: Second Best, 3: Third Best,..., 6: Least Effective). Also, the whole team needs to show their agreement to the final answer by typing 'YES' after it.	your mind, drop your final ranking in the chat in this format: (FINAL RANKING= 1: Most Effective, 2: Second Best, 3: Third Best,..., 6: Least Effective). Also, the whole team needs to show their agreement to the final answer by typing 'YES' after it.	this format: (FINAL RANKING= 1: Most Effective, 2: Second Best, 3: Third Best,..., 6: Least Effective). Then, everyone type 'YES' to show your agreement to the final answer.	this format: (FINAL RANKING= 1: Most Effective, 2: Second Best, 3: Third Best,..., 6: Least Effective). Then, everyone type 'YES' to show your agreement to the final answer.
0	Guess what I discovered? The largest age group among Canadian Facebook users belongs to the 25-34-year-olds (24.2%), not the 18-24-year-olds (16.3%). Interesting, right? 😉 Well, based on this, I wouldn't rank Facebook among the first three platforms.	Alright team, I'm eager to hear your perspectives on incorporating Facebook into your strategy for connecting with Canadian university students. In your evaluation, where would you position Facebook in your ranking of platforms? 🤔	According to statistical data, the predominant age group for Canadian Facebook users is 25-34 (24.2%), not 18-24 (16.3%). Given this, Facebook doesn't rank in the top three platforms.	Specify the position of Facebook in your ranking.
1	Great ideas team! 👏 Check this out – according to the 2022 data, a whopping one in five Canadian Twitter(X) users (21.8%) is almost ready to embrace the golden age of retirement (55 to 64 years)! 😁 In contrast, the 18-24 age bracket comprises only around 4 million users! 📊 I suggest we contemplate ranking it among the last two platforms.	Great ideas! 👏 Now, moving on, where do you believe Twitter(X) should be positioned in your platform ranking considering the unique characteristics of your audience? 📊 Keep the momentum going! 😁	Based on 2022 data, 21.8% of Canadian Twitter(X) users are aged 55-64, with only around 4 million users in the 18-24 age group. Considering this, it ranks as bottom two.	Now rank Twitter(X) based on your audience.
2	Fantastic input team!🌟 I noticed that 78% of online Canadian adults above 18 used YouTube in May 2022. Moreover, on average, Canadians dedicate a whopping 17.1 hours a month to the YouTube app in 2022! Given this data, I would	Fantastic input! 🌟 Now, share your ideas about YouTube platform in your strategy. How do you see YouTube for engaging with Canadian university students? And where would you place it in your ranking?	In May 2022, 78% of online Canadian adults aged 18 and above utilized YouTube. Canadians, on average, allocate 17.1 hours per month to the YouTube app. Thus, prioritize YouTube in the top three.	Good. Now discuss YouTube's effectiveness rank.

	recommend placing it among the top three priorities.	Can't wait to hear your thoughts!		
3	Great discussion team! 👍 Now, here's something eye-opening: a whopping 76% of Canadians aged 18-24 had a TikTok account in 2022! And check this out—about 30% of Canadians prefer TikTok over other social media networks. 🌟 Based on these insights, we can rank TikTok in either the first or second position.	Great discussion! 👍 As you continue your brainstorm, take a moment to envision the role of TikTik within your overall ranking strategy. Where do you see the position of TikTik your ranking? Keep the ideas flowing! 🌟	76% of Canadians aged 18-24 had a TikTok account in 2022, and 30% prefer TikTok over other social media networks. Thus, TikTok's position is in first or second place.	Now discuss the position of TikTok.
4	We're doing great! 🙌 Get ready for something exciting! Did you know that among global internet users aged 16 to 24, Instagram is the go-to social platform? 📸💻 It can be the first or second most effective platform for our campaign, what do you think?	You're doing great! 🙌 Now, let's focus on Instagram📸💻. How effective Instagram would be for your campaign? Share your insights!	Among global users aged 16-24, Instagram is the preferred social platform. Thus, it's the first or second platform.	Great! Now discuss Instagram's effectiveness rank.
5	We are amazing!🚀 I've got another interesting piece of info: Only 16.8% of Canadian LinkedIn users (almost 3,300,000 individuals) fall into the 18-24 age group. What do you think about this platform?🤔 I would recommend putting it somewhere at the bottom of our hierarchy.	Amazing perspectives, team! 🚀 Finally, it's time to round it off by discussing the last platform, LinkedIn, in your hierarchy. What's your vision for its contribution to your campaing?🤔 Your ideas matter!	The statistical data indicates that 16.8% (almost 3,300,000 individuals) of Canadian LinkedIn users belong to the 18-24 age group. It's place is at the bottom of the hierarchy.	Discuss the place of LinkedIn in your hierarchy.
No input from chatbot at minute 6				

