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Social companionship with artificial intelligence: Recent trends and future avenues

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ABSTRACT

The social companionship (SC) feature in conversational agents (CAs) enables the emotional bond and consumer relationships. The heightened interest in SC with CAs led to exponential growth in publications scattered across disciplines with fragmented findings, thus limiting holistic understanding of the domain and warrants a macroscopic view of the domain to guide future research directions. The present study fills the research void by offering a comprehensive literature review entailing science performance and intellectual structure mapping. The comprehensive review revealed the research domain's major theories, constructs, and thematic structure. Thematic and content analysis of intellectual structure resulted in a conceptual framework encompassing antecedents, mediators, moderators, and consequences of SC with CAs. The study discusses future research directions guiding practitioners and academicians in designing efficient and ethical AI companions.

1. Introduction

Due to digital advancements, customers now reach companies regardless of geographical location, time, and channel does not limit the interactional continuity between firms and consumers (Suwono and Sihombing, 2016). Additionally, deploying Artificial Intelligence (AI) lifts consumers' services (Ameen et al., 2021) to the next level through personalization and convenience. Therefore, firms deploy emerging technologies powered by AI to offer seamless experiences to their customers. AI-enabled conversational agents (CAs) that provide digital assistance and build customer relations become significant in such a scenario. They are now evolving with new capabilities enabling them to engage users for prolonged interactions.

CAs unfold paradigm shifts in human-computer interaction (Biundo et al., 2016). Leading organizations like Amazon and Google use digital assistants with a sense of humour (Bothun et al., 2017). Gate box, a hologram virtual social companion, helps users to combat loneliness and offer human-like emotional support (Hirano, 2016). "Love Plus," a videogame by Konami, allows users to build a romantic relationship with a digital character (Lowry, 2015). AI-enabled conversational agents now offer emotional support (Provoost et al., 2017) and establish human-relational bonds with the users (Darcy et al., 2021). Therefore, CAs offering social companionship to their users are referred to as AI companions.

The deployment of empathetic chatbots transcends different industries like banking, health care, e-commerce, education, and tourism (Adam et al., 2021; Lee et al., 2020b; Rhee and Choi, 2020; Hsieh, 2011; Bickmore et al., 2013) due to its multifaceted role. In recent years, many researchers have reviewed the literature on conversational agents (Lim et al., 2022; Rapp et al., 2021) or AI agents for health support (Gasteiger et al., 2021). However, the literature on social companionship with conversational agents is scattered, thus limiting our understanding towards the field.

But why conducting a systematic literature review on companionship with conversational agents is of urgent? Because brands prefer to invest in new and emerging technologies. According to the Conversational AI market report (2021), the global market for conversational AI is projected to reach 18.4 billion by 2026. The evolution of CAs with advanced capabilities allows users to shift towards new and updated versions of chatbot applications. For example, ChatGPT, launched in

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November 2022 by Open.AI, can now remember earlier user conversations. ChatGPT can write essays, poems, news articles, and stories for users, and thus has reached one million users in just five days of launch. Extant literature discusses CAs with varied functions and capabilities. The question is whether investigating these capabilities can lead to a long-term relational bond, such as companionship between users and AI. Ultimately, an AI system's companionship development quality could trigger continued usage intention. AI companions can influence user thoughts, decisions, behaviours, purchasing patterns etc.

Recently, researchers have examined the effects of CA capabilities (like social presence, anthropomorphic features, interaction style, and media richness) on consequences like loneliness reduction, emotional connection, attitude towards the product, intention to use, and customer satisfaction (Jones et al., 2021; Araujo, 2018; Adam et al., 2021; Rhee and Choi, 2020; Lee et al., 2020a; Cheng and Jiang, 2020). Advance CAs can now reduce the user's loneliness (Skjuve et al., 2021), provide social interaction support to children and people with special needs (Ramadan et al., 2021; Safi et al., 2021), reduce patients' loneliness (Loveys et al., 2019), and provide life support and companionship to older adults (Tsiourti et al., 2016).

