



## RESEARCH ARTICLE OPEN ACCESS

# From Virtual Trainers to Companions? Examining How Digital Agency Types, Anthropomorphism, and Support Shape Para-Social Relationships in Online Fitness

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## ABSTRACT

The role of virtual trainers in online fitness has increasingly captured the attention of consumers and brands as digital technology becomes more interwoven with daily life. This study extends the para-social relationship theory by developing and testing a research model through five studies that simulate online fitness interactions. In Study 1, we examine the model and find that three characteristics (interactivity, authenticity, and companionship) positively influence consumers' social perceptions (perceived warmth and competence), para-social relationship building, and intentions to continue using the service. Our findings also reveal that the moderating roles of coach types (human vs. avatar vs. agent) in Study 2, anthropomorphic appearance levels (high vs. low) in Study 3, and the nature of support provided (emotional vs. technical) in Study 4 significantly affect users' social perceptions and their intentions to continue using the service. Interestingly, compared to humans and avatars, using agent coaches requires greater authenticity to strengthen the para-social relationship. When using low-anthropomorphic digital agents and avatars, building para-social relationships more effectively promotes consumers' continued usage intentions. Additionally, the relationship between para-social relationship building and continued usage intentions was stronger in the emotional support group than in the technical support group. In Study 5, we found that continued usage intention positively affects online fitness subscription behaviors. These findings have implications for integrating digital agencies to enhance consumer experience and engagement in health-focused digital environments, especially for physical fitness service providers and platform course designers.

## 1 | Introduction

The integration of digital technologies into daily life, along with the shift toward remote work environments, has dramatically altered lifestyles (e.g., remote and home fitness) in the post-pandemic era (McDonough et al. 2022). This shift has increased the challenges consumers face when interacting with digital agencies, but it has also introduced more personalized services to meet diverse consumer needs. Digital agencies, including interactive entities such as avatars and agents, bridge the gap

between human interaction and digital interfaces (Ågerfalk 2020; Nowak and Biocca 2003). Specifically, avatars are digital representations controlled by humans, while agents are autonomous entities governed by computer algorithms (Morke, Kernal, and Nass 1999; Nowak and Biocca 2003). Digital agencies enhance consumer experience by mimicking human behaviors and supporting interactive marketing campaigns. They are increasingly used in service scenarios, providing visual and audio stimuli that boost mental and social values. This evolution has not only redefined the boundaries

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between work and personal life but has also fostered new approaches to health and well-being, particularly in online fitness (Hickey-Mason 2021).

The online fitness market has seen remarkable growth, valued at USD 15.3 billion in 2023, with a projected compound annual growth rate of over 32%, potentially reaching USD 172.4 billion by 2032 (Global Market Insights 2024). Online fitness platforms offer the flexibility to work out at any time and location through apps and wearable devices (Statista 2023), catering to a broad audience, including those who might not have easy access to traditional gym facilities due to geographic or time constraints. Furthermore, certain games have incorporated fitness companionship systems into their interactive platforms, providing agent companionship designed to keep users active and underscore the role of digital agents in managing personal health. An example is “Love and Deepspace,” a mobile otome game released in 2024, which achieved 10 million global downloads within the first week of its release (Griffiths 2024). In this context, avatars or virtual trainers offer real-time guidance, monitor progress, customize workout plans based on user performance, and provide motivation, making them more effective than static workout videos or generic fitness apps (Kwok et al. 2021). However, while previous research has investigated online health communities and health behavior (Mokmin and Jamiat 2021; Stragier et al. 2016), less focus has been placed on the interactive processes involved in online fitness, especially in areas such as socialization, emotional value, and relationship building (Alabed et al. 2024; Söderlund and Oikarinen 2021).

Due to the relational attributes of emotional unidirectionality in human-agency interactions, the encounter between humans and digital agencies may be considered para-social (Noor, Rao Hill, and Troshani 2022; Tsiotsou 2015). The concept of a para-social relationship was initially established to explain the illusory connection that audiences form with television characters, celebrities, fictional characters, or organizations (Horton and Richard Wohl 1956). It describes a one-sided psychological relationship in which audiences perceive these figures as friends, despite recognizing that they have minimal genuine existence as real humans (Horton and Richard Wohl 1956). In recent years, the rapid advancement of digitalization has expanded the applicability of the para-social relationship concept. For example, the anthropomorphic attributes of inanimate entities have been shown to trigger para-social interactions among consumers (Han and Yang 2018; Lou et al. 2023; Noor, Rao Hill, and Troshani 2022; Tsai, Liu, and Chuan 2021). Some research has underscored the necessity of designing these agents to enhance their authenticity and interactivity, creating an experience akin to interacting with real people—an essential aspect of effective digital agency design (Chen, Hyun, and Lee 2022; Etamad-Sajadi 2016). Furthermore, the emotional support and companionship offered by anthropomorphic agents can evoke human-like perceptions, affection, and cognition, facilitating empathy and emotional intelligence (Lee et al. 2017; Ramadan, F. Farah, and El Essrawi 2021). These interactions help individuals manage stress and anxiety, highlighting the potential of these agents to serve as empathetic companions and deliver psychological benefits through cognitive and affective engagement (Kim and Hur 2024; Liu-Thompkins, Okazaki, and Li 2022). However, there remains a lack of clarity on how the

traits of digital agencies influence consumers' social perceptions (Cuddy, Fiske, and Glick 2008) and relationship building. To explore the diverse features of digital agencies, this study examined three typical characteristics, which were “interactivity (with interactive features),” “authenticity (with role features),” and “companionship (with social features).”

Existing literature has examined the effects of digital agents and anthropomorphism on relationship strength in various contexts (Belanche et al. 2021; Tsai, Liu, and Chuan 2021). However, limited research has focused on how these factors shape the psychological processes involved in para-social relationships within interactive environments like online fitness platforms (see Appendix A for a summary of relevant literature). Specifically, how does the human perception process develop based on the characteristics of digital agencies? How is the projective apprehension of human-agency relations formed in human understanding? Based on these notions, a framework is needed to streamline the connection between the characteristics and forms of presentation of the agencies and consumers' perceptions of these digital entities in specific service scenarios, leading to relationship formation and subsequent behavioral outcomes (e.g., subscriptions). Our study revisits these factors to offer new insights, in addition to understanding the moderating effects of the types of digital agency, anthropomorphism, and support types. Thus, this study aims to investigate human-agency interactions by posing two main research questions:

- i. *This research focuses on digital agencies' psychological and social characteristics (i.e., interactivity, authenticity, and companionship) over other discussed physical traits and shows the mechanism for building human-agency relationships.*
- ii. *The research investigates contingencies, such as how the types of agency (i.e., agents vs. avatars vs. human coaches), the levels of physical appearance anthropomorphism (i.e., low vs. high), and the types of support provided (i.e., technical vs. emotional), affect the psychological perception process, which was rarely discussed in the literature.*

The authors conducted five studies within online fitness environments to address these research questions. These studies utilized the para-social relationship theory to explore how various features of digital agencies—including their types, levels of anthropomorphism, and types of support—influence interactive processes, the building of human-agency relationships, consumers' ongoing fitness intentions, and online fitness subscription behavior. In the following section, the authors developed a research model by reviewing existing literature and formulating hypotheses.

## 2 | Theoretical Background

### 2.1 | Agency's Traits - Interactivity, Authenticity, and Companionship

The existing literature on digital agencies discusses their traits across three main dimensions: (1) Visual Traits: These are the physical characteristics consistent across various digital

agencies and are generally context-free. For instance, in different scenarios where agents are embedded, their authenticity is often judged based on visible features like eyes and mouths (Sheehan, Jin, and Gottlieb 2020), non-verbal behaviors such as facial expressions and body posture (Etienne et al. 2023), and vocal elements like tone and pitch (Roy and Naidoo 2021). These traits are considered fundamental across different types of digital agencies. (2) Perceptual Traits: These traits are scenario-specific, emerging in contexts where specific competencies and functionalities are expected. For example, certain digital agents are designed to meet specific perceptual expectations in particular settings, such as intellectual perception (Moussawi, Koufaris, and Benbunan-Fich 2021), and consumer reaction to the automation of service robots (Castelo et al. 2023). (3) Social Traits: These traits emphasize the interactive and emotional aspects of digital agencies, focusing on how they can evoke feelings of warmth (Belanche et al. 2021), empathy (Kim and Hur 2024), and companionship (Lee et al. 2017) in users.

Although there is growing interest in understanding the impact of various digital agencies' characteristics, existing research remains fragmented, often addressing individual traits in isolation without a cohesive framework. This has led us to focus on interactivity, authenticity, and companionship as critical characteristics of digital agencies due to their central role in shaping user experiences (e.g., Etemad-Sajadi 2016; Lee et al. 2017; Lou et al. 2023; Ramadan, F. Farah, and El Essrawi 2021).

*Interactivity* has been extensively researched within brand websites and influencer marketing, primarily evaluated through a website's responsiveness to user actions (Coyle and Thorson 2001; Jun and Yi 2020). In the context of human-agency interaction, interactivity shares similarities with these earlier findings in brand-consumer engagement. It is characterized by how users perceive responsiveness, engagement, and communication when interacting with a digital agency's platform (Labrecque 2014). This concept transcends traditional user interface design, embracing a more dynamic exchange of information and engagement that focuses on the content and behavioral cues, such as language and actions, present during the interaction.

In the context of human-agency interaction, *authenticity* refers to the genuineness and expression of a consumer's perception of a digital agency during an interaction (de Brito Silva et al. 2022; Nowak 2001), which impacts user trust, satisfaction, and long-term engagement (Chen, Hyun, and Lee 2022; Cinelli and LeBoeuf 2020; Jun and Yi 2020). Focusing on the functionality value rather than the human-like appearance, this concept gauges the extent to which an interactive coach appears real to the user in terms of fulfilling expected roles, such as providing instructions and support.

Finally, *companionship*, a critical facet of digital interaction, often leads to positive emotional experiences and significantly influences user satisfaction and well-being (Baldassare, Rosenfield, and Rook 1984). Within human-agency interactions, companionship pertains to the degree to which a digital agency can emulate a companion or friend during engagements with a user (Bickmore et al. 2012; Buhrmester and Furman 1987; Lee et al. 2017). This dimension enables humans

to forge sustainable relationships with intelligent assistants in various applications, such as smart homes (Lee et al. 2017), autonomous vehicles (Wu, Wang, and Yuen 2023), and wearable health devices (Fronczek et al. 2023). Given its critical role in relationship building, this study defines companionship as a blend of attachment, commitment, and intimacy experienced between a user and a digital agency within an online fitness context.

## 2.2 | Functional Outcomes—Perceived Warmth and Competence

To understand how individuals form impressions in digital interactions, several theories, such as Stereotype Theory and Social Perception Theory, offer explanations. Stereotype Theory, as defined by Fiske et al. (2002), explains how individuals categorize others into groups based on perceived common characteristics, thereby forming simplified assumptions about the behaviors and attributes of group members. Social Perception Theory, as outlined by Cuddy, Fiske and Glick (2008) and Fiske, Cuddy and Glick (2007), more explicitly explores how individuals assess others through two critical dimensions: perceived warmth and perceived competence.

Consistent with the findings of Fiske, Cuddy and Glick (2007), perceived warmth involves an individual's subjective evaluation of another person or entity, assessing traits such as approachability, friendliness, empathy, and genuineness. This perception reflects assessments of the other party's intentions, goodwill, and amiability towards oneself and others. Warmth perception is identified in frontline research as essential for enhancing the perceived value of services (Belanche et al. 2021). Perceived warmth is described variously in the literature, including terms such as empathy (Liu-Thompkins, Okazaki, and Li 2022), benevolence (Ogbeibu, Senadjki, and Gaskin 2018), and affective trust (Hildebrand and Bergner 2021). It is reasonable to propose that perceived warmth leads to proximity behavior (Cuddy, Fiske, and Glick 2008; Fiske, Cuddy, and Glick 2007), conveying to the consumer that the service provider genuinely cares about their needs (Belanche et al. 2021), thereby enhancing satisfaction and promoting consumption.

Meanwhile, the concept of perceived competence, as defined by Ames and Flynn (2007), refers to an individual's subjective assessment of another person or entity's aptitude, proficiency, expertise, and capabilities within a specific domain. This concept is vital for understanding social interactions, particularly when evaluating the impact of social presence and perception in digital environments (Čaić et al. 2020; Kim and Hur 2024). For example, in task-oriented human-agent interaction service scenarios, perceiving an agent's capabilities positively affects consumers' service value expectations and behavioral intentions (Belanche et al. 2021).

