Marketing and Communication in a Computer-Mediated Environment

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by

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Dissertation submitted in partial fullfllement of the requirements for the degree of Doctor of Philosophy in Business and Socioeconomic Sciences in the department of tourism and service management in the Post-Graduate School of MODUL University Vienna.

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ABSTRACT

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AFFIDAVIT

I hereby affirm that this dissertation represents my own written work and that I have used no sources and aids other than those indicated. All passages quoted from publications or paraphrased from these sources are properly cited and attributed.

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18 April, 2023

Date

ABSTRACT

With the emergence of disruptive technologies such as artificial intelligence, social media, big data analytics, and robotics, communication has shifted towards interactivity and co-creation between parties. While computer-mediated communication (CMC) has eliminated time and geographic constraints, major criticisms center around the absence of social presence, facial expression, emotional interaction, and multisensory experiences. Therefore, this dissertation aims to explore how humans react to digital stimuli in marketing within computer-mediated environments on a sensorial, cognitive, affective, and behavioral level. This is done by investigating the use of textual paralanguage with service chatbots (Study 1), consumer reactions towards different types of emoji sentiments on social media (Study 2), and the impact of CGI influencers' facial expressions on user engagement (Study 3). The relevance for this dissertation is grounded in the knowledge within three main areas, including digital sensory experience, the emotions as social information model, and the computers are social actors paradigm. Each study outlined the limitations of the empirical research along with the theoretical contribution and managerial implications of the findings. The interdisciplinary nature of this dissertation will provide new insights for scholars and practitioners in marketing in computer-mediated environments and beyond.

ACKNOWLEDGEMENTS

This dissertation represents not only a two-year journey but a culmination of a six-year effort that began during my fourth year of undergraduate studies. While I never envisioned pursuing a PhD, life can be unpredictable. Year after year, I have grown stronger and more confident as a researcher - starting as a student helper in Macau and now emerging as a true scholar in Vienna. Throughout this journey, I am grateful to the many invaluable individuals who have joined me, supporting me in navigating through uncertainties and guiding me towards clarity.

First, I express my sincerest gratitude to my supervisor, Prof. Astrid Dickinger, whose unwavering support, invaluable guidance, and insightful feedback have been instrumental in shaping the final outcome of this work. I am particularly appreciative of the incredible amount of freedom she provided, allowing me to explore my interests with greater depth and breadth. I am also thankful for the positive relationship we developed in this journey. Despite my occasional pushiness and tendency to chase deadlines, Astrid remained patient and approachable, always willing to provide assistance whenever I encountered obstacles. This enabled me to work independently while knowing that her guidance was available whenever needed.

I also extend my gratitude to the members of my PhD committee, Denis Helic, Josef Mazanec, and Kevin So, whose valuable feedback and suggestions have enriched my research. Their critical evaluation and constructive comments have helped me to refine my work and push it to new heights. Their collective expertise has provided me with a broader perspective on the subject matter and challenged me to think more deeply about the implications of my findings.

I would also like to acknowledge several mentors from Macao Institute for Tourism Studies and Salzburg University of Applied Sciences - especially Roman Egger, Barbara Neuhofer, and Henrique Ngan, for their support in cultivating and training me into the researcher I am today, with enhanced writing skills as well as creative and critical thinking abilities.

Moreover, I express my heartfelt appreciation to everyone who has contributed in one way or another to the success of my PhD thesis, including my friends who never understand what a PhD entails, my PhD classmates who have been my constant companions, my hiking buddies in Austria who have lent an ear to my complaints, and the people I met in conferences who provided encouragement and inspiration.

Finally, I would like to express my profound gratitude to my parents, who have provided me with unconditional love, support, and understanding throughout my journey, despite their belief that writing a paper only takes a day. Their unwavering encouragement and belief in me have been my greatest motivation. I am humbled and grateful for the contributions of each and every person who has played a part in making this dissertation a reality, and I hope that my research will contribute positively to the field and inspire future scholars in their own pursuits.

PUBLICATIONS AND AUTHOR'S CONTRIBUTION

Study 1 of this dissertation have been used in a manuscript entitled "See Me, Hear Me, and Touch Me: The use of Textual Paralanguage in Altering Digital Sensory Experiences with Chatbots" to the Journal of Service Research. The manuscript was submitted on 30 November 2022 and has passed the desk review. At the time of the submission of the dissertation, the manuscript was under review.

Study 2 of this dissertation have been used in a manuscript entitled "Emojis as visual semiotics in digital communication" to the International Journal of Research in Marketing. The manuscript was submitted on 03 March 2023 and has passed the desk review. At the time of the submission of the dissertation, the manuscript was under review.

Study 3 of this dissertation have been used in a manuscript entitled "Uncovering the emotional secrets of computer-generated imagery influencers: The power of facial action units" to the Journal of Retailing and Consumer Services. The manuscript was submitted on 11 April 2023 and has passed the desk review. At the time of the submission of the dissertation, the manuscript was under review.

The author of this dissertation is the sole author of Study 1. Study 2 was co-authored with Astrid Dickinger and Roman Egger. Study 3 was co-authored with Astrid Dickinger, Kevin Kam Fung So and Roman Egger. However, the author of this dissertation took the lead in the research. Specifically, Roman's tasks were to help with programming, but the programming codes and instructions were all given by the author of this dissertation. Kevin acted as a reviewer and provided feedback when Study 3 was completed. The author of this dissertation is the first one for all three studies. An overview of the author contribution is detailed below.

	Task	Author contribution
Paper 1	Ideation	Joanne
	Conceptualisation	Joanne
	Methodology	Joanne
	Data collection	Joanne
	Data analysis	Joanne
	Writing	Joanne
Paper 2	Ideation	Joanne

	Conceptualisation	Joanne, Astrid
	Methodology	Joanne
	Data extraction	Joanne
	Python	Roman (Instructions were given by Joanne)
	Data analysis	Joanne, Roman
	Writing - Original Draft	Joanne
	Writing - Review & Editing	Joanne, Astrid
Paper 3	Ideation	Joanne
	Conceptualisation	Joanne, Astrid
	Methodology	Joanne
	Data extraction	Joanne
	Data analysis	Joanne, Roman
	Writing - Original Draft	Joanne
	Writing - Review & Editing	Joanne, Astrid, Kevin

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
AU	Action Unit
CMC	Computer-Mediated Communication
CGI	Computer-Generated Imagery
CASA	Computers Are Social Actors
CorEx	Correlation Explanation
DMO	Destination Marketing Organisation
EASI	Emotions As Social Information
FACS	Facial Action Coding System
RMSE	Root Mean Squared Error
tf-idf	Term frequency-inverse document frequency

1 PREMABLE

1.1 Introduction

In the 21st century, a variety of technologies such as social media, big data analytics, robots, chatbots, and emergingly, artificial intelligence (AI) has laid the groundwork for the current digital landscapes (Chuah & Yu, 2021; Solakis et al., 2022). The pace at which disruptive technologies are arriving not only creates entirely new products and services, but fundamentally alters global connectivity and online communication (Goldenberg & Gross, 2020). This evolution is particularly relevant for marketing which relies heavily on the proliferation of information and communication technologies (Krishen et al., 2021). In a computer-mediated environment, communication focuses on the role of interactivity and co-creation between parties (Krishen et al., 2021; Neuhofer, 2016). Although computer-mediated communication (CMC) streamlines communication by eliminating time and geographic constraints, major criticisms of CMC centre on the absence of social presence (Derks et al., 2008), facial expression (Elder, 2018), emotional interaction (Aldunate & González-Ibáñez, 2016), and multisensory experiences (Petit et al., 2019). Nevertheless, different from early days where text served as the dominant form in message delivery, recent innovations have provided alternatives to enrich text exchanges (Aldunate & González-Ibáñez, 2016). Well known examples can be seen from emojis, pictures, and stickers, amongst others. Emergingly, the contemporary umbrella of CMC goes beyond graphical representations by also involving AI, robots (Herring, 2019) and computer-generated imagery (CGI) (Ahn et al., 2022).

Knowing that in-person interaction can be extended to CMC (Togans et al., 2021), understanding of human reactions to digital stimuli on the integration of sensorial, cognitive, affective, and behavioural aspects is of high importance to advance the current knowledge of marketing in computer-mediated environments. From a marketing perspective, effective use of visual elements is beneficial for enhancing engagement, fostering emotion (Yu & Egger, 2021), and signalling brand personalities (Luangrath et al., 2017). For instance, emojis implicitly convey personality traits for a business in branding (Moussa, 2021), while colour has been used as a subliminal factor to increase user engagement on social media in destination marketing (Yu & Egger, 2021). From a consumer perspective, interaction with digital stimuli heightens customer journey and facilitates experience co-creation on numerous levels (Varkaris & Neuhofer, 2017). For example, social networking sites are revealed as a space for people to express their anticipation before an event (Neuhofer et al., 2020). Other studies indicated that consumers are more likely to reveal their feelings and emotions during crises, especially on social media (Azer et al., 2021). With the advancement of AI, marketers can even design service chatbots with humanlike characteristics (Crolic et al., 2022) and manipulate their linguistic style (Spillner & Wenig, 2021) so as to facilitate relational connection and enrich user experiences (Fotheringham &

Wiles, 2022). Likewise, going beyond AI, the latest trends in CMC on social media seem to shift towards the direction of CGI (Ahn et al., 2022).

However, while acknowledging the multimodal nature of CMC (Herring, 2019), existing literature remains largely on the analysis of textual components (McShane et al., 2021). Despite examining visual images has gained its popularity in the disciplines of service and marketing (Luo et al., 2021; Yu & Egger, 2021), the emotional / affective aspects and the behavioural reactions of consumers still deserve further exploration in the digital world. In order to offer theoretical contributions to the understanding, research, and design of digital stimuli, an interdisciplinary approach that bridges psychology, linguistics, semiotics, and data-driven science into marketing in computer-mediated environments would enlighten scholars and practitioners with new insights.

Thus, this dissertation is motivated by the central research question: how do humans react to digital stimuli in the context of marketing in computer-mediated environments on a sensorial, cognitive, affective, and behavioural level? The following research questions stimulate and underpin the above enquiry (see Table 1). Specifically, this dissertation focuses on three distinct directions: 1) from the aspect of sensation and cognition, the first study unfolds the use of textual paralanguage in altering digital sensory experiences with service chatbots, 2) on a behavioural level, the second research investigates consumer engagement towards emoji types across social media posts featuring different marketing attributes, and 3) from the affective aspect, the third study focuses on the facial expression of CGI influencers and their impact on user engagement. A synthesis of the three research papers follows.

TABLE 1. RESEARCH QUESTIONS OF THIS DISSERTATION

How do humans react to digital stimuli in the context of marketing in computer-mediated environments ?	
Sensorial and cognitive level	RQ1: How can textual paralanguage alter consumers' digital sensory experiences when communicating with service chatbots?
Behavioural level	RQ2: What is the relationship between emoji types and user engagement across social media posts with different attributes?
Affective level	RQ3: How do different emotional expression of CGI influencers affect consumer engagement?

1.2 Synthesis of the articles included in this dissertation

On the sensorial and cognitive level, the first study investigates the use of textual paralanguage in influencing digital sensory experiences and their subsequent impacts on satisfaction and usage intention during a chatbot-led service encounter. Despite that service chatbots have been increasingly adopted by businesses to streamline customer experiences, one major challenge lies in the absence

of emotion and personal touch in the digital world. However, while acknowledging that consumer perception and behaviour are influenced by their sensation, little is known about how to simulate sensory experiences in online chat conversations. In order to enrich text-based CMC, this study adopts a 2x2x2 full factorial design by manipulating auditory, tactile, and visual cues as well as their interplay between sensation, mental simulation, and consumer experiences. Since emoticons and stylistics can be applied to increase sensory stimulation in CMC (Tu, 2000), the findings present novel alternatives to best deploy service chatbots. By bridging psychological variables and communicative style to the wider context of customer service, this study adds knowledge to the use of textual paralanguage as an emerging means to simulate sensation and revolutionise the conventional chatbot marketing practices.

Moving to the behavioural level, the second study aims to explore visual semiotics (i.e., emojis) across social media posts with different attributes and their subsequent behavioural impact on engagement. Specifically, the research context is based on tourism and destination marketing since emojis are found to be more suitable for hedonic products/experiences in digital communication (Das et al., 2019). Amongst various platforms, Instagram serves as a dominant channel for marketers to deliver destination personality (Egger et al., 2022), trigger engagement (Yu et al., 2020), and create a physical-emotional bond with potential tourists (Aramendia-Muneta et al., 2020). While over 50% of the Instagram posts contain at least one emoji (Bai et al., 2019), their effect in different contexts remains underexplored (Das et al., 2019). First, Instagram posts published by 30 destination marketers were collected and classified using topic modelling. Thereafter, emojis, with their corresponding sentiment values and characteristics, were extracted and analysed for each of the identified topics so as to examine their effectiveness in triggering user engagement using permutation feature importance. By taking visual semiotics and data science into digital marketing, this research contributes to the current CMC practices and bridges the usage of emoji in the context of social media and tourism. Additionally, revealing the status quo of emoji usage on Instagram offers practical implications to the emotionalization of marketing offerings.

Lastly, concerning the emotional level, the third study shifts the focus to human-computer interaction on the rise of CGI influencers in the digital environment. CGI influencers mirror their human counterparts with a social media account and nurture connections with online audiences (Drenten & Brooks, 2020). Different from anthropomorphic agents that often trigger a sense of eeriness (Ahn et al., 2022), it appears that CGI influencers have diverged from the territory of uncanny valley when marketing on social media (Arsenyan & Mirowska, 2021). In order to streamline the emerging parasocial relationship, this research aims to investigate the emotional expression of CGI influencers and their subsequent influences on user engagement in different marketing contexts. The methodological approach involves the use of facial recognition and image clustering based on Instagram data. Underpinning the theoretical lens of the computers are social actors (CASA) framework critical in the digital era, the

findings advance the state-of-the-art knowledge in human-computer interaction and pave a new avenue for the marketing sphere.

1.3 Theoretical overview and research contribution

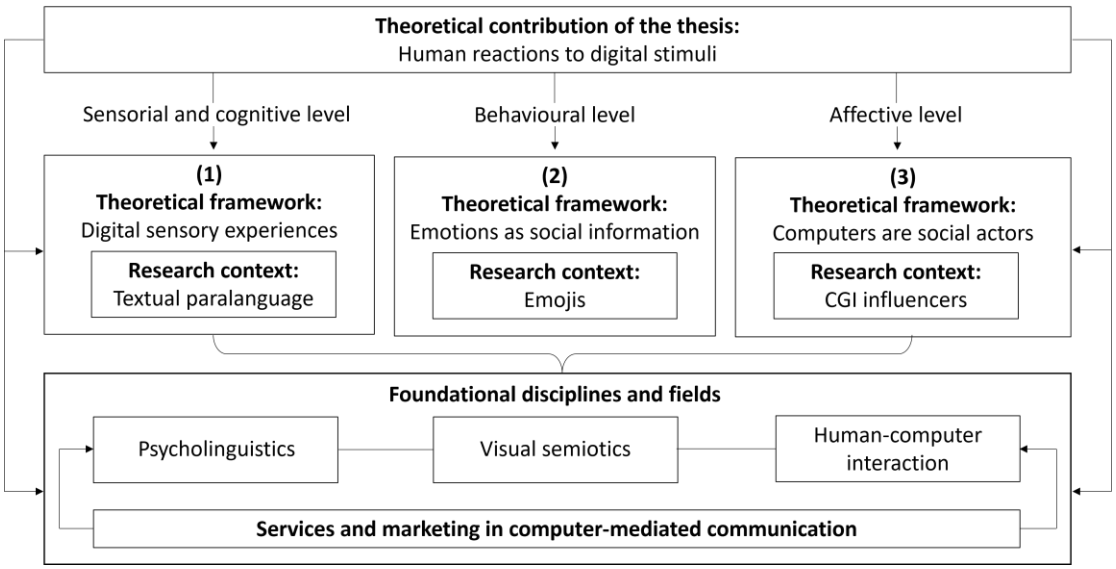
In synthesising the current knowledge gaps, it appears that there is a need for further exploration and re-conceptualisation of how human reacts to digital stimuli. The relevance and rationale for this research are grounded in the knowledge within three main areas identified in the literature, including digital sensory experience, the emotions as social information (EASI) model, and the CASA paradigm. Since digital technology is increasingly prevalent in our daily lives, a better understanding is necessary in light of how different types of digital stimuli can potentially 1) simulate sensation and affect perception, 2) deliver emotional communication, and lastly, 3) act as social actors to trigger engagement. As people are exposed to various forms of digital stimuli, it is essential to understand how they do so to make informed decisions about the use of digital technology. Given that people are increasingly exposed to various forms of digital stimuli, a more comprehensive understanding of the effects can help navigate the ever-expanding digital landscape and make more informed choices, ultimately leading to more positive outcomes for the social-ecological systems.

Notably, while Study 2 and Study 3 are data-driven in nature, it is important to highlight the paradigm shift in knowledge discovery at an epistemological level. Despite that ongoing debates exist concerning whether data can speak for themselves (Kitchin, 2014), this dissertation is akin to the lightweight theory-driven approach proposed by Elragal and Klischewski (2017). During the process of knowledge generation, implicit assumptions or a basis of theory are inherent because "*humans cannot not hypothesise*" (Mazanec, 2020). Knowing the fact that any analytical choice is not out of random, and curiosity comes from rudimentary hypotheses (Mazanec, 2020), knowledge transmission between theories and data can span across a continuum illustrated in the chapter of Egger and Yu (2022).

Furthermore, while theory-driven mindsets remain the dominant approach in marketing research, it has become possible to express some reservations about this belief. A thought-provoking question is whether the conventional practice reflect today's data-rich reality and account for pressing (societal) issues? In order to accommodate an increasingly data-driven environment, marketing scholars initiated a call to pave a way for empirics-first research (Golder et al., 2022). Their seminal work emphasises that future mainstream research should begin with a real-world marketing phenomena or observation, and proceed to valid insights and thoughts without necessarily establishing or testing theory (Golder et al., 2022). Notably, the empirics-first methodology is not opposed to theory as implicit assumptions are always inherent throughout the process (Elragal & Klischewski, 2017; Mazanec, 2020). The process is iterative in nature and interaction with the literature remains at all stages. Yet, to act as a steppingstone to theory, researchers should begin with exploratory inquiries and analyse data with an open mind to advance understanding (Golder et al., 2022).

The theoretical foundation of this dissertation is graphically depicted in Figure 1. As demonstrated, the lightweight theory-driven approach allows this work to move beyond pure quantitative analysis (e.g., discovering patterns) by integrating knowledge from various domains, thereby paving the way for entirely new perspectives. Figure 1 shows the discipline of services and marketing (*overall discipline*) and the embedded three foundational fields (*psycholinguistics, visual semiotics, and human-computer interaction*) this dissertation is based upon. The final theoretical contribution of this dissertation, human reactions to digital stimuli, adds original knowledge, which through a feedback loop flows back into the respective literature, theoretical frameworks, and the wider disciplines. Slightly different from conventional approaches solely based on relevant theories pertaining to a study, this dissertation is in line with the nature of knowledge-based practices but additionally offers a data-led technique that expands upon the state-of-the-art knowledge on human reactions to digital stimuli. By outlining a transparent methodological guideline in each study, replication of the method is possible in broader consumption contexts that can be built upon for future research.

FIGURE 1. THEORETICAL FOUNDATION OF THE THESIS



1.4 Structure of thesis

The thesis is divided into four chapters, with each chapter featuring a paper that focuses on a specific research topic related to the intersection of technology and human behaviour. Chapter 2 discusses the use of textual paralanguage in altering digital sensory experiences with chatbots. Chapter 3 explores the use of emojis as visual semiotics in digital communication, with a specific focus on tourism and destination marketing. Chapter 4 investigates the emotional display of CGI influencers, with a particular emphasis on the power of facial action units.

Each chapter follows a similar structure, with the introduction outlining the purpose and importance of the research, the literature review presenting existing knowledge on the topic, the methodology

describing the research design and data collection methods, the results section presenting the findings, the discussion section interpreting the results and relating them to the literature, and the conclusion summarising the key findings and their theoretical and practical implications. Each chapter also includes an abstract, limitations, and recommendations for future research.

2 PAPER 1: SEE ME, HEAR ME, AND TOUCH ME: THE USE OF TEXTUAL PARALANGUAGE IN ALTERING DIGITAL SENSORY EXPERIENCES WITH CHATBOTS

ABSTRACT

One major challenge of employing service chatbots lies in the absence of emotion and personal touch in the digital world. While acknowledging that consumer perception and behaviour are influenced by their sensation, little is known about how to stimulate sensory experiences in online chat conversations. To enrich text-based computer-mediated communication, this research investigates the use of textual paralanguage in influencing digital sensory experiences during a chatbot-led service encounter. The findings imply that the interplay between textual cues related to artifacts, bodily touch, and vocalisation triggers consumers' mental simulation and sensation, and elicits higher satisfaction. By bridging psychological variables and communicative style to the wider context of digital services and marketing, this study adds knowledge to the use of textual paralanguage as an emerging means to simulate sensation and revolutionise the conventional chatbot design.

Keywords: textual paralanguage; digital sensory experience; chatbot; mental simulation; computer-mediated communication

2.1 Introduction

With the advancement of artificial intelligence (AI) and rising expectations from consumers, the use of service chatbots has soared in popularity (Crolic et al., 2022; Huang & Rust, 2021). From banking and finance to retail and hospitality, more businesses are adopting AI chatbots to address a variety of customer needs and reduce waiting time to service access (Xiao & Kumar, 2021). By simulating human conversation through text messages on websites and social media (McShane et al., 2021), chatbots provide frictionless experiences (Fotheringham & Wiles, 2022) and improve customer satisfaction (Crolic et al., 2022). However, since interaction is a fundamental part in service encounters, scholars have criticised the absence of emotion and personal touch in the digital world (Huang & Rust, 2018). To intentionally design experiences in chatbot-led service communication, recent studies have reinforced the human role as a novel feature of chatbot anthropomorphism (Fotheringham & Wiles, 2022; Uysal et al., 2022). By demonstrating humanlike characteristics, anthropomorphised chatbots deliver a sense of familiarity and facilitate relational connections (Fotheringham & Wiles, 2022). Conventional strategies include imbuing AI chatbots with names and avatar pictures (Kim et al., 2022) and altering the language style (Elsholz et al., 2019).