Despite available examples of companion chatbots like Replika, Mitsuku, XiaoIce and Gate box, the ethical implications of such advanced chatbots that can form long-term connections with users have been the subject of ongoing debate among scholars (Murtarelli et al., 2021). While some argue that these chatbots can provide valuable social support and companionship (Ta et al., 2020), others express concern about the potential for manipulation and exploitation (Possati, 2022). In such a case, an absence of a systematic literature review makes it challenging to address these issues comprehensively. Notably, the consolidation of the area can unfurl immense opportunities for marketers, practitioners, academicians, and customers. Therefore, converging literature on CAs for social companionship becomes essential.

As technology is heading towards feeling AI, research on AI companions proliferates. However, the literature still lacks a comprehensive framework to unveil SC's antecedents, mediators, moderators, and outcomes with CAs. Moreover, current trends and ways forwards remain fuzzy without a systematic literature review. The following research questions remain unanswered:

RQ1. . *What are the publication and citation trends in SC with CAs?*

RQ2. . *Which are the top sources, publications, and authors in SC with CAs?*

RQ3. . *What are the major theories in SC with CAs?*

RQ4. . *What are the major themes in SC with CAs?*

RQ5. . *What are the antecedents, mediators, moderators, and outcomes of SC with CAs?*

RQ6. . *Which directions should future research pursue to advance the SC with CAs?*

The present study attempts to fill the void and discern the holistic view of the research domain with performance and intellectual structure mapping. The thematic and content analysis enables the bird's eye view of the domain (Donthu et al., 2021a).

The present study is organized into nine sections. Section 2 presents the theoretical background, Section 3 discusses the review methodology, Section 4 focuses on performance analysis, Section 5 details theoretical foundations, Section 6 unfolds the intellectual structure, Section 7 proposes a conceptual framework, Section 8 discusses future research directions, and Section 9 concludes the article.

2. Theoretical background

AI applications are revolutionizing management streams like human resources, strategy, and operations (Sridevi and Suganthi, 2022; Kar and Kushwaha, 2021). Marketing is no exception, as chatbots advancements and their capabilities have led to their adoption as customer service agents in the past decades. Firms deploy modern chatbots to enrich the customer experience with new technologies (Kushwaha et al., 2021; Chaturvedi and Verma, 2022). Rapp et al. (2021), conducted a literature review on text-based chatbots research and found that the modern chatbot designs are heading towards providing empathy, emotional experience, and prolonged interactions. The field of AI now touches upon the theory of mind and self-awareness of artificially intelligent systems (Verma et al., 2021). Emerging themes in AI-enabled technologies include feeling AI, emotional AI, empathetic AI and affective computing (Huang et al., 2019). Therefore, the future for brands lies in creating, communicating and delivering AI companions that can provide long time emotional and functional support to the consumers.

According to Lim (2012), AI companions are "*robots or virtual conversational agents that possess a certain level of intelligence and autonomy as well as social skills, allowing them to establish and maintain long-term relationships with users*." The field of human-computer interaction has evolved from interface design to social acceptability and believability (Pesty and Duhaut, 2011). AI companions mitigate the loneliness of individuals seeking emotional and social support, which became significant in the Covid-19 isolation phase (Odekerken-Schröder et al., 2020).

2.1. Conversational agents (CAs)

CAs are software agents designed to mimic human conversations via natural language processing through communication channels like speech, text, gestures, and facial expressions (Laranjo et al., 2018), often appear as text-based chatbots, digital avatars, and social robots (Radziwill and Benton, 2017). CAs can be digital assistants, recommendation agents, and social companions (McGoldrick et al., 2008). Chatbots offer functional utilities that help customers perform digital tasks like setting the alarm or reminder, checking the weather, playing songs, searching for information, including product recommendations, etc. (Chaturvedi and Verma, 2022). CAs assist consumers in ordering products via voice commands (Aw et al., 2022). Affective computing advancements enabled CA to build emotional connections with humans. According to Hamilton et al. (2021), humans prefer recommendations from known ties (friends or companions in their network) and repeat purchase intention based on voice assistants recommendations leads to brand loyalty (Maroufkhani et al., 2022). Thus, advanced AI companions can maintain long-term relationships with humans, moderate their emotions, and induce purchase intentions and brand loyalty (McLean et al., 2021).