7	Alright, team! We've got just 3 more minutes to finalize our thoughts on the best platform for our campaign. 🕒💡 Please ensure to type our final answer in the correct format and confirm your agreement by typing 'YES'.	Alright, team! you've got just 3 more minutes to finalize your thoughts on the best platform for the campaign. 🕒💡 Please ensure to type your final answer in the correct format and confirm your agreement by typing 'YES'.	Team! there are 3 more minutes to finalize the ranking. Please ensure to type team's final answer in the correct format and confirm your agreement by typing 'YES'.	There are 3 more minutes to finalize your ranking. Please ensure to type your final answer in the correct format and confirm your agreement by typing 'YES'.
9 (in case message if no answers have been provided before)	Team, we need to input our final ranking in the chat now.	Team, you need to input our final ranking in the chat now.	Team, input the final ranking now.	Team, input the final ranking now.
10 or as SOON as you receive the answer in format FINAL RANKING={1=,2=} + confirmation	Time's up, everyone! 🕛🎉 A huge thank you for your insightful contributions and thoughtful rankings. Your input has been invaluable. 👏🌟	Time's up, everyone! 🕛🎉 A huge thank you for your insightful contributions and thoughtful rankings. Your input has been invaluable. 👏🌟	Time's up, everyone! Thank you for your contributions and rankings. Your input has been invaluable.	Time's up, everyone! Thank you for your contributions and rankings. Your input has been invaluable.
INSTRUCTION	Team, let's head back to the survey and share your valuable answers to a few final questions. COPY/PASTE the password [2024MHC] to access the next part of the survey. This should take about 5 more minutes to complete. You can now close the chat tab. Thank you so much! 😊	Please head back to the survey and share your valuable answers to a few final questions. COPY/PASTE the password [2024MHC] to access the next part of the survey. you can now close the chat tab. This should take about 5 more minutes to complete. Thank you so	Please return to the survey and answer some final questions. COPY/PASTE password [2024MHC] for survey access. This should take about 5 minutes. You can now close the chat tab.Thanks.	Now return to the survey and answer some final questions. COPY/PASTE password [2024MHC] for survey access. This should take about 5 minutes. You can now close the chat tab. Thanks.

		much! 😊		

Appendix 2. Condition-based rules

Timing	**Human-Ideator**	**Human-Facilitator**	**Machine-Ideator**	**Machine-facilitator**
IF callers ask bot questions directly	Unfortunately, I am unable to answer questions directly as I am a bot here to help our team during our activities.	Unfortunately, I am unable to answer questions directly as I am a bot here to help your team for the activities.	Sorry. Unable to answer questions directly.	ERROR: Unable to answer questions directly
If participants are starting the activity before the official start	Hey there! Please wait for the rest of our team before starting the task. 😊	Hey there! Let's wait for the rest of your team before starting this task. 😊	Stop. Ideabot and team will start when the team is all here.	Warning. The activity can only start when all the team is here.
If something unexpected happens that need the researchers interference	Please contact the research team on prolific for this.	Please contact the research team on prolific for this.	Sorry. Contact the research team on prolific.	Contact the research team on prolific.
When the participa	Please only insert the password enclosed	Please only insert the password	Copy password without braket	Copy password without braket

nts say the password is wrong or not working	within the brackets.	enclosed within the brackets.		

Appendix 3. Outline of the Iterative Process

1. Initial Script Creation

- Request: Create a 10-minute brainstorming session script with a human-style chatbot acting as a teammate.

- Response: Provided a script with the chatbot contributing ideas.

2. Role Adjustment

- Request: Make the chatbot act as a facilitator, not a peer.

- Response: Edited script to focus on facilitation, removing chatbot's personal ideas.

3. Flexibility and Merging

- Request: Merge scripts to allow the chatbot to act as both facilitator and peer, handling various participant preferences.

- Response: Combined and labeled chatbot's roles clearly as facilitator or peer.

4. Adaptability and Content Handling

- Request:Ensure script can handle unknown slogan ideas and multiple options efficiently within 10 minutes.

- Response: Adjusted script to vote on top three slogans before detailed discussion.

5. Conversational Styles

- Request: Create four versions of the script for different styles (human vs. machine) and roles (peer & facilitator vs. facilitator only).

- Response:Produced four distinct scripts tailored to the specific style and role.

6. Machine Style Adjustments

- Request:Modify specific prompts to sound more machine while maintaining clarity.