Notably, the anthropomorphised object per se is not the main determinant, but rather is its humanoid traits (e.g., natural language) that allow people to make inferences of human social rules (Uysal et al., 2022). Yet, which particular anthropomorphic characteristics simulate greater mind perception remains ambiguous (Uysal et al., 2022). From users' perspectives, what has been largely overlooked when developing humanoid attributes is their sensory experiences, which in fact, serve as the most intuitive external manifestation of anthropomorphism (Zhang et al., 2022). Grounded in consumer psychology, sensory marketing is the use of different sensory appeals to affect one's perception and behaviour (Krishna, 2012). In technology-induced service encounters, sensory experiences can be altered through voice or speaking ability (Zhang et al., 2022). Grasping the nature of mental simulation, in online communication, simulation refers to the process of self-projection in a hypothetical reality so as to activate possible cognitive and bodily states (Tu, 2000). For example, emoticons and stylistics can be applied to increase sensory stimulation in computer-mediated communication (CMC) (Tu, 2000) to ensure customer retention in text comprehension (Marmolejo-Ramos & Cevasco, 2014).

Seeing that conversations with AI chatbots are often text-based, one way to enrich sensory experiences in the digital context (Orth et al., 2022) is the use of textual paralanguage. Textual paralanguage refers to written manifestations of nonverbal audible, tactile, and visual elements (Luangrath et al., 2017). Examples include "!!!" for emphasis, "hmm" for alternants, handshake symbols, as well as body-related and non-tactile emojis. In particular, since brains react to human-based emojis similar to real visages of actual humans (McShane et al., 2021), the use of textual paralanguage benefits marketing and service humanisation (Ge, 2020). As services gradually evolve from physical to digital, marketers have adopted textual paralanguage (such as those related to artifacts, bodily touch, and vocalisation) to optimise the level of perceived interactivity (Dijkmans et al., 2020), elicit social experiences (Cicco et al., 2020), promote consumer relationships (Ge, 2020), increase social presence, and improve satisfaction (Hayes et al., 2020). However, existing knowledge is mainly derived from the lens of emoji usage, whereas leveraging sensory language has been left behind. While knowing that textual paralinguistic cues can enrich text-based CMC and trigger positive emotion (Hayes et al., 2020), whether textual paralanguage can alter digital sensory experiences and their subsequent impacts remains unknown (Luangrath et al., 2017). This is particularly relevant to services and marketing due to the connection between sensation and consumers' cognitive, affective, and social processes (Gao & Lan, 2020; Pagani et al., 2019).

Despite the significance of multisensory experiences in the digital environment (Stead et al., 2022), the status quo of service and marketing research tend to be limited to one particular sense, such as touch (Overmars & Poels, 2013), vision (Yu & Egger, 2021), or auditory perception alone (Klink, 2000). This becomes problematic especially in online service encounters, in which consumers switch among different sensory stimuli simultaneously (Stead et al., 2022). Moreover, although a plethora of literature has investigated digital textual communication, the focuses are dominant by the end results such as purchase intention, product evaluation (Crolic et al., 2022), user motives, and consumer attitudes

(Cicco et al., 2020). As sensation influences perception in a traditional context (Krishna, 2012; Tu, 2000), whether this notion can be applied to the digital era is yet to be answered. Thus, services marketing lacks comprehensive understanding of customer sensitivities to digital sensory language (Bashirzadeh et al., 2022).

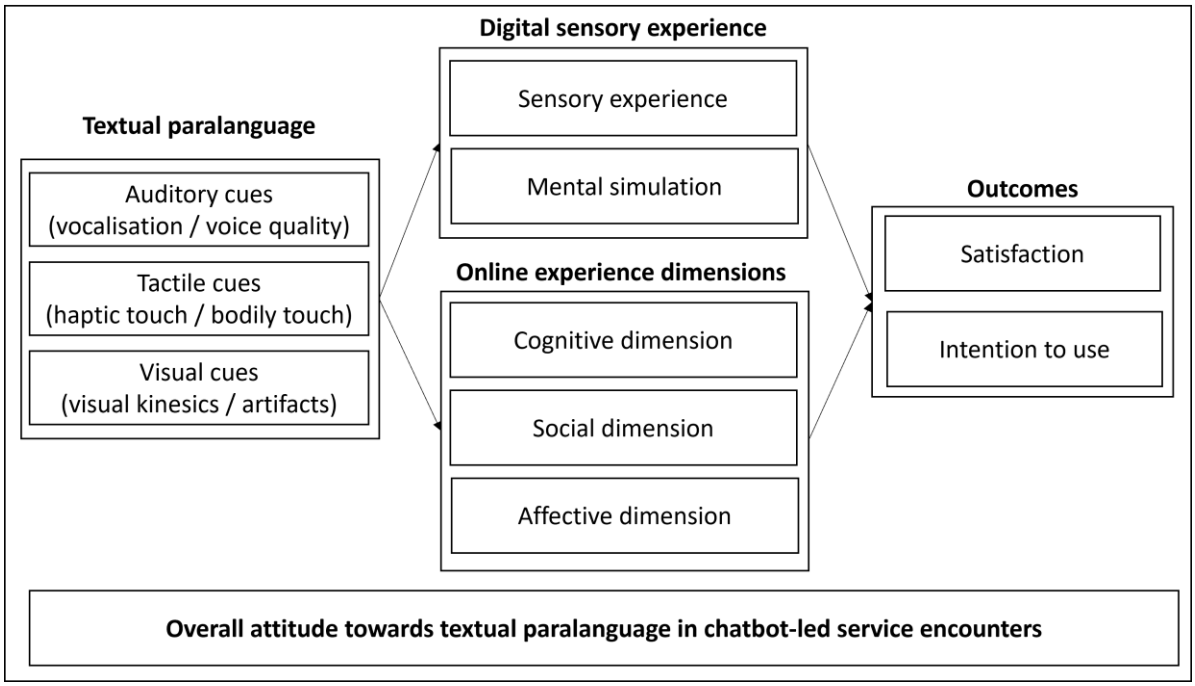
Following the call to examine multisensory cues (Stead et al., 2022) and design elements in text-based CMC (Bashirzadeh et al., 2022; Luangrath et al., 2017), this research aims to investigate the use of textual paralanguage in influencing digital sensory experiences and their subsequent impacts on satisfaction and intentions to use in an AI chatbot-led service encounter. By bridging the science of psycholinguistics into the discipline of service marketing, the findings contribute to current practices and understanding of CMC and add knowledge to the use of textual paralinguistic cues as an emerging means to simulate sensation. By presenting novel ways to best design and deploy service AI chatbots, this cross-disciplinary research has potential in revolutionising the conventional practice of chatbot communication and their language style.

2.2 LITERATURE REVIEW

In pursuit of the stated research objectives, the conceptual framework is as follows (Figure 2), including: (i) different types of textual paralanguage as the main antecedents, (ii) digital sensory experience and online experience as the dependent variables, and (iii) customer satisfaction and intentions to use as the outcomes.

The remainder of the review discusses AI chatbots and humanisation. It then provides three key sensory signals (i.e., auditory, tactile, and visual) that can be presented by textual components as well as their influences on users. Lastly, the review offers a discussion of sensory experiences in digital services and marketing. To determine which human sense was stimulated each sensory aspect is addressed and analysed independently. Nonetheless, knowing that overall experiences are shaped by multiple sensory stimuli (Petit et al., 2019), the influences of sensory cues as a whole on consumers' online experiences based on their cognitive ((Bleier et al., 2019), social (Sands et al., 2021), and affective dimension ((Iglesias et al., 2019) are also examined.

FIGURE 2. CONCEPTUAL FRAMEWORK



2.2.1 Humanised service chatbot in computer-mediated environments

The development of AI-based technologies has profoundly changed the interaction between humans and computers (Huang & Rust, 2021). Under the discourse of CMC (Becker et al., 2020), chatbots serve as a major form of AI-enabled media technologies (Huang & Rust, 2021). Chatbots, which mimic human speech or text, have transformed today's digital environments. Along with various service mega-disruptions, online users are increasingly exposed to chatbots. In addition to carrying out basic tasks such as sending tickets and giving recommendations (Araujo, 2018) with standard responses, AI chatbots are capable of solving free-text inquiries in a more conversational nature (Spillner & Wenig, 2021). That is, their role has transcended from a tool of communication to an active communicator in contexts previously handled by human agents. In recent years, companies from various industries have collectively jumped on board with the revolution of chatbots so as to revamp marketing practices and escalate customer experiences (Haugeland et al., 2022; Hoyer et al., 2020). However, conflicting with the nature of service encounters with communication-intensive and customer-facing work, it appears that consumers are deprived of the human element, thereby craving more human connection for social and emotional reasons.

In order to facilitate relational connections, humanlike characteristics have been integrated into chatbot design (Hoyer et al., 2020). Commonly known as anthropomorphic chatbots (Ramesh & Chawla, 2022), typical features range from having human names and humanoid appearance (e.g., avatars) (Kim et al., 2022) to the capability of mimicking intonation (Spillner & Wenig, 2021). For instance, Araujo (2018) affirmed that the presence of personality signalled by humanlike language enhances perceived

anthropomorphism and improves users' emotional connection. Meanwhile, the use of avatars influences social presence and subsequent impacts on trustworthiness and enjoyment in online retailing environments (Cicco et al., 2020). Another study focuses on communicative style by exploring the interplay between messages with emojis and users' perceptions towards the attractiveness and competence of chatbots (Beattie et al., 2020). Nonetheless, it is important to note that humanisation of virtual agents does not necessarily fit into all service contexts. For example, in service failures, the use of anthropomorphic chatbots decreases customer satisfaction and intentions due to expectancy violations (Crolic et al., 2022), whereas avatar design in the service recovery process leads to various levels of consumer loyalty (Jones et al., 2022). In terms of conversation style, the study of Haugeland et al. (2022) concludes that task-oriented dialogues, which aim to achieve certain outcomes effectively, would benefit from including design elements of humanoid characteristics.

Afterall, these humanised features aim to encourage interaction, alter mind perceptions (Uysal et al., 2022), and ultimately trigger emotional reactions (Haugeland et al., 2022). As service chatbots become more humanised, deploying experiences with an appropriate level of anthropomorphism would improve user satisfaction (Crolic et al., 2022). However, while acknowledging that conversations with service chatbots rely mainly on text, intentional design of textual elements remains underexplored. Among various anthropomorphic cues, there seems to be a strong focus on the appearance of chatbots (Cicco et al., 2020; Crolic et al., 2022; Tsai et al., 2021), with other experiential factors in optimising experiences (Ramesh & Chawla, 2022) being left behind.

2.2.2 Textual paralanguage: The use of auditory, tactile, and visual cues

One prominent, but overlooked, technique to enrich text-based communication is to alter textual elements and digital language (Luangrath et al., 2017). From a linguistic perspective, efforts have been made on using imperative statements in advertisements (e.g., Visit us!) (Fitzsimons et al., 2014) and vowel sounds (e.g., Bilan vs Bolan) in creating brand personality (Klink, 2000). Yet, similar to face-to-face interaction, nonverbal information, which are processed through the five senses, should also be conveyed in written language (Togans et al., 2021). Since sound, touch, and visuals are more relevant to personal interaction, Luangrath et al. (2017) contextualise a typology of textual paralanguage in CMC, which is defined as "*written manifestations of nonverbal audible, tactile, and visual elements that supplement or replace written language* (p. 98)". Specifically, auditory elements comprise voice qualities (e.g., exclamation marks, contractions) and vocalisations (e.g., sound/filler words). Tactile kinesics refer to bodily touch (e.g., hug and kiss) and haptic touch (e.g., high-five and handshake), whereas visual textual cues include visual kinesics (e.g., body-related emojis) and artifacts (e.g., non-kinesics / non-tactile emojis).

Interestingly, when textual paralanguage is embedded with the aforementioned sensory signals, people react to such situation as if they would do in an in-person communication (McShane et al., 2021). The intuition lies in that processing (digital) sensory cues goes beyond a cognitive process by tapping

into one's emotional and physiologic aspects (Luangrath et al., 2017). In fact, this reaction is not uncommon and can be traced back to the science of reading, where learners tend to imitate gestures or behaviours (e.g., sound out words) when encountering sensory cues (e.g., auditory signal) (Ehri, 2005). In services and marketing, businesses have joined the new tech bandwagon by utilising textual paralanguage to humanise digital customer experiences (Hayes et al., 2020). Unsurprisingly, the effect of visuals (e.g., emojis) seems to be the most researched area in chatbot communication, whereas words that signal sound and touch appear to be underexplored aspects. A recent study suggests that emojis used by an airline chatbot induce positive sensorial experiences (Jiménez-Barreto et al., 2021) as they are more socially attractive and credible (Beattie et al., 2020). In another context, scholars suggested that incorporating emojis for the anthropomorphic design of chatbots strengthen user engagement and interaction in the beverage industry (Tsai et al., 2021).

Turning to words that signal sounds, earlier literature has outlined auditory cues in online communication, such as vocal spelling (e.g., reallllyyyy), punctuation for expressing attitude (e.g., !!!) and capital letters for signalling tone of voice (e.g., OMG) (Riordan & Kreuz, 2010). These cues not only provide hints on the degree of a sender's emotion, but facilitate social connections between users (Liebman & Gergle, 2016). Thus, conversational agents can be humanised by using spoken language similar to humans in terms of pitch, volume, and pace (Fast & Schroeder, 2020). Concerning tactile cues through the use of interpersonal touch (Luangrath et al., 2017), tactile stimulation is the most emotional experience and can effectively influence one's social behaviour (Gallace & Spence, 2010). Despite that research on the effect of physical contact in online communication remains scarce (Gallace & Spence, 2010; Stead et al., 2022), virtual touch sensations have received attention in the context of online shopping (Overmars & Poels, 2013) and human-robot interaction (Gallace & Spence, 2010). While various interfaces have emerged to advance digital haptic messages such as virtual try-on and mid-air haptics (Petit et al., 2019), triggering the sense of touch might not be as complicated as one imagine. In fact, several textual paralinguistic elements convey physical touch and a sense of closeness (e.g., *hug*) (Luangrath et al., 2017). Yet, given the potential of sensory modalities in escalating experiences (Stead et al., 2022), tactile kinesics still receive little attention in digital services and marketing (Luangrath et al., 2017).

2.2.3 Sensory marketing: From offline to online

While acknowledging that paralinguistic cues trigger strong auditory, haptic, and visual experiences (Hayes et al., 2020; Luangrath et al., 2017), little is known regarding whether consumers (unconsciously) mimic the expression delivered through text (Luangrath et al., 2017) in AI chatbot-led service encounters. Grounded in sensory marketing, it is a technique that attempts to manipulate consumers' perception and behaviour by leveraging various senses (Krishna, 2012) because sensory stimuli allow one to imagine taking a specific action and anticipate possible outcomes through perceptions and experiences (Royo-Vela & Black, 2020). That is, consumers use mental simulation to assess how they

may benefit from a product or service. For example, the sound of food can influence perceived freshness and quality (Zampini & Spence, 2005). Different voice pitch and vocal speech have effect on listeners' perceived credibility and competence towards a speaker (Dahl, 2011).

Since sensation implicitly relates to one's cognitive, affective, and social processes, subsequent influences can be noticed in brand experience (Gao & Lan, 2020; Pagani et al., 2019) or purchase intention (Orth et al., 2022). Notably, depending on the nature of sensory cues in marketing, the quality of an experience differs. For instance, consumers' perceptions might be influenced by the number of sensory touchpoints (Krishna, 2012) or the way they are delivered (e.g., online vs. offline) (Orth et al., 2022). In the meantime, following the design principles (Pine & Gilmore, 2011), these sensory stimuli should be unique and distinctive so as to optimise customer experiences (Gao & Lan, 2020). Additionally, it is equally important to ensure that the designed sensory triggers are in line with the nature of business and consumer's consumption purposes (Gao & Lan, 2020). Nevertheless, neuroscientists have suggested that human brains process multiple sensory modalities as a unified perception (Seilheimer et al., 2014). Therefore, any single sense should not be investigated as a stand-alone subject (Stead et al., 2022). Instead, it is the interplay between multiple sensory triggers that shapes the overall service experiences (Petit et al., 2019). Despite the multifaceted nature of human senses, researchers have been mostly focusing on the sense of sight due to its high relevance to digital marketing (Hagtvedt, 2022), whereas tactile perceptions are barely investigated (Stead et al., 2022). Although literature related to auditory experiences is emerging (Petit et al., 2019), the simultaneous occurrence of multiple sensory stimuli in general merits further attention (Stead et al., 2022).

Fast forward to today's digital world, the advancement of communication technologies has enabled transference of embodiment between offline and online (Togans et al., 2021). Rooted in knowledge of cognitive psychology and neuroscience, it is possible to decouple cognitive activities from a real-world situation even when the sensory stimuli are represented by words or images (Niedenthal et al., 2005). For example, reading odour-related words (e.g., cinnamon) (González et al., 2006) or viewing someone's hands grasping food (Basso et al., 2018) can activate motor regions of the brain. Likewise, designing physiological elements associated with feelings of closeness and love using gestures (e.g., hand holding, kissing) can simulate haptic interactions in instant messaging (Hassenzahl et al., 2012), which potentially compensates the lack of social interaction especially for high-touch people (Petit et al., 2019). As the servicescape is moving towards digital environments, the significance of the alignment effect in natural language interfaces has been highlighted in psycholinguistics due to its role in streamlining chatbot-led communication and enhancing user engagement (Spillner & Wenig, 2021). Answering the call to uncover novel tools (Hagtvedt, 2022) and make digital service encounters more immersive and enjoyable (Petit et al., 2019), the synergy between different types of textual sensory cues (Packard & Berger, 2021), thus, deserves further investigation.

2.3 METHODOLOGY

2.3.1 Experimental design and stimuli development

To investigate the use of textual paralanguage as an emerging means to simulate sensation, a 2x2x2 full factorial design was employed based on the following attributes and levels: 2 auditory (i.e., vocalisation / voice quality) x 2 tactile (i.e., haptic touch / bodily touch) x 2 visual (i.e., visual kinesics / artifacts) textual paralinguistic cues. Table 2 presents a list of eight combinations. A control group without any sensory cues was included for manipulation checks. Appendix A presents the stimuli used in this research. Specifically, in appendix A (a), the "ahh" and "well" signal vocalisation; the handshake (🤝) and high-five (🙏) symbols illustrate haptic touch; the thumbs up (👍) and smiley face (😊) emoji represent visual kinesics. In appendix A (b), voice quality is imitated by "!!!", "I'm", and "I've"; bodily touch is displayed by the hugging (🤗) and kissing (😘) emoji; lastly, the time (🕒) and package (📦) emoji act for artifacts. The same textual paralinguistic cues apply to other conditions with different combinations.

TABLE 2. CONDITIONS USED IN THE EXPERIMENT

Condition	Auditory cues	Tactile cues	Visual cues
1	Vocalisation	Haptic touch	Visual kinesics
2	Voice quality	Bodily touch	Artifacts
3	Vocalisation	Haptic touch	Artifacts
4	Voice quality	Haptic touch	Artifacts
5	Vocalisation	Bodily touch	Visual kinesics
6	Voice quality	Haptic touch	Visual kinesics
7	Vocalisation	Bodily touch	Artifacts
8	Voice quality	Bodily touch	Visual kinesics

2.3.2 Scenario development

An inquiry-based scenario related to changing the delivery time is developed as the followings: "You ordered a microwave online last week. The package was supposed to arrive yesterday, but you have not received anything. You go to the website of the delivery company and try to track the status of your package online. However, it shows pending on scheduled delivery. In order to have some clarifications, you decide to contact the support team. On the website, you see that you can inquire about the delay using the customer service chatbot. While you are being connected to the chatbot, you have imagined a typical situation of communicating with a bot".

A pre-test was conducted with 33 consumers to assess the appropriateness of the scenario to ensure that it resembles a typical real-life situation. Participants were instructed to answer the following questions based on a 5-point Likert scale (from 1 = strongly disagree to 5 = strongly agree): 1) It is easy to imagine myself in the scenario, 2) The scenario is realistic, and 3) I can relate to the scenario. Additionally, in order to ensure that the designed textual paralinguistic cues are noticeable, participants indicted whether they were aware of any emoji, sound and filler words after reading the conversation.

The results confirmed that the chatbot conversation used in the current study could resemble a typical service inquiry situation (imagination: M=4.21, SD=0.93; realism: M=3.76, SD=1.17 and relatability: M=4.18, SD=0.81), and these evaluations were similar across the nine different conversations based on one-way ANOVAs (imagination: F (8, 32) = .746, p =.651; realism: F (8, 32) = 1.406, p =.244; and relatability: F(8, 32) = 1.017, p =.450). Likewise, participants indicated that they have noticed the corresponding textual paralinguistic cues, except those assigned to the control group. The results confirmed a successful manipulation.

2.3.3 Sampling procedure

A total of 193 participants were recruited through a convenience sampling technique. Surveys were distributed either during class time in different universities or on various social media platforms. A between-subject design was used, where participants were randomly assigned to one of the eight conditions. The sample size in this research is similar to other experimental studies in digital services and marketing (Pagani et al., 2019). Upon reading the description, participants were presented with the above scenario and were asked to imagine themselves interacting with an AI service chatbot.

Thereafter, participants completed self-administered questionnaires. The survey items were modified from the mental simulation scale (Royo-Vela & Black, 2020) and the sensory experience scale (Gao & Lan, 2020). In addition to the influence of each of the auditory, tactile, and visual cues, the survey further measured the effect of sensory cues in general on consumers' cognitive (Bleier et al., 2019), social (Sands et al., 2021), and affective aspects (Iglesias et al., 2019). Participants were also asked to indicate their satisfaction and intention to use, adapted from the study of Sands et al. (2021). All items were rated based on a 5-point Likert scale, where 1 refers to strongly disagree and 5 is strongly agree. Finally, the last section focuses on consumers' overall attitude towards textual paralanguage and socio-demographic information. The survey items are included in appendix B.

2.4 RESULTS

2.4.1 Descriptive statistics

Table 3 provides an overview of participants' socio-demographic information. Specifically, males (49.2%) and females (50.8%) were nearly equally distributed, with a majority of younger population

aged below 35 years old (91.7%). Most of the participants hold a bachelor's degree (43.4%) or higher (37.9%) and mainly come from the USA, China, Austria, Australia, the United Kingdom, and Germany, to name a few. Regarding their usage frequency of textual paralanguage, emojis were the most commonly adopted ones (M=3.96; SD=1.02), followed by sound words (M=3.68; SD=1.07) and filler words (M=3.50; SD=1.13). Moreover, the results suggested that participants like to receive textual paralanguage cues when interacting with chatbots (M=3.70; SD=0.84). They also find them useful (M=3.69; SD=0.88) and appropriate (M=3.66; SD=0.92) in general (Table 4). A summary of the mean value for each stimulus and their subsequent impacts is presented in Table 5.