Research has consistently shown that nonhuman entities are often perceived as human-like when attributed to warmth and competence (Aaker, Garbinsky, and Vohs 2012; Fiske, Cuddy, and Glick 2007). This perception tends to enhance the consumer experience, particularly in interactions with chatbots (Hu et al. 2021; Kim and Hur 2024) and service robots (Stroessner and

Benitez 2019). However, direct evidence connecting specific anthropomorphic characteristics of digital agencies to these dimensions of social perception is still limited. This research focuses on how the specific characteristics of digital agencies—interactivity, authenticity, and companionship—influence social perceptions. Interactivity fosters a sense of involvement and can enhance the perceived warmth and competence of the digital agency by making the interaction feel more personal and responsive (Coyle and Thorson 2001; Jun and Yi 2020). An authentic digital agency can be perceived as more competent and warm because it appears more reliable and trustworthy (de Brito Silva et al. 2022). Companionship involves the degree to which a digital agency emulates a companion or friend, enhancing the perception of warmth by providing a sense of closeness (Lee et al. 2017). Based on these premises, we propose the following hypotheses:

**H1** *Perceived agency characteristics—interactivity (H1a), authenticity (H1b), and companionship (H1c) — have positive effects on consumers' perceived warmth.*

**H2** *Perceived agency characteristics—interactivity (H2a), authenticity (H2b), and companionship (H2c)—have positive effects on consumers' perceived competence.*

### 2.3 | Connectional Outcome–Para-Social Relationship Building

The intersection of human interaction and technology has significantly evolved, fostering complex relationships between humans and digital entities. Specifically, two factors—superiority (Obrenovic et al. 2024) and dependency (Han and Yang 2018; Ramadan, F. Farah, and El Essrawi 2021)—have garnered significant attention as anchors for understanding the relationship between human and digital identities. Various positions of human-agency relations within digital contexts can be mapped through these factors, leading to three typical views:

1. The first view is characterized by the functional extension of individual power, with the user exercising intellectual or affective control over digital functionalities, such as in discussions about the role of autonomous robots in human work (Hu et al. 2021; Wu, Wang, and Yuen 2023).
2. The second view suggests that digital agencies possess comparable intelligence, capability, and emotional resonance, which leads consumers to develop deeper relationships with them, as seen in the discussion about intelligence personal assistants research (Chen, Hyun, and Lee 2022; Han and Yang 2018).
3. The third view emphasizes the superiority of digital entities in terms of capability, recognizing the exceptional features of robots with super-computing capability and reasoning power, which raises concerns about AI potentially overriding human actions (Obrenovic et al. 2024).

Marketing researchers increasingly examine the dynamics between humans and interaction objects using communication theories from multiple perspectives, such as para-social relationship theory (Horton and Richard Wohl 1956). Through these lenses, para-social relationship theory, particularly in

alignment with the second view, offers valuable insights into how consumers perceive and interact with digital intelligence and interfaces (Han and Yang 2018; Tsai, Liu, and Chuan 2021). Para-social relationship theory highlights the impact of these relationships on marketing outcomes. Previous research demonstrates how para-social relationships can enhance brand engagement, trust, decision-making processes, and consumer loyalty through the intimate connections formed between consumers and brand representatives, such as influencers or mascots (Aw and Labrecque 2023; Labrecque 2014). Moreover, consumers' tendency to follow the advice of trusted social partners underscores the practical effectiveness of para-social relationships in marketing (Djafarova and Rushworth 2017).

Building on the foundational insights of the Stereotype Content Model, the dynamics between consumers and brands mirror interpersonal relationships, eliciting similar emotional responses and influencing consumer behavior (Kervyn, Fiske, and Malone 2012). Research indicates that consumers evaluate brands along the same dimensions as people—specifically, intention and competence—suggesting that the cognitive processes underlying brand and interpersonal assessments are similar (Aaker, Garbinsky, and Vohs 2012; Kervyn, Fiske, and Malone 2012). Additionally, Aaker, Garbinsky and Vohs (2012) argued that perceived warmth and competence are pivotal in establishing consumer-brand relationships. Inspired by these insights, our study extends the applicability of the Stereotype Content Model and para-social relationship theories to the unexplored field of human-agency interactions. For example, the perception of warmth and competence in service robots positively affects consumers' expectation value (e.g., social and emotional value), which are integral to forming and maintaining long-term relationships, such as loyalty (Belanche et al. 2021). Moreover, current research demonstrates that socially assistive digital agents can make consumers feel understood and foster social connections (Čaić, Odekerken-Schröder, and Mahr 2018). This extension is based on the premise that just as consumers anthropomorphize brands by attributing human-like qualities, they may also perceive and interact with digital agencies through the lens of para-social relationships and stereotypical content considerations. Therefore, the following hypotheses are proposed:

**H3a** *Consumers' perceived warmth towards digital agencies positively impacts their establishment of para-social relationships.*

**H3b** *Consumers' perceived competence towards digital agencies positively impacts their establishment of para-social relationships.*

Based on the review of key characteristics of digital agencies in Section 2.1, research has found that authenticity positively influences consumer perceptions (Cinelli and LeBoeuf 2020), higher levels of interactivity in web marketing enhance user engagement and satisfaction (Coyle and Thorson 2001), and perceived companionship can provide users with social support (Lee et al. 2017), further strengthening their relationship with the interactive entity. Drawing from these insights, it is posited that these characteristics of digital agencies significantly enhance human-agency relationships. Accordingly, we propose the following hypotheses:

**H4a** Consumers' perceived interactivity with digital agencies positively impacts their establishment of para-social relationships.

**H4b** Consumers' perceived authenticity of digital agencies positively impacts their establishment of para-social relationships.

**H4c** Consumers' perceived companionship with digital agencies positively impacts their establishment of para-social relationships.

## 2.4 | Continued Usage Intention

In marketing communication, continuance intention refers to a consumer's decision to use a product or service over time (Hsieh, Rai, and Keil 2008). This intention is significantly influenced by satisfaction, perceived usefulness, and previous usage experiences (Bhattacharjee 2001). In the context of human-agency interaction, the determinants of consumers' continuance intentions expand to include user interface design (Pizzi et al. 2023), perceived interactivity (Etemad-Sajadi 2016), and the impact of social influence and community support (Chen, Sengupta, and Adaval 2018). These factors enhance user satisfaction and foster sustained engagement with digital platforms and services (Söderlund and Oikarinen 2021).

Social perceptions play a crucial role in influencing consumer behaviors, with recent expansions into human-agent interaction highlighting its importance (Belanche et al. 2021; Hu et al. 2021). For instance, the autonomy of virtual assistants has been shown to affect consumers' perceptions of their warmth and competence, which in turn influences their willingness to continue usage (Hu et al. 2021). Similarly, research by Stroessner and Benitez (2019) indicates that robots perceived as warm can create high levels of comfort, leading to positive evaluations and an increased desire for engagement. In the context of human-agency interaction, we hypothesize that the social perceptions of digital agencies significantly influence the consumer's continuation intentions (Pizzi et al. 2023). Accordingly, we propose the following hypotheses:

**H5a** Perceived warmth positively impacts continued usage intention.

**H5b** Perceived competence positively impacts continued usage intention.

Research has consistently shown that solid emotional engagement, such as attachment (Malär et al. 2011) and interaction (Etemad-Sajadi 2016), plays a crucial role in shaping continued usage intentions. Tsiotsou (2015) found that para-social interactions with video game characters significantly fostered players' loyalty and emotional connection, subsequently influencing their continued engagement with the game. Similarly, in the context of intelligent personal assistants, research has demonstrated that forming para-social relationships enhances user satisfaction, positively affecting their willingness to continue using the service (Han and Yang 2018; Tsai, Liu, and Chuan 2021). Despite these insights, gaps remain in our understanding of the antecedents that lead users to develop para-

social relationships with digital agencies, particularly how the characteristics of these agencies influence users' continuation intentions. To address this gap, we propose the following hypothesis:

**H5c** The establishment of para-social relationships positively impacts continued usage intention.

## 2.5 | Role of Digital Coaches' Types

Digital agencies serve as intermediaries or independent entities that extend beyond the roles of service providers and recipients, encompassing agents and avatars (Nowak and Biocca 2003). Digital agents, governed by a computer or algorithm (Morkes, Kernal, and Nass 1999), mediate interactions within human-computer interaction (Gong and Nass 2007), or human-robot interaction (Ciechanowski et al. 2019). In contrast to digital agents, digital avatars are virtual representations controlled by individuals, embodying a specific form of computer-mediated communication and personal expression (Morkes, Kernal, and Nass 1999; Nowak and Biocca 2003). Historically, users' acceptance of such technologies has been evaluated through functional characteristics like usefulness and ease of use (Davis 1989). As technology advances, specific attributes of digital agencies, including their ability to facilitate social activity, interpersonal interaction, control, sensation seeking, and innovativeness, significantly influence their sociability and effectiveness in fostering perceptual connections and influencing user behavior (Čaić et al. 2020; Söderlund and Oikarinen 2021).

Some digital agencies are equipped with human-like features that can make users feel as though they are interacting with an actual human assistant (Epley et al. 2008; Pizzi et al. 2023). However, it is crucial to acknowledge that these interactions do not equate to human-human interactions, as users remain aware that they are engaging with a digital agency. This awareness can significantly affect their engagement and overall experience in various scenarios. A meta-analysis by Fox et al. (2015) highlighted that participants' perceptions of digital entities were markedly influenced by whether they were informed they were interacting with an agent or an avatar. Given the subtle yet significant differences in how avatars and agents are perceived and their consequential impact on user experience and engagement, we propose the following hypotheses:

**H6a** The strength of the relationships between perceived agencies' characteristics and social perception will differ between agents, avatars, or human coaches.

**H6b** The strength of the relationships between perceived agencies' characteristics and para-social relationships will differ between agents, avatars, or human coaches.

**H6c** The strength of the relationships between social perception and para-social relationships will differ between agents, avatars, or human coaches.

**H6d** The strength of the relationships between social perception, para-social relationships, and continued usage intention will differ between agents, avatars, or human coaches.

## 2.6 | Role of Appearance Anthropomorphic Level

Anthropomorphism is the attribution of human characteristics or traits to nonhuman agencies (Epley, Waytz, and Cacioppo 2007). Incorporating anthropomorphism in digital communications significantly enhances the interaction experience by influencing consumer behavior and improving communication efficiency. Epley et al. (2008) discussed the motivational determinants of anthropomorphism, highlighting that social connection needs directly impact how digital agents are perceived and accepted. This was further elaborated by Epley et al. (2007) three-factor theory of anthropomorphism, which identified elicited agent knowledge, effectance motivation, and sociality motivation as critical in anthropomorphizing nonhuman entities.

Research has demonstrated that endowing nonhuman entities with human-like characteristics can affect user behavior in various contexts. For example, Blut et al. (2021) provided evidence from a meta-analysis showing the significant impact of anthropomorphic features in service provision, reinforcing the importance of service robots' humanlike characteristics in consumer perceptions. More specifically, Pelau, Dabija and Ene (2021) emphasized the role of interaction quality, empathy, and perceived psychological characteristics in the acceptance of AI in the service industry, aligning with this study's focus on enhancing user experience through anthropomorphism. Similarly, studies like those by Lim et al. (2024) have shown that participants exhibit fewer negative reactions toward less anthropomorphized robots. However, it has also been observed that lower levels of anthropomorphism may lead to less intense psychological engagement, suggesting a complex relationship between levels of anthropomorphism and user experience (Ciechanowski et al. 2019).