2.2. Social companionship (SC)

According to Benyon and Mival (2010), SC refers to "a pleasant and accessible relationship with an interactive source, emerging out of the social and emotional investment of a person which requires a level of trust, compatibility, and familiarity with the source that results in a feeling of security, and general wellbeing." CAs designed for SC are called "Artificial Companions (AI Companions)," which can substitute human relations by observing users' past experiences (Campos and Paiva, 2010). For example, in-home companions help users schedule and perform routine health care activities, mobile companions help in outdoor physical activities, and virtual cooking companions help by recommending daily recipes (Turunen et al., 2011). AI companion toys engage children in long-term relationships (Adam et al., 2010). "Replika: My AI friend" is an advanced AI companion with therapeutic resources and partners to reduce users' loneliness (Skjuve et al., 2021). Interaction with the social chatbot (like Mitsuku) reduces the need for physical, social presence (Croes and Antheunis, 2021).

2.3. Evolution of AI companions

Over the past few decades, AI companions have come a long way in terms of their capabilities and acceptance in society. The current study, presents four shifts in the evolution of AI companions. In 1996, the world saw the first AI companion in the form of Tamagotchi (Bloch and Lemish, 1999), a small virtual pet that users could take care of on a LED-based digital screen. The toy was designed to simulate the experience of caring for a virtual pet for which users could develop a sense of responsibility and attachment. While it used a simple design with rule-based modeling and physical buttons for user interaction, it sparked an interest in having a digital companion. As technology advanced, the capabilities, architecture and companionship features improved. Table 1, summarizes the evolution of AI companions from 1996 to 2022.

In 2001, Baby harp Seal PARO, a therapeutic robot, entertained patients in hospitals, older adults and other lonely individuals (Takayanagi et al., 2014). The robot is designed to look like a baby Seal with real fur. Its architecture includes fuzzy logic and reinforcement learning techniques, enabling PARO to behave like a real seal. Although the design of the robot is limited in the range of actions and expressions, it provides significant emotional support to the users and allows them to love and care for someone. Nabaztag, released in 2008, is a rabbit-shaped smart device that can announce weather forecasts and news headlines, play MP3 streams, and send and receive messages (Cavazza et al., 2008). User interaction with a rabbit information console provided a sense of care for the rabbit and formed a bond with it over time.

The technological evolution of AI companions then shifted to anthropomorphic characters with the release of KASPAR, a child-shaped doll-like robot in 2005 (Wood et al., 2019). The robot is specially designed for Kids with autism disorder that allow users to love and care for the robot with responsive facial expressions on the human touch. Such companions possess limited conversational capabilities, thus restricting users from enhanced interactions. With natural language processing (NLP) and deep learning-based modeling techniques, Apple released Siri with a technological breakthrough in 2011 (Thorne, 2020). Siri assists users with digital tasks such as making phone calls, setting alarms, playing music and videos etc. The virtual assistant was only available for Apple devices, but its functional utility helped users manage their digital tasks. Amazon launched Alexa in 2014 with recurrent neural networks (RNNs) and learning-based modeling to provide a richer user experience to its customers (Gao et al., 2018). The functional intelligence of Alexa and its humorous responses to the users enabled it to improve proximity with amazon customers. Despite a complex design with many functions, such as intelligent home automation and digital assistance, Alexa has yet to understand user emotions and respond accordingly.

The third shift in the evolution of AI companions observed the introduction of affective computing into chatbot designs. Microsoft Asia released an empathetic chatbot called XiaoIce in 2014. The CA is designed to provide emotional support to the users with its ability to understand user emotions through sentiment analysis (Zhou et al., 2020). Modern architecture with Convolutional neural networks (CNNs) and long-short-term memory networks (LSTM) allowed XiaoIce to engage users for prolonged interaction and develop human-like bonds. However, the chatbot only continues the discussion for the user until input from the user is received. Replika is an advanced version of the emotional chatbot launched in 2016. Its unique design allows AI to mimic human romantic conversations with the users (Ta et al., 2020). One technological breakthrough with Replika is its ability to initiate conversations with the user without input, just like humans. RNNs, LSTM and reinforcement learning techniques allow Replika to provide its users with emotional and mental health support up to a level that can reduce feelings of loneliness. With one of the most advanced chatbot designs, Replika has yet to learn about digital assistance and home automation skills. Gatebox, a holographic virtual assistant launched in 2016, has both the capabilities that provide utilitarian and emotional support to its users (Hirano, 2016).