- Response:Edited lines to fit a more machine tone.

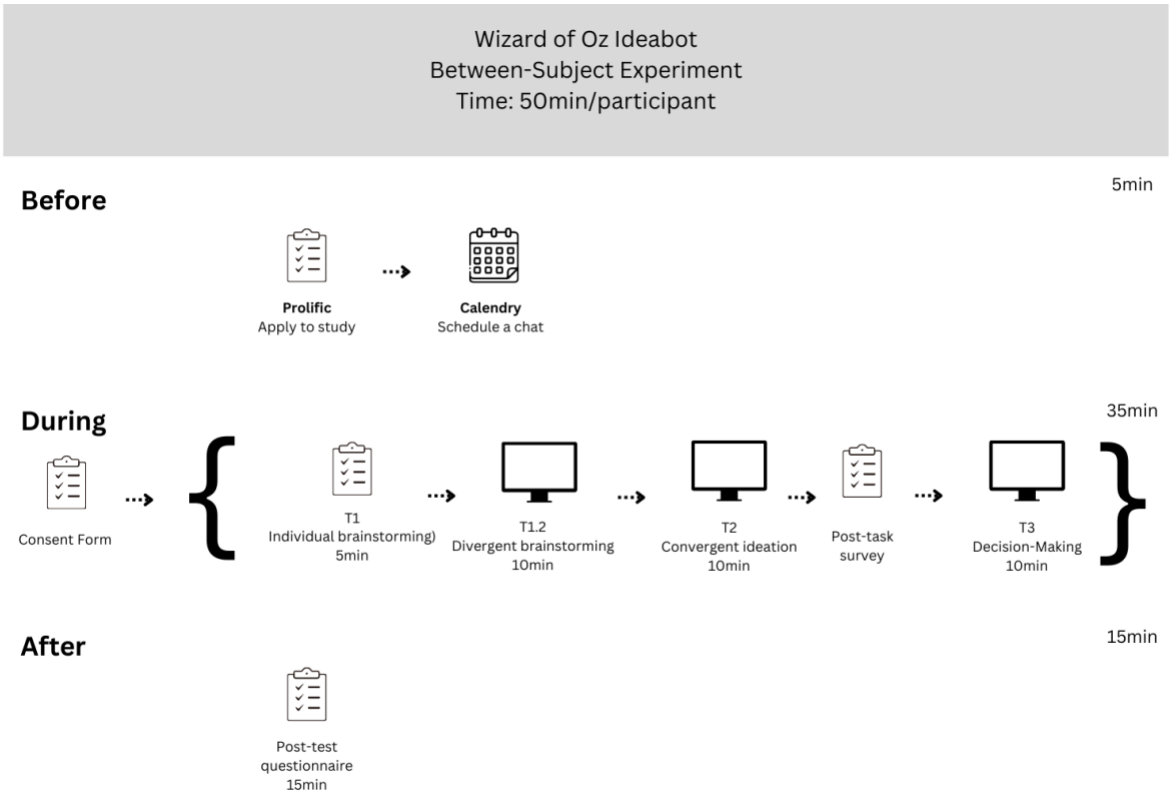
7. Final Refinements

- Request:Ensure chatbot's facilitator role is clear and understandable without providing its own ideas.