Therefore, it is necessary to further investigate the effects of different anthropomorphic appearances of digital agencies in various manipulation scenarios, particularly in the context of online fitness environments, where the nature of interactive objects can significantly influence consumer psychological perception (Nowak and Rauh 2005). We have defined the H7 and H8 as follows:

### In avatar groups:

**H7a** *The strength of the relationship between perceived agencies' characteristics and social perception will differ between low- and high-anthropomorphism avatar coach groups.*

**H7b** *The strength of the relationship between perceived agencies' characteristics and para-social relationships will differ between low- and high-anthropomorphism avatar coach groups.*

**H7c** *The strength of the relationship between social perception and para-social relationship will differ between low- and high-anthropomorphism avatar coach groups.*

**H7d** *The strength of the relationship between social perception, para-social relationship, and continued usage intention will differ between low- and high-anthropomorphism avatar coach groups.*

### In agent groups:

**H8a** *The strength of the relationship between perceived agencies' characteristics and social perception will differ between low- and high-anthropomorphism agent coach groups.*

**H8b** *The strength of the relationship between perceived agencies' characteristics and para-social relationship will differ between low- and high-anthropomorphism agent coach groups.*

**H8c** *The strength of the relationship between social perception and para-social relationship will differ between low- and high-anthropomorphism agent coach groups.*

**H8d** *The strength of the relationship between social perception, para-social relationship, and continued usage intention will differ between low- and high-anthropomorphism agent coach groups.*

## 2.7 | Role of Types of Support (Emotional vs. Technical)

The distinction between emotional support and technical support has attracted considerable interest in recent years, particularly within the realm of online interactions and digital agencies (e.g., online communities, digital coaching systems, and social media) (Bickmore et al. 2012; Gelbrich, Hagel, and Orsingher 2021; Golaszewski et al. 2022). Emotional support involves aiding individuals by primarily addressing their emotional needs and providing comfort, empathy, and reassurance to enhance well-being and alleviate stress (Cohen and Wills 1985). Importantly, emotional support plays a crucial role in online health communities, where empathy and understanding significantly impact participants' mental health and their commitment to healthy behaviors (Lin and Kishore 2021). Similarly, in sports, emotional support from digital coaches has been linked to increased motivation and sustained engagement in health and fitness programs (Golaszewski et al. 2022).

On the other hand, previous research has predominantly conceptualized technical support as a consumer's perception of the capabilities, ability, and usefulness of the objects they interact with. Technical support is thereby defined as focusing on providing solutions to specific problems, usually related to product or service functionality, and aims to enhance users' knowledge or resolve technical issues (Das 2003; Nambisan 2011). Such support is deemed essential for enabling users to effectively utilize technology tools to achieve their intended purposes, thereby enhancing user experience and maintaining service quality (Gelbrich, Hagel, and Orsingher 2021).

A notable trend is that digital agencies are increasingly designed with human-like characteristics to provide both emotional and technical support. However, the effectiveness of these types of support may vary depending on the context and individual user preferences. Studies have indicated that users often respond positively to digital agents that exhibit empathy (Kim and Hur 2024), while others have shown that in technical support forums, users prefer clear and concise technical advice over

emotional comfort (M. Liu et al. 2020). This variation suggests that the desired balance between emotional and technical support may fluctuate based on users' immediate needs and the nature of the platform. We therefore hypothesized:

**H9a** *The strength of the relationship between perceived agencies' characteristics and social perception will differ between digital coaches who provide emotional and technical support.*

**H9b** *The strength of the relationship between perceived agencies' characteristics and para-social relationships will differ between digital coaches who provide emotional and technical support.*

**H9c** *The strength of the relationship between social perception and para-social relationships will differ between digital coaches who provide emotional and technical support.*

**H9d** *The strength of the relationship between social perception, para-social relationships, and continued usage intention will differ between digital coaches who provide emotional and technical support.*

## 2.8 | Behavioral Outcome–Online Fitness Subscription

Subscriptions, as a particular form of consumer relationship that embodies loyalty, are characterized by repeated deliveries rather than single purchases (Kerschbaumer et al. 2023). With the rise of online subscription services, some scholars have begun to explore consumer attitudes and actual behavior in music and video streaming services (Cesareo and Pastore 2014; Mäntymäki, Islam, and Benbasat 2020). Chakraborty et al. (2023) demonstrated that trust, stemming from emotional and functional value perceptions, is a significant predictor of subscription renewal intentions on over-the-top platforms. Usage intention is pivotal in driving actual consumer behavior, particularly in subscription-based services. In fact, Claudy, Garcia and O'Driscoll (2015) have extended the understanding of the intention-behavior gap based on behavioral reasoning theory, reinforcing the notion that intention is a critical precursor to adoption behavior, however, they do not empirically test the link between adoption intention and actual behavior. Thus, we posited that in online fitness platforms, there is a positive relationship between the intention to continue using the service and the likelihood of subscribing:

**H10** *Continued usage intention has a positive relationship with Online Fitness Subscriptions*

*Five studies were conducted based on those mentioned above: Study 1 examined the structural model, Study 2 explored the role of digital agency types, Study 3 investigated the impact of anthropomorphic appearance level in digital agencies, Study 4 analyzed the effects of different types of support provided by digital agencies, and Study 5 tested the relationship between continued usage intention and online fitness subscriptions. Figure 1 illustrates the proposed research model.*

## 3 | Methodology

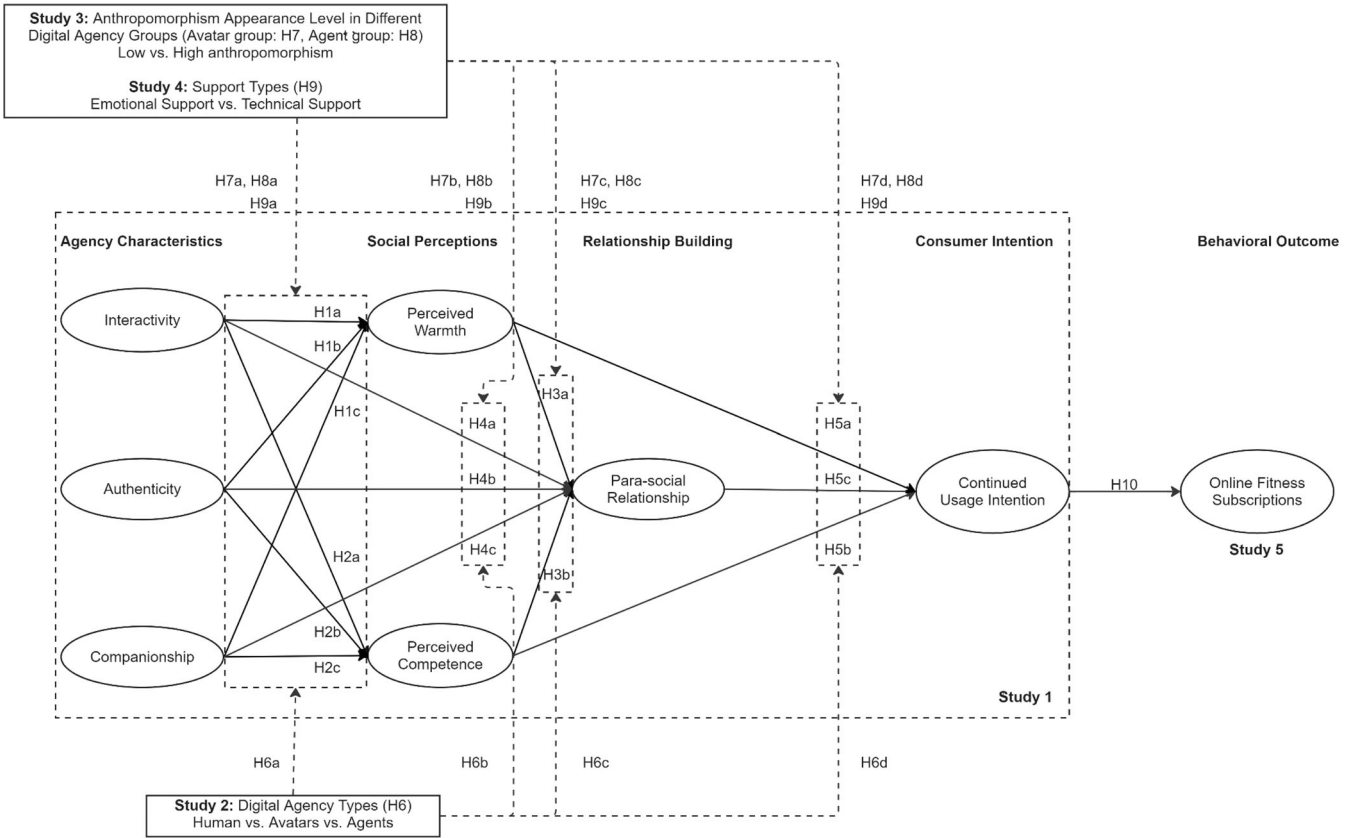
### 3.1 | Measurement

To ensure the validity and reliability of the measurement items, we utilized items from existing scales that were empirically tested in relevant previous studies (see Appendix B). Specifically, four measurement items for both *interactivity* and *para-social relationships* were adapted from Labrecque (2014). For the concept of *authenticity*, three measurement items were adapted from Nowak (2001). The study also included four measurement items for *companionship* (Bickmore et al. 2012; Buhrmester and Furman 1987; Lee et al. 2017). Additionally, the study adapted a three-item scale for *perceived warmth* as well as a three-item scale for *perceived competence* (Čaić et al. 2020; Johnson and Grayson 2005). Finally, *continued usage intention* was assessed using a five-item measure adapted from Bhattacharjee (2001) and Davis, Bagozzi and Warshaw (1992). All these measurements were assessed via semantic scales with 7-point Likert scale anchors ranging from 1 (strongly disagree) to 7 (strongly agree). Additionally, we used categorical variables to measure participants' willingness to subscribe to online fitness: (1) Recurring subscriptions: "I decided to subscribe to this coach's courses for next year," and (2) Non-recurring subscriptions: "I decided not to subscribe to this coach's courses for next year". Importantly, before data collection commenced, the university's ethics committee approved the questionnaire and sampling procedures.

### 3.2 | Initial Investigation Procedure

To minimize the potential for error in our study, a pilot test was first conducted in May 2022 to ensure the effectiveness of the stimuli of the digital agency types and anthropomorphic features. Eleven participants were invited to confirm the successful manipulation of the experimental scenarios and video stimuli. For example, the length of the experimental video was adjusted from 20 to 60 s to ensure that participants were fully immersed in the experimental scenarios. Additionally, 104 participants were invited to undergo a bias test, and all the images of digital coaches used in the experiment passed the bias test, indicating that participants did not exhibit any appearance bias against the five digital coaches. In the pre-experiment questionnaire, we included a question to assess participants' prior experience with online exercise: "Have you ever attended an online exercise before?" This question helped us gauge participants' baseline intentions and familiarity with online fitness trainers. Over 98% of participants indicated that they had used online fitness platforms before, suggesting a high prior engagement with such services.

Subsequently, a web-based quasi-experiment was conducted to collect data from June to August 2022. Respondents were recruited from Credamo (<https://www.credamo.com/#/>), a Chinese professional platform for online psychological experiments with a sample pool of 3 million participants. Data were collected nationwide from diverse demographics to represent the general public accurately. To ensure data quality, the following settings were implemented:



**FIGURE 1** | Proposed research model.

- i. Participants could only access the experiment via the computer-based webpage to ensure that they viewed the experimental video;
- ii. The response area was limited to one participant within a 1 km radius by IP address, and each IP address could only be attended once;
- iii. Samples with a response time of fewer than 400 s were classified as ineligible;
- iv. Participants received 10 RMB (approximately 1.17 GBP) as a token of appreciation for their participation in the experiment.

### 3.3 | Experiment Procedure

The experiment was divided into three phases: pre-experiment questionnaire filling, experimental scenario stimulation (watching a 1-min sports fitness video), and post-experiment questionnaire filling.

After reading the purpose of the experiment and the consent form, the participants were asked to complete a pre-experiment questionnaire, which included their previous exercise experience and demographic information such as gender, age, education, and income. Participants were then randomly assigned to a fitness trial session where they were informed whether the digital coach guiding them through the fitness training was a human coach, a digital avatar of a human coach, or an agent coach. They were asked to watch a 1-min fitness video featuring

the digital coach. More specifically, in Study 1 and Study 5, participants watched a video featuring one of five different coaches (see Figure 2). In Study 2, participants watched a video featuring one of three different coaches (see Figure 4). In Study 3, participants watched a video featuring one of four different coaches (see Figure 5). In Study 4, one group of participants saw coaches who provided emotional support during the interaction (i.e., coach introduction and video playing stage, see Figure 6), while others saw coaches who provided technical support.