The fourth and most recent shift is observed with the introduction of generative AI into CAs. The recent launch of ChatGPT equipped with the third generation of the generative pre-trained transformer model and self-supervised learning in November 2022 reached one million users in the first five days. The CA can generate original content, respond to a wide range of prompts and questions, and discuss any subject as long as the user wants (Dwivedi et al., 2023). It can also remember previous conversations with the user. Fig. 1 represents the four technological shifts from 1996 to 2022.

3. Research methodology

Systematic literature review (SLR) is an appropriate approach to address the research questions pertaining to current trends and future research directions in the research domain (Whittemore et al., 2014). The present study delves into the literature on SC with CAs to uncover the performance analysis (authors, sources, and documents) and intellectual structure (themes, constructs, and theories) of the current literature (Donthu et al., 2021a). The scientific approach makes the review replicable, transparent, and objective. The present study replicable research protocol contains five steps of in-depth analysis and adheres to established guidelines in previous studies (Verma and Yadav, 2021; Verma et al., 2021; Mhatre et al., 2020) to reveal current trends and the way forward. Fig. 2 highlights the flow process to conduct the current literature review.

3.1. Stage 1: search strategy

The search strategy delimits source types to only journals to retrieve scientific, contemporary, and explanatory literature (Chandra et al., 2022; Lim et al., 2022). For literature search and retrieval, the bibliometric database Scopus, instead of other alternatives, such as the web of science, google scholar, etc., is preferred, as Scopus ensures the stringent criteria for indexation of published documents (Verma, 2022; Chandra et al., 2022; Lim et al., 2022).

3.2. Stage 2: selection of search string

A pool of keywords reflecting the research domain and the possible synonyms of keywords formed the search string. The search string was also added to the keyword's repository used in similar review studies in extant literature. Academic experts were consulted for the finalization of the search string. The search was focused on the social companionship aspects of the conversational agents and thus keywords such as chatbot or social bot were excluded from the search to avoid a large number of irrelevant results. Search strings include keywords like “Artificial Intelligent agents” OR “AI agents” OR “Digital Assistants” OR “Virtual Assistants” OR “Conversational AI” OR “Conversational agents” OR “AI companion” OR “Digital Companion” OR “Virtual Companion” OR “Artificial Companion” AND “Companion” OR “Love” OR “Friend” OR “Bond” OR “Emotion”. In May 2022, the search performed in the Scopus Bibliometric database resulted in 988 documents. The resultant literature database was downloaded in Bibtex (.bib) and comma-separated value (.csv) file formats for further processing.

3.3. Stage 3: filtering the initial results (inclusion and exclusion criteria)

The Scopus database functions, such as sorting and filtering, facilitated the organization of codes for language, subject area, document type, and source type. Two-stage filtering instrumentalizes the precise data collection. Initially, filtering is operationalized on the filtering menu available in the Scopus database, followed by manual filtering through careful scanning of each document. In the initial filtering, documents were delimited to publications in the English language; document type as article or review; source type as journals and

Table 1
Evolution of AI companions from 1996 to 2022.