TABLE 3. SUMMARY OF PARTICIPANTS' SOCIO-DEMOGRAPHIC BACKGROUND

Variables		Frequency	Percentage
Gender	Male	95	49.2
	Female	98	50.8
Age	18-24	58	30.0
	25-34	119	61.7
	35-44	16	8.3
Educational level	High school	36	18.7
	Bachelor's degree	84	43.4
	Master's degree	61	31.6
	PhD degree	9	4.7
	Prefer not to say	3	1.6
Nationality	USA	19	9.8
	China	15	7.8
	Austria	14	7.3
	Australia	14	7.3
	United Kingdom	13	6.7
	Germany	12	6.2
	Canada	9	4.7
	France	9	4.7
	Italy	9	4.7

	Belgium	7	3.6
	Portugal	6	3.1
	Brazil	6	3.1
	Taiwan	6	3.1
	Other European countries	29	15.0
	Other Asian countries	12	6.2
	Other African countries	7	3.6
	Other Middle East countries	4	2.1
	Other Oceanian countries	2	1

TABLE 4. PERCEPTIONS TOWARDS THE USE OF TEXTUAL PARALANGUAGE

Variables		Mean	SD
Likeness	Emojis	3.83	1.01
	Filler words	3.51	1.11
	Sound words	3.76	1.08
	Overall	3.70	0.84
Appropriateness	Emojis	3.92	1.06
	Filler words	3.45	1.15
	Sound words	3.62	1.11
	Overall	3.66	0.92
Usefulness	Emojis	3.80	1.08
	Filler words	3.53	1.11
	Sound words	3.76	1.10
	Overall	3.69	0.88

TABLE 5. MEAN (UPPER) AND STANDARD DEVIATION (LOWER) OF EACH STIMULUS AND THEIR IMPACTS

			Mental simulation			Sensory (Volume)			Sensory (Unique)			Sensory (consistent)			Online experience			Outcome	
Auditory cue	Tactile cue	Visual cue	Aud.	Tac.	Vis.	Aud.	Tac.	Vis.	Aud.	Tac.	Vis.	Aud.	Tac.	Vis.	Cog.	Soc.	Aff.	Sat.	Int.
Vocal	Haptic	Kinesics	3.82	3.93	3.83	3.85	3.38	3.81	3.97	3.79	3.89	3.68	3.74	3.90	4.03	4.15	4.04	4.10	4.02
			0.94	0.84	0.85	1.07	1.03	0.95	0.95	1.02	0.90	0.98	0.83	0.80	0.75	0.74	0.70	0.83	0.96
		Artifacts	3.36	3.72	3.33	3.15	3.08	3.31	3.14	3.26	3.54	3.47	3.51	3.63	3.46	3.74	3.67	3.61	3.73
			1.14	0.69	0.83	0.90	1.10	0.85	0.91	1.00	0.99	0.70	0.80	0.89	0.84	0.69	0.77	0.61	0.66
	Body	Kinesics	3.57	3.71	3.47	3.51	3.06	3.53	3.47	3.22	3.54	3.82	3.33	3.75	3.69	3.84	3.67	3.92	3.92
			0.88	0.74	0.97	0.96	1.34	1.03	1.06	1.23	0.93	0.76	0.91	0.79	0.75	0.74	1.01	0.70	0.71
		Artifacts	3.71	3.81	3.79	3.64	3.56	3.76	3.63	3.51	3.67	3.64	3.56	3.76	3.80	4.12	4.07	4.21	3.85
			0.85	0.75	0.93	1.04	1.18	1.16	1.00	0.97	1.04	1.09	0.95	0.85	0.84	0.74	0.84	0.62	0.86
Voice	Haptic	Kinesics	3.96	3.85	3.72	3.58	3.63	4.00	3.67	3.58	3.89	3.75	3.71	3.93	4.07	4.15	4.22	4.21	4.26
			0.74	0.55	0.75	0.92	0.78	0.62	1.00	0.82	0.72	0.86	0.76	0.55	0.60	0.58	0.58	0.43	0.51
		Artifacts	3.74	4.06	3.78	3.64	3.57	3.81	3.64	3.78	3.83	3.76	3.74	4.08	3.92	4.10	4.04	4.06	4.01
			0.87	0.65	0.82	0.99	0.95	0.99	0.93	1.08	0.93	0.88	0.92	0.84	0.74	073	0.88	0.72	0.74

Body	Kinesics	3.82	4.14	3.79	3.76	3.53	3.68	3.49	3.49	3.72	3.89	3.57	4.04	3.99	4.15	4.17	4.28	4.19
		0.81	0.64	0.70	1.08	1.18	1.11	1.21	1.19	0.96	0.70	0.78	0.71	0.68	0.45	0.61	0.54	0.50
	Artifacts	3.61	3.85	3.46	3.38	3.11	3.75	3.67	3.46	3.46	3.92	3.57	3.97	3.74	3.84	3.90	4.04	3.99
		0.96	0.82	1.07	1.13	1.20	0.95	1.00	1.07	1.06	1.04	0.98	0.59	0.87	0.66	0.65	0.84	0.77

Note: Aud.=Auditory; Tac.=Tactile; Vis.=Visual; Cog.=Cognitive; Soc.=Social; Aff.=Affective; Sat.=Satisfaction; Int.=Intention

TABLE 6. OVERALL RESULTS OF THE THREE-WAY ANOVA: F-VALUE AND SIGNIFICANCE

	Mental simulation			Sensory (Volume)			Sensory (Unique)			Sensory (consistent)			Online experience			Outcome	
	Aud.	Tac.	Vis.	Aud.	Tac.	Vis.	Aud.	Tac.	Vis.	Aud.	Tac.	Vis.	Cog.	Soc.	Aff.	Sat.	Int.
Auditory	1.64	3.00	0.42	0.13	1.42	2.24	0.18	0.74	0.23	1.92	0.77	5.09*	2.73	1.01	4.06*	3.69	4.87*
Tactile	0.10	0.01	0.10	0.01	0.39	0.13	0.08	1.50	1.97	1.37	1.75	0.00	0.34	0.22	0.15	1.51	0.03
Visual	2.07	0.21	0.85	2.38	0.17	0.49	0.82	0.02	0.99	0.46	0.00	0.18	3.88*	1.49	0.90	2.22	3.65
Auditory x tactile	0.47	0.27	0.46	0.16	1.25	0.97	0.06	0.02	0.34	0.00	0.01	0.00	0.38	0.76	0.25	0.89	0.07
Auditory x visual	0.04	0.00	0.03	0.16	1.15	0.07	2.04	0.46	0.03	0.71	0.00	0.64	0.02	0.30	1.12	0.26	0.05
Tactile x visual	1.36	0.21	0.72	0.41	0.47	3.18	4.22*	0.95	0.23	0.01	0.71	0.02	1.72	1.18	2.44	3.25	0.43
Auditory x tactile x visual	1.24	3.89*	5.73*	4.68*	3.29	0.70	1.79	2.91*	1.56	0.00	0.91	1.35	3.08	5.90*	3.76	4.98*	0.17

Note: Aud.=Auditory; Tac.=Tactile; Vis.=Visual; Cog.=Cognitive; Soc.=Social; Aff.=Affective; Sat.=Satisfaction; Int.=Intention; *p < .05

2.4.2 Main analysis

2.4.2.1 Mental simulation

In order to investigate the interaction effects between different textual paralinguistic cues and their impacts on consumer experiences with an AI chatbot, mixed model ANOVAs were conducted based on the experimental conditions, as illustrated in Table 6. Starting from mental simulation, a three-way significant interaction was found in influencing the sense of touch, F (1, 185) = 3.892, p = .046, and sight, F (1, 185) = 5.735, p = .018, whereas no significant effects were identified for hearing, F (1, 185) = 1.242, p = .266. By taking a closer look at the factors triggering mental simulation of touch, the results suggested that auditory cues had a significant main effect in the presence of bodily touch, in which, the use of voice quality (vs. vocalisation) led to greater simulation, F (1, 93) = 2.386, p = .026. Yet, in the presence of haptic touch, there was no significant interaction effect, F (1, 92) = 2.186, p = .143, nor any main effect on auditory, F (1, 92) = 0.787, p = .377 and visual cues, F (1, 92) = 0.385, p = .536. As for the simulation of vision, although there was no significant interaction effect in the presence of visual kinesics, F (1, 92) = 1.636, p = .204, nor any main effect on auditory, F (1, 92) = 0.383, p = .537 and tactile cues, F (1, 92) = 0.751, p = .388, the results indicated a significant two-way interaction effect between auditory and tactile cues in the presence of artifacts, F (1, 93) = 4.299, p = .041. Specifically, the combination of bodily touch and vocalisation triggered greater simulation of vision, while haptic touch needed to be accompanied by voice quality to generate visual mental imagery.

2.4.2.2 Sensory experiences

With regards to sensory experiences, first, concerning to what extent the textual paralanguage activated participants' senses, there were no significant three-way interaction effects on the sense of touch, F (1, 185) = 3.294, p = .071, and vision, F (1, 185) = 0.702, p = .403. Yet, the results indicated a significant three-way interaction on hearing, F (1, 185) = 4.677, p = .032. Interestingly, in the presence of vocalisation, there was a significant two-way interaction effect between visual and tactile cues, F (1, 93) = 4.117, p = .045. The combination of haptic touch and visual kinesics triggered hearing the most, whereas the synergy of haptic touch and artifacts had the least impact. However, in the presence of voice quality, there was no significant interaction effect, F (1, 92) = 1.105, p = .296, nor any main effect on visual, F (1, 92) = 0.622, p = .432, and tactile cues, F (1, 92) = 0.039, p = .844.

In terms of the uniqueness of textual paralanguage, a significant three-way interaction was found on touching, F (1, 185) = 2.909, p = .038, but not on seeing, F (1, 185) = 1.562, p = .213, and hearing, F (1, 185) = 1.792, p = .182. Yet, for hearing, the results revealed a significant two-way interaction between tactile and visual cues, F (1, 185) = 4.220, p = .041. In this case, regardless of the type of auditory cues, the use of haptic touch and visual kinesics was perceived as the most unique in simulating hearing, followed by bodily touch and artifacts, visual kinesics and

bodily touch, and haptic touch and artifacts. As for the uniqueness of the chatbot in simulating touch, in the presence of haptic touch, there was a significant two-way interaction effect between visual and auditory cues, F (1, 92) = 3.233, p = .042. In this respect, the synergy of visual kinesics and vocalisation stood out, while the combination of vocalisation and artifacts was perceived as less unique.

Finally, regarding the consistency between sensory stimuli and consumers, the results did not indicate any significant three-way interaction effect on the hearing, F (1, 185) = 0.001, p = .977, touching, F (1, 185) = 0.907, p = .342, and visual characteristics of the chatbot, F (1, 185) = 1.352, p = .246. However, there was a significant main effect on the visual characteristics by using different auditory cues, F (1, 185) = 5.093, p = .025. Particularly, the participants perceived that voice quality (vs. vocalisation) was more consistent with their visual perception towards the designed service encounter.

2.4.2.3 Overall experiences

Turning to overall online experiences, a significant three-way interaction effect was revealed for the social aspect, F (1, 185) = 5.905, p = .016. Interestingly, in the presence of artifacts, the combination of bodily touch and vocalisation was the most effective in building rapport, while the use of haptic touch and vocalisation had the least impact. However, when visual kinesics were included, the synergy of bodily touch and vocalisation became the least effective, whereas haptic touch elicited stronger social feeling in combination of either vocalisation or voice quality. In terms of the cognitive, F (1, 185) = 3.078, p = .081, and affective dimension, F (1, 185) = 3.760, p = .054, no three-way interaction effects were found. Nevertheless, without considering the type of tactile and auditory cues, the results suggested that the inclusion of visual kinesics was cognitively perceived as more informative than artifacts, F (1, 185) = 3.877, p = .040. Meanwhile, regardless of the type of tactile and visual textual language, there was a significant main effect on the use of auditory cues in triggering consumers' emotional experiences, F (1, 185) = 4.058, p = .045. Interestingly, affective experiences were stronger when the chatbot used voice quality instead of vocalisation.

2.4.2.4 Satisfaction and intention to use

Finally, the results implied that the use of visual, tactile, and auditory cues indeed had an impact on consumer satisfaction, F (1, 185) = 4.985, p = .027. In particular, when vocalisation was adopted by the chatbot, there was a significant two-way interaction between visual and tactile cues, F (1, 93) = 7.683, p = .007. The findings implied that the synergy of bodily touch and artifacts resulted in the highest consumer satisfaction, whereas artifacts and haptic touch had the lowest. However, in the presence of voice quality, the combination of visual kinesics and bodily touch resulted in higher consumer satisfaction, compared to the use of artifacts and bodily touch. Despite that no three-way interaction effect was found for intention to use, F (1, 185) = 0.168, p = .683, there was a significant main effect on the use of auditory textual paralanguage,

F (1, 185) = 4.922, *p* = .028. Among which, including voice quality would lead to higher usage intention compared to the use of vocalisation in chatbot-led communication.

2.5 DISSCUSSION

As services and marketing practices go hand in hand with technological advancements, the significance of anthropomorphic design features has been reinforced in AI-driven services (Chuah & Yu, 2021). In addition to the end results such as consumer satisfaction, businesses are encouraged to focus on the experiential process (Ramesh & Chawla, 2022). Contrary to in-person service encounters, communication with AI chatbots is still limited in sensory interactions and lack multisensory atmospheric cues that enable them to interact with users in a humanlike way. In order to compensate the shortage of sensory elements, textual paralanguage serves as a way to humanise interaction and has potential in triggering imagination of the absent senses (Luangrath et al., 2017). Yet, the differential impacts that a particular anthropomorphic feature may have in eliciting mind perceptions and enriching consumer experiences are yet to be discovered (Uysal et al., 2022). Hence, this research intertwines the lens of sensory marketing with AI service chatbot interactions.

Overall, it is unsurprising to see the effect of mental simulation in touch, which is often proclaimed as the most essential human sense (Krishna, 2012). Consistent with previous findings in the psychological and sociological discipline, this research also showed that the immediate nature of touch conveys a sense of uniqueness in communication technologies (Wang & Quek, 2010). When bodily touch such as hugging and kissing are used in text communication, they deliver a stronger sense of human connection (Maryam et al., 2020), compared to haptic touch such as handshakes. An additional observation is that voice quality (e.g., *!!!*) can further amplify the touch effect of mental simulation when they appear together with body-related textual cues. However, despite the perceived uniqueness of haptic touch discovered in this study, it appears that such novelty is insufficient to trigger mental simulation, as opposed to bodily textual signals. One reason to explain the inadequate effect of haptic touch could be that the action has been performed already based on the presentation of the handshake (🤝) or high-five (🙏) emoji (i.e., two hands from two actors), unlike hugging (🤗) and kissing (😘) where one actor is absent from the graphics.

Turing to mental simulation of vision, when body-related cues are embedded with filler sounds (e.g., “ahh”), the effect of artifacts could be magnified. Potentially, it could be that filler sounds can maintain a speakers’ control over the conversation in visual language (Chong et al., 2012). On the contrary, because contractions (presented by voice quality in this study e.g., “I’m”, “I’ve) are perceived as more friendly and personal (Cornbleet & Carter, 2001), consumers might still be able to envision themselves seeing the facial expression of the chatbot in the presence of haptic touch (without displaying facial cues), thereby enhancing the suitability in the chatbot-led service encounter. Since contractions are often considered appropriate in instant messaging

(Cornbleet & Carter, 2001), it could be argued that the use of voice quality in chatbot communication improves its visual appeal. The significance of visual appeal in online environments and interactive interfaces has been emphasised by earlier literature (Yu & Egger, 2021) to foster purchase intention (Chi, 2018). Therefore, when interacting with AI chatbots, this study underscored the use of auditory textual paralanguage (especially voice quality) as sensory input to enhance perceived visual aesthetics and encourage usage intention.

Furthermore, the findings seem to infer an overwhelming effect stirred by the extent of anthropomorphic characteristics. Borrowing from the lens of uncanny valley (Mori, 1970), there is a threshold at which chatbots equip too many humanlike features. This phenomenon can be best illustrated by the social dimension of customer experiences in the current research. Particularly, although textual cues related to bodily touch (🤗,😘) creates a sense of closeness (Luangrath et al., 2017) with artifacts (🕒, 🟫), bodily touch does not blend well with visual kinesics (👍,😊). Together with the inclusion of filler sounds that conveys a speaker's autonomy (Chong et al., 2012), bodily touch (🤗,😘) and visual kinesics (👍,😊) appear to reduce social interactions. However, whether the underlying factors should be traced back to the notion of sensory overload (Spence et al., 2014) or uncanny valley (Hoyer et al., 2020) (because of three faces showing) remain an open question in chatbot communication. On the other hand, seeing that interactions are co-created and highly valued in services and marketing (Donthu et al., 2022), the findings support that consumer satisfaction largely depends on the interpersonal interaction with employees (Srivastava & Kaul, 2014). Specifically, the interplay between textual cues related to artifacts, bodily touch, and vocalisation elicits social experiences and higher satisfaction.

Moreover, this study showcased that the sense of hearing could be mobilised by the synergy of tactile, visual, and auditory stimuli. Accordingly, consumers may attach meanings and perceive physical features for an object (Krishna, 2012) if they have simulated themselves hearing the voice of the chatbot, thereby enhancing the perceived anthropomorphism. Building on the interplay between music/sound and emotion (Klink, 2000), the findings further affirmed that the use of auditory cues elicits consumers' affective feelings. Echoing the aforementioned point where contractions are more personal (Cornbleet & Carter, 2001), consumers' emotional experiences were indeed amplified by the use of voice quality. In order to improve the effect of vocalisation in activating hearing, this study reinforced that the presence of face in online environments is essential (Palmares et al., 2021) (e.g., by using visual kinesics 😊 and haptic touch 🙏). Since people subconsciously process one's facial expression, facial cues function as a supplement to other information presented in an online platform (Barnes & Kirshner, 2021). As suggested by the study's findings, it is possible that the use of visual kinesics could improve consumers' perception with cognitive stimulation.

On a holistic level, the findings are in line with knowledge of neuroscience, where textual paralanguage is sufficient to function as sensory stimuli in digital environments (Niedenthal et al.,

2005), albeit subject to the synergy of multisensory design elements. Certainly, depending on the goals of marketing strategies, the use of textual paralanguage should be adjusted accordingly since different combination results in various effects on digital sensory experiences and satisfaction.

2.6 CONCLUSION

2.6.1 Theoretical contribution

There is no doubt that ongoing development in AI and machine learning technologies continue making service chatbots more natural and humanlike. Technological acceleration in the service delivery process further increases demands on anthropomorphic versions of service chatbots (Crolic et al., 2022; Kim et al., 2022). By leveraging nonverbal communication through textual paralanguage as novel design elements (Bashirzadeh et al., 2022; Luangrath et al., 2017), this research advances the existing body of knowledge on chatbot interaction and provides answers to the interplay between textual sensory signals and digital sensory experiences. As a cross-disciplinary study, the contribution bridges the science of psycholinguistics and CMC into digital services and marketing. This study reinforces the necessity to go beyond the status quo of conventional practices and explores possible design elements to optimise consumer experiences with AI technologies (Chuah & Yu, 2021). Distinct from the mainstream research heavily relies on avatar pictures or human names, this study highlights the role of auditory, tactile, and visual textual paralanguage as well as their synergistic effect on potentially triggering consumers' mental simulation, sensation, and online experiences.

Through the innovative experimental design with a particular focus on textual paralanguage as a proxy of anthropomorphic features (Uysal et al., 2022), the findings provide new insights concerning how service chatbots can be humanised (Fotheringham & Wiles, 2022) by manipulating the language style in the current digital environments (Liu et al., 2019). However, marketers should also be aware of the risk that triggering multiple senses may have adverse effects (e.g., sensory overload), thereby leading to negative experiences (Spence et al., 2014). In a nutshell, the study design transcends the status quo by providing possible solutions for the creation of multisensory interaction in an online space (Orth et al., 2022; Petit et al., 2019), uncovering new methods for sensory marketing (Hagtvedt, 2022), and consolidating the simultaneous occurrence of human senses even within digital service environments (Stead et al., 2022).

2.6.2 Practical implications

Seeing that new services and technologies have emerged for businesses to respond to the changing strategies, rolling plans and adjustments are of importance. With the rapid growth in chatbot adoption, the findings provide valuable suggestions to the wider context of service encounters. Deliberate marketing efforts in changing communication style should be considered

in the strategic deployment of chatbots (Crolic et al., 2022). For instance, presuming that the ultimate service goal is to create a stronger sense of connection with users or to stand out from competitors, body-related textual cues are recommended. If marketers intend to create a more personal communication while not using face-related textual cues, sound words can be considered in chatbot design. Likewise, in order to enhance consumer usage intention or trigger emotional experiences, embedding auditory features such as using exclamation marks (e.g., "!!!") and contractions (e.g., "I'm") in chatbot communication would be beneficial.

Nonetheless, one should note these methods might not be suitable for all types of service encounters. Marketers also need to bear in mind that incorporating more sensory cues does not always guarantee a better outcome. For example, based on the study's design, it appears that including three facial symbols (e.g., 🤗,😘, and 😊) in a short conversation might lead to less social interactions. Of course, such results still depend on the design of other textual sensory signals. Borrowing the lens of experience design (Neuhofer et al., 2021), effective chatbot communication requires intentionality to carefully craft an environment that simulates a state of optimal experiences. Afterall, digital sensations do not emerge from a single trigger, but a rich symphony of multiple stimuli that are inherent in a simultaneous activation process.

2.6.3 Limitations and recommendations

This study is not without its limitations. First, from the perspective of sensory design, this study only focuses on three senses although they are deemed to be the most relevant in personal interaction (Luangrath et al., 2017). Future research is recommended to covey taste and smell using other types of textual paralanguage, which could be applicable to marketing strategies in businesses related to fragrances, food and nutrition. Moreover, since the designed service inquiries/scenarios used in this study was rather general, it is necessary to explore the effect of textual paralanguage in different service encounters and situations (e.g., hedonic vs utilitarian, service failure and recovery).

Concerning the socio-demographic background of the participants, it is critical to note that cultural issues emerge in the interpretation of sensory stimuli. Particularly for emojis, despite that official definitions are taken (Emojipedia, 2022), nuances in the use of emojis or other textual cues across cultures exist due to linguistic differences. In order to capture the potential of digital sensory experiences more comprehensively, scholars are advised to extend the scope of this research by considering language and cultural diversity. Additionally, this study focuses mostly on younger generations. While they play a major social role in creating and interpreting trends on the Internet, the current findings may not be applied to other generational groups.