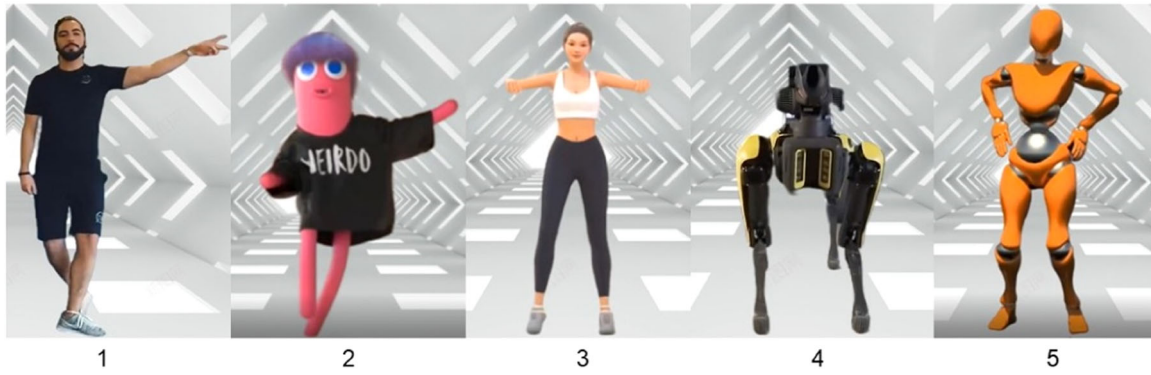
After watching the video, participants completed a questionnaire about their fitness experience and psychological perceptions of the digital coach. Finally, participants were asked to recall the type of coach they interacted with, providing a validity check for the experimental manipulation.

### 3.4 | Manipulation Check

A rigorous manipulation check procedure was implemented to ensure the effectiveness of the experimental manipulations regarding digital agency types, levels of anthropomorphic appearance, and types of support. In this between-subject quasi-experiment, participants were randomly assigned to watch coaching videos featuring different types of coaches (human, agent, or avatar), levels of anthropomorphism (low vs. high), and types of support (emotional or technical) scenarios.

To assess the manipulation of digital agency types, participants were asked a specific recall question to determine the type of





**FIGURE 2** | Digital coaches stimulus. 1. Human coach: a real human trainer; 2. Avatar coach-low anthropomorphism: a cartoonish avatar with minimal human-like features; 3. Avatar coach-high anthropomorphism: a cartoonish avatar with enhanced human-like features; 4. Agent coach-low anthropomorphism: a robotic agent with minimal human-like features; 5. Agent coach-high anthropomorphism: a robotic agent with enhanced human-like features.

digital coach they interacted with after viewing the video: “Was the coach you interacted with a human, an avatar, or an agent?” This question aimed to confirm whether participants correctly identified the digital agency type presented in the experiment. Similarly, to verify the type of support provided by the coach, participants were asked: “Did the coach provide primarily emotional support (e.g., motivational phrases) or technical support (e.g., specific exercise instructions)?” This question ensured that participants accurately recalled the nature of support provided during the interaction. During the data cleaning phase, the authors compared the recall answers with the provided experimental group numbers, and incorrect recalls led to the exclusion of data from three subjects. The recall accuracy for digital agency types and types of support was above 95%, validating our manipulation procedures (Oppenheimer, Meyvis, and Davidenko 2009).

The manipulation of anthropomorphism was evaluated through a query regarding the coach’s resemblance to a real person on a 7-point Likert scale (1 = not at all, 7 = very much) after viewing the video. The question was: “How similar did the coach look to a real human being?” Independent samples t-tests showed significant differences ( $t = 5.432$ ,  $df = 9$ ,  $p < 0.001$ ) between the high anthropomorphism group ( $M = 3.97$ ,  $SD = 1.086$ ) and the low anthropomorphism group ( $M = 2.44$ ,  $SD = 1.260$ ), indicating effective manipulation as participants discerned the intended levels of anthropomorphism.

## 4 | Results

Several statistical analyses were conducted with the assistance of SPSS 28 and SmartPLS 4 software for structural equation modeling and multigroup analysis. In the first stage, SPSS 28 was utilized to test for the common method bias. Subsequently, SmartPLS4 was used to test both the validity and reliability of the measurement and structural models. In particular, some measures in this study were adapted to suit the composite-based structural equation modeling technique for Study 1’s exploratory analysis and to address model identification issues, with H1–H5 being tested. Also, measurement invariance of composite models (MICOM) analysis and multigroup bootstrap analysis (MGA) were employed for Study 2 to Study 4,

examining H6–H9. Finally, a logistic regression test was used to examine Study 5.

### 4.1 | Study 1: Para-Social Relationship Building

#### 4.1.1 | Descriptive Statistics

In Study 1, participants were randomly assigned to interact with all types of digital coaches (i.e., human coach, avatar coach with low or high anthropomorphism, and agent coach with low or high anthropomorphism) to test the applicability of our conceptual model comprehensively. As shown in Figure 2, 1548 responses were collected for Study 1. After removing both incomplete and outlier responses, 1488 samples remained for testing the research model (see Appendix D for Study 1’s demographic data). To ensure nonresponse bias, the means of all variables were compared between early (the first 5% of participants who responded) and late (the last 5% of participants who responded). The mean scores for all main variables used in this study were not significantly different between the early and late responses at the 5% significance level (see Appendix C).

#### 4.1.2 | Common Method Bias

The utilization of self-reported data in any study may introduce common method bias (Podsakoff et al. 2003). To address this concern, we conducted the full collinearity test (Kock and Lynn 2012). Multicollinearity was diagnosed using the variance inflation factor (VIF) test, and reversed coding was employed. The results indicate that multicollinearity is not a limitation of the study, as all VIFs are below 5.0 (Hair et al. 2022) (see Appendix E; Study 1).<sup>1</sup>

#### 4.1.3 | Measurement Model Test

As shown in Appendix E, the reliability and validity of the measurements were tested. All factor loading values of the constructs exceeded the 0.70 threshold (Hair et al. 2022). Cronbach’s alpha and composite reliability values of the measurement construct were also greater than the threshold of 0.70 (Hair et al. 2022), indicating satisfactory reliability. Additionally, all values of the average

variance extracted (AVE) for the measurement constructs exceeded the threshold of 0.50 (Fornell and Larcker 1981), demonstrating acceptable convergent validity. Furthermore, to establish discriminant validity, Appendix F displays the results of the heterotrait-and-monotrait (HTMT) matrix correlation. Our results indicate that none of the HTMT values were above the conservative threshold value of 0.90 (Henseler, Ringle, and Sarstedt 2015), suggesting good discriminant validity.

#### 4.1.4 | Structural Model Test

The structural model was evaluated using the bootstrapping method (Henseler, Hubona, and Ray 2016). The standardized root mean square residual (SRMR) value was utilized to assess the goodness of fit of the structural model. As shown in Figure 3, the SRMR value is 0.051, which is below the threshold of 0.08 (Henseler, Hubona, and Ray 2016). The value of NFI is 0.903, exceeding the threshold of 0.90. These results provided adequate evidence to support the model fit (Henseler and Schubert 2020).

Furthermore, 67.3% of the variance in perceived warmth and 74.9% in perceived competence were explained by perceived characteristics of agencies (interactivity, authenticity, and companionship). Additionally, 83.9% of the variance in para-social relationships was explained by perceived warmth and competence, while para-social interaction explained 85.7% of the variance in continued usage intention. These results illustrate that agency characteristics can positively influence users' social perceptions. Moreover, these characteristics and social perceptions can help users build para-social relationships with digital coaches, consequently affecting their continued usage intentions.

Figure 3 shows that interactivity ( $\beta_{\text{interactivity} \rightarrow \text{perceived warmth}} = 0.408$ ,  $p < 0.001$ ), authenticity ( $\beta_{\text{authenticity} \rightarrow \text{perceived warmth}} = 0.076$ ,  $p < 0.05$ ) and companionship ( $\beta_{\text{companionship} \rightarrow \text{perceived warmth}} = 0.397$ ,  $p < 0.001$ ) had a significant positive effect on perceived warmth. Therefore, H1 was supported. Similarly, interactivity ( $\beta_{\text{interactivity} \rightarrow \text{perceived competence}} = 0.285$ ,  $p < 0.001$ ), authenticity ( $\beta_{\text{authenticity} \rightarrow \text{perceived competence}} = 0.219$ ,  $p < 0.001$ ), and companionship ( $\beta_{\text{companionship} \rightarrow \text{perceived competence}} = 0.434$ ,  $p < 0.001$ ) had significant positive

effects on perceived competence. Hence, H2 was supported. These findings highlighted that the perception of digital coaches' characteristics can directly affect consumers' perceived warmth and competence during the interaction.

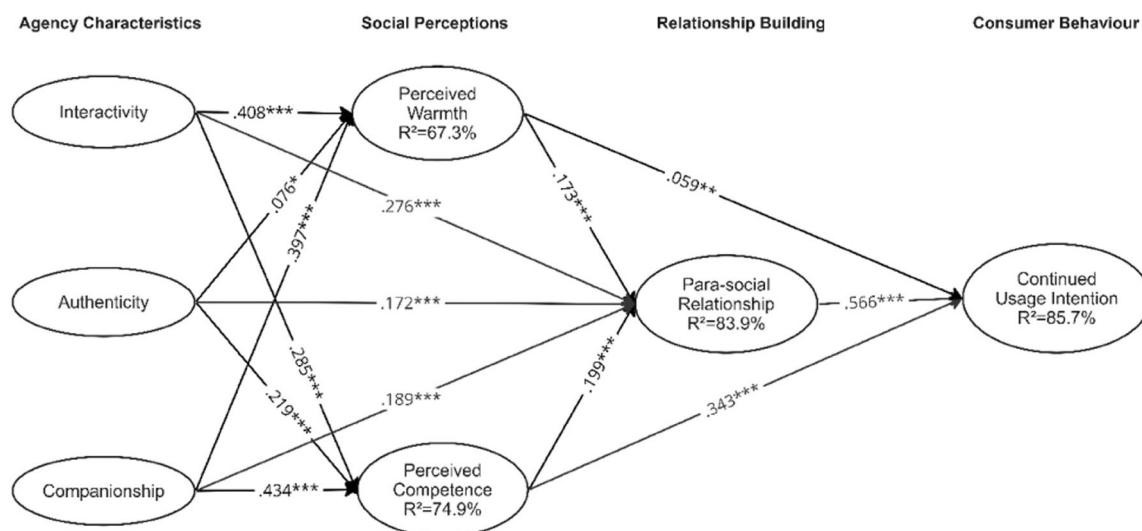
Additionally, perceived warmth ( $\beta_{\text{perceived warmth} \rightarrow \text{para-social relationship}} = 0.173$ ,  $p < 0.001$ ) and perceived competence ( $\beta_{\text{perceived competence} \rightarrow \text{para-social relationship}} = 0.199$ ,  $p < 0.001$ ) were significantly related to the establishment of para-social relationship. Therefore, H3 was supported. Moreover, perceived characteristics of agencies ( $\beta_{\text{interactivity} \rightarrow \text{para-social relationship}} = 0.276$ ,  $p < 0.001$ ;  $\beta_{\text{authenticity} \rightarrow \text{para-social relationship}} = 0.172$ ,  $p < 0.001$ ;  $\beta_{\text{companionship} \rightarrow \text{para-social relationship}} = 0.189$ ,  $p < 0.001$ ) also significantly contributed to the building of para-social relationship. Hence, H4 was supported. These findings suggest that consumers' perceived characteristics and social perceptions of a digital coach can positively impact their building of para-social relationships with this digital coach.

Furthermore, significant relationships were found between perceived warmth ( $\beta_{\text{perceived warmth} \rightarrow \text{continued usage intention}} = 0.059$ ,  $p < 0.01$ ), perceived competence ( $\beta_{\text{perceived competence} \rightarrow \text{continued usage intention}} = 0.343$ ,  $p < 0.001$ ), and para-social relationship ( $\beta_{\text{para-social relationship} \rightarrow \text{continued usage intention}} = 0.566$ ,  $p < 0.001$ ) with continued usage intention, respectively. Therefore, H5 was supported. The findings indicate that establishing para-social relationships and competence perception significantly impacted consumers' willingness to continue watching the online fitness course. Although perceiving warmth can also have a positive influence, its effect was limited.

#### 4.1.5 | Mediating Effect

A bootstrapping approach (Hayes 2009) was used to test whether social perception mediated the impacts of digital agency characteristics on para-social relationships and whether para-social relationships mediated the social perception of continued usage intention.

As shown in Table 1, the indirect effects of interactivity ( $\beta_{\text{interactivity} \rightarrow \text{perceived warmth} \rightarrow \text{para-social relationship}} = 0.071$ ,  $t = 6.267$ ,



**FIGURE 3** | Path analysis results. \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$  (two-tailed), SRMR = 0.051, NFI = 0.903.