Characters	Artificial pets			Anthropomorphic characters	
Name	Tamagotchi (Bloch and Lemish, 1999)	PARO (Takayanagi et al., 2014)	Nabaztag (Cavazza et al., 2008)	KASPAR (Wood et al., 2019)	Apple's Siri (Thorne, 2020)
Time	1996	2001	2005	2005	2011
Theme	Virtual pet	Therapeutic robot	Information console	Therapeutic robot	Digital assistant
Description	A virtual Pet in a small egg-shaped toy with a mini led screen.	A baby harp seal robot with real fur, flippers, and vocalizations.	A rabbit-shaped smart device with two long ears that could move.	A child-shaped doll-like robot.	A virtual assistant in apple smart phones
Architecture	Rule-based modeling	Fuzzy logic and reinforcement learning	Rule-based modeling	Rule-based modeling	Deep learning-based modeling
Capabilities	The user could feed the pet, play games with it, and even discipline it if it misbehaved.	Recognizing human voices, human touch,	The weather forecast, stock market report, news headlines, alarm clock, e-mail alerts, sending and receiving messages, and MP3-Streams.	Singing songs, recognizing the human touch	Voice command, information search, setting alarms, reminders, making phone calls, announcing weather forecasts, playing music and videos, and third-party app integration.
Appearance	Virtually embodied	Physically embodied	Physically embodied	Psychically embodied	Disembodied
Medium of interaction	Physical buttons on the toy	Touch Sensors	Voice-based, LED lights display, and web interface	Touch Sensors	Text, Image, and Voice
Key specialty	A portable toy with a microprocessor could allow users to interact with a virtual pet.	Robot focuses on emotional support by mimicking the behaviour of a real baby Seal.	Integration of Wi-fi connectivity into a consumer device	Expressive face	Conversational ability to understand the natural language of users and reply accordingly
Companionship feature	The toy was designed to simulate the experience of caring for a virtual pet for which users could develop a sense of responsibility and attachment.	Baby harp seal that users could love and care for by moving their hands on its fur and receiving its reactions.	An artificial rabbit that users could interact with, care for and form bond with over time	Human child-like appearance with facial expressions that Kids could love and care for.	Siri's ability to learn about users over time and its integration with various third-party apps and services made it a more helpful assistant for users.
Key limitations	Small monochrome screen with limited graphics. Basic medium of interaction with the help of buttons only.	A limited range of actions and expressions also required regular maintenance and charging.	The device could not display videos, images, and text, also limited in interacting with the users affectively.	Limited interaction abilities as it was designed for kids with autism disorder.	Siri is unable to remember earlier conversations with users. Lack of self-disclosure and emotional engagement. It is limited to Apple devices.
Characters	Anthropomorphic characters				AI characters
Name	Amazon's Alexa (Gao et al., 2018)	Microsoft's XiaoIce (Zhou et al., 2020)	Replika (Ta et al., 2020)	Gate box (Hirano, 2016)	ChatGPT (Dwivedi et al., 2023)
Time	2014	2014	2016	2016	2022
Theme	Digital assistant	Empathetic chatbot	Personal companion	Personal companion	Versatile chatbot
Description	A virtual assistant in smart home devices and smart phones.	A friendly chatbot who can understand user emotions.	A companion chatbot that mimics romantic conversations	A holographic domestic companion and smart assistant	A versatile AI chatbot that can write poems, stories, news articles and generate original text on any subject. It can also play various roles like travel advisor, book author act.
Architecture	Learning Based Modeling, Recurrent Neural Networks (RNNs), Long-short term memory networks (LSTM)	Convolutional neural networks (CNNs), long-short term memory networks (LSTM)	LSTM, RNNs, and Reinforcement learning.	Learning based modeling, computer vision, robotics, internet of things, emotion recognition	Generative Pre-trained Transformer, self-supervised learning
Capabilities	Functional intelligence to perform tasks such as switching off or on lights and other appliances, playing music, making phone calls, announcing weather, setting alarms etc..	Named entity recognitions, sentiment analysis and emotional intelligence enable XiaoIce to engage users for prolonged conversations.	Emotional intelligence, mental health support and gamification allows Replika to mimic romantic conversations with the users.	Emotional intelligence, Functional intelligence in home automation, mental health support, social media integration	Capable of generating original content, can respond to wide range of prompts and questions, can discuss any subject as long as user wants. Can remember previous conversations with the user.
Appearance	Disembodied	Virtually embodied	Virtually embodied	Holographic embodiment	Disembodied
Medium of interaction	Text, voice, image	Text, voice, image	Text, voice, image	Text, voice, image	Text
Key specialty	Alexa skills kit to integrate Alexa with wide range of smart home devices.	To generate emotionally responsive and contextually relevant responses	Focus on emotional intelligence, empathy, self-disclosure and mimicking human romantic conversations.	A physical appearance of favorite character that users can live with.	Generative AI is the key specialty in ChatGPT
Companionship feature	Voice based device controls, and humorous responses of Alexa make user-Alexa relationship proximal in nature.	Emotional support and ability to engage users in prolonged interactions enable XiaoIce to form relational bonds with the users	Emotional support, mental health support and ability to converse romantically allows Replika to make users feel emotionally connected.	Emotional support, mental health support, and home automation support allow users to consider AI a living partner.	Providing writing support, information support and the ability to play versatile roles enables ChatGPT to establish long-term relationships with the users.