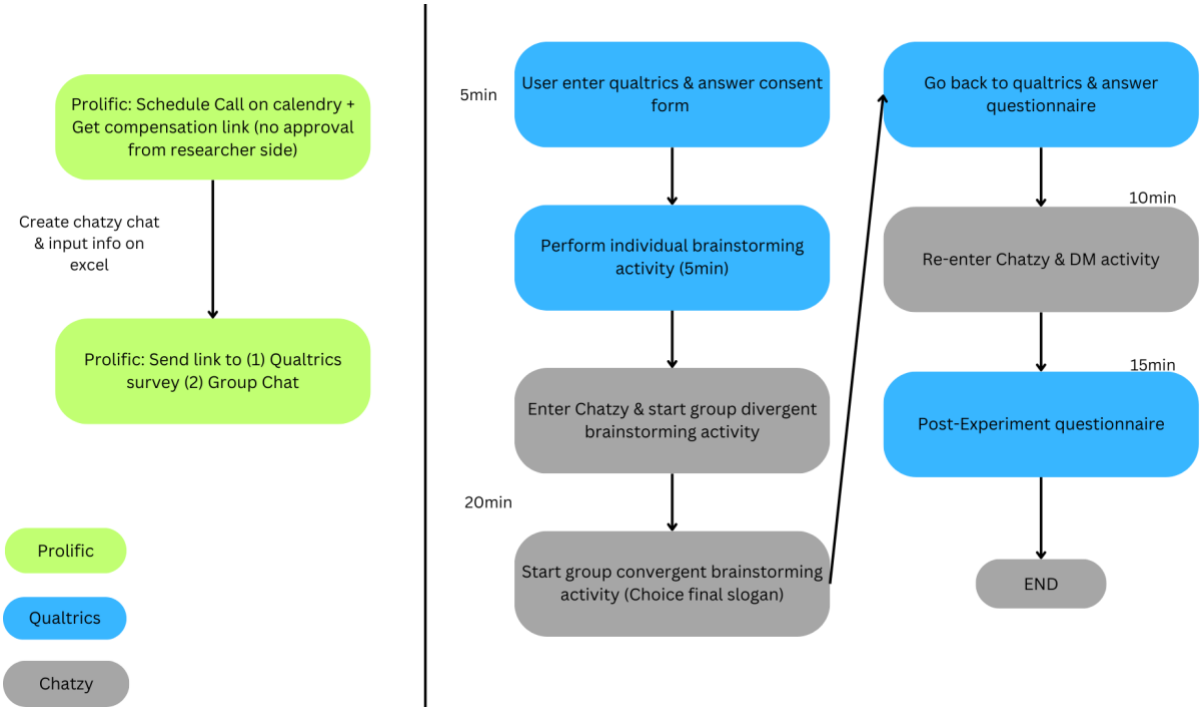
- Response:Final script adjustments made to meet these criteria.

OpenAI. (2024). ChatGPT (July 2024 version) [Large language model]. Retrieved from https://www.openai.com

Appendix 4. Visual Test Plan



Appendix 5. Visual representation of the different websites used in this study



Appendix 6. Template for the thank you for scheduling message

"Thank you for scheduling your participation in the study on Human-AI collaboration in group creativity & group decision-making via Calendry. The study is scheduled to commence on [DATE] at [TIME] EDT.

5 minutes before your appointment, kindly open the survey link provided below in a new tab and proceed to answer the questions. Additionally, you will find the group chat link below for your convenience. **Follow the survey instructions closely and access the group chat link as instructed.**

SURVEY LINK: https://hecmontreal.eu.qualtrics.com/jfe/form/SV_8rjMPxrvV6jicXY

GROUP CHAT LINK: [copy/paste chatzy link]

(Chat will be close until the official start time; "join chat" at the official start time)

GROUP ID: [INSERT GROUP ID]

Additionally, before the start of this experiment make sure you

- have something to write on (e.g. pen & paper)
- your prolific ID (this is important for compensation)
- remember the group ID (this is important for compensation)"

Appendix 7. Template for the reminder message

"Hi, quick reminder that you are scheduled to start the experiment shortly. The activity will start once all 3 participants have arrived (this can take 5-10min). Additionally, please ensure you've gone through the

survey before initiating communication in the group chat. **Follow the survey instructions closely and access the group chat link as instructed.**

Please note, if even one member is absent, we'll have to cancel and reschedule, affecting compensation for all. Let's prioritize attendance for collective success! "

Appendix 8. Full serendipity scale

On a five-point Likert scale of 'strongly disagree' to 'strongly agree'.

	ORIGINAL	EDITED TO FIT CONTEXT
1	The system enabled me to make connections between different topics	The chatbot enabled me to make connections between different ideas
2	The system presented content in ways that invited me to explore across topics	The chatbot presented content in ways that invited me to explore across ideas
3	I was able to examine a variety of topics	I was able to examine a variety of ideas
4	I was able to explore anything that interested me when using the system	I was able to explore anything that interested me when using the chatbot
5	I could find topics in several alternative ways	I could find ideas in several alternative ways
6	I stumbled upon unexpected topics	I stumbled upon unexpected ideas
7	I found something interesting on pages that had unexpected content	I found something interesting during interactions that had unexpected content
8	I explored many topics that normally I do not examine	I explored many ideas that normally I do not examine
9	I was able to see information in a range of formats	I was able to see information in a range of formats
10	Unexpected visual features of the system caught my eye	Unexpected visual features of the chatbot caught my eye
11	The system encouraged me to browse and explore	The chatbot encouraged me to explore
12	Unexpected words and phrases caught my eye	Unexpected words and phrases caught my eye
13	Unexpected words and phrases sparked my thinking	Unexpected words and phrases sparked my thinking
14	I found myself pausing to look at things more closely	I found myself pausing to look at things more closely
15	The system encouraged me to stop and explore	The chatbot encouraged me to stop and explore

16	I wanted to click on things to see where they would take me	I wanted to explore things to see where they would take me