TABLE 1 | Mediation effect results.

Paths	Total effect			Direct effect			Indirect effect					
	$\beta$	$t$	$p$	$\beta$	$t$	$p$	$\beta$	$t$	$p$	LLCI	ULCI	Results
Interactivity → perceived warmth → para-social relationship	0.403	14.258	0.000***	0.276	9.445	0.000***	0.071	6.267	0.000***	0.050	0.094	Partial
Interactivity → perceived competence → para-social relationship							0.057	5.652	0.000***	0.038	0.078	Partial
Authenticity → perceived warmth → para-social relationship	0.229	8.592	0.000***	0.172	7.022	0.000***	0.013	2.262	0.024*	0.002	0.025	Partial
Authenticity → perceived competence → para-social relationship							0.044	5.070	0.000***	0.028	0.062	Partial
Companionship → perceived warmth → para-social relationship	0.344	13.635	0.000***	0.189	7.396	0.000***	0.069	5.660	0.000***	0.047	0.094	Partial
Companionship → perceived competence → para-social relationship							0.086	6.323	0.000***	0.060	0.114	Partial
Perceived warmth → para-social relationship → continued usage intention	0.157	6.772	0.000***	0.059	2.777	0.006**	0.098	6.876	0.000***	0.071	0.127	Partial
Perceived competence → para-social relationship → continued usage intention	0.456	16.607	0.000***	0.343	13.206	0.000***	0.113	6.714	0.000***	0.080	0.145	Partial

Note:  $\beta$  = coefficient,  $t$  = T-value, Percentile bootstrap: 95% confidence interval, LLCI/ULCI = lower (2.5%)/upper (97.5%) limit of the confidence interval. \*\*\* $p$  < 0.001; \*\* $p$  < 0.01; \* $p$  < 0.05.

$p < 0.001$ ; 95% CI: [0.050, 0.094]), authenticity ( $\beta_{\text{authenticity} \rightarrow \text{perceived warmth} \rightarrow \text{para-social relationship}} = 0.013$ ,  $t = 2.262$ ,  $p < 0.05$ ; 95% CI: [0.002, 0.025]), and companionship ( $\beta_{\text{companionship} \rightarrow \text{perceived warmth} \rightarrow \text{para-social relationship}} = 0.069$ ,  $t = 5.660$ ,  $p < 0.001$ ; 95% CI: [0.047, 0.094]) on para-social relationship regarding perceived warmth were significant. The indirect effects of interactivity ( $\beta_{\text{interactivity} \rightarrow \text{perceived competence} \rightarrow \text{para-social relationship}} = 0.057$ ,  $t = 5.652$ ,  $p < 0.001$ ; 95% CI: [0.038, 0.078]), authenticity ( $\beta_{\text{authenticity} \rightarrow \text{perceived competence} \rightarrow \text{para-social relationship}} = 0.044$ ,  $t = 5.070$ ,  $p < 0.001$ ; 95% CI: [0.028, 0.062]), and companionship ( $\beta_{\text{companionship} \rightarrow \text{perceived competence} \rightarrow \text{para-social relationship}} = 0.086$ ,  $t = 6.323$ ,  $p < 0.001$ ; 95% CI: [0.060, 0.114]) on para-social relationship regarding perceived competence were significant.

Additionally, the total effects ( $\beta_{\text{total (interactivity} \rightarrow \text{para-social relationship)}} = 0.403$ ,  $t = 14.258$ ,  $p < 0.001$ ;  $\beta_{\text{total (authenticity} \rightarrow \text{para-social relationship)}} = 0.229$ ,  $t = 8.592$ ,  $p < 0.001$ ;  $\beta_{\text{total (companionship} \rightarrow \text{para-social relationship)}} = 0.344$ ,  $t = 13.635$ ,  $p < 0.001$ ) and direct effects of interactivity ( $\beta_{\text{interactivity} \rightarrow \text{para-social relationship}} = 0.276$ ,  $t = 9.445$ ,  $p < 0.001$ ), authenticity ( $\beta_{\text{authenticity} \rightarrow \text{para-social relationship}} = 0.172$ ,  $t = 7.022$ ,  $p < 0.001$ ), and companionship ( $\beta_{\text{companionship} \rightarrow \text{para-social relationship}} = 0.189$ ,  $t = 7.396$ ,  $p < 0.001$ ) on para-social relationship were significant. Thus, the characteristics of digital agencies enhanced para-social relationships, partially mediated by perceived warmth and perceived competence.

Similarly, the indirect effects of perceived warmth ( $\beta_{\text{perceived warmth} \rightarrow \text{para-social relationship} \rightarrow \text{continued usage intention}} = 0.098$ ,  $t = 6.876$ ,  $p < 0.001$ ; 95% CI: [0.071, 0.127]) and perceived competence ( $\beta_{\text{perceived competence} \rightarrow \text{para-social relationship} \rightarrow \text{continued usage intention}} = 0.113$ ,  $t = 6.714$ ,  $p < 0.001$ ; 95% CI: [0.080, 0.145]) on continued usage intention regarding para-social relationship were significant. The total effects ( $\beta_{\text{total (perceived warmth} \rightarrow \text{continued usage intention)}} = 0.157$ ,  $t = 6.772$ ,  $p < 0.001$ ;  $\beta_{\text{total (perceived competence} \rightarrow \text{continued usage intention)}} = 0.456$ ,  $t = 16.607$ ,  $p < 0.001$ ) and direct effects of perceived warmth ( $\beta_{\text{perceived warmth} \rightarrow \text{continued$

usage intention = 0.059,  $t = 2.777$ ,  $p < 0.01$ ), and perceived competence ( $\beta_{\text{perceived competence} \rightarrow \text{continued usage intention}} = 0.343$ ,  $t = 13.206$ ,  $p < 0.001$ ) on continued usage intention were also significant. Hence, social perception triggered continued usage intention and was partially mediated by the para-social relationships.

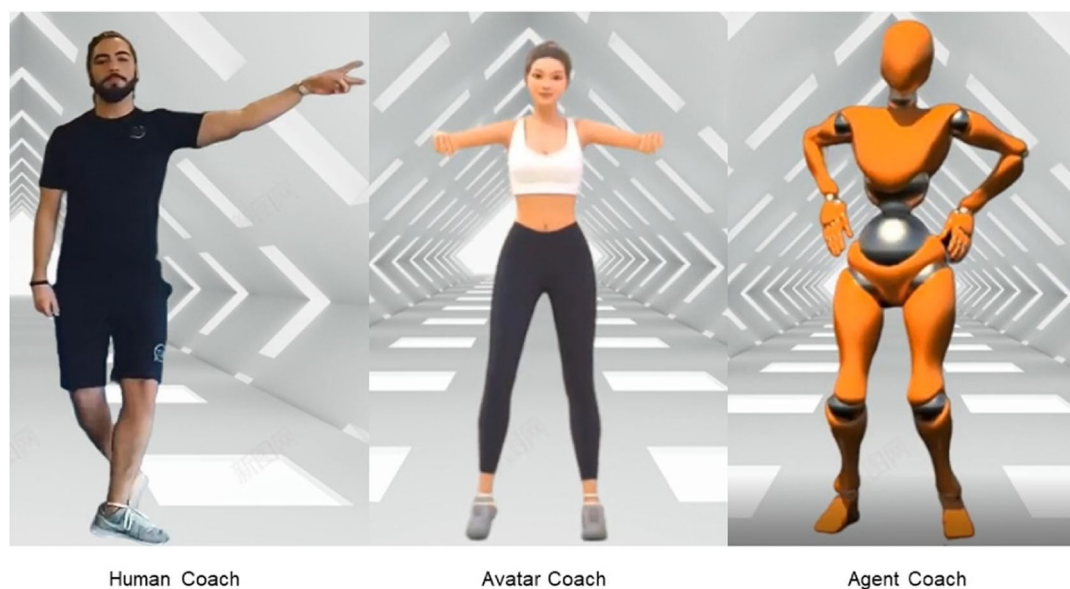
## 4.2 | Study 2: Role of Digital Agency Types

### 4.2.1 | Descriptive Statistics

To examine the role of different types of digital agencies, three experimental groups were created for Study 2 (901 samples): the human coach group comprised 292 samples, the avatar coach group comprised 290 samples, and the agent coach group comprised 319 samples (see Figure 4).<sup>2 3</sup> The demographic profile can be seen in Appendix D for Study 2.

### 4.2.2 | Measurement Invariance Test

Before examining the types of digital coaches,<sup>4</sup> MICOM testing was conducted, followed by group comparisons using MGA (Cheah, Amaro, and Roldán 2023; Henseler, Hubona, and Ray 2016). Our MICOM results show partial invariance, as the configural invariance test was achieved, and the permutation  $p$ -values for compositional invariance across the three comparison groups (human vs. avatar, human vs. agent, and avatar vs. agent) were insignificant ( $p$ -values were above 0.05; see Appendix G for Study 2). However, full measurement invariance could not be achieved because the permutation  $p$ -values for the study constructs' mean and variance invariance were less than 0.05. Therefore, a group comparison study of our proposed path coefficients among the three groups can be further examined.



**FIGURE 4** | Types of digital coach as stimulus.

### 4.2.3 | Assessment of Group Differences

Subsequently, MGA was conducted to explore the differences among the human, avatar, and agent coach groups. The differences in path coefficients between the three data sets are reported in Table 2.

First, the study verified between-group differences between agency characteristics perceptions and social perceptions. The results indicated that the relationships between authenticity and perceived warmth, as well as authenticity and perceived competence, varied across the three groups. These relationships in the human coach group ( $\beta_{\text{human}}$  (authenticity  $\rightarrow$  perceived warmth) = 0.156,  $p < 0.05$ ,  $\beta_{\text{human}}$  (authenticity  $\rightarrow$  perceived competence) = 0.303,  $p < 0.001$ ) were stronger than in the avatar ( $\beta_{\text{avatar}}$  (authenticity  $\rightarrow$  perceived warmth) = 0.007,  $p = 0.465$ ,  $\beta_{\text{avatar}}$  (authenticity  $\rightarrow$  perceived competence) = 0.177,  $p < 0.01$ ) and agent coach groups ( $\beta_{\text{agent}}$  (authenticity  $\rightarrow$  perceived competence) = 0.166,  $p < 0.01$ ). However, the relationship between companionship and perceived warmth and perceived competence in the human coach group ( $\beta_{\text{human}}$  (companionship  $\rightarrow$  perceived warmth) = 0.233,  $p < 0.001$ ,  $\beta_{\text{human}}$  (companionship  $\rightarrow$  perceived competence) = 0.305,  $p < 0.001$ ) were weaker than the avatar group ( $\beta_{\text{avatar}}$  (companionship  $\rightarrow$  perceived warmth) = 0.442,  $p < 0.001$ ) and the agent group ( $\beta_{\text{agent}}$  (companionship  $\rightarrow$  perceived warmth) = 0.432,  $p < 0.001$ ,  $\beta_{\text{agent}}$  (companionship  $\rightarrow$  perceived competence) = 0.433,  $p < 0.001$ ). Also, the relationship between interactivity and perceived competence in the human coach group ( $\beta_{\text{human}}$  (interactivity  $\rightarrow$  perceived competence) = 0.243,  $p < 0.001$ ) was weaker than the avatar group ( $\beta_{\text{avatar}}$  (interactivity  $\rightarrow$  perceived competence) = 0.396,  $p < 0.001$ ). Therefore, H6a was partially supported.

Moreover, an interesting finding was that the relationship between authenticity and para-social relationship building for the human coach group ( $\beta_{\text{human}}$  (authenticity  $\rightarrow$  para-social relationship) = 0.059,  $p = 0.197$ ) and avatar group ( $\beta_{\text{avatar}}$  (authenticity  $\rightarrow$  para-social relationship) = 0.121,  $p < 0.01$ ) were weaker than the agent coach group ( $\beta_{\text{agent}}$  (authenticity  $\rightarrow$  para-social relationship) = 0.220,  $p < 0.001$ ). However, the relationship between interactivity and para-social relationship in the human coach group ( $\beta_{\text{human}}$  (interactivity  $\rightarrow$  para-social relationship) = 0.351,  $p < 0.001$ ) was stronger than the agent coach group ( $\beta_{\text{agent}}$  (interactivity  $\rightarrow$  para-social relationship) = 0.222,  $p < 0.001$ ). These results partially support H6b.