(*continued on next page*)

Table 1 (*continued*)

Characters	Artificial pets			Anthropomorphic characters	
Key limitations	Lack of contextual understanding, cannot answer long and complex queries and lack of emotional understanding.	XiaoIce is only limited to Japanese and Chinese languages. Responses sometimes feel scripted or repetitive. Lack of functional intelligence like Alexa. Lack of self-disclosure.	Lack of functional intelligence like Alexa, limited conversational skill to stretch a discussion.	Only limited to Japanese and English language, relatively expensive to buy.	Lack of functional abilities, disembodiment and limited to text based interaction medium.

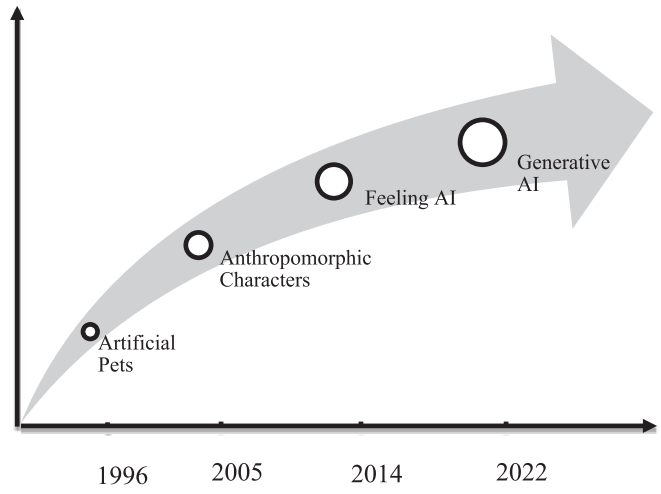

Fig. 1. Technological shifts in the evolution of AI Companions.

conference proceedings; and subject area as "Social science, Psychology, Decision Science, Arts and Humanities, Neurosciences, Health Professions, Business, Management and Accounting, Economics Econometrics and Finance, and Multidisciplinary." Manual filtering involves careful scanning of documents for the relevancy and specificity of the research domain. Two-stage filtering led to a reduced number of 197 documents.

3.4. Stage 4: data collection, data cleaning, and data processing

Post-screening, the data set was triangulated for data verification. Two researchers and a group of experts opined the suitability of data. Finally, 126 papers formed the consideration set for further processing. The present study uses an inductive approach to drive data insights (Far and Rad, 2018; Lim et al., 2022). Besides the inductive approach, deductive analysis helped in performance analysis and science mapping of the research domain (Donthu et al., 2021a). Performance analysis reveals the publication trend by identifying the domain's top authors, documents, and sources. Content and thematic analysis revealed the prevailing theories, constructs, keyword co-occurrence, and bibliographic coupling themes. The present study uses Microsoft excel for content analysis, Biblioshiny R software, and VOSviewer software for a network of themes (Donthu et al., 2021a).

3.5. Stage 5: data analysis strategy

The study relies on the keyword Co-occurrence network and bibliographic coupling analysis to reveal different knowledge clusters present in the domain. Network analysis is performed through VOS viewer, which creates clusters of keywords or documents based on their weight (Van Eck and Waltman, 2011) and supports the content analysis. The bibliographic coupling is a widely preferred technique that reveals the thematic analysis (Boyack and Klavans, 2010). The present study employs network analysis to understand the interrelationship between documents, keywords, authors, or citations (Pilkington and Catherine, 1999). The data clustering algorithm is the foundation of network analysis to discern the intellectual structure of the research domain (Chen et al., 2010). Nodes in a cluster possess similar characteristics in the network (Radicchi et al., 2004). The network parameters, such as edges' thickness and density, depict the similarity index between the scientific actors (Leydesdorff and Rafols, 2011; Radicchi et al., 2004). Betweenness centrality identifies the most prominent nodes in the shared linkage (Hjørland, 2013). Network's modularity index is calculated using the Louvain algorithm. Leading eigenvalues, or spin glass algorithms, measure the strength of the relationship between nodes (Blondel et al., 2008). We prefer the Louvain algorithm in the present study as it optimizes the network run in time 0 (n log n). The software eliminates the outliers of the network present in the form of isolated nodes on the map. The algorithm returns an optimized value with the network's modularity ranging from −1 to +1. For a weighted graph, the modularity is formulated as