Methodologically speaking, consumer experiences were measured with self-report questionnaires. Input from neuroscience techniques such as eye-tracking, galvanic skin response, or electroencephalogram should be assessed. A more feasible alternative could be the use of implicit

association test. Further research is thus still needed to be able to understand and create effective online multisensory experiences for consumers in a more objective manner.

3 PAPER 2: EMOJIS AS VISUAL SEMIOTICS IN DIGITAL COMMUNICATION

Abstract

Knowing that emojis, as a type of visual symbols, can serve as a proxy of emotion in digital environments without explicit declaration, their diversity has substituted words in much online communication. Yet, despite that visual semiotics paves the way for new epistemological viewpoints in digital marketing, not all symbols have received equal attention. This study aims to explore emojis across social media posts featuring different topics and their impact on engagement. By employing topic modelling approaches and permutation feature importance based on multiple regression models, the findings identified 21 topics based on diverse marketing offerings as well as the relative importance of different emoji types in predicting whether users engage with certain posts. By bridging visual semiotics, data science, and digital marketing, this research provides a deeper understanding of leveraging visual semiotics through their embedded valence. It further benefits the richness of computer-mediation communication and offers practical insights to the wider services and marketing discipline.

Keywords: emoji; visual semiotics; user engagement; social media; digital communication; data science

3.1 Introduction

Along with the well-known "face with tears of joy" emoji (😂) chosen by the Oxford Dictionaries as the word of the year in 2015 (Steinmetz, 2015), emojis continue to be embraced by Internet users around the globe. As of 2021, there were 3,633 emojis recorded in the Unicode Standard system (Emojipedia, 2022). These visual symbols convey nuanced emotional states (Ge & Gretzel, 2018), facilitate more expressive messages (Gomes & Casais, 2018), and foster interpersonal relationships (Bai et al., 2019). Meanwhile, emojis also reflect social phenomena (Hagen et al., 2019) and function as social information (Baek et al., 2021), though it may happen implicitly. For instance, in the early stages of the COVID-19 pandemic, the use of syringe emoji (💉) increased, whereas smiley face emojis (e.g., 😊) declined (Emojipedia, 2022).

In the contemporary digital environment, emojis stand out from other visual archetypes such as memes and stickers (Herring, 2019). Their uniqueness lies in the social dimension, where the social presence can be established especially through face-related emojis (Aldunate & González-Ibáñez, 2016). Grounded in cultural and psychological research, extending face-to-face settings to digital context (Togans et al., 2021) has made emojis a popular resource to enrich text-based computer-mediated communication (CMC) (Bai et al., 2019). Going beyond technology-induced human interaction, emojis have paved new avenues for visual semiotics (Ge, 2020) and digital

communication (McShane et al., 2021) in marketing, advertising, and branding (Bai et al., 2019). To date, as more advertisers move into digital media, the ability to visually differentiate marketing offerings can be escalated by the use of visual language (Bashirzadeh et al., 2022).

Stemming from the theoretical lens of visual semiotics (Aiello, 2020), leveraging emotional design factors is particularly relevant to social media marketing where the ultimate goal is to create positive experiences and improve user engagement (Smith & Rose, 2020). Echoing the emotions as social information (EASI) model, emotional expressions shape information by triggering affective reactions in observers (Baek et al., 2021), which subsequently lead to different behavioural reactions (Erle et al., 2022). Knowing that brains react to face-based pictographs similar to real visages of actual humans (McShane et al., 2021), digital communication can be perceived as more emotionally intense when emojis are included (Erle et al., 2022). Through the lens of the EASI model, displaying emotions in different modalities such as using bodily postures or symbols has a similar effect as the actual expression (van A. Kleef, 2017).

Yet, while acknowledging the connection between consumer emotion and engagement, little is known regarding the sentiment delivered by visual symbols in diverse marketing settings (Das et al., 2019; Ge, 2020; Ko et al., 2022). Certainly, scholars have initiated the trend to construct emoji sentiment dictionaries (Jaeger et al., 2019; Novak et al., 2015); yet later studies have not fully bridged the valence of emojis into the social media landscape. Furthermore, existing understanding is mainly limited to positive and face-based emojis, with the impact of negative and non-facial emojis being left behind (Huang et al., 2021). While a few empirical studies attempt to unfold the sophistication of emojis in more specific contexts such as consumer reactions to advertising (Das et al., 2019), the appropriateness of stimuli design has been questioned as emojis are not commonly used in those real life situations (Erle et al., 2022). On a holistic level, previous literature related to emojis was mainly derived from Twitter data (Hagen et al., 2019; Li et al., 2019; McShane et al., 2021), which is distinct from the nature of visually cantered platforms (e.g., Instagram). Consequently, the connection between emoji types and user engagement across social media posts projecting different level of emotional experiences and contextual situations is still an open question (Das et al., 2019).

Following the call to examine the effectiveness of using emojis to initiate user engagement (Ge, 2020; Huang et al., 2021; McShane et al., 2021), this study aims to explore emoji usage across marketing posts with different attributes and their subsequent behavioural impact on engagement. Seeing that these visual symbols serve as quasi-nonverbal cues, a deeper understanding of the variance of emoji usage can add to the richness of CMC and ultimately, optimise experiences in the digital environment (Lu et al., 2016). By bridging visual semiotics and digital marketing, this research advances the complexity of the EASI paradigm by involving a more dynamic expression and anthropomorphic interface (Erle et al., 2022). The findings further contribute to the understanding of emotion embedded in visual cues and their potential impact on consumer

behaviour. The consideration of sentiment polarity of emojis benefits digital experience co-creation and offers insights to the wider services and marketing discipline for social media optimisation (Luangrath et al., 2022).

3.2 Literature review

3.2.1 Visual semiotics in the digital landscape

The notion of experience economy has transformed consumer behaviour in the new digital frontier (Kannan & Li, 2017). Especially for hedonic products and services, consumers no longer purchase pure goods, but are largely allured by social status and lifestyles (Ramaswamy & Ozcan, 2016). In order to decipher purchases driven by one's subconscious perceptions and emotion, the study of signs, signals, and symbols comes into play (Zakia & Nadin, 1987). Under the umbrella of communication theory, semiotics refers to a discipline that interprets signs within a particular environment (Oswald, 2012). Specifically, anything that carries meaning, either implicitly or explicitly, can be treated as symbolic elements (DeRosia, 2008). Following Peirce's theory of signs, signifiers can be divided into icons, symbols, and indexes (Aiello, 2020). Common examples include words, pictures, and gestures, among others. To date, semiotics not only serves as the essence of cultural anthropology, but has also integrated semantics and pragmatics into the business and marketing disciplines (Rongbin Wang, 2019).

Echoing the belief that symbolic components can resound equally as strongly as words, visual semiotics emerges alongside the ubiquity of the Internet (Aiello, 2020). For instance, scholars have looked into the association of visual elements on branding and website communication (Wang et al., 2020). Other studies have discussed memes (Aiello, 2020), symbolic anthropomorphism (Kwak et al., 2020), and emojis in social media marketing (Huang et al., 2021). In essence, semiotics in digital marketing transcends language borders and contributes to the study of comprehensive brand communication. Thus, embracing the tenets of semiotic analysis allows marketers to identify trends in particular context and understand how the emotional stimuli of a brand resonate with targeted recipients (Lohmann et al., 2017).

The growing popularity of visual semiotics can be explained from three distinct angles. As marketers increase their presence on digital media (Kannan & Li, 2017), the advertising dilemma is producing an increase in noise. Effective use of visual language can thus strengthen marketing differentiation (Bashirzadeh et al., 2022). Meanwhile, as aforementioned that marketing offerings have transformed from tangible to ephemeral and intangible experiences (Ramaswamy & Ozcan, 2016), semiotics diverts the meaning-making process and tells stories in different voices based on one's subjective reality and judgement (Aiello, 2020). More recently, while knowledge generation advances in parallel with big data development, relatively little insights exist in terms of data interpretation (Elragal & Klischewski, 2017). Hence, the semiotic approach acts as a complement to big data from an interpretive standpoint (Oswald, 2012).

Nevertheless, while signs and symbols have added a deeper layer of analysis and laid the groundwork for entirely new epistemological perspectives in digital marketing (Aiello, 2020), not all types of visual semiotics have received equal attention (Bashirzadeh et al., 2022; Huang et al., 2021). In addition to the widely-investigated pictures and texts (McShane et al., 2021; Yu & Egger, 2021), the rise of visual language, dominated by the use of emojis, is believed to be the most significant aspect of marketing rhetoric in CMC (Ge & Gretzel, 2018). Yet, despite the study of digital communication being a vital research trend in the field of marketing, advertising, and branding, there is a lack of thorough analysis on the dynamics of how emojis interact with language to realise meaning (Rongbin Wang, 2019).

3.2.2 Emojis as social information in computer-mediated communication

Fast forward to the digital economy in the 21st century, where face-to-face emotions are gradually replaced by emojis in online communication (Smith & Rose, 2020), emojis deliver richer information compared with plain text and have been investigated in diverse research fields. For instance, computer scientists delve into the sentiment of emojis based on user-generated content, whereas communication studies reveal that both facial and non-facial emojis connotate emotional expressions (Bai et al., 2019). In marketing, it is not surprising to see emojis embedded in advertising or marketing materials due to their visual and emotional attributes (Moussa, 2021). Existing literature underlines that smiley emojis have contagious effects in a digital service setting (Smith & Rose, 2020), which can subsequently heighten playfulness of social media posts and encourage user engagement (McShane et al., 2021). Interestingly, recent research further demonstrated that consumers who base their actions on immediate consequences tend to rely on emojis that deliver a sense of calmness and relaxation (Huang et al., 2021).

The interplay between emojis and consumer behaviour can be theorised from the EASI model (van Kleef, 2009), which involves affective and inferential processes that lead to various behavioural outcomes. The former suggests that facial expressions are transmittable and can influence an individual's experience, whereas the latter implies an understanding towards the displayed emotion in a certain situation (Erle et al., 2022). Notably, despite their distinction, the inferential and affective pathways should not be considered as independent occurrences (Smith & Rose, 2020). Since the EASI model can transcend physical settings into online environments (Erle et al., 2022), emotional expressions embedded in the digital context (e.g., through emoji usage) serve as social information for users to respond accordingly (Baek et al., 2021). That is, emojis can function as a proxy of emotion in the digital landscape (Jaeger et al., 2019) and fundamentally transform how messages unfold (Elder, 2018). Meanwhile, emojis allow consumers to re-evaluate their behaviour and decisions owing to the significance of face perception and recognition of social interaction (Elder, 2018).

The number of likes and shares as reactions to pictographs of social media posts can be increased with a growing number of emojis included in a message (McShane et al., 2021). This is

due to the positive feelings triggered by emotional emojis (Ko et al., 2022). Likewise, other scholars suggested that emojis play a subtle role in signalling brand personality (Moussa, 2021) and can surrogate social cues commonly missing in computer-mediated environments (Bashirzadeh et al., 2022). Nonetheless, it is noteworthy that the EASI model does not limit to face-based emojis. In fact, as long as the displayed emotion can be perceived by observers, embedding feelings of different modalities such as bodily postures or symbols has comparable impact (van A. Kleef, 2017). This claim is reinforced by recent research that discovers the capability of using object-based emojis to enhance message clarity (Hand et al., 2022) and the perception of positive affect (Riordan, 2017).

3.2.3 The interplay between emojis, emotion, and engagement on social media

Acknowledging that the diversity of emojis has replaced/substituted words in digital communication and crossed language barriers (Bashirzadeh et al., 2022), one major reason for their popularity is that emojis transport emotional signals to a digital world lacking explicit expression (Erle et al., 2022). Just as visual semiotics conveys feelings to viewers (Alshenqeeti, 2016), the aesthetic and attractive nature of emojis delivers emotional states and modifies the tone in CMC (Hand et al., 2022). Notably, the emotional functions of visual semiotics are not restricted to face-based symbols, but can be extended to other forms such as those related to animals, activities, or travel that remain under-investigated. Bridging the knowledge of data science, researchers have contextualised and quantified emojis using sentiment analysis (Chen et al., 2018; Jaeger et al., 2019; Novak et al., 2015). The first and the most well-known measurement is the Emoji Sentiment Ranking proposed by Novak et al. (2015). This sentiment lexicon has been employed in later studies to compare emoji usage across countries (Li et al., 2019) and to analyse the connection between linguistic functions and emoji sentiment (Hu et al., 2017). Not surprisingly, emojis related to smileys and people are the most commonly adopted category on social media, followed by animals and nature, food and drink, and travel and places (Li et al., 2019).

Yet, what is lacking in the state-of-the-art knowledge is consumer reactions towards the joint effect of the intended sentiment conveyed by emojis in different situations (Ko et al., 2022). One classic example is Instagram, where over 50% of posts contain at least one emoji (Bai et al., 2019). Recent research has showcased that the presence of emojis often generates positive outcomes and encourages user engagement (Ge, 2020). Compared to other visual design elements (Luangrath et al., 2017), this phenomenon is akin to the EASI model, where consumer reactions are influenced by the observable emotional expressions (Baek et al., 2021). Similar to website design in human-computer interaction literature (Cyr et al., 2010), affection building plays a critical role in triggering engagement and relationship on social media (Ge, 2020). Logically, delivering positive emotion should lead to a greater level of engagement (Swani et al., 2017). Likewise, if engagement rate is an indication of successful marketing campaigns, upregulating con-

sumer experiences through the manipulation of the valence of posts would amplify the contagion effect (Smith & Rose, 2020), thereby resulting in higher engagement (Goldenberg & Gross, 2020) and ultimately influencing one's decisions (Villamediana-Pedrosa et al., 2018).

However, in spite of their significance in marketing and CMC, existing knowledge of the combination of emojis and user engagement towards brand-related posts remain scant (Das et al., 2019; Huang et al., 2021; Ko et al., 2022). From a methodological perspective, while evaluating communication trends on user-generated content has emerged (Dijkmans et al., 2020), analysing social media featuring short and unstructured format (Egger & Yu, 2022b) would further shed light on novel insights that might have been overlooked. When speaking of social media, most research centres on text-based communication (McShane et al., 2021) or the impact of (positive) face-based emojis (Huang et al., 2021). Yet, in order to bring the status quo of marketing and advertising literature to the next digital sphere, looking into negative and/or non-facial emojis is equally important (Huang et al., 2021). On a general level, although emojis have added a new layer for digital language, visual semiotics is rarely examined together with the respective context (Ko et al., 2022).

3.3 Methodology

3.3.1 Research context: Tourism and destination marketing

Since emojis are highly context sensitive (Bai et al., 2019), their usage in digital marketing communication is found to be more suitable for hedonic products/experiences (Das et al., 2019). In order to improve internal validity and offer more valuable knowledge than the generalised one (Stremersch et al., 2023), this study selected tourism and destination marketing as the specific context. Along with the hedonic nature of tourism experience, emojis are also frequently used by destination marketers (Shao et al., 2020). When marketing tourism destinations on social media such as Instagram (Bai et al., 2019; Chen et al., 2018), emojis are visual symbols that characterise destination attributes (Shao et al., 2020) and illustrate graphic representation of emotional experiences (Angeli et al., 2020).

The functions of emojis in post captions are manifold, including 1) highlighting emotional experiences at attractions (e.g., 🌞 and 😌 for relaxing atmosphere at the beach), 2) building emotional connection (e.g., 💞 or 🤩 for playful and positive connections with the destination), 3) depicting a theme (e.g., 🍝 and 😋 for empathising with gastronomic experiences), and 4) providing information (e.g., 💰 and ⏳ for creating a sense of urgency on cost-related information). That is, emoji-based representations embellish social media posts through implicit expressions of feelings and sentiment (Novak et al., 2015). Therefore, this study investigates emoji usage across social media posts featuring different topics related to tourism and their subsequent behavioural impact on user engagement. A detailed description of this study's five-step methodological procedure follows below.

3.3.2 Step 1: Country selection and data extraction

Destinations are represented by destination marketing organisations (DMOs) who typically promote the respective country destinations on various social media channels. Countries to be included in this study are chosen based on the GLOBE framework that facilitates the comparison of dimensions of national culture and is suitable for consumer behaviour related to digital environments (Mooij, 2017). There countries per GLOBE cluster are finally selected. Based on the listed countries, three countries without an official Instagram account by the respective DMO were omitted. Data extraction was conducted in July 2022 using Phantombuster for all available posts of each account. Extracted data included post captions, date of the post, number of likes and comments, check-in location, post URLs, and image/video URLs. Owing to the focus of this study, ensuring that the extracted posts contain a wide range of emojis is critical. Hence, Python was used to extract emojis in the captions. Thereafter, the researchers weighted the number of unique emojis by the number of posts per country. The top three countries with the highest percentage of unique emojis in each cluster were selected for subsequent analysis (Table 7).

TABLE 7. A LIST OF THE GLOBE COUNTRIES AND EMOJI STATISTICS

Cluster	Country	Instagram account	Unique emojis count	Number of posts	Weighted unique emojis
Anglo	Australia	australia	445	9,798	4.54%
	Canada	explorecanada	271	3,935	6.89%
	England	lovegreatbritain	413	2,548	16.21%
	Ireland	tourismireland	318	2,234	14.23%
	New Zealand	purenewzealand	161	1,340	12.01%
	South Africa	meetsouthafrica	48	2,147	2.24%
	USA	visittheusa	247	2,665	9.27%
Confucian Asia	China	visitchina	50	514	9.73%
	Hong Kong	discoverhongkong	152	2,536	5.99%
	Japan	visitjapanjp	199	1,416	14.05%
	South Korea	visitkorea_travel	179	1,099	16.29%
	Singapore	visit_singapore	213	1,348	15.80%
	Taiwan	taiwantourism.na	151	277	54.51%
	Albania	albania.tourism	355	4,224	8.40%

Eastern Europe	**Georgia**	exploregeorgia	336	3,254	10.33%
	Greece	visitgreecegr	73	3,221	2.27%
	Hungry	visithungary	409	1,381	29.62%
	Kazakhstan	visit_kazakhstan.kz	5	21	23.81%
	Poland	polska.travel	238	9,42	25.27%
	Russia	visitrussia	32	3,12	10.26%
	Slovenia	feelslovenia	405	4,416	9.17%
Germanic Europe	**Austria**	visitaustria	495	3,940	12.56%
	Germany	germanytourism	184	3,068	6.00%
	Switzerland	myswitzerland	216	1,902	11.36%
	The Netherlands	visitnetherlands	372	2,963	12.55%
Latin America	**Argentina**	visitargentina	401	3,024	13.26%
	Brazil	visitbrasil	219	2,869	7.63%
	Colombia	colombia.travel	194	1,806	10.74%
	Costa Rica	visit_costarica	136	2,263	6.01%
	Ecuador	ecuadortravel	154	1,164	13.23%
	El Salvador	elsalvadortravel	260	3,387	7.68%
	Guatemala	visitguatemala_	347	3,091	11.23%
	Mexico	visitmexico	317	3,337	9.50%
Latin Europe	**France**	francefr	343	2,501	13.71%
	Israel	visit_israel	285	1,749	16.30%
	Italy	italiait	57	5,446	1.05%
	Portugal	visitportugal	96	3,382	2.84%
	Spain	spain	351	4,796	7.32%
Middle East	Egypt	experienceegypt	124	2,888	4.29%
	Morocco	visit_morocco_	289	1,789	16.15%
	Qatar	visitqatar	153	2,964	5.16%

	Turkey	goturkiye	257	5,856	4.39%
Nordic Europe	**Denmark**	govisitdenmark	425	3,659	11.62%
	Finland	ourfinland	151	1,941	7.78%
	Sweden	visitsweden	190	2,303	8.25%
Southern Asia	India	incredibleindia	77	3,684	2.09%
	Indonesia	wonderfulindonesia	78	3,395	2.30%
	Iran	visitiran_ir	39	1,317	2.96%
	Malaysia	malaysia.truly.asia	247	3,013	8.20%
	Philippines	tourism_phl	141	969	14.55%
	Thailand	tourismthailand	142	2,554	5.56%
Sub-Saharan Africa	**Namibia**	namibiatourismboard	90	465	19.35%
	Nigeria	ntbnigeria	209	584	35.79%
	South Africa	meetsouthafrica	48	2,147	2.24%
	Zambia	zambia_tourism	83	371	22.37%
	Zimbabwe	tourismzimbabweofficial	62	554	11.19%

Note: Countries in bold are selected for data analysis; Kazakhstan is not considered due to the limited number of posts available

3.3.3 Step 2: Data pre-processing

Data pre-processing and cleaning were performed using natural language processing modules in Python based on post captions for the selected countries. Specifically, language identification was applied to eliminate non-English posts, resulting in a total of 61,518 posts. Notably, posts with bilingual texts (i.e., English and the native language of a corresponding country) were still assigned to English in this study. However, because the number of words from different languages would be rather minor comparing to the English texts, their impact on data analysis is assumed to be little. Next, a list of stopwords was prepared, and hashtags, usernames, numbers, and unknown characters were removed. Stemming and lemmatisation were performed, and text data was tokenised into small units.

3.3.4 Step 3: Topic modelling

This study adopted topic modelling to classify posts featuring different destination attributes. Due to the short and unstructured nature of social media posts, the correlation explanation (CorEx) algorithm was chosen. CorEx is a hierarchical approach based on an information-theoretic framework (Gallagher et al., 2017), which typically outperforms other modelling techniques especially when addressing Instagram data (Arefieva et al., 2021). Since CorEx is capable of searching the most illuminating representations of unidentified phenomena (Rizvi et al., 2019), topic separability can be guaranteed while coherence and comparability are maintained (Gallagher et al., 2017). Researchers in digital marketing have recently embraced these benefits in order to design innovative and creative strategies (Egger & Yu, 2021; Rizvi et al., 2019).

Notably, the number of topics is decided by the researchers based on the changes of overall total correlation, which represents a certain portion of each topic (Gallagher et al., 2017). In the current dataset, the inspection for the whole corpus returned a 14-topic solution with the highest total correlation. Therefore, to avoid generic topics, 14 served as a benchmark and the analysis was run for each GLOBE cluster separately. For each of the identified topics, CorEx returned a list of keywords by transforming text into term frequency-inverse document frequency (tf-idf) weights, which suggests terms contributing the most to a certain concept (Arefieva et al., 2021). Similar to other studies applying the CorEx algorithm, the naming procedure of the topics was conducted by the researchers based on key terms (Arefieva et al., 2021; Egger & Yu, 2021).