In addition, the study validated the between-group difference in social perception of para-social relationship building. The results show no significant differences among the three groups in the role of social perceptions on para-social relationships. Hence, H6c was rejected. This result suggests that the type of digital coach—whether agent, avatar, or human—does not significantly impact the relationship between social perceptions and para-social relationship building.

Last, the study tested between-group differences between social perception and continued usage intention. The relationship between perceived warmth and continued usage intention in the human group ( $\beta_{\text{human}}$  (perceived warmth  $\rightarrow$  continued usage intention) = 0.124,  $p < 0.01$ ) was stronger than in the agency group ( $\beta_{\text{avatar}}$  (perceived warmth  $\rightarrow$  continued usage intention) = 0.025,  $p = 0.301$ ,  $\beta_{\text{agent}}$  (perceived warmth  $\rightarrow$  continued usage intention) = 0.027,  $p = 0.273$ ). The relationship between perceived competence and continued

usage intention in the avatar group ( $\beta_{\text{avatar}}$  (perceived competence  $\rightarrow$  continued usage intention) = 0.413,  $p < 0.001$ ) was stronger than the agent group ( $\beta_{\text{agent}}$  (perceived competence  $\rightarrow$  continued usage intention) = 0.300,  $p < 0.001$ ) and human group ( $\beta_{\text{human}}$  (perceived competence  $\rightarrow$  continued usage intention) = 0.249,  $p < 0.001$ ). However, the relationship between para-social relationship and continued usage intention in the agent group ( $\beta_{\text{agent}}$  (para-social relationship  $\rightarrow$  continued usage intention) = 0.641,  $p < 0.001$ ) was stronger than the avatar group ( $\beta_{\text{avatar}}$  (para-social relationship  $\rightarrow$  continued usage intention) = 0.533,  $p < 0.001$ ). Therefore, H6d was partially supported. Overall, Study 2 can conclude that H6 was partially supported.

## 4.3 | Study 3: Role of Anthropomorphic Level

### 4.3.1 | Descriptive Statistics

As illustrated in Figure 5,<sup>5,6</sup> Study 3 was carried out to investigate further the influence of anthropomorphic levels on appearance and the types of digital coaches within online fitness scenarios. Participants were randomly assigned to interact with one of four digital coaches, and the four experimental groups (1194 samples) were meticulously designed: the avatar group, where both low-anthropomorphic coach (299 samples) and high-anthropomorphic coach (298 samples) representations were utilized, and the agent group, where low-anthropomorphic coach (299 samples) and high-anthropomorphic coach (298 samples) representations were compared. This enabled a comprehensive analysis of the impact of these different appearances on user engagement and interaction within the online fitness context. The demographic profile can be seen in Appendix D for Study 3.

### 4.3.2 | Measurement Invariance Test

Consistent with Study 2<sup>7</sup>, we conducted the MICOM analysis in Study 3 (Henseler, Hubona, and Ray 2016). Appendix G for Study 3 indicates that the compositional invariance criteria were met in Step 2 ( $p > 0.05$ ), while in Step 3, not all composite mean and variance means achieve nonsignificant results. Hence, only partial measurement invariance was supported, and a comparison of path coefficients between the groups can be reported.

### 4.3.3 | Assessment of Group Differences

MGA was performed to explore the differences between low and high-anthropomorphic coaches in avatar and agent coach groups, and the differences in path coefficients between the four datasets were reported in Table 3.

First, the study verified between-group differences between agency characteristics perceptions and social perceptions. In the avatar groups, the relationship between interactivity and perceived warmth ( $\beta_{\text{low-anthropomorphism}}$  = 0.521,  $p < 0.001$ ;  $\beta_{\text{high-anthropomorphism}}$  = 0.327,  $p < 0.001$ ), and perceived competence ( $\beta_{\text{low-anthropomorphism}}$  = 0.434,  $p < 0.001$ ;  $\beta_{\text{high-anthropomorphism}}$  = 0.262,  $p < 0.001$ ) was stronger in the low-anthropomorphic avatar group

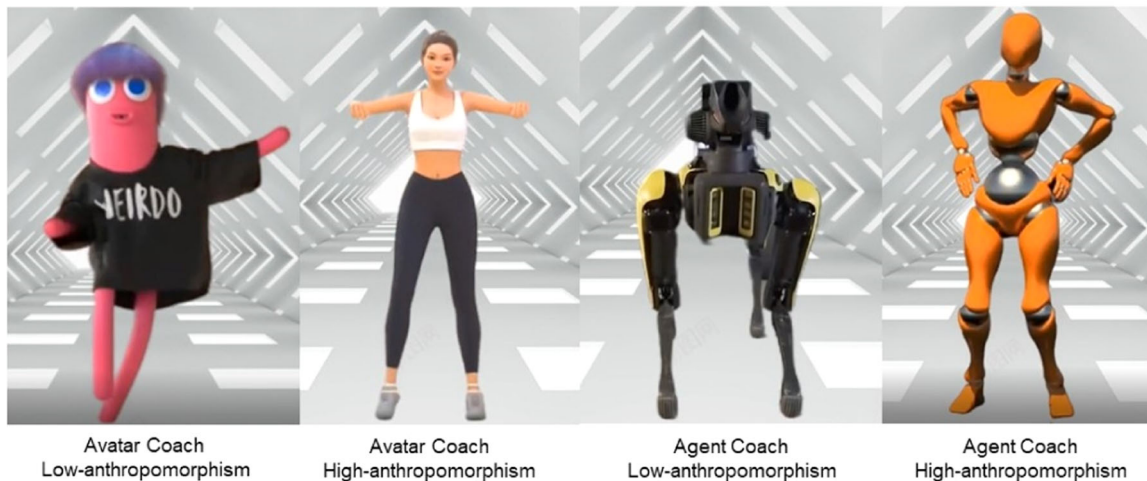
TABLE 2 | MGA results of types of digital coach.

Path	Human coach (N = 292)						Avatar coach (N = 290)			Agent coach (N = 319)			Coefficient difference		
	Human coach (N = 292)		Avatar coach (N = 290)		Agent coach (N = 319)		Human versus avatar		Human versus agent		Avatar versus agent				
	$\beta$	p	$\beta$	p	$\beta$	p	$\beta$	p	$\beta$	p	$\beta$	p	$\beta$	p	
$\beta_{\text{interactivity}} \rightarrow \text{perceived warmth}$	0.386	0.000***	0.440	0.000***	0.402	0.000***									
$\beta_{\text{authenticity}} \rightarrow \text{perceived warmth}$	0.156	0.022*	0.007	0.465	0.086	0.090	0.149 <sup>a</sup>								
$\beta_{\text{companionship}} \rightarrow \text{perceived warmth}$	0.233	0.001***	0.442	0.000***	0.432	0.000***	-0.209*							-0.199*	
$\beta_{\text{interactivity}} \rightarrow \text{perceived competence}$	0.243	0.000***	0.396	0.000***	0.355	0.000***	-0.153*								
$\beta_{\text{authenticity}} \rightarrow \text{perceived competence}$	0.303	0.000***	0.177	0.002**	0.166	0.006**	0.126 <sup>a</sup>							0.137 <sup>a</sup>	
$\beta_{\text{companionship}} \rightarrow \text{perceived competence}$	0.305	0.000***	0.363	0.000***	0.433	0.000***								-0.128 <sup>a</sup>	
$\beta_{\text{interactivity}} \rightarrow \text{para-social relationship}$	0.351	0.000***	0.245	0.000***	0.222	0.000***								0.130 <sup>a</sup>	
$\beta_{\text{authenticity}} \rightarrow \text{para-social relationship}$	0.059	0.197	0.121	0.002**	0.220	0.000***								-0.161*	
$\beta_{\text{companionship}} \rightarrow \text{para-social relationship}$	0.252	0.000***	0.183	0.000***	0.175	0.000***									
$\beta_{\text{perceived warmth}} \rightarrow \text{para-social relationship}$	0.115	0.026*	0.202	0.000***	0.141	0.005**									
$\beta_{\text{perceived competence}} \rightarrow \text{para-social relationship}$	0.190	0.003**	0.263	0.000***	0.265	0.000***									
$\beta_{\text{perceived warmth}} \rightarrow \text{continued usage intention}$	0.124	0.003**	0.025	0.301	0.027	0.273	0.099 <sup>a</sup>							0.097 <sup>a</sup>	
$\beta_{\text{perceived competence}} \rightarrow \text{continued usage intention}$	0.249	0.000***	0.413	0.000***	0.300	0.000***	-0.164*							0.113 <sup>a</sup>	
$\beta_{\text{para-social relationship}} \rightarrow \text{continued usage intention}$	0.590	0.000***	0.533	0.000***	0.641	0.000***								-0.108 <sup>a</sup>	

Note:  $\beta$  = coefficient, NFI = 0.908, SRMR = 0.048.

\*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$ .

<sup>a</sup> $p < 0.1$ .



**FIGURE 5** | Anthropomorphic level stimulus. Avatar coach-low anthropomorphism: a cartoonish avatar with minimal human-like features; Avatar coach-high anthropomorphism: a cartoonish avatar with enhanced human-like features; Agent coach-low anthropomorphism: a robotic agent with minimal human-like features; Agent coach-high anthropomorphism: a robotic agent with enhanced human-like features.

compared to the high-anthropomorphic avatar group. In contrast, the relationship between authenticity and perceived warmth ( $\beta_{\text{low-anthropomorphism}} = -0.077, p = 0.298$ ;  $\beta_{\text{high-anthropomorphism}} = 0.143, p < 0.05$ ) was stronger in the high-anthropomorphic avatar group than in the low-anthropomorphic avatar group. Therefore, H7a was partially supported. However, there were no significant differences between agency characteristics perceptions and social perceptions in the agent group; hence, H8a was rejected. This could be due to the inherent nonhuman nature of agent coaches, which might limit anthropomorphism's impact on users' social perceptions, making the differences in anthropomorphism less relevant in this context.

In the agent groups, the relationships between authenticity and para-social relationship establishing ( $\beta_{\text{low-anthropomorphism}} = 0.184, p < 0.001$ ;  $\beta_{\text{high-anthropomorphism}} = 0.331, p < 0.05$ ) were significantly stronger in the high-anthropomorphic group compared to the low-anthropomorphic group. This suggests that perceived authenticity makes users more likely to develop deeper social and emotional connections with high-anthropomorphic agents. Therefore, H8b was partially supported. However, there were no significant differences between agency characteristics perceptions and para-social relationship building in the avatar groups. H7b was rejected. This may be because users already expect avatars to exhibit human-like qualities. After all, they are essentially representations of real people. Therefore, variations in anthropomorphism may not be as impactful in altering the strength of para-social relationships with avatars, compared to agents where anthropomorphism plays a more critical role in enhancing perceived authenticity and social connection.

Next, the study validated the between-group differences in social perception and relationship building. In the agent groups, only the relationship between perceived competence and para-social relationship in the low-anthropomorphic agent group ( $\beta_{\text{low-anthropomorphism}} = 0.296, p < 0.001$ ) was stronger than in high-anthropomorphic agent groups ( $\beta_{\text{high-anthropomorphism}} = 0.120, p < 0.1$ ), hence H8c was partially

supported. However, there were no significant differences in the role of anthropomorphic level between the social perception and para-social relationship building in either avatar group. Hence, H7c was rejected.

Last, we tested between-group differences between social perception, para-social relationship, and continued usage intention. In avatar groups, the relationship between perceived warmth and continued usage intention ( $\beta_{\text{low-anthropomorphism}} = 0.004, p = 0.935$ ;  $\beta_{\text{high-anthropomorphism}} = 0.167, p < 0.01$ ) was weaker in the low-anthropomorphic avatar group compared to the high-anthropomorphic avatar group. This result highlights that high-anthropomorphic avatars can better evoke warmth perception and thus influence the consumers' continued usage intention. Conversely, the relationship between para-social relationship and continued usage intention in the low-anthropomorphic avatar ( $\beta_{\text{low-anthropomorphism}} = 0.591, p < 0.001$ ;  $\beta_{\text{high-anthropomorphism}} = 0.470, p < 0.001$ ) and agent groups ( $\beta_{\text{low-anthropomorphism}} = 0.708, p < 0.001$ ;  $\beta_{\text{high-anthropomorphism}} = 0.549, p < 0.001$ ) was stronger than in the high-anthropomorphic avatar and agent group. Therefore, H7d and H8d were partially supported. Overall, our Study 3 can conclude that both H7 and H8 were partially supported.