$$Q = \frac{1}{2m}\sum_{ij}^{\infty}\left(a_{ij} - \frac{k_i k_j}{2m}\right)\delta(CiCj)$$

4. Performance analysis of SC with CAs

Most reviews examine the performance of research constituents, e.g., authors, journals, and documents (Lim et al., 2022; Donthu et al., 2021a; Chandra et al., 2022), to show the significance of the chosen field. The current study attempts to unfurl publication and citation trends for research on SC with CAs. According to Mukherjee et al. (2022), top publications and top authors of the research field support practitioners in identifying significant contributions in the given field, along with a list of experts in that domain. Additionally, a list of top sources helps researchers and academicians to target suitable journals for publication of their studies in the given field. In this regard, the current study maps the performance analysis of SC with CAs in the following sub-sections.

4.1. Publication and citation trend of SC with CAs (RQ1)

Table 2 presents the publication and citation trends for research on SC with CAs. The table indicates that the field is about nineteen years old. The initial papers started appearing in 2003, and the domain evolved gradually. The dataset contains 126 documents (TP) published in 87 different sources, with 106 cited publications (TCP) and a productivity average of 6.63 publications per year. Fig. 3 represents the publication trend and indicates the sharp growth in the last three years. The exponential growth in the last three years indicates the growing interest in the social companionship aspect of conversational agents. The involvement of digital assistants in consumers' lives can be attributed to social fabrics and emotional connections developed by conversational agents.

The table indicates that studies on SC with CAs have received 2231 citations (TC), with an average citation per publication of 17.70 (TC/TP). The h-index (citation impact) of the field 25 (h) informs that twenty-five publications have received at least 25 (h) citations. In