Nonetheless, since social media texts are often short and unstructured, uninterpretable topics were assigned as noise (Egger & Yu, 2022b) and removed from subsequent analysis. These noises were caused mostly by the inclusion of a list of usernames without @ that could not be identified in the pre-processing phase and a mixture of non-English terms in the post captions.

3.3.5 Step 4: Emoji classification and sentiment

Based on the extracted emojis, their respective categories were allocated based on Unicode (2020) version 13.1, including ‘Smileys & Emotion’, ‘People & Body’, ‘Animals & Nature’, ‘Food & Drink’, ‘Travel & Places’, ‘Activities’, ‘Objects’, ‘Symbols’, and ‘Flags’. Moreover, holding the assumption that emojis are embedded with emotional valence, emojis were quantified based on the Emoji Sentiment Ranking (Novak et al., 2015). The sentiment scores, ranging from -1 to +1, were computed from over 1.6 million tweets (Novak et al., 2015). The Emoji Sentiment Ranking was chosen as it covers a total of 751 most frequently used emojis, comparing to other recently developed measurements (e.g., EmoTag with 150 emojis (Md Shoeb et al., 2019)). Meanwhile, besides English texts, the sentiment data additionally considers informal social media posts written in 13 European languages (Novak et al., 2015), which better fits the nature of this dataset.

All extracted emojis are first converted to the Unicode representation and associated with their respective sentiment values and categories. In the case of duplicated emojis categories, the average sentiment scores were used. However, since the scores are available only for emojis with at least five occurrences in the Emoji Sentiment Ranking (Novak et al., 2015), only the most frequently used ones were included for the following analysis. Posts without any emojis were removed, and a maximum of 30 emojis is possible, resulting into 30,806 posts.

3.3.6 Step 5: Permutation feature importance based on regression models

To explore whether a certain type of emoji contributes to engagement across posts with diverse topics, permutation feature importance was performed based on multiple regression models in the Orange 3 software. First, the average engagement rate of each identified topic was calculated by dividing the total number of likes and comments of a post with a marketer's follower numbers (Yu & Egger, 2021). Thereafter, this research employs feature importance to explain regression models between engagement rate and emoji types.

In predictive modelling, multiple regression models were built, and elastic net regularisation was adopted. Regularisation is the approach for calibrating machine learning models to minimise the adjusted loss function and prevent overfitting and underfitting (Gelper & Stremersch, 2014). The models were then measured by calculating the root mean squared error (RMSE) metric for performance evaluation. RMSE is preferable in the current research over other metrics due to its capability in comparing the accuracy among different models (Hakim et al., 2021). RMSE implies how erroneous the model's predictions are when compared to observed values (Hakim et al., 2021). The lower the RMSE is, the better the results are.

Since the ultimate goal is to predict future values for marketers, permutation feature importance was conducted to measure the change in model error after the feature's values have been permuted by utilising the given data to calculate the contribution of each feature to the prediction (Zhou et al., 2021). As with most data science research, the precise performance caused by reordering the feature could be random (Zhou et al., 2021). Thus, the unpredictability of permutation importance was determined by repeatedly shuffling the variables. The number of times to permute a feature was five for all topics.

3.4 Results and discussion

The empirical approach used in this study consists of two components. First, the analysis begins with an overview of the identified topics related to diverse attributes based on the extracted marketing posts. Thereafter, machine learning algorithms were built to investigate the extent to which the nine types of emojis predict consumer engagement on social media. Notably, since the interpretation of learning algorithms requires human judgement and researchers' domain knowledge (Egger & Yu, 2022a; Hannigan et al., 2019), the analysis was followed by interpretable

machine learning methods to assess feature importance. The iterative process provides additional insights on the impact of different features on user engagement.

3.4.1 Topic modelling for the attributes of marketing posts

Table 8 presents an overview of the topics related to different destination attributes. As previously indicated, the topic names were derived from key terms with greater tf-idf weights. Since topic modelling is qualitative by nature, human judgment and interpretation of the topics are crucial (Hannigan et al., 2019). To enable information retrieval, references for the naming procedure were taken from the study of Picazo and Moreno-Gil (2019), where 497 destination/tourism categorisation have been summarised from previous literature.

Since examining cultural or country-specific characteristics is beyond the scope of this study, similar topics identified in each country have been combined. The intention was to focus on destination attributes that can be generalised to other areas with similar offerings. This practice echoes the value of context-specific research because the findings may be more influential for the specific audience that matches their situation (Stremersch et al., 2022). Consequently, five topics related to marketing posts were also excluded for subsequent analysis (i.e., 'Calls-to-action', 'Cross-promotion', 'Interactivities activities', 'Memory, inspiration, and imagination', 'Photo credits'), resulting in a total of 21 topics derived from 21,537 posts. Notwithstanding other visual elements that may influence a user's desire to interact with a post, this research dives deeper into the effect of emojis correlating with distinct mixtures of topics. As explained earlier, this is in line with the notion that authors typically think of post captions first and embellish them with emojis according to the content they want to promote.

TABLE 8. AN OVERVIEW OF THE IDENTIFIED TOPICS

Topics	n	Example keywords
Atmosphere		
Emotion and feeling	3,583	amazing, sunset, lovely, beautiful evening, love, enjoy, happy, nice, awesome
Relaxing and peaceful moments	290	calm, serene, refreshment, self-recovery, healing, relax, magical, mood, peaceful, relax listen
Country landscape		
Architecture and buildings	1,625	castle, department store, wall, tower, wharf, architect, structure, abbey, sepulchre, Romanesque building
Cityscape	3,661	valley, library, night view, city, science, town, nice walk, capital, street, tallest,
Culture, history, and art		

Culture and history	349	royal, crown, palace, queen, emperor, Sisi, significant, empress, royal pavilion, past
Culture and tradition	2,467	culture, local, represent, baptism, Yardenit, K'iche', flee destruction, tannery, traditional, practice
Religion	406	Christian, monk, temple, early Christian, buddha, tooth relic, lantern, Rama, unique, Polka
World Heritage sites	1,065	heritage, world, site, cathedral, roman, UNESCO, heritage list, ancient, old, national
Entertainment		
Events and festivals	449	World Cup, celebration, mall, Eileen festival, international, world tourism, Patrick's Day, conventions, conference, food festival
Holidays and vacation	137	Christmas, birthday, New Year, Chinese, happy, celebration, countdown, merry, vacation, forward
Scenes in movies and games	283	game, throne, series, maze, HBO, fun, trumpet, squid game, creeper, surreal
Gastronomy		
Cuisine and food	348	dumpling, apple, soup, dish, curry, dessert, chicken, spick, beef, breakfast
Wine and beverage	209	Green tea, tasty, Muskateller, Sauvignon Blanc, taste, wine, Welschriesling, land, harvest, grape
Infrastructure and institutions		
Accommodation and transportation	213	hotel, ride, bike, center, locate, green, lodge, accommodation, train, compartment
Regulations	731	continue, follow, restriction, guideline, government, permit, safety measure, NCDC, requirement, protocol
Leisure and recreation		
Adventure activities	266	adrenaline junkie, glacier, paraglide, shark, fear, air balloon, safari, outdoor, adventurous, guide
Mountain and water activities	249	yacht race, extreme, sailing, scuba, water, hiking, adventurer, outdoor vibe, sunbath, explore
Natural landscapes and scenery		
Beach and seascape	2,405	beach, cliff, summer bay, bay resort, sea, ocean, costal view, causeway, sands, lighthouse

Flora and fauna	752	silver grass, canola flower, flower bloom, blossom, leopard, elephant, bee-eater, plum, cat, pumpkin patch
Landscapes in national parks	633	park, national, Etosha national, Kafue national, El Leoncito national, park Tekapo, geothermal, nature reserve, gorgeous, natural
Mountains and water impression	1,416	mount, peak, volcanic cone, formation coastal, mountains, rush water, lake, trail, fjord, river
Marketing (excluded for analysis)		
Calls-to-action	430	repost, share, follow, Instagram, thank, use hashtag, account, capture thank, check story, upcoming story
Cross-promotion	1,259	link, bio, click, hashtag, make collaboration, partnership, read page, tour link, visit link, Instagram
Interactivities activities	787	giveaway, comment, winner, lucky, video film, gift card, hashtag challenge, challenge Instagram, prize, good answer
Memory, inspiration, and imagination	213	trip prior, website, update, pre, creative, caption, favourite experience, remember, share experience, memory
Photo credits	1,793	chance, feature, Instagram page, mention, tag, photo, credits, photographer, curator, location
Noise (excluded for analysis)		
Noise	4,787	Not applicable

3.4.2 Interpreting permutation feature importance

In order to explain the regression models, the analysis was followed by permutation feature importance. Table 9 illustrates the relative importance of the top five emojis versus the others based on Instagram posts with different attributes. The x-axis highlights feature importance, in which a longer bar indicates higher importance than a shorter one. The black line shows the average value along with the standard deviation across all algorithm iterations based on the RMSE metric. The y-axis implies the relative importance order of different emoji types, where the top is the most influential, and the bottom is the least influential. Notably, negative values for permutation importance may occur occasionally. More commonly seen in small datasets, this issue happens when the feature was irrelevant, but the predictions based on shuffled data were more accurate due to chance. Feature importance is crucial in that determining which model input contributes most serves as a central part of model building and evaluation to avoid generating “black-box” models (Zhou et al., 2021).

Starting from topics listed under atmosphere, unsurprisingly, the findings suggested that face-/human-based emojis ("i.e., *Smileys & Emotion*, *People & Body*") are paramount to predicting whether users engage with posts describing emotional experiences and feelings. Since humans respond to face-based pictograms comparable to real visages (McShane et al., 2021), the results are in line with earlier literature emphasising emotional contagion in the digital sphere (Smith & Rose, 2020). Hence, as face-/human-based visual cues contribute to interpersonal emotion transfer, a higher engagement rate can be expected (Goldenberg & Gross, 2020). Likewise, the same notion may apply to other hedonic-driven consumption such as holidays and vacation and scenes in movies and games, listed under the entertainment category. Specifically, as the sense of immersion plays a major role in eliciting experiences (Petit et al., 2019), human-based emojis may function as a proxy to real life situations (McShane et al., 2021), thereby altering one's perceptions and stimulate positive feelings. However, consistent with the effect of face stimuli found in clinical studies (Sheth & Pham, 2008) and digital marketing (Landwehr et al., 2011), it seems that when marketers intend to deliver a sense of calmness and relaxing atmosphere, face-based pictographs, which are deemed to trigger arousal, are not applicable. Instead, it is *symbols* and *animals & nature* that are more compelling. This phenomenon can be interpreted from the psychological benefits of nature-based experiences. Echoing the notion that the EASI model can fit in different modalities (van A. Kleef, 2017), natural representation can elicit peacefulness and calmness (Conti & Lexhagen, 2020) and symbols engage consumers in an imaginary relationship that satisfies unmet emotional requirements for intangible experiences (Oswald, 2015).

Turning to country landscape, the findings are similar for posts related to cityscape and architecture and buildings, where *objects* and *people & body* serve as the dominant visual signs in triggering user engagement on social media. This implies two directions. First, as people embellish texts with visual cues, viewers might prefer emojis related to buildings (*objects* category) in city-based posts. Yet, in addition to the *objects* itself, involving users into the context is necessary in digital marketing (Smith & Rose, 2020) to empathise experience co-creation, which can be achieved by leveraging people-related emojis. This is also the case for posts featuring world heritage sites. Notably, in architecture and buildings, *animals & nature* also ranked as one of the top features predicting engagement. This owes to the topic covering not only buildings within a city, but also rural attractions such as towers, castles, and walls which are often surrounded by natural environments. Nonetheless, *travel & places* outperformed *animals & nature* in cityscape in influencing engagement.

Next, the results uncovered an interesting prediction that *flags* are essential factors contributing to the engagement rate of posts related to culture, history, and tradition. In particular, individuals naturally associate flags with a national identity and related cultural touchstones underneath (Beskow & Carley, 2020). Thus, to improve user engagement, this study reinforces the significance of cultural recognition and self-identify on social networking sites (Gündüz, 2017). It is only when marketers value the underlying identity that consumers can empathise with the

context. Specific to culture and history, *objects* are found to be equally crucial. One potential reason lies in that most of the posts are related to empires in history. Thus, for example, when marketers share information about queen and crown, posts with congruent emojis (e.g., 👑 (*objects*)) might be used, thereby stimulating higher emotional feedback (Dessart, 2018). Concerning religious posts, although the results appear to be unexpected (i.e., *smileys & emotion* are essential to predict user engagement), the interplay between emotional experiences and religious affiliation has been highlighted in earlier research (Patwardhan et al., 2020). In line with knowledge on nonverbal communication, it has been discovered that epistemological positive emotions have recognisable facial indicators (Sauter, 2017), and face-based emojis potentially prompt strong emotional reactions.

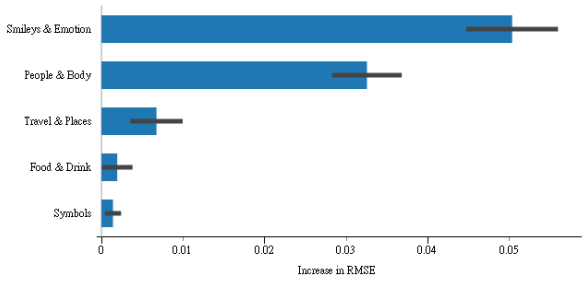
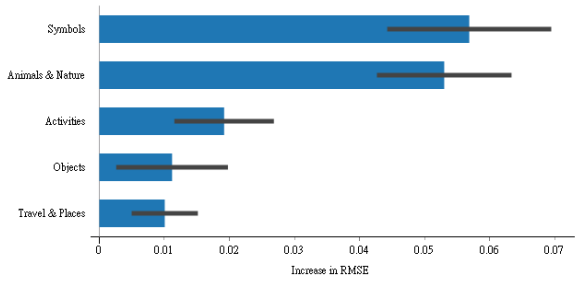
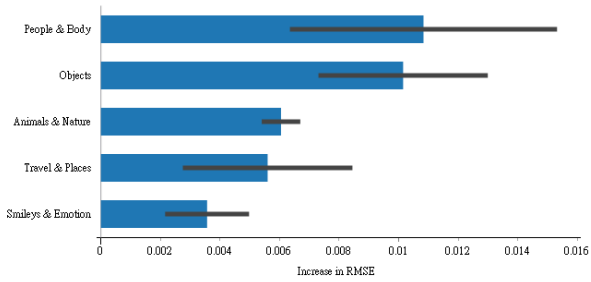
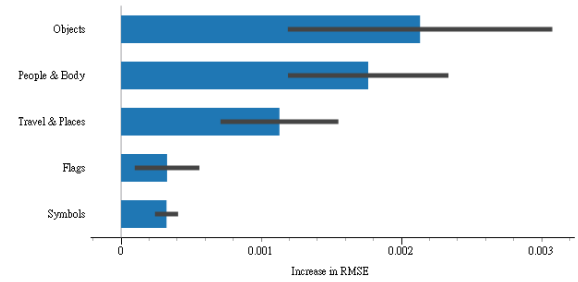
As for the hotel industry, the significance of *activities* for events and festivals is expected since *activities* cover a wide range of emojis related to events and sports, which allows viewers to resonate with the content (Park & Kim, 2018). Likewise, in light of the service-oriented nature of accommodation and transportation, social presence, human factors, and value co-creation are the compelling reasons that influence the overall experiences (Grönroos, 2011). Delivering positive vibes of hospitality and compelling experiences in digital communication is achieved by using *people & body* emojis. While intuition may suggest that *food & drink* should be the salient factor for posts related to gastronomy, the findings revealed that *smileys & emotion* are predominant. Grounded in sensory marketing, gastronomic experiences integrate all five senses (Krishna, 2012) and triggering sensation through consuming food might require one's involvement. Positive hedonic responses associated with sensory cues are found to be significant predictors of food consumption (McCrickerd & Forde, 2016). Accordingly, the use of face-based emojis may initiate the effects of imaginary eating and ultimately lead to higher engagement (Zorjan et al., 2020).

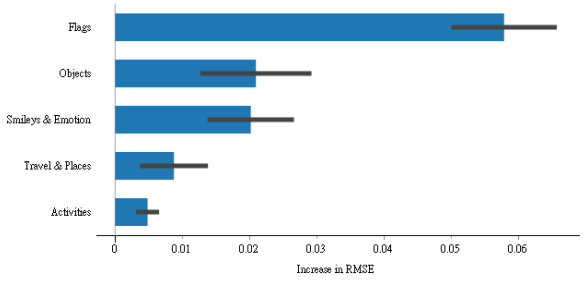
Turning to leisure and recreation, this study implies that *travel & places* can serve as an informative signal of whether users are likely to engage with the content related to adventure activities (e.g., paragliding, glacier tour). Since adventure travel triggers a sense of excitement or fear (Janowski et al., 2021), it is reasonable to see that *smiley & people* are the secondary visual cues to make the captions more vivid and engaging. As for mountain and water activities such as hiking, sailing, and scuba diving, the results show that *objects* are paramount to triggering user engagement. Supported by recent research, besides recognising the activities, emotional and behavioural changes can be observed already the anticipation period (e.g., begin with planning and packing) (Wu et al., 2020). This implies that visualising accessories for outdoor activities (e.g., sunglasses, hiking boots) are more important than using *animals & nature* to symbolise the actual experiences.

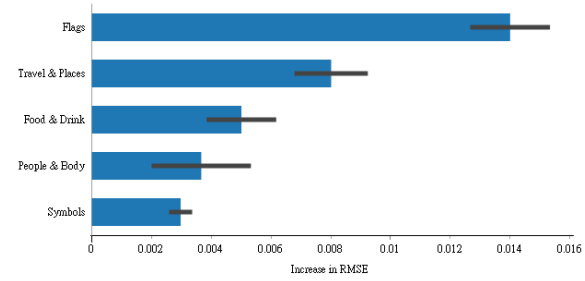
Regarding natural landscapes and scenery, overall, *people & body* are critical to predict user engagement for captions featuring beach and seascape and mountain and water impressions. Just as involvement of human factors is capable of facilitating consumer immersion in nature

environments (Hansen & Mossberg, 2017) and the EASI paradigm may transcend physical settings to digital ones (Erle et al., 2022), leveraging *people & body* could enhance the feeling of immersion and the sense of being there that are necessary in natural tourism. Nevertheless, a slight difference is that *travel & places* are the secondary factors for beach and seascape, whereas *animals & nature* play a subordinate role for mountain and water impressions. Possible reasons could be that the former covers more ocean-related emojis such as wave (🌊), sun (🌞), and beach with umbrella (🏖️), while the latter is more commonly used in natural context. Yet, when it comes to natural scenery located in national parks, the findings revealed that *objects* are the key to predict consumer engagement. This phenomenon may arise from the dominant usage of camera (📷) or pushpin (📌, 📍) in marketing posts. What is worth noting is that although these emojis seem to be usual for location-specific posts, users might have gotten used to such visual signs. That is, when seeing posts without *objects*, unfamiliarity / unexpectation might discourage consumer engagement especially in the digital sphere (Lo Presti et al., 2021).

TABLE 9. VISUALISATION OF PERMUTATION FEATURE IMPORTANCE

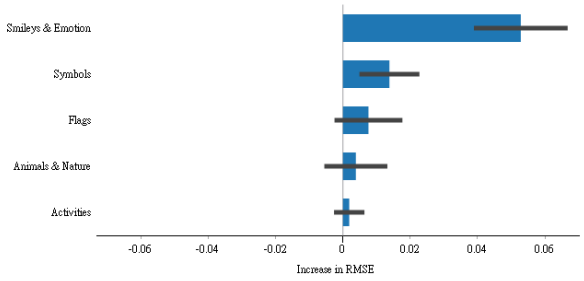
Atmosphere	
Emotion and feeling	Relaxing and peaceful moments
	