## 4.4 | Study 4: Role of the Types of Support

### 4.4.1 | Measurement Invariance Test

Consistent with the previous study<sup>8</sup>, Appendix G for Study 4 shows that the results of step 2 indicated that all measurement variables established partial measurement invariance, with all constructs achieving nonsignificant results. However, in step 3, not all composite mean and variance mean achieved nonsignificant results. Hence, only partial measurement invariance was supported, and a comparison of path coefficients between the groups can be reported.

TABLE 3 | MGA results of levels of anthropomorphism.

Path	Avatar						Agent					
	Low N = 299			High N = 298			Low N = 299			High N = 298		
	$\beta$	p		$\beta$	p		$\beta$	p		$\beta$	p	Coefficient difference
$\beta_{\text{interactivity}} \rightarrow \text{perceived warmth}$	0.521	0.000***		0.327	0.000***		0.404	0.000***		0.388	0.000***	
$\beta_{\text{authenticity}} \rightarrow \text{perceived warmth}$	-0.077	0.298		0.143	0.049*		0.057	0.411		0.140	0.045*	
$\beta_{\text{companionship}} \rightarrow \text{perceived warmth}$	0.445	0.000***		0.391	0.000***		0.433	0.000***		0.377	0.000***	
$\beta_{\text{interactivity}} \rightarrow \text{perceived competence}$	0.434	0.000***		0.262	0.000***		0.286	0.000***		0.283	0.000***	
$\beta_{\text{authenticity}} \rightarrow \text{perceived competence}$	0.107	0.076		0.226	0.001**		0.240	0.033*		0.153	0.000***	
$\beta_{\text{companionship}} \rightarrow \text{perceived competence}$	0.400	0.000***		0.412	0.000***		0.435	0.000***		0.479	0.000***	
$\beta_{\text{interactivity}} \rightarrow \text{para-social relationship}$	0.219	0.000***		0.265	0.000***		0.164	0.008**		0.257	0.000***	
$\beta_{\text{authenticity}} \rightarrow \text{para-social relationship}$	0.180	0.000***		0.170	0.000***		0.184	0.000***		0.331	0.000***	
$\beta_{\text{companionship}} \rightarrow \text{para-social relationship}$	0.193	0.001**		0.140	0.009***		0.230	0.000***		0.116	0.028*	
$\beta_{\text{perceived warmth}} \rightarrow \text{para-social relationship}$	0.194	0.000***		0.184	0.000***		0.143	0.004***		0.191	0.000***	
$\beta_{\text{perceived competence}} \rightarrow \text{para-social relationship}$	0.225	0.000***		0.242	0.000***		0.296	0.000***		0.120	0.085 <sup>a</sup>	
$\beta_{\text{perceived warmth}} \rightarrow \text{continued usage intention}$	0.004	0.935		0.167	0.001**		0.000	0.994		0.069	0.195	
$\beta_{\text{perceived competence}} \rightarrow \text{continued usage intention}$	0.377	0.000***		0.328	0.000***		0.253	0.000***		0.336	0.000***	
$\beta_{\text{para-social relationship}} \rightarrow \text{continued usage intention}$	0.591	0.000***		0.470	0.000***		0.708	0.000***		0.549	0.000***	
												0.159*

Note:  $\beta$  = coefficient, NFI = 0.907, SRMR = 0.049.

\*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < .05$ .

<sup>a</sup> $p > 0.1$  (two-tailed).



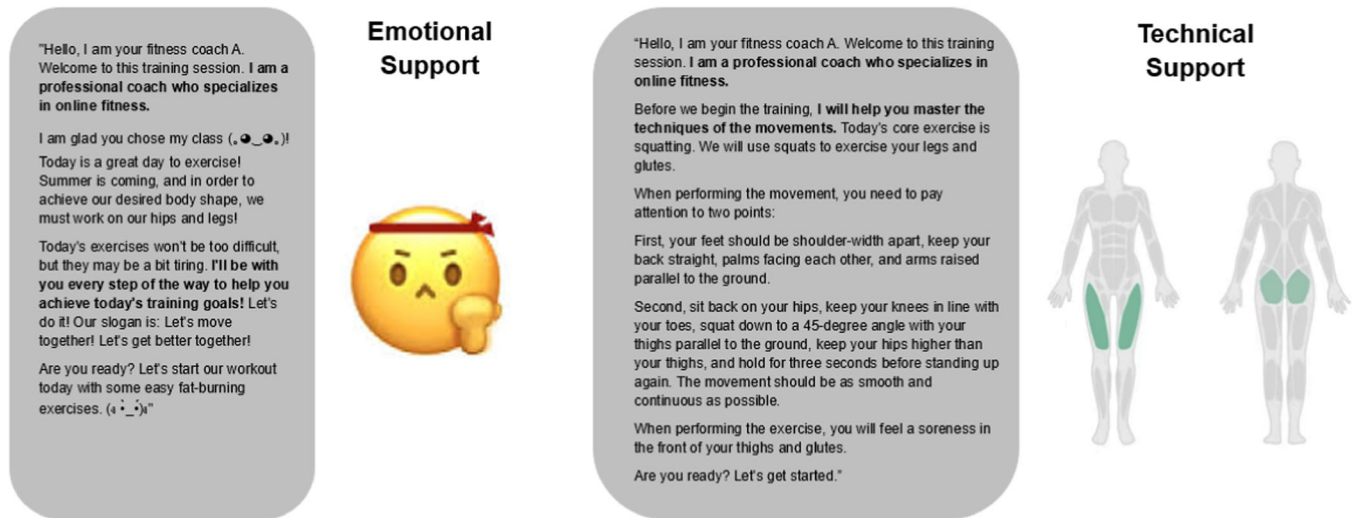


FIGURE 6 | Types of support stimulus.

#### 4.4.2 | Descriptive Statistics

Two experimental groups (993 samples) were designed for Study 4, emotional support (496 samples) versus technical support (497 samples), to explore the role of support types. After participants entered the experiment, the digital coach provided different types of support during self-introduction (see Figures 6<sup>9 10</sup>) and exercise (e.g., in the emotional support group video stimulus, coaches said phrases like “Come on, you can do it,” “You are the best,” and “Hold on” during the interaction. Conversely, in the technical support group, coaches provided instructions: “Keep your belly in,” “chest straight, do not hunch your back,” and “Allow your body to relax and move easily”). This enabled a comprehensive analysis of the impact of these different support types from digital coaches on user engagement and interaction within the online fitness context. The demographic profile can be seen in Appendix D for Study 4.

#### 4.4.3 | Assessment of Group Differences

MGA was performed to explore the differences between emotional and technical support groups, and the differences in path coefficients between the two datasets were reported in Table 4.

The authors first verified between-group differences between agency characteristics perceptions and social perceptions. The relationship between interactivity and perceived warmth ( $\beta_{ES}(\text{interactivity} \rightarrow \text{perceived warmth}) = 0.379, p < 0.001, \beta_{TS}(\text{interactivity} \rightarrow \text{perceived warmth}) = 0.472, p < 0.001$ ), as well as authenticity and perceived competence ( $\beta_{ES}(\text{authenticity} \rightarrow \text{perceived competence}) = 0.187, p < 0.001, \beta_{TS}(\text{authenticity} \rightarrow \text{perceived competence}) = 0.268, p < 0.001$ ) in emotional support group was weaker than technical support group. Conversely, the relationship between companionship and perceived warmth ( $\beta_{ES}(\text{companionship} \rightarrow \text{perceived warmth}) = 0.420, p < 0.001, \beta_{TS}(\text{companionship} \rightarrow \text{perceived warmth}) = 0.290, p < 0.001$ ), as well as interactivity and perceived competence ( $\beta_{ES}(\text{interactivity} \rightarrow \text{perceived competence}) = 0.332, p < 0.001, \beta_{TS}(\text{interactivity} \rightarrow \text{perceived competence}) = 0.194, p < 0.001$ ) in emotional support group was stronger than in the technical support group. Therefore, H9a was partially supported.

Next, the authors validated the between-group difference between agency characteristics perceptions and para-social relationship building. The relationship between interactivity and para-social relationship in the emotional support group ( $\beta_{ES}(\text{interactivity} \rightarrow \text{para-social relationship}) = 0.131, p < 0.01$ ) was weaker than in the technical support group ( $\beta_{TS}(\text{interactivity} \rightarrow \text{para-social relationship}) = 0.325, p < 0.001$ ). In contrast, the relationship between companionship and para-social relationship in the emotional support group ( $\beta_{ES}(\text{companionship} \rightarrow \text{para-social relationship}) = 0.300, p < 0.001$ ) was stronger than in the technical support group ( $\beta_{TS}(\text{companionship} \rightarrow \text{para-social relationship}) = 0.107, p < 0.05$ ). Hence, H9b was partially supported.

Then, the authors explored the between-group difference between social perception and para-social relationship building. The results show no significant differences among the two groups. Hence, H9c was rejected.

Last, an interesting finding was that the relationship between para-social relationship building and continued usage intention for the emotional support group ( $\beta_{ES}(\text{para-social relationship} \rightarrow \text{continued usage intention}) = 0.643, p < 0.001$ ) was stronger than in the technical support group ( $\beta_{TS}(\text{para-social relationship} \rightarrow \text{continued usage intention}) = 0.531, p < 0.001$ ). Therefore, H9d was partially supported. Overall, our Study 4 can conclude that H9 was partially supported.

#### 4.5 | Study 5: Continued Usage Intention Increase Online Fitness Subscriptions

A logistic regression was conducted to evaluate the impact of continued usage intention on the uptake of online fitness subscriptions (see Table 5)<sup>11</sup>. The omnibus test yielded a statistically acceptable overall goodness-of-fit ( $\chi^2(1) = 83.540, p < 0.001$ ). Similarly, the goodness-of-fit for the Hosmer and Lemeshow indicates a significant result ( $\chi^2(8) = 66.589, p < 0.001$ ). Notably, there is a statistically significant relationship between continued usage intention and online fitness subscriptions ( $\beta = 0.380, p < 0.000$ ), with an overall accuracy in prediction of 69.76% (approximately 70% correctly predicted

TABLE 4 | MGA results of levels of support types.

Path	Emotional support (ES) (N = 496)		Technical support (TS) (N = 497)		Coefficient difference
	$\beta$	p	$\beta$	p	
$\beta_{\text{interactivity}} \rightarrow \text{perceived warmth}$	0.379	0.000***	0.472	0.000***	-0.093*
$\beta_{\text{authenticity}} \rightarrow \text{perceived warmth}$	0.020	0.653	0.072	0.299	
$\beta_{\text{companionship}} \rightarrow \text{perceived warmth}$	0.420	0.000***	0.290	0.000**	0.130*
$\beta_{\text{interactivity}} \rightarrow \text{perceived competence}$	0.332	0.000***	0.194	0.000***	0.138*
$\beta_{\text{authenticity}} \rightarrow \text{perceived competence}$	0.187	0.000***	0.268	0.000***	-0.081*
$\beta_{\text{companionship}} \rightarrow \text{perceived competence}$	0.380	0.000***	0.456	0.000***	
$\beta_{\text{interactivity}} \rightarrow \text{para-social relationship}$	0.131	0.009**	0.325	0.000***	-0.195**
$\beta_{\text{authenticity}} \rightarrow \text{para-social relationship}$	0.219	0.000***	0.232	0.000***	
$\beta_{\text{companionship}} \rightarrow \text{para-social relationship}$	0.300	0.000***	0.107	0.036*	0.193**
$\beta_{\text{perceived warmth}} \rightarrow \text{para-social relationship}$	0.129	0.013*	0.167	0.003**	
$\beta_{\text{perceived competence}} \rightarrow \text{para-social relationship}$	0.234	0.000***	0.168	0.002**	
$\beta_{\text{perceived warmth}} \rightarrow \text{continued usage intention}$	0.021	0.651	0.041	0.526	
$\beta_{\text{para-social relationship}} \rightarrow \text{continued usage intention}$	0.643	0.000***	0.531	0.000***	0.112*
$\beta_{\text{perceived competence}} \rightarrow \text{continued usage intention}$	0.301	0.000***	0.375	0.000***	

Note:  $\beta$  = coefficient, \* $p < 0.1$  (two-tailed), NFI = 0.911, SRMR = 0.051.  
 \*\*\* $p < 0.001$ , \*\* $p < 0.01$ ; \* $p < 0.05$ .

TABLE 5 | Logistic regression results.

Independent variable	Dependent variable: Online fitness subscriptions (recurring subscription vs. Non-recurring subscription)				
	Coefficients ( $\beta$ )	SE	Wald	p value	Exp $\beta$ (Coefficients)
Continued usage intention	0.380	0.042	81.537	0.000	1.463
Intercept	-1.036	0.221	21.935	0.000	0.355
<b>Criteria</b>					
Omnibus test			$\chi^2 (1) = 83.540^{***}$		
Hosmer and Lemeshow			$\chi^2 (8) = 66.589^{***}$		
Nagelkerke's $R^2$			0.078		

Note: SE = Standard Error.

\*\*\* $p < 0.001$ .

TABLE 6 | Confusion matrix.

	Predicted value = 0.0 (nonrecurring subscription)	Predicted value = 1.0 (recurring subscription)	Percentage correct
<b>Subscription = 0.0 (nonrecurring subscription)</b>	53	371	12.500
<b>Subscription = 1.0 (recurring subscription)</b>	79	985	92.575
<b>Total</b>			69.758

cases; see Table 6) and an explained variance of 7.8% (see Table 5; result of Nagelkerke  $R^2$ ). Hence, H10 was supported. It can, therefore, be concluded that as the intention to continue usage increases, the likelihood of having a recurring subscription increases. In particular, for each unit increase in “continued usage intention,” the probability of recurring subscription increases by a ratio of 1.463. In other words, the likelihood of a user recurring online fitness subscription is approximately  $(1.463 - 1 = 0.463)$  46.3% higher for every unit increase in continued usage intention.

## 5 | Discussion and Conclusion

### 5.1 | Theoretical Contributions

The contributions of this work are as follows. First, this paper goes beyond examining the physical traits of digital agencies in customer communication, focusing instead on the humanized communication induced by psychological and social characteristics. The study was conducted in a highly interactive user scenario, where interactions move from mere functionality to encompassing emotional interaction in human-agency interactions, highlighting the potential benefits of human-agency companionship across diverse domains. Our research contributes to existing theories by extending the characteristics of digital agencies to influence consumers' social perceptions, establish para-social relationships with nonhuman agencies, and ultimately lead to desirable behavioral outcomes (online fitness subscriptions). In Study 1, we developed a new research model to elucidate the mechanism of para-social relationship building, with social perceptions as significant mediating variables. We revealed that three attributes of a digital coach—interactivity,

authenticity, and companionship—positively impact consumers' social perceptions. Then, social perceptions positively influence the establishment of para-social relationships and subsequently enhance consumers' continued usage intention. This finding lays the groundwork for future studies to explore the moderating factors within the framework.

Secondly, this paper provides a clear and affirmative answer to the research question of which types of digital agencies can foster social perceptions and para-social relationships. This study discovered that agents with higher genuine sensations would strengthen this mechanism. In Study 2, we observed that while authenticity was significantly related to perceived warmth in the human coach group, this relationship was not significant in the avatar and agent coach groups. The relationship between authenticity and perceived competence was significant in the three groups but stronger in the human coach group than in the avatar and agent coach groups. This suggests that authenticity is more influential when the digital coach is human, possibly due to consumers' inherent expectations regarding human interactions (Lou et al. 2023). In contrast, agent and avatar coaches improved the perceived competence and warmth through interactivity and companionship.

Moreover, users relied more on perceived authenticity to establish para-social relationships with an agent or avatar coach than when interacting with human coaches. This is because authenticity plays a reduced role in establishing para-social relationships when users already know that the person they are interacting with is real (Chen, Hyun, and Lee 2022). When establishing a relationship with agent coaches, users may consider authenticity a more important attribute because it helps them overcome potential psychological barriers to interacting

with nonhuman entities (de Brito Silva et al. 2022; Lou et al. 2023). Conversely, other factors, such as interactivity, maybe more critical in interactions with human coaches because authenticity is already a precondition. Moreover, the positive effect of the para-social relationship on continued usage intention is stronger in agent groups than in avatar groups. This may be because, in an agent-coaching environment (nonhuman), users rely more on the social and emotional connections they make with their digital agents to decide whether or not to continue using the service. These findings reveal digital agents' unique roles and impacts in building social relationships and maintaining user engagement. This is particularly important in sports fitness, where trust and connection with the coach can significantly influence consumer engagement (McDonald et al. 2022).

Third, this study advances knowledge by reexamining the role of appearance anthropomorphism within the spectrum of digital agencies in marketing communication. Study 3 elucidated the positive impact of high physical anthropomorphism on enhancing perceptions of warmth by bolstering the authenticity of avatars, thereby stimulating consumers' intentions for continued usage. While highly anthropomorphic agents typically excel in fostering users' para-social relationships through authenticity, less anthropomorphic designs also demonstrate unique efficacy in certain contexts, such as, raising the user's competence perception of the agent's to pull in the para-social relationship. Additionally, the findings provide a valuable complementary perspective: agents with low anthropomorphism are adept at heightening users' perceptions of warmth and competence through enhanced interactivity. For low anthropomorphic agencies, establishing para-social relationships helps to increase consumers' continued use intention. This underscores the importance of recognizing the intricacies and variations in anthropomorphism levels during the design of digital agents.

Fourth, this study enhances the para-social relationship theory by elucidating how types of support in consumer service—emotional versus technical—can modulate the intensity of consumer relationships in an agency-mediated environment. Specifically, the findings of Study 4 indicate that users receiving emotional support from digital coaches perceive heightened companionship, fostering stronger para-social relationships (Golaszewski et al. 2022). Departing from the trend of merely providing functional fulfillment akin to human counterparts (Ames and Flynn 2007; Belanche et al. 2021), there has been a noticeable shift toward imbuing digital agents with additional affective value (Fiske, Cuddy, and Glick 2007), thereby offering mental companionship (Liu-Thompkins, Okazaki, and Li 2022), fostering social relationships (Cuddy, Fiske, and Glick 2008), and ultimately enhancing human welfare (Fitzpatrick, Darcy, and Vierhile 2017). This underscores the potential of emotional support not only as a pragmatic aid but also as a pivotal catalyst in cultivating feelings of affiliation and rapport with digital coaches, consequently enhancing user retention. Meanwhile, technical support remains indispensable for addressing practical facets of coaching. The reliance on interactivity to bolster para-social relationships within technical support underscores the imperative for digitally mediated coaching platforms to embody responsive and engaging dynamics mirroring human

interaction. To a certain extent, our findings align with previous studies, exploring how agencies can simultaneously meet functional, emotional, and social needs by providing informative guidance and social companionship.

Lastly, this study further contributes to the growing body of literature on consumer subscription behaviors by empirically demonstrating the critical role of continued usage intention in influencing subscription adoption. Our findings align with prior research indicating that usage intention is pivotal in driving actual consumer behavior (Claudy, Garcia, and O'Driscoll 2015). By confirming the positive relationship between continued usage intention and online fitness subscriptions, this study closes the gap identified by Claudy, Garcia and O'Driscoll (2015), who suggested the importance of intention but did not empirically test its direct link to actual behavior. This study's results show that as consumers' intention to continue using a service increases, their likelihood of subscribing also rises significantly, supporting the hypothesis that usage intention has a positive impact on subscription behavior.

## 5.2 | Practical Implications

This study offers valuable insights into designing and implementing online fitness programs and similar scenarios featuring human-agency communication, where technical and emotional support coexist to yield psychological and social outcomes. First, these insights suggest that when employing different types of digital agents, it is essential to focus on enhancing specific characteristics based on the type of interaction. For agent and avatar coaches, perceived authenticity helped foster relationships, while interactivity and companionship helped enhance perceptions of warmth and competence. Fitness platforms should thus provide customizable digital coaching options that empower users to select from live, avatars, or virtual coaches. Meanwhile, this entails adapting the coach's interaction style and visual appearance to align with consumer preferences. For instance, AI-driven emotion recognition can further enhance personalization by using biometric data like heart rate to adjust workout difficulty or tone of coaching. This could involve recognizing when a user is feeling stressed or fatigued and providing encouragement or reducing the intensity of the workout accordingly, keeping users emotionally engaged.

Moreover, the study elucidates the varying impact of digital communications (by human, avatar, and agent coach) on consumers' psychological perceptions and intentions to continue usage. The stronger influence of para-social relationships on continued usage intention in agent groups highlights the importance of social and emotional bonds in these environments. Highly interactive platforms should prioritize emotional connections with customers, as emotional bonds often lead to continued intentions and subscription behaviors, encouraging users to participate in fitness activities and improve their physical and mental health. For example, platforms like Fitbit could use emotion-based push notifications, where personalized reminders are sent to users based on their activity level. If users have not met their exercise goals, a motivating notification could prompt them to get active, or the system could celebrate

milestones, reinforcing positive behavior. These insights serve to inform fitness companies in crafting more personalized and effective fitness experiences, thereby enhancing user retention in online fitness programs.

### 5.3 | Limitations and Future Research

This study bears room to improve in future endeavors. Firstly, the operation of the experiment in a specific, single-lingual online fitness human-computer interaction environment warrants further studies to test the generalizability of the findings to other domains where customer-agent interactions share different levels of relevance, such as therapy and healthcare. Future research could explore the applicability of these insights across various digital platforms and environments to broaden understanding. Second, while the study focused on different types of digital coaching interactions, levels of anthropomorphism, and types of support, it did not consider user personality traits that may interact with preferences for different types of digital companionship. Subsequent research could investigate how individual differences, such as technophobia, consumer empowerment, and participants' varying familiarity with digital agencies may have influenced their interaction experiences and responses, potentially impacting the study's outcomes. Moreover, the experiments conducted in this study did not incorporate recognition or appropriate responses to users' emotional cues, including tone of voice, facial expressions, and language patterns. Future research could explore techniques such as sentiment analysis, affective computing, and empathy modeling to enhance the emotional intelligence of digital agents. Additionally, while the quasi-experimental design used in this study was robust, it could not capture the long-term effects and changes in user perceptions and behaviors. Future research could employ longitudinal studies to track changes, providing insight into how ongoing interactions with digital coaches evolve and potentially lead to lasting behavioral changes. Moreover, it is recommended that future research builds on the findings of this study by conducting a field experiment using the proposed model. This would enable the measurement of participants' actual behavior, thereby increasing the robustness and replication of the findings.

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#### Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

#### ENDNOTES

- <sup>1</sup>The CMB result does not appear to be of concern for Study 2 to Study 4 (see Appendix E) as the multicollinearity results appear below 5.
- <sup>2</sup>In Study 2, we applied the same methodology procedure and measurement items outlined in Study 1 (see section 3).
- <sup>3</sup>Similar to Study 1, to ensure nonresponse bias, the means of all variables were compared between early and late respondents (see Appendix C for Study 2).

- <sup>4</sup>Similar to Study 1, the result of reliability, convergent validity, and discriminant validity are satisfactory in Study 2 (see Appendix E and F).
- <sup>5</sup>In Study 3, we applied the same methodology procedure and measurement items outlined in Study 1 (see section 3).
- <sup>6</sup>Similar to Study 1, to ensure nonresponse bias, the means of all variables were compared between early and late respondents (see Appendix C for Study 3).
- <sup>7</sup>Similar to Study 1, the result of reliability, convergent validity, and discriminant validity are satisfactory in Study 3 (see Appendix E and F).
- <sup>8</sup>Similar to Study 1, the result of reliability, convergent validity, and discriminant validity are satisfactory in Study 4 (see Appendix E and F).
- <sup>9</sup>In Study 4, we applied the same methodology procedure and measurement items outlined in Study 1 (see section 3).
- <sup>10</sup>Similar to Study 1, to ensure nonresponse bias, the means of all variables were compared between early and late respondents (see Appendix C for Study 4).
- <sup>11</sup>Study 5 employs the same data set as Study 1 to further investigate the impact of continued usage intention on the likelihood of engaging in online fitness subscriptions as an actual behavior. As posited by Akinci et al. (2007) as well as McCarty and Hastak (2007), the utilization of logistic regression in Study 5 can prove advantageous for the discernment of patterns pertaining to actual behavior, particularly when the behavior in question is of a categorical nature with respect to online fitness subscriptions. Thus, no further measurement model assessment is needed in Study 5 because the result is the same as in Study 1 (see Appendix C to Appendix F).

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### Supporting Information

Additional supporting information can be found online in the Supporting Information section.