Country landscape	
Architecture and buildings	Cityscape
	
Culture, history, and art	
Culture and history	Culture and tradition

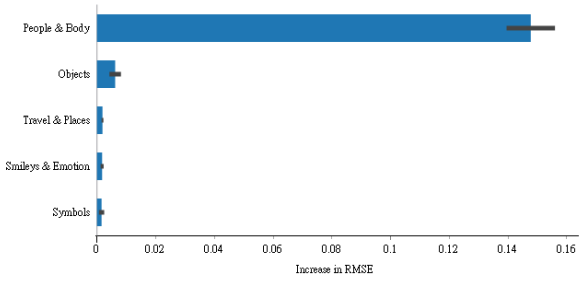




Religion

World Heritage sites

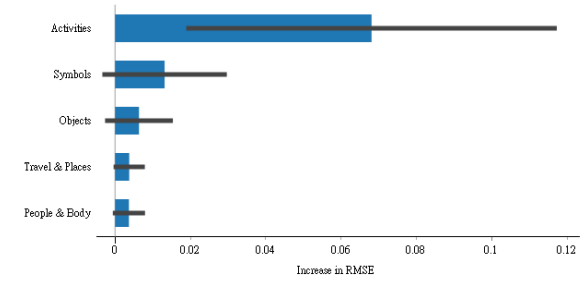


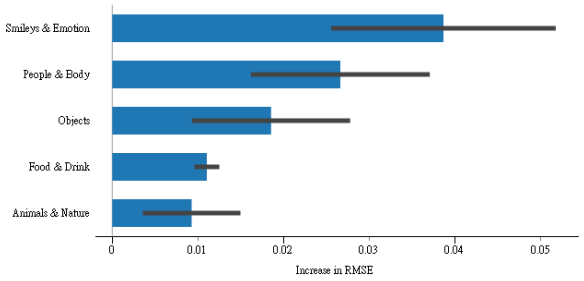


Entertainment

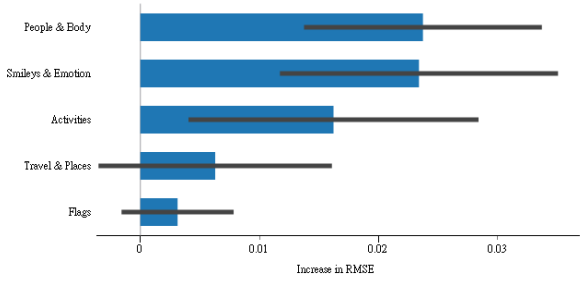
Events and festivals

Holidays and vacation





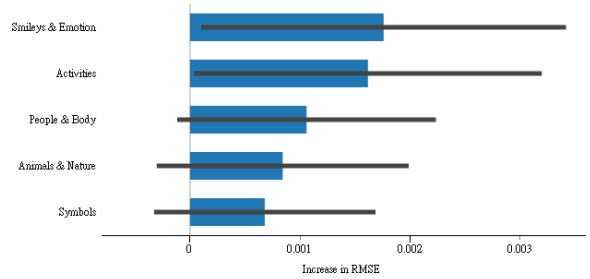
Scenes in movies and games

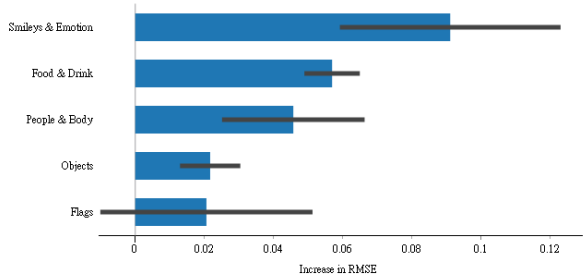


Gastronomy

Cuisine and food

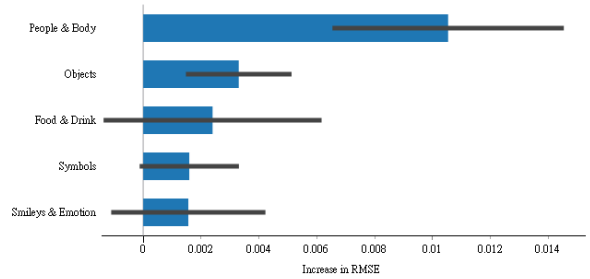
Wine and beverage



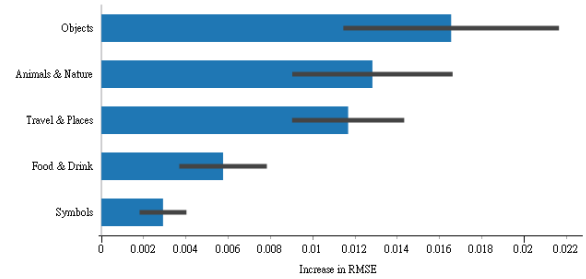


Infrastructure and institutions

Accommodation and transportation

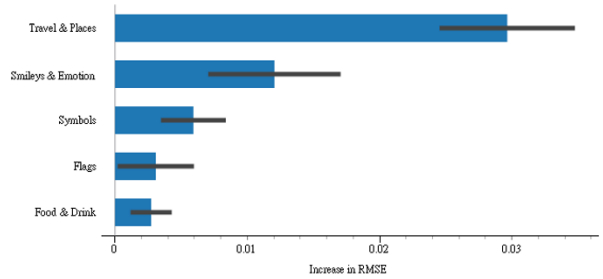


Regulations

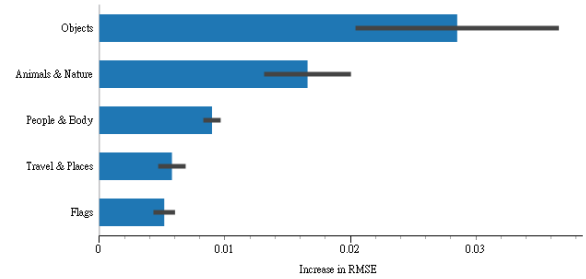


Leisure and recreation

Adventure activities

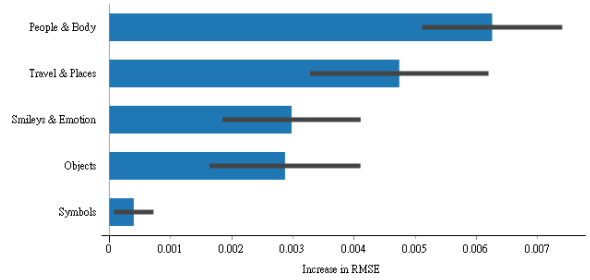


Mountain and water activities

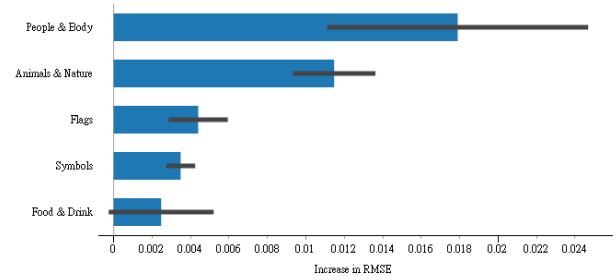


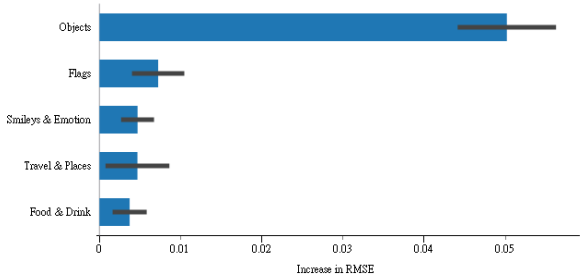
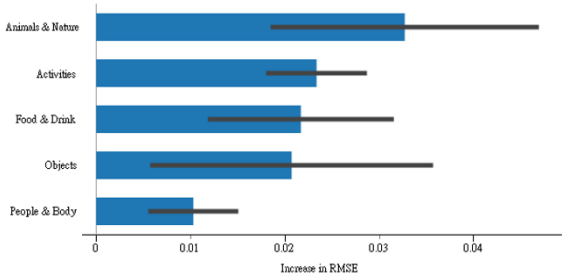
Natural landscapes and scenery

Beach and seascape



Mountains and water impression



Landscapes in national parks	Flora and fauna
	

3.5 Conclusion

3.5.1 Theoretical contribution

By bridging visual semiotics with data science and marketing, this interdisciplinary study sheds light on several theoretical contributions. First, the findings extend knowledge from data analytics research on emoji sentiment (Novak et al., 2015) to digital marketing and communication. By incorporating diverse modalities (Huang et al., 2021) (i.e., emoji types), this study broadens the scope and possibility of the EASI paradigm (van A. Kleef, 2017). Specifically, the findings take the EASI paradigm to the digital landscape and add original knowledge to the integration of emoji sentiment and user engagement on social media. The fact that emotional messages can be embedded with not only face-based symbols, but also other symbolic elements that convey meanings and feelings has been reinforced (DeRosia, 2008). Different from literature largely relying on positive and face emojis (Huang et al., 2021), this research is novel in that it takes an interpretable machine learning approach to assess the relative feature importance of emoji variance, demystifying the interplay between emojis and consumer engagement (Huang et al., 2021; McShane et al., 2021).

Furthermore, through the integration of topic modelling techniques that classify marketing content based on their embedded features, the findings affirmed the sensitive nature of visual symbols that differs across marketing settings (Das et al., 2019; Ko et al., 2022). Notably, despite that the context was under the umbrella of tourism discourse, the value of this study in the respective domain is not neglectable. Recently, marketing scholars have criticised the dark side of focusing on generalisability (Stremersch et al., 2023). Since knowledge is developed for both academics and practitioners, the findings may be more valuable as the size of the potential audience reduces (Stremersch et al., 2023).

Overall, this study enlightens a deeper understanding of leveraging visual semiotics to the richness of CMC (Luangrath et al., 2017) so as to streamline experience co-creation. As sentiment polarity of emojis has rarely been considered in digital marketing, design science may benefit

from involving emotional elements (Volo, 2021). Instead of analysing general products in marketing, the application of tourism may inspire unexpected discoveries since new phenomena are often found under unusual conditions (Stremersch et al., 2023). Meanwhile, as scholars highlights the significance of empirics-first methodology (Golder et al., 2022), beginning research with real-world observations acts as a steppingstone to knowledge advancement and allows marketers to make inferences on the potential impact of different emoji types on user engagement. In essence, this study advances the understanding, research, and design of visual symbols in the social media landscape. The innovative thematic and analytical focus of this study offers a robust and transparent guidance to navigate through epistemological exploration to methodological challenges for the wider services and marketing discipline.

3.5.2 Practical implications

By revealing the relationship between emojis and user engagement, this study offers managerial insights at micro, macro, and methodological level. At the micro level, the results are particularly beneficial to destination marketers when promoting tourism offerings with different attributes. For instance, when sharing information related to architecture, accommodation, or heritage sites, enriching posts with *people & body* is effective in triggering consumer engagement, potentially due to the higher sense of perceived involvement. Likewise, for posts featuring natural landscapes, marketers may consider using people- (e.g., 🧍) and nature-/travel-based emojis (e.g., 🌴) to enhance one's imagination. Meanwhile, *flags* seem to be more useful in the case of cultural related captions, whereas *objects* can be considered when promoting activities. Overall, unlike case studies limited in generalisation, the essence of this research is that destinations with similar resources can adapt their post captions accordingly, overcoming the issues resulted from geographical regions.

At the macro level, this study reinforces the notion that visual semiotics conveys feelings and emojis serve as an indirect factor mediating consumer engagement on social media. Marketers in other fields are encouraged to re-evaluate their current adoption of emojis. It is noteworthy that effective marketing strategies involve intentionality, to purposely craft the social media landscape that increases the chance for emotional exchange to occur. Methodologically speaking, the step-by-step procedure provides a hands-on guide for marketers in other industries to bring visual symbols presented on social media to light in order to optimise marketing contents. Certainly, visual semiotics, per se, is not the only factor influencing consumers' behaviour, but their perceived valence plays a subtle and implicit role on one's engagement.

3.5.3 Limitations and recommendations

This research is not without its limitations. First, although emojis are proclaimed as the first universal language (Wu et al., 2022), interpretation of the same symbol varies. In this research, while the location/culture of marketers is apparent, it was merely possible to extract the socio-

demographic information for all Instagram users. Nonetheless, despite its context-sensitive nature, cultural variations have not halted the worldwide acceptance of emojis. Meanwhile, as the study context is based on tourism, it remains unknown whether the results are applicable to other hedonic offerings. Future studies are recommended to replicate the methodological procedures in other settings such as retail or services marketing on social media.

Methodologically speaking, despite that the Emoji Sentiment Ranking has covered 751 commonly used emojis (Novak et al., 2015), some of the recently released emojis may have been excluded from the analysis. In an attempt to advance the understanding of emoji communication, data analysts are urged to update the emoji sentiment lexicon continuously based on different social media platforms. As for data analysis, while regression provides an overview of the relative feature importance, this modelling technique missed out to establish a connection between the impact of features. Scholars are encouraged to compare the results with other learning methods such as support vector machine.

Moving on to data interpretation, while knowing that users only need to learn a few rules that are mostly universal across regions due to the limited options of emojis available compared to traditional languages, interpretation of the study's results had to rely on relevant literature and researchers' domain knowledge. Hence, validating the results with qualitative techniques would be highly valuable. For example, scholars are suggested to create prompts based on the respective emojis and ask participants about their associations and if the visuals would trigger engagement via focus groups or interviews.

4 PAPER 3: UNCOVERING THE EMOTIONAL IMPACT OF COMPUTER-GENERATED IMAGERY INFLUENCERS ON USER ENGAGEMENT THROUGH FACIAL ACTION UNITS AND ARTIFICIAL INTELLIGENCE

Abstract

This study investigates the impact of emotional display on user engagement of computer-generated imagery influencers through the lens of computers are social actors. The research measured emotional display by facial action units, which breaks down emotions into individual components of muscle movements. By using facial recognition algorithms based on 1,028 pictures shared by Lil Miquela, the findings disclosed the significance of happiness, sadness, disgust, and surprise in triggering user engagement when promoting diverse products with visually captivating content. It highlights the importance of balancing the intensity of muscle movement to streamline the interplay between technology, human behaviour, and digital communication.

Keywords: computer-generated imagery; facial action unit; social media

4.1 Introduction

The rapid advancement of artificial intelligence (AI) has enabled widespread digital transformation and given rise to avatars and computer-generated universes that promote unparalleled levels of social connectivity (Ahn et al., 2022; Miao et al., 2022). This revolutionization enables more immersive interactions with consumers in various industries, such as entertainment (Kim & Yoo, 2021) and retailing (Chuah & Yu, 2021), through far-reaching and impactful non-human digital communications that simulate a more realistic experience, thus improving customer engagement (Rahman et al., 2023). Although anthropomorphic characters have been met with criticism over uneasiness and eeriness resulting from the uncanny valley effect (Block & Lovegrove, 2021; Mori, 1970), the increasing sophistication of computer graphics has begun to shift public attitudes towards humanlike characters, demonstrating that viewers may not always respond negatively. For instance, computer-generated imagery (CGI) influencers, such as Lil Miquela and Imma, are a remarkable innovation that leverages the power of AI to create digital personas that look and behave like real humans, thus pushing the boundaries of what is possible in the realm of virtual media (Drenten & Brooks, 2020).

In addition to their curated online presence, CGI influencers have the potential to express emotions in a way that avatars could not. The use of animation and rendering techniques allows CGI influencers to mimic the subtleties of human expressions (Ahn et al., 2022). CGI influencers can consistently convey a broad spectrum of emotions, which is a feat that may prove challenging for their human counterparts to maintain. Adding on to the six basic emotions (i.e., happiness,

sadness, surprise, fear, anger, and disgust) identified by Ekman (1992), a more sophisticated approach for assessing facial expressions is the examination of facial muscle movements through action units (AUs) (Ngan & Yu, 2019). Prior research has demonstrated the utility of AUs in enabling an objective deconstruction of potential facial muscle activations that lead to specific emotional expressions (Schoner-Schatz et al., 2021), such as in the context of service encounters (Ngan & Yu, 2019). This offers a more nuanced and detailed understanding of the emotions being exhibited by computer-generated imagery influencers and their impact on user engagement.

Despite the growing fascination with CGI, consumers' reactions to virtual influencers within the marketing context remain ambiguous from an emotional aspect (Miao et al., 2022; Mrad et al., 2022). Reflecting the paradigm of computers are social actors (CASA), this theory posits that humans instinctively apply interpersonal relationship principles and respond to computers in a social manner (Gambino et al., 2020; Nass et al., 1994). These responses are often elicited by social cues conveyed by computers (Nass & Brave, 2005). Emotional displays, as one type of non-verbal social cues, thus serve as a crucial element in influencing viewer reactions such as their liking and commenting behaviour on social media (Aramendia-Muneta et al., 2020). In other words, since social media engagement implicitly reflect emotional experiences (Jones & Lee, 2022), it can be assumed that the dynamics of emotional exchange lead to a higher degree of behavioural responses. Hence, the significance of facial expression of virtual agents has been underscored as a means to stimulate behaviour in marketing (Chuah & Yu, 2021; Zhang et al., 2022).

The emergence of virtual influencers on popular platforms (Mrad et al., 2022) suggests that they have successfully overcome the territory of uncanny valley for many people. From marketing perspectives, collaborating with CGI influencers provides brands with enhanced control and safety over their marketing campaigns (Drenten & Brooks, 2020; Sands et al., 2022), as evidenced by partnerships with industry leaders such as Calvin Klein, Puma, and Prada. Although the ethics of CGI influencers remains debatable, there is no denying that the computer-generated universe is the next big thing. As emphasised by recent studies, marketers are urged to prepare for next-level social, design, and creative experiences in AI (Grundner & Neuhofer, 2021) to enhance knowledge in online influencer marketing (Leung et al., 2022a). In such context, understating of how consumers react to CGI influencers is of high importance (Chuah & Yu, 2021) in order to encourage user engagement (Leung et al., 2022b), which (in)directly, may improve parasocial relationships on social media (Hwang & Zhang, 2018; Mrad et al., 2022).

Although user engagement on social media indicates the level of audience involvement with a brand or content (Cheung et al., 2022), there is limited understanding of CGI influencers in the marketing field (Drenten & Brooks, 2020; Mrad et al., 2022), in contrast to the attention given to celebrities (Djafarova & Rushworth, 2017; Hwang & Zhang, 2018). Therefore, by acknowledg-

ing the importance of emotional interaction in digital communication, this study aims to investigate emotional expressions of CGI influencers and their potential influences on user engagement in order to unfold their behavioural impact in contemporary human-computer interaction.

By focusing on the interplay between emotional expressions and user engagement, the contribution of this research is manifold. Theoretically, in light of the CASA paradigm (Ahn et al., 2022; Nass et al., 1994), this study quantifies facial expressions of CGI influencers using AUs and their impact on user engagement. On a methodological level, through the use of data mining and facial recognition algorithm, this study provides novel findings to answer the call to look beyond the status quo of AI in the foreseeable marketing ecosystems. From a practical point of view, the findings shed light on the effectiveness of emotional displays on engagement. This knowledge unlocks the full potential of collaborating with CGI influencers through strategically programming to showcase different products on social media with visually captivating content.

4.2 Literature review

4.2.1 The emergence of CGI influencers

The increasing sophistication of AI has enabled the fabrication of humanoid objects for use in services and marketing (Wirtz et al., 2018). In physical environments, examples can be seen from humanlike robots in hotels, frontline, restaurants, and airports (Wirtz et al., 2018; Yu, 2020), whereas marketers also adopt AI in the digital landscape such as avatars (Miao et al., 2022), humanoid chatbots (Spillner & Wenig, 2021), and virtual agents (Sands et al., 2022). The commonality among the aforementioned cases are their anthropomorphic attributes, which aim to humanise digital experiences when in-person interaction is absent (Araujo, 2018). However, a major criticism of robots and AI is their level of human-likeness (Yu, 2020), with many consumers finding current applications to be rather unreal, resulting in feelings of eeriness and creepiness (Söderlund, 2022). Commonly known as the uncanny valley effect, the theory refers to one's negative emotional reactions towards anthropomorphic characteristics or audio/visual simulations that closely resemble humans (Mori, 1970). Although uncanny valley is based on solid knowledge (Söderlund, 2022; Zhang et al., 2022), it does not seem to keep up with the more recent development in computer graphics (Ahn et al., 2022).

Under the umbrella of computer-mediated communication (Herring, 2019), scholars reinforced the possibility to combine different modalities to facilitate connection and enrich experiences in the digital era (Fotheringham & Wiles, 2022). One trendy and novel case is the integration of robots and graphics, leading to the development of CGI (Ahn et al., 2022). Over time, technologies for creating CGI have grown more sophisticated and advanced (Miao et al., 2022). Given that CGI is driving innovation in video games and movies, it appears inevitable that it will turn into future marketing practice. Recently, CGI influencers have become a relatively new phenomenon on social media (Mrad et al., 2022). Similar to human counterparts, CGI influencers have a

carefully curated online presence with well-followed social media profiles and an awareness of trending topics (Baklanov, 2021). However, what sets CGI influencers apart is that they are specifically designed to look and act in a manner desired by content marketers (Drenten & Brooks, 2020). By taking on digital personalities (Mrad et al., 2022), CGI influencers have high perceived physical and social attractiveness, which consequently stimulates consumer engagement (Ahn et al., 2022).

Certainly, the compelling impact brought by CGI influencers is undeniable (Deng & Jiang, 2023). Recent research showed that CGI influencers can significantly influence consumer decision-making (Da Silva Oliveira & Chimenti, 2021), evaluation of the endorsed brands (Ahn et al., 2022), and online experiences (Mrad et al., 2022). Thus, it is valuable to re-examine the interactions between technology and humans, as well as the conflicts between reality and artifice in digital environments (Drenten & Brooks, 2020). Nevertheless, due to the infancy of computer-generated characters in marketing (Miao et al., 2022), knowledge of consumer experiences with CGI influencers remains limited and requires further exploration (Ahn et al., 2022).

4.2.2 User engagement in social actor framework

To consolidate the understanding of virtual influencers (Deng & Jiang, 2023), tracing back to the root of how humans communicate with machines showcasing social potential is necessary (Gambino et al., 2020). Grounded in human-computer interaction, the CASA paradigm operates on the premise that interactions with computers, technologies, and new media are fundamentally social and natural (Nass et al., 1994). When computers demonstrate humanlike attributes, consumers tend to anticipate that they will conform to a range of social norms (Wang, 2017), such as language use, humanlike facial features, and the ability to convey emotions (Xu et al., 2022). However, one shall keep in mind that the CASA theory does not apply to all forms of social technology (Nass & Moon, 2000). In fact, this paradigm only applies when technological artifacts exhibit adequate social cues that imply their ability to serve as a point of reference for social interaction (Gambino et al., 2020).

In light of the AI revolution, the CASA paradigm has been applied in various technology-oriented services such as chatbots, smartphones, voice assistants, and social robots (Xu et al., 2022). Previous research conducted under the CASA framework demonstrated that humanoid interfaces have the potential to enhance users' trust and performance in decision-making processes (Bass et al., 2011). Relevant studies further showed that service robots equipped with gesture-based interfaces can promote communication (Mara & Appel, 2015) and stimulate user engagement (Chuah & Yu, 2021). More recently, anthropomorphism has been reinforced as a major mechanism by which consumers respond in a social manner (Xu et al., 2022). When interpreting human social behaviours on social media, engagement is found to be the most conspicuous phenomenon (Lim et al., 2020). For instance, when virtual agents portray emotion in a theatrical manner,

user engagement can be established through likes or comments (Chuah & Yu, 2021), which subsequently accelerates the connections between the audience and media figures (Lim et al., 2020).

In recent years, user engagement has emerged as a key metric for measuring the success of social media marketing campaigns (Jones & Lee, 2022). Specifically, the engagement rate can be defined as the level of interaction between users and social media content, including likes and comments (Yu & Egger, 2021). Liking behaviours are often associated with positive emotions such as happiness and excitement, whereas commenting behaviours suggest higher levels of engagement and interactivity on social media (Swani et al., 2017). In marketing, existing literature has demonstrated the positive relationship between user engagement and brand loyalty (Labrecque, 2014), trust (Da Silva Oliveira & Chimenti, 2021), and reputation (Song et al., 2020). Hence, when marketers collaborate with virtual influencers embedded with humanlike characteristics, they are engaging in social interaction with the audience in a manner that is consistent with the social nature of the CASA paradigm (Nass et al., 1994). Consequently, by understanding how humanlike factors may influence one's behaviours, businesses can create more effective and engaging social media content that resonates with their audience and encourages greater levels of engagement (Cheung et al., 2022; Fotheringham & Wiles, 2022).

4.2.3 Emotional displays in the digital landscape

Under the assumption that in-person interaction can be extended to computer-mediated communication (McShane et al., 2021), relevant examples can be found in live streaming platforms, where the display of emotions has been shown to be a powerful trigger for engagement (Lin et al., 2021). In this regard, studies have emphasised the importance of emotional expression in non-human or virtual entities as a means of facilitating social interactions (Landwehr et al., 2011) and promoting user engagement on social media (Chuah & Yu, 2021). Arising through the interplay of large-scale brain networks with cognition, emotion is a multifaceted state of feeling that has physical and psychological impacts on one's thinking and behaviour (Barrett & Satpute, 2013). Since hedonic consumption is upon selling emotional experiences and is affectively rich in nature (Longoni & Cian, 2022), latest research calls an urgent need to demystify the interplay between facial expression of digital agents and consumers' reactions, especially in one-to-many screen-mediated marketing contexts (Bharadwaj et al., 2022).

As machines become more advanced, there is a growing body of research that highlights the potential of AI to generate emotional connections (Huang & Rust, 2021). For instance, earlier scholars underpinned that robot-displayed emotions have compelling impact on consumer reactions in the near future (Wirtz et al., 2018). Echoing the CASA paradigm, the phenomenon of encountering psychological characteristics while interacting with AI could trigger a sense of empathy and emotional bonds (Rincon et al., 2019), which can be reinforced by knowledge of an-

thropomorphic objects. The study of Cameron et al. (2018) discovered that facial emotional expressions can trigger affective responses and increase one's likability towards humanlike robots. In the same vein, research conducted by Chuah and Yu (2021) uncovered the display of surprise and happiness as critical emotions stimulating positive feelings in consumer service and experience context.

With the help of advanced data analytics, recent studies have embraced facial emotional recognition as a powerful tool to advance knowledge on interpersonal communication (Song, 2021). One method for quantifying emotions, which has its roots in psychology, involves the use of the Facial Action Coding System (FACS) (Ekman & Friesen, 1978). FACS identifies visually discernible facial movements that correspond to the expression of a particular emotion (see section 3.3 for details). Commonly referred to as AUs, they break down facial expressions into individual components as an objective measurement (Ngan & Yu, 2019). For instance, Liu et al. (2018) classified consumers' facial expression into a set of emotions using facial muscles when watching movies and trailers. Other scholars evaluated the role of emotional displays of a salesperson and reinforced that emotional cues can digitally simulate in-person interaction (Bharadwaj & Shipley, 2020). Nonetheless, while acknowledging that emotional exchange is a mutual process (Goldenberg & Gross, 2020), how emotional display of digital agents can influence consumer reactions is underexplored (Bharadwaj et al., 2022). In the context of CGI influencers, their novelty further surges an urgency to understand consumers' reactions in digital media (Ahn et al., 2022; Cheung et al., 2022; Drenten & Brooks, 2020).

4.3 Methodology

In order to explore the effect of emotional expression of CGI influencers on user engagement presented by images, Lil Miquela was selected as the study context. Notably, despite the existence of other virtual influencers, Lil Miquela appears to be the most active and humanlike one on Instagram with over than 1,000 posts. In contrast, other popular CGI influencers such as Bermuda and Shudu have less than 300 posts. Since context plays a significant role in shaping consumer behaviour, context-specific research can help identify the unique aspects of a particular market and provide a basis for the development of culturally sensitive and relevant marketing strategies (Stremersch et al., 2023).

First appeared on social media in 2016, Lil Miquela has ballooned in popularity since 2018 as a cultural icon and has been embraced by the fashion, beauty, and music industries, among others. As of 2022, its Instagram account has attracted over three million followers. Primarily used as a marketing tool, Lil Miquela has been featured in product endorsements for streetwear and luxury brands such as Calvin Klein and Prada (Miao et al., 2022). Its unique style and appearance represent a new frontier in marketing and retail, where virtual influencers are becoming a valu-

able asset for companies looking to engage with audiences in innovative ways. After the introduction of the selected virtual influencer, the following section outlines the methodological steps.

4.3.1 Data extraction

To identify Instagram posts published by Lil Miquela, the official account (@lilmiquela: https://www.instagram.com/lilmiquela) was used as the data source. Data extraction was conducted using the Instagram API Scraper available on Apify in February 2023. There was a total of 1,249 posts at the time of data collection. Extracted data includes post captions, number of likes and comments, post URLs, image URLs, and the type of posts (image/video). For carousels, only the first picture of each post was extracted. To ensure that facial expression of Lil Miquela can be captured precisely, the subsequent analysis focused on static images. After the removal of video-based posts and data that were corrupt due to wrong delimiters, the final dataset contained 1,028 posts. Thereafter, all pictures were downloaded in Python based on image URLs.

4.3.2 Image annotation and clustering

Since Lil Miquela has partnered with several brands in different sectors, the purpose of this step is to cluster the extracted posts into different categories based on the pictorial elements. Specifically, the process of annotating images was done using Google Cloud Vision API. For each image, the entities were displayed by the most prominent image labels with a confidence level greater than 0.5 (Chen & Chen, 2017).

These labels were then combined as one document. By applying document embeddings with FastText, they were converted into numbers, where labels appearing near to one another in a vector space are with comparable connotations (Egger, 2022). Subsequently, the approach proceeded by clustering photos based on their observed labels using the Louvain algorithm. In addition to its usage in identifying communities in social networks (Nguyen et al., 2018), the Louvain algorithm is heuristic and has recently been adopted as a technique for image classification in retailing and marketing (Ma & Palacios, 2021; Yu & Egger, 2021).

4.3.3 Detecting facial expressions in pictures

In order to unfold facial expressions conveyed by Lil Miquela, this study taxonomised facial movements by their appearance on the face based on FACS (Ekman & Friesen, 1978) using the Py-Feat package in Python. Py-Feat quantifies facial behaviour and muscle movements that correspond to a displayed emotion through AUs (Baltrusaitis et al., 2018). Table 10 lists most of the possible AUs commonly associated with a particular emotional expression (i.e., happiness, sadness, surprise, fear, disgust, anger). Notably, emotion expressions (e.g., sadness) often combine different sets of AUs (AU1 + AU4 + AU15). Additional AUs less commonly used to train models were not considered in this research.

Since some of the pictures included multiple virtual influencers, the pipeline started with the detection of the number of faces in an image. For each face, the output included the activation of AUs and corresponding emotions with the intensity ranging from 0 to 1. Overall, the data contained 598 pictures with a single face, 404 pictures with multiple faces, and 35 without any face showing in the images. In case of multiple faces, the presented AUs and emotions were averaged. Those without any face were not included in the analysis of facial expression.

TABLE 10. LIST OF AUS AND THEIR CORRESPONDING EMOTIONS

Action Unit	Description	Emotion
AU1	Inner Brow Raiser	Sadness, surprise, fear
AU2	Outer Brow Raiser	Surprise, fear
AU4	Brow Lowerer	Sadness, fear, anger
AU5	Upper Lid Raiser	Surprise, fear, anger
AU6	Cheek Raiser	Happiness, disgust
AU7	Lid Tightener	Fear, anger
AU9	Nose Wrinkler	Disgust
AU11	Nasolabial Deepener	Disgust, fear
AU12	Lip Corner Puller	Happiness
AU15	Lip Corner Depressor	Sadness, disgust
AU17	Chin Raiser	Disgust
AU20	Lip Stretcher	Fear
AU23	Lip Tightener	Anger
AU25	Lip Part	Happiness, surprise, fear
AU26	Jaw Drop	Fear, surprise

4.3.4 Analysing emotion and user engagement

After obtaining the emotional states of the CGI influencer presented in pictures, the analysis moved on to the evaluation of user engagement using stepwise multiple regression analysis. The engagement rate was calculated based on the total number of likes and comments of a post and dividing it by the number of followers of Lil Miquela (2,897,266 as of February 2023) (Stevanovic, 2020). Yet, as assessed by visual inspection of the plots that the engagement rate and emotional intensity were strongly positively skewed, a log transformation was performed to transform all

variables to approximately conform to normality. The Variance Inflation Factor showed that all values were below the recommended threshold of 5 (Menard, 2001), with the highest being 1.80. After the transformation, all other requirements for regression analysis were met. The stepwise procedures were then conducted for each of the clusters. When particular emotion(s) had been identified as the most important variable in predicting user engagement, its corresponding AUs were analysed to further reveal the effect of different intensity of facial movements.

4.4 Results

4.4.1 Image clustering and descriptive statistics

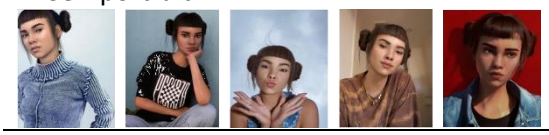
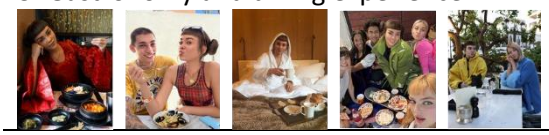
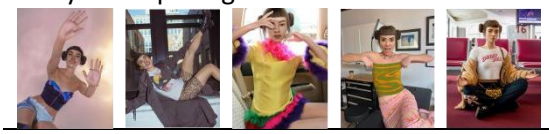
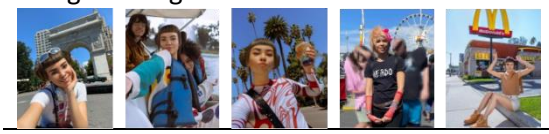
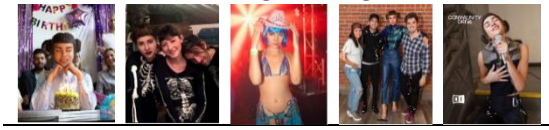
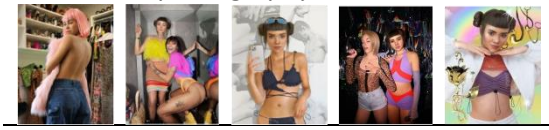
Overall, the Louvain algorithm generated 10 image clusters, which correspond to different visually captivating products in various sectors. The evaluation, ranging from -1 to 1, was conducted using network modularity in Gephi. The modularity algorithm is a method for detecting communities by looking for nodes that are more densely connected than to the rest of the network (Blondel et al., 2008). The metric was 0.737, suggesting a good clustering result. Next, to facilitate the naming process of each cluster, human visual inspection was performed on the designated pictures and image labels with higher term frequency-inverse document frequency. Table 11 provides an overview of the identified clusters and their corresponding emotional intensity embedded in pictures and the respective engagement rate. Notably, pictures categorised in cluster 10 were excluded as they are either posters or did not contain faces in the pictures.

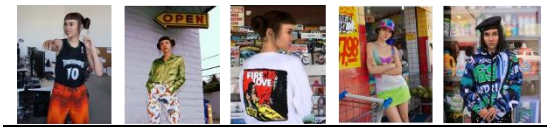
Based on the identified topics, the results pointed towards two main topics within the fashion retail market, namely, '*fashion and branded content*' and '*urban fashion*'. These pictures are often used by influencers to promote clothing brands and showcase their style. They are typically staged and may include a mix of indoor and outdoor settings. Yet, the latter, '*urban fashion*', is particularly noteworthy as it not only showcases one's personal fashion sense, but also captures the ambiance and surroundings of a particular location, akin to street style photography. Furthermore, the analysis revealed that virtual influencers utilising '*car model shot*' as part of their content strategy have gained significant traction in the market, indicating a potential strategy to boost interest and engagement among potential consumers.

Another stream of pictures are more hedonic in nature, such as '*gastronomy and dining experience*', '*social events and gatherings*', and '*sightseeing and entertainment*'. Gastronomic phots are often taken in social settings such as restaurants, cafes, or homes to feature the food and social experiences. Similarly, images capturing social events often include multiple individuals to document and share the experience with others, accompanied by captions or hashtags that emphasize the social aspect of the gathering, such as 'brunch with friends' or 'dinner party vibes'. Tourism-related pictures are often taken while visiting tourist destinations or landmarks to convey their enjoyment of the experience.

Not surprisingly, several image clusters feature the influencer itself such as '*self-portrait*', '*dynamic posing and motion shot*', and '*glamour photography*'. Particularly, '*self-portrait*' is often associated with promotion of accessories as most pictures focus on different parts of the face, including hair, skin, forehead, and nose (based on the detected image labels). Likewise, pictures clustered as '*dynamic posing and motion shot*' focus on the influencer itself, but are mostly full shots. The findings revealed that they are taken with an artistic/creative approach to capturing motion or physical activities in various settings, such as in a gym, outdoors, or during an event. Conversely, different from fashion photography, a glamour shoot is not about the clothes, but physical beauty and charm.

TABLE 11. SUMMARY OF VISUALLY CAPTIVATING PRODUCTS AND EMBEDDED EMOTIONS IN DIVERSE SECTORS

Image cluster	n	EN	FR	DG	AG	HN	SP	SN
1: Self-portrait 	182	-1.70 (0.31)	-2.16 (0.91)	-2.96 (1.03)	-1.95 (0.82)	-1.99 (1.03)	-1.91 (0.99)	-1.13 (0.69)
2: Fashion and branded content 	149	-1.69 (0.20)	-2.33 (0.79)	-3.00 (1.01)	-1.57 (0.73)	-1.95 (0.94)	-1.96 (1.00)	-1.10 (0.63)
3: Gastronomy and dining experience 	127	-1.80 (0.28)	-2.02 (0.89)	-2.77 (0.90)	-1.61 (0.80)	-1.45 (0.93)	-1.54 (0.87)	-1.16 (0.72)
4: Dynamic posing and motion shot 	126	-1.62 (0.21)	-2.12 (0.84)	-2.94 (0.81)	-1.55 (0.74)	-1.75 (1.02)	-1.83 (0.87)	-1.07 (0.7)
5: Sightseeing and entertainment 	116	-1.65 (0.17)	-2.33 (0.9)	-2.86 (1.00)	-1.56 (0.88)	-1.46 (1.08)	-1.88 (0.97)	-1.24 (0.78)
6: Social events and gatherings 	103	-1.68 (0.26)	-2.12 (0.77)	-2.70 (0.78)	-1.62 (0.75)	-1.12 (0.92)	-1.54 (0.77)	-1.24 (0.71)
7: Glamour photography 	79	-1.66 (0.26)	-2.16 (0.76)	-3.02 (0.98)	-1.63 (0.88)	-1.66 (0.98)	-1.79 (0.97)	-1.23 (0.74)
8: Car model shot 	52	-1.67 (0.19)	-2.22 (0.91)	-2.68 (0.90)	-1.67 (0.82)	-1.53 (1.21)	-1.68 (0.96)	-1.29 (0.78)
9: Urban fashion								

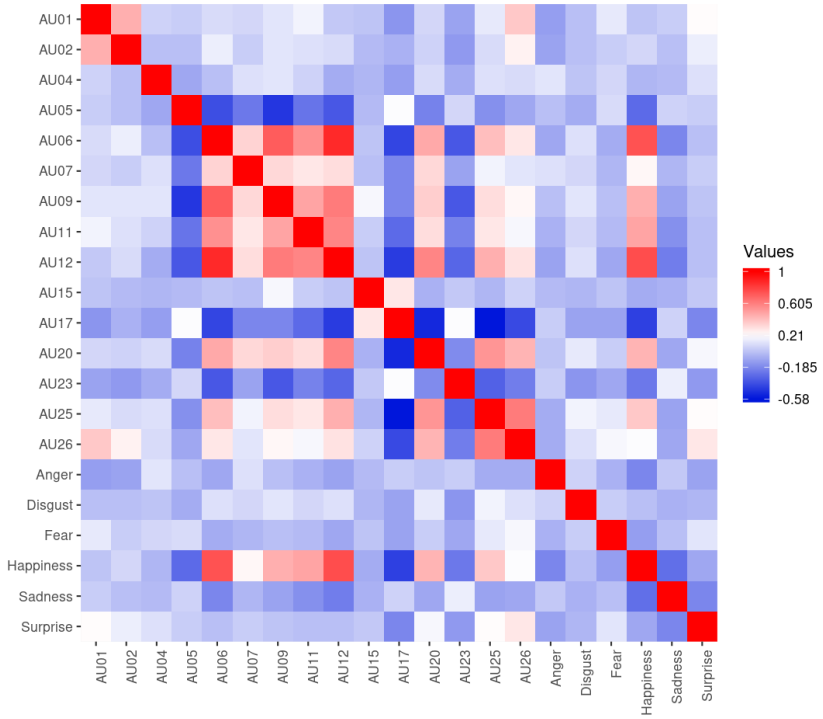
	51	-1.74 (0.21)	-2.27 (0.85)	-2.79 (0.94)	-1.47 (0.64)	-1.55 (0.95)	-1.70 (0.97)	-1.06 (0.62)
10: Unidentified images								
	35	Not applicable						

Note: EN=Engagement rate (log); FR=Fear (log); DG=Disgust (log); AG=Anger (log); HN=Happiness (log); SP=Surprise (log); SN=Sadness (log)

4.4.2 Emotional analysis on visually captivating products in diverse sector

A Pearson's correlation was run to provide an overview of the relationship between AUs and emotional expressions (Figure 3). Notably, the six emotions mentioned in the analysis are the aggregated muscle movements listed in Table 10 above. Overall, the findings are mostly in line with the characteristics of human emotions. For instance, there is a significant and strong positive relationship between happiness and AU6 (r = .739, p < .001), AU12 (r = .751, p < .001), and AU25 (r = .371, p < .001). Likewise, AUs related to surprise also demonstrated a significant and positive relationship; namely AU1 (r = .225, p < .001), AU2 (r = .155, p < .001), AU25 (r = .215, p < .001), and AU26 (r = .283, p < .001). However, since individuals portray emotions differently, the intensity of AUs varies and some may not be observed for the same expression. This variability is also reflected in the findings, where not all AUs displayed a significant relationship. An example can be seen from disgust. Although AU6 (r = .111, p < .001), AU9 (r = .124, p < .001), AU11 (r = .069, p = .031), and AU17 (r = -0.105, p = .001), had a significant relationship, AU15 (r = -0.029, p =.369) which is also related to disgust did not.

FIGURE 3. CORRELATION BETWEEN AUS AND EMOTIONS



Thereafter, a backward stepwise regression analysis was applied to differentiate the contribution of emotional variables in each cluster. All models contained six emotions as the predictors at the outset. The significance level for variable entry and exit was .05. At each step, variables having the lowest correlation with user engagement were removed until no additional variables met the exclusion criteria. The final models were left with one emotional variable in each cluster, with R^2 of .32 for cluster 1, .34 for cluster 2, .64 for cluster 4, .36 for cluster 5, .42 for cluster 7, and .51 for cluster 9. The regression equations were significant ($F_{\text{cluster 1}}$ [1, 180] = 3.979, p =.048; $F_{\text{cluster 2}}$ [1, 147] = 5.123, p =.025; $F_{\text{cluster 4}}$ [1, 124] = 8.531, p =.004; $F_{\text{cluster 5}}$ [1, 114] = 4.296, p =.040; $F_{\text{cluster 7}}$ [1, 77] = 9.543, p =.003; $F_{\text{cluster 9}}$ [1, 49] = 5.671, p =.021).

Specifically, for both cluster 1 (β = -.044, p = .048) and cluster 5 (β = .031, p = .040), happiness was the strongest predictor. For cluster 2 (β = -.057, p < .001) and cluster 7 (β = -.118, p = .003), sadness was found to be the most influential one. Disgust contributed significantly to the model for cluster 4 (β = .065, p = .004), whereas surprise was found to be the strongest predictor for cluster 9 (β = .069, p = .021). Yet, despite the variability in emotional expression, the findings indicated that none of the emotional variables met the criterion for clusters 8, 3, and 6, resulting in zero steps for these clusters. This outcome is particularly notable for clusters related to the social aspect of Lil Miquela, and may be attributed to the presence of multiple digital avatars in these photographs. As a result, these clusters were excluded from further analysis.

4.4.3 Analysis of AUs and user engagement: A deeper level of emotional display

After identifying the emotional variables present in each cluster, the analysis proceeded to a more detailed examination of facial muscle movements based on the visually captivating products that Lil Miquela is promoting (Table 12). As emotional expressions typically involve the activation of multiple AUs, multiple regression was conducted to explore how variations in AU intensity relate to changes in user engagement. Starting from happiness (AU6, 12, and 25), the results indicated that the models were significant for both cluster 1 ($F(3, 178) = .631$, $p = .023$, $R^2 = .21$) and cluster 5 ($F(3, 112) = .229$, $p = .031$, $R^2 = .16$). Interestingly, the findings disclosed that AU6 had a significant but negative relationship for cluster 1 ($\beta = -.380$, $p = .017$), while AU12 had a significant and positive relationship for cluster 5 ($\beta = .017$, $p = .023$) with the engagement rate. As for sadness (AU1, 4, and 15), the results presented a significant model for cluster 2 ($F(3, 145) = 2.661$, $p = .050$, $R^2 = .33$), with AU1 having a negative and significant relationship ($\beta = -.334$, $p = .030$). However, the model for cluster 7 was not statistically significant ($F(3, 75) = .527$, $p = .748$, $R^2 = .29$).

Turning to cluster 4, where the expression of disgust (AU6, 9, 11, 17) was found to be the most influential variable to user engagement. The analysis further demonstrated a significant model ($F(4, 121) = 1.571$, $p = .047$, $R^2 = .21$), where AU9 was found to have a significant and negative relationship ($\beta = -.129$, $p = .002$). Lastly, for cluster 9, the results indicated a significant model for the combination of AUs (AU1, 2, 5, 25, 26) related to surprise ($F(5, 45) = 1.253$, $p = .003$, $R^2 = .35$). Notably, AU1 had a significant but negative relationship to user engagement ($\beta = -.607$, $p = .008$), whereas AU2 had a positive one ($\beta = 1.096$, $p = .048$).

TABLE 12. ESTIMATION RESULTS OF REGRESSION ANALYSIS

	AU1	AU2	AU4	AU5	AU6	AU9	AU11	AU12	AU15	AU17	AU25	AU26
Happiness												
C1	-	-	-	-	-.380*	-	-	.297	-	-	.005	-
C5	-	-	-	-	.042	-	-	.017*	-	-	.030	-
Sadness												
C2	-.334*	-	-.086	-	-	-	-	-	.175	-	-	-
C7	-.351	-	-.166	-	-	-	-	-	.100	-	-	-
Disgust												
C4	-	-	-	-	.230	-.129*	-.010	-	-	.159	-	-
Surprise												
C9	-.607*	1.09*	-	-.514	-	-	-	-	-	-	.002	-.026

Note C=cluster; *$p < 0.05$

4.5 Discussion

The emergence of CGI influencers in recent years has brought a new dimension to the landscape of social media. In line with the findings of this study, their popularity has led to collaborations with several brands (Sands et al., 2022), including those in the retail, tourism, and gastronomy industries, amongst others. However, in addition to the expected image clusters such as fashion-

related topics (Mrad et al., 2022), this study demonstrated the capacity of virtual influencers to engage online users on a more personal level, appealing to their sense of lifestyle and values, and fostering deeper connections with their audience. This is where emotional expressions come into play (Gambino et al., 2020; Song, 2021). Potentially, the emotional connection between virtual influencers and online users facilitates parasocial relationship (Deng & Jiang, 2023) and stimulate user engagement (Ahn et al., 2022). Overall, this study revealed the expression of happiness, sadness, disgust, and surprise to be influential in the design of CGI influencers for different contexts and settings.

First, in line with the state-of-the-art knowledge, anthropomorphic attributes lead to both positive and negative impact in human-AI interaction (Baek et al., 2022). Although intuition may suggest that smiles signal positive social intentions (Beattie et al., 2020), scholars have referred the expression to be rather eerie due to the uncanny valley effect (Baek et al., 2022; Söderlund, 2022). As suggested by the study's findings, happiness does not always lead to positive reactions. Yet, the findings indicated that the impact of emotional expressions on user engagement may vary depending on the context, and that negative reactions do not always hold true for CGI influencers (Ahn et al., 2022). For instance, in pictures related to hedonic experiences (e.g., travel and sightseeing), expressing moments of pleasure appears to encourage user engagement, whereas in self-portrait photography, which is often used in promoting accessories, smiling was found to have an adverse effect.

Interestingly, by looking at a more sophisticated level of facial movements, the analysis revealed a striking similarity to existing knowledge in psychology, with AU6 and AU12 emerging as the most influential facial muscles in delivering positive emotions (Gunnery et al., 2013). It is worth noting that although AU6, which triggers crow's feet wrinkles, is often seen as a reliable signal of an authentic smile (Ngan & Yu, 2019), interestingly, the findings suggested that its activation actually led to a decrease in user engagement in the case of self-portrait pictures. One potential explanation could be that the muscle movements of CGI influencers are still not fully seamless, and as a result, viewers may be more likely to associate the authenticity of an expression with the region around the eyes (Grandey et al., 2005). This may be particularly true in close-up shots posted on social media, where the eyes are a prominent feature of the image. Indeed, in cases where there are imperfections in the CGI influencer's expression, the activation of AU6 may indeed be a critical factor that discourages engagement from users. However, AU12, which is associated with the display of a social smile and often involves the showing of teeth (Gunnery et al., 2013), was found to be a salient factor in increasing engagement in pictures related to travel and sightseeing where happiness is expressed. Existing research has shown that people are more likely to perceive a person as happy and approachable when they smile with teeth because it creates a more open and inviting facial expression (Ngan & Yu, 2019), which can foster feelings of connection and positivity. This highlights the importance of considering the context in which

facial expressions are being used (Bharadwaj et al., 2022), and tailoring them accordingly to maximise their impact on user engagement.

Turning to the impact of expressing sadness, the findings highlighted '*fashion and branded content*' and '*glamour photography*' to avoid involving its respective AUs. For instance, using AU1 in pictures related to fashion content may not always be desirable because it is associated with the lowering of the eyebrows and the wrinkling of the forehead (Ekman & Friesen, 1978; Goh et al., 2020). This facial expression can create a sense of seriousness, concern or tension, which may be incongruent with the desired mood (e.g., confidence, relaxation) or image of the content (e.g., aspirational lifestyle). Likewise, this study suggested that preventing the virtual influencers from expressing sadness may improve user engagement particular for glamour photography. Potentially, this type of pictures stereotypically conveys an alluring or seductive impression (Rose et al., 2012), wearing revealing clothing, or displaying other aspects of their physical appearance in a way that is intended to be aesthetically pleasing. Hence, as with fashion photography, overly expressive facial features may detract from the overall aesthetic or composition of the image.

With regards to surprise that plays a significant role in pictures related to urban fashion, the findings are align with existing knowledge, where surprise can evoke a sense of novelty and energy (Skavronskaya et al., 2020). Since urban fashion is often associated with creativity, individuality, and being on the cutting edge of trends (Gentina & Kratzer, 2020), expression of surprise can reinforce these associations by creating a sense of excitement and interest among viewers. However, it is interesting to note that there is a negative relationship between user engagement and the activation of AU1 in such contexts. Due to the association of AU1 with sadness (Goh et al., 2020), the findings reinforced the importance of balancing facial muscles of surprise to avoid confusion and maintain the desired behavioural reactions from the viewers.

Finally, disgust is a powerful and intense emotion that can create a sense of tension or conflict (Slaby & Scheve, 2019). In the context of dynamic posing and motion shot photography, its use may create a sense of contrast and intensity, drawing viewers' attention and leaving a lasting impression (Henderson, 2003). This can be especially effective in capturing the attention of viewers who are scrolling through their feeds and looking for visually striking content. However, it is important to note that activating AU9, which is associated with the wrinkling of the nose and the upper lip (Ekman & Friesen, 1978), may have a negative effect on the overall aesthetic of the image. While it can convey a sense of disgust, it can also create a distorted or unflattering facial expression (Fischer et al., 2012) that detracts from the desired effect of the photograph. The activation of AU9 may also be perceived as being overly expressive or contrived, which can undermine the authenticity of the image.

4.6 Conclusion

4.6.1 Theoretical contribution

By exploring how CGI influencers can effectively communicate emotions to their audience, this research provides valuable insights into the interplay between technology, human behaviour, and marketing strategies. As CGI influencers blurs the line between reality and fiction, this study reinforces the theoretical lens of the CASA paradigm (Ahn et al., 2022; Nass et al., 1994) that is pivotal to the connections between the audience and media figures (Chen, 2016). This research differs from the traditional CASA paradigm that concentrates on the connection between humans and agents (Arsenyan & Mirowska, 2021; Gambino et al., 2020). Examining the impact of facial expressions and emotions of CGI influencers offers novel insights into how emerging digital entities can establish a feeling of presence and increase engagement, and how these factors can be optimised to trigger positive user behaviours.

By analysing facial expressions of CGI influencers, this study reinforces the assumption that optimising emotional experiences in computer-mediated communication serves as a fundamental factor in influencing viewers' reactions in services and marketing (Chuah & Yu, 2021; Grundner & Neuhofer, 2021). Meanwhile, as CGI influencers are ultimately digital creations, this research adds original knowledge to the uncanny valley theory (Arsenyan & Mirowska, 2021). By identifying features of CGI influencers that lead to positive/negative user engagement, this study contributes to the understanding of how to avoid the uncanny valley effect through appealing and effective design. Hence, the findings advance knowledge of the design of future robotic systems that are intended to interact with humans, answering the call to uncover the characteristics of digital images that make businesses more compelling in social media (H. Li et al., 2023).

Given that CGI influencers do not exist in the physical world, understanding their emotional expressions can enable individuals to form deeper connections (Miao et al., 2022) and cultivate personal intimacy in the realm of human-to-virtual-agent interactions (Block & Lovegrove, 2021; Hwang & Zhang, 2018). On a psychological level, this research provides insights into how humans respond to computer-generated entities capable to convey emotional expressions and how they are processed when promoting different products in various market sectors. Furthermore, the underpinning logic of CASA allow mutual communication on an emotional level for CGI influencers and the public (Mrad et al., 2022), laying a solid foundation for sentimental and experiential communication of virtual agents. Overall, by learning from Lil Miquela, the most popular CGI influencer collaborating with multiple brands (Baklanov, 2021), this study provides cutting-edge perceptions of robotics, AI, and computer vision in the context of retailing and marketing..

4.6.2 Practical implications

The importance of emotional expression of CGI influencers in influencing user engagement on social media cannot be overstated. Emotions play a crucial role in human decision-making, and the same is true for social media users. When users see content that elicits an emotional response, whether positive or negative, they are more likely to engage with it through liking, commenting, or sharing the post. This research can provide implications into how digital marketing strategies can be optimised to improve user engagement, while avoiding the uncanny valley effect.

For instance, the use of close-up photos by retailers can effectively highlight the details of accessories. However, when using CGI influencers to promote these items with self-portrait pictures, it is important to avoid the expression of happiness and pay close attention to the intensity of AU6. On the other hand, the findings implied that happiness is effective to promote hedonic experiences (e.g., travel activities). In this scenario, designers can further leverage the activation of AU12 to enhance user engagement. However, caution must be exercised when activating AU1 as its intensity should be balanced with other relevant AUs. For example, although presenting surprise is effective for pictures related to urban fashion, the intensity of AU1 should be minimised as people easily refer AU1 to the expression of sadness.

Notably, since consumers are often savvy and can easily detect when retailers use emotional manipulation to push a product, it is essential that brands work with experienced marketing professionals and animators who can create a compelling and authentic emotional expression. Altogether, emotional expression is a critical component of the success of CGI influencers in social media marketing. As the use of CGI influencers continues to grow, it will be interesting to see how brands and social media users continue to interact with them on an emotional level.

4.6.3 Limitations and recommendations

This research is not without its limitations. Primarily, while the value of context-specific research has been highlighted (Stremersch et al., 2023), future studies are encouraged to continue exploring the future development of CGI influencers when available so as to increase the generalisability of the findings. However, although Lil Miquela is one of the most active and humanlike influencers, it is still uncertain whether the current techniques enable her to express the full range of human emotions and to what degree her facial muscle movements resemble those of humans. Moreover, readers should keep in mind that emotions and facial expressions are not the only factors influencing user engagement rate on Instagram. Although this study additionally performed image clustering to enhance the robustness of the results, other implicit components such as the influencer's personality may also have impact on users' reactions. Likewise, despite that Instagram is a visual-centered platform, scholars are recommended to uncover the synergy of post captions and pictures on the engagement rate. Notably, this study took the number of

likes and comments as a proxy of user engagement, yet whether they represent the actual level of engagement remains unknown. Thus, considering experimental methods or incorporating biometrics (e.g., eye tracking) to evaluate the internal states of viewers or the amount of time spent engaging with the content could be beneficial. Finally, as there is a strong link between emotion and culture, future studies should take into account cultural differences when interpreting facial expressions, particularly when analysing more CGI influencers in the future.

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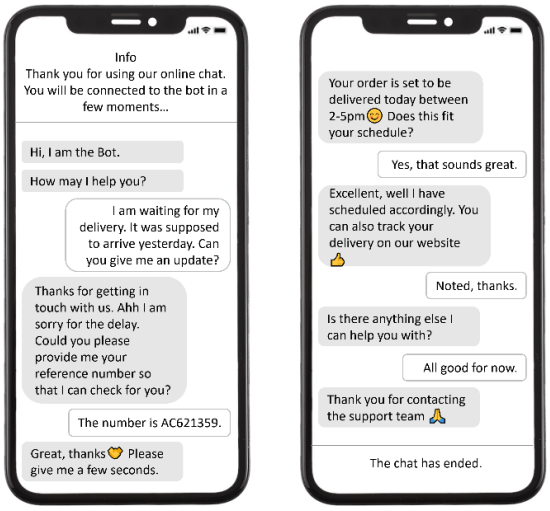
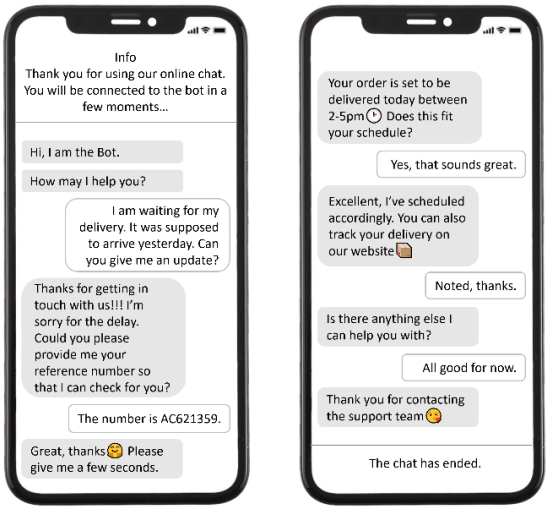
APPENDIX A: EXPERIMENTAL STIMULI

a. Condition 1



b. Condition 2



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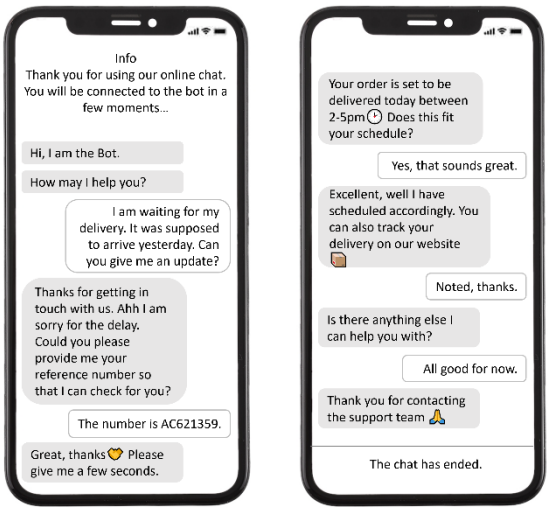
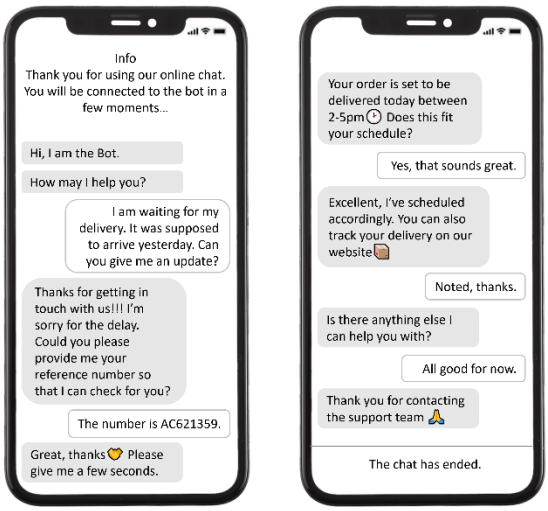
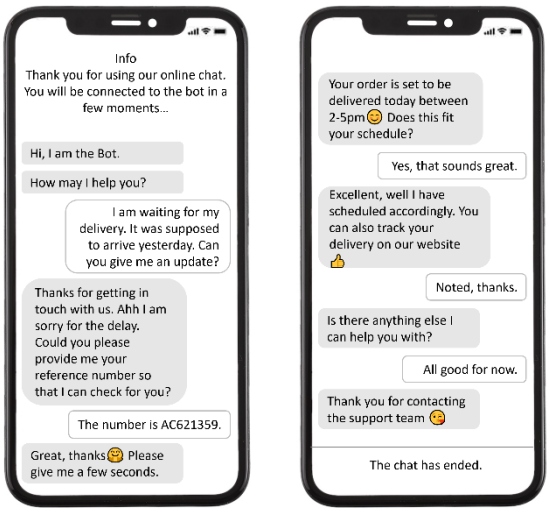


d. Condition 4



e. Condition 5



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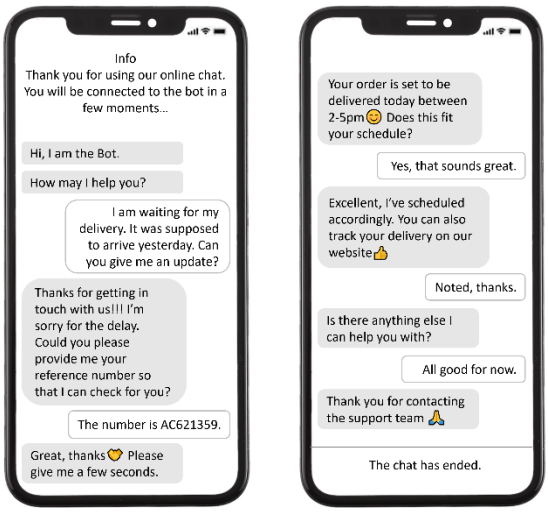
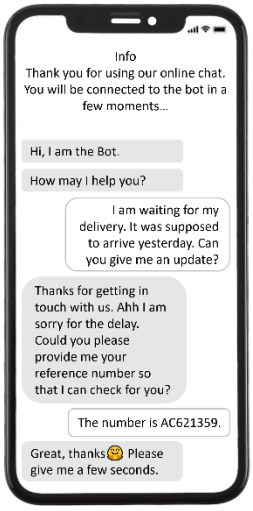
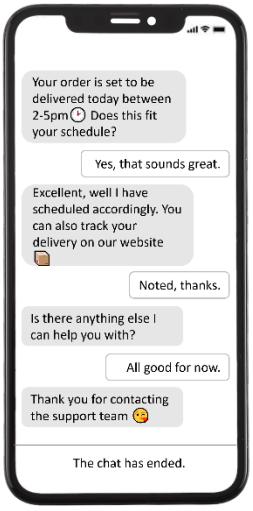
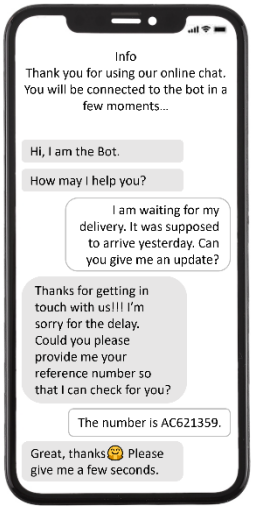


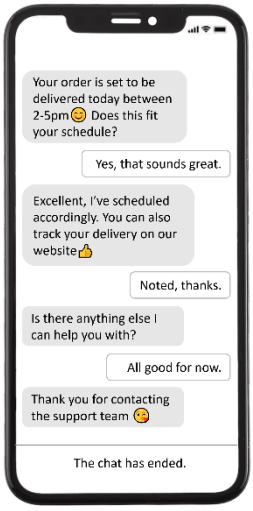
g. Condition 7



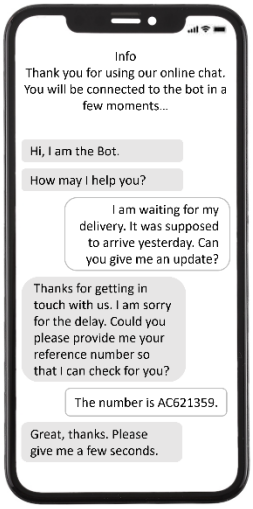


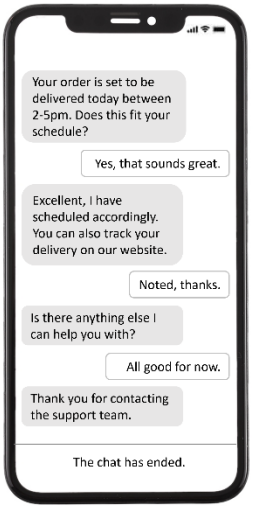
h. Condition 8





i. Control





APPENDIX B. SURVEY ITEMS

Construct / Variable	Item	Source
Mental simulation (tactile)	While reading the conversation, I envisioned myself having in-person interaction with the chatbot. While reading the conversation, I imagined that the chatbot was interacting with me. While reading the conversation, I simulated myself having in-person interaction with the chatbot.	Escalas (2004)
Mental simulation (auditory)	While reading the conversation, I envisioned myself hearing the voice of the chatbot. While reading the conversation, I imagined that the chatbot was talking to me. While reading the conversation, I simulated myself hearing the voice of the chatbot.	
Mental simulation (visual)	While reading the conversation, I envisioned myself seeing the facial expression of the chatbot. While reading the conversation, I imagined that the chatbot displayed its facial expression. While reading the conversation, I simulated myself seeing the facial expression of the chatbot.	
Sensory experience – volume (auditory)	The chatbot mobilised my sense of hearing. The chatbot provided me with a lot of sensory stimulation for hearing. The communication with the chatbot had many sensory elements related to hearing.	Gao & Lan (2020)
Sensory experience: volume (tactile)	The chatbot mobilised my sense of touch. The chatbot provided me with a lot of sensory stimulation for touch. The communication with the chatbot had many sensory elements related to touch.	
Sensory experience: volume (visual)	The chatbot mobilised my sense of sight. The chatbot provided me with a lot of sensory stimulation for sight.	

	The communication with the chatbot had many sensory elements related to sight.
Sensory experience: volume (overall)	Overall, the chatbot mobilised many of my senses. Overall, the chatbot provided me with a lot of sensory stimulation. Overall, the communication with the chatbot had many sensory elements.
Sensory experience: uniqueness (auditory)	The chatbot is different from other bots that I have used in simulating hearing. The chatbot stands out from other bots based on in simulating hearing. I think the chatbot is unique in simulating hearing.
Sensory experience: uniqueness (tactile)	The chatbot is different from other bots that I have used in simulating touching. The chatbot stands out from other bots based on in simulating touching. I think the chatbot is unique in simulating touching.
Sensory experience: uniqueness (visual)	The chatbot is different from other bots that I have used in simulating seeing. The chatbot stands out from other bots based on in simulating seeing. I think the chatbot is unique in simulating seeing.
Sensory experience: uniqueness (overall)	Overall, the chatbot is different from other bots that I have used in its sensory aspects. Overall, the chatbot stands out from other bots based on its sensory aspects. Overall, I think the chatbot is unique in its sensory aspects.
Sensory experience: consistency (auditory)	The hearing characteristics of the chatbot are suitable for this service encounter. The hearing characteristics of the chatbot are consistent with my identity. The hearing characteristics of the chatbot are consistent with my values.

Sensory experience: consistency (tactile)	The touching characteristics of the chatbot are suitable for this service encounter. The touching characteristics of the chatbot are consistent with my identity. The touching characteristics of the chatbot are consistent with my values.	
Sensory experience: consistency (visual)	The visual characteristics of the chatbot are suitable for this service encounter. The visual characteristics of the chatbot are consistent with my identity. The visual characteristics of the chatbot are consistent with my values.	
Sensory experience: consistency (overall)	Overall, the sensory characteristics of the chatbot are suitable for this service encounter. Overall, the sensory characteristics of the chatbot are consistent with my identity. Overall, the sensory characteristics of the chatbot are consistent with my values.	
Online experience: cognitive aspect	I learned a lot from using this chatbot with sensory characteristics. The sensory characteristics of this chatbot is useful. I think the sensory characteristics of this chatbot is helpful.	Bleier et al. (2019)
Online experience: social aspect	This chatbot creates a feeling of “warmth” during the service interaction. I enjoy interacting with this chatbot. This chatbot relates well to me as a customer. I feel comfortable interacting with this chatbot.	Sands et al. (2020)
Online experience: affective aspect	I enjoy being a customer of this chatbot. I have positive feelings about this chatbot. I feel attached to this chatbot.	Iglesias et al. (2019)
Satisfaction	The choice to interact with this chatbot would be a good one. I would be satisfied with the service interaction.	Sands et al. (2020)

	I would truly enjoy interacting with this chatbot.
Intention to use	If I were going to request a service, I would consider interacting with this chatbot.
	If I were requesting a service, the likelihood I would use this chatbot is high.
	My willingness to use this chatbot would be high if I were requesting a service.
	The likelihood that I would consider using this chatbot is high.