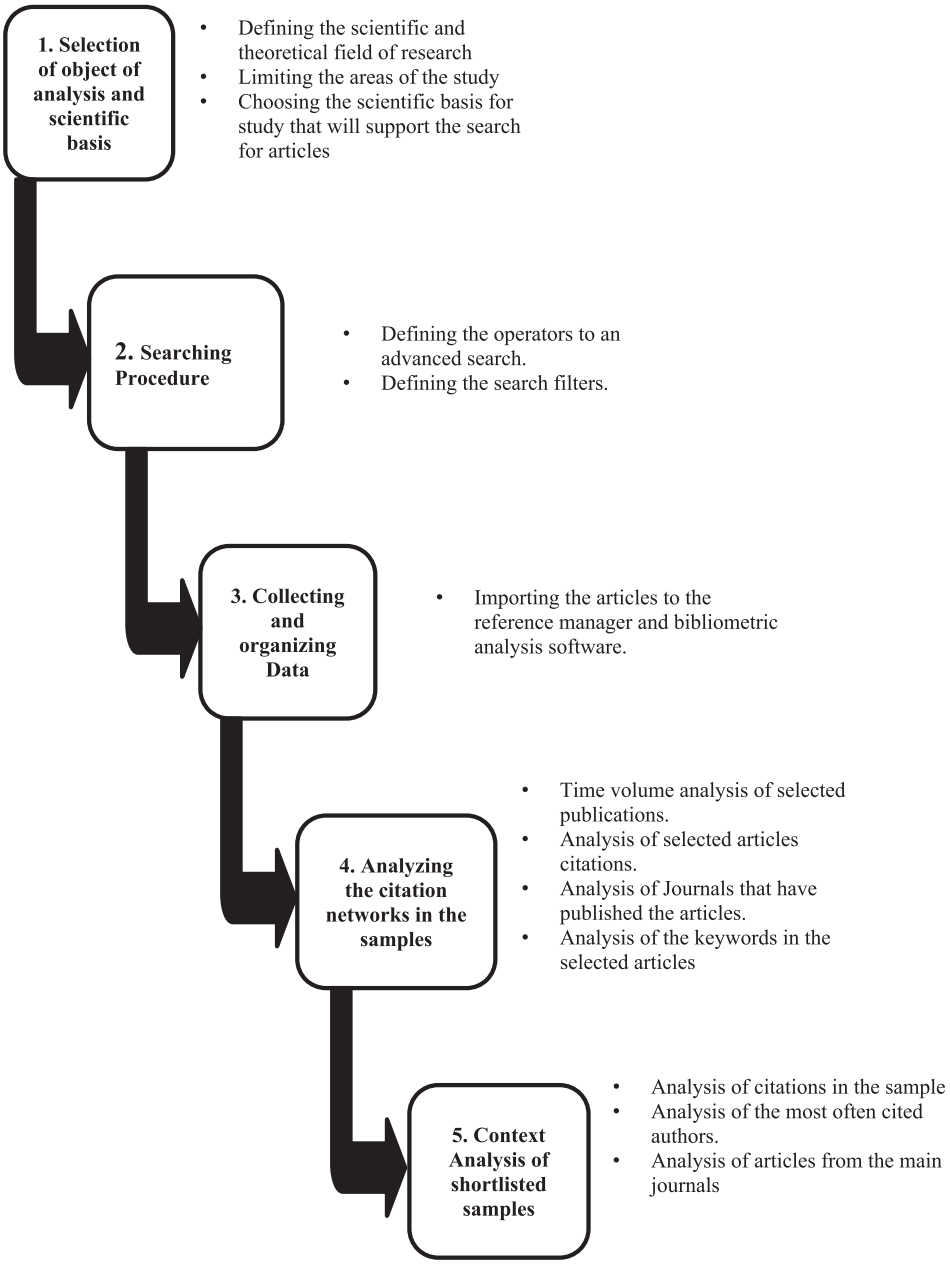

Fig. 2. Highlights the flow process for the review.

contrast, the field's g-index (citation influence) is eight, which indicates that *eight* publications have received at least 64 (g^2) citations each. The authorship information in the table reveals a total of 428 authors (including repetition) (NCA) or 391 unique authors (excluding repetition) (NUA) contributing to the field. The dataset includes fifteen single-authored publications (SA), while 111 documents are co-authored publications (CA). The collaboration index (CI=NCA-TP÷TP) of 3.14 signifies that each lead author has collaborated with an average of 3.14 co-authors (CI). Most of the documents in the dataset are empirical studies (92.85 %), while only 9 (7.14 %) are non-empirical.

4.2. Top sources for SC with CAs (RQ2)

Table 3 presents the top ten sources for publications in SC with CAs based on the highest number of citations received. The table indicates that Computers in Human Behaviour receives the highest number of citations (TC: 286), with only five publications in a short period (starting in 2018). The research papers published in Computers in Human Behaviour garnered the highest average number of citations (C/Y: 57.20) per year, signifying the journal as the leading source for publication in the given field. Social companionship entails behavioural aspects with AI-enabled conversational agents rationalizing the higher publications in journals/conferences focusing on the interface between computers and human behaviour. Conference on human factors in computing systems proceedings is the most impactful conference source (h-index = 5 and g-index = 5) for researchers working on SC with CA. Noteworthily, the top 10 sources for publications on social companionship with conversational agents include the majority of sources (40 %) from the area of Computer Science (CS) (i.e., *Computers in Human Behaviour, International Journal of Human-Computer Studies, Conference on Human Factors in Computing Systems – Proceedings and Conference on Human Factors in Computing Systems – Proceedings and Lecture Notes in Computer Science)* followed by the sources from the area of information systems (IS) (i.e., *Frontiers of Information Technology and Electronic*

Table 2
Bibliometric information of SC with CAs.

Panel A. Publication information	Statistic
Total publications (TP)	126
Total cited publications (TCP)	106
Total sources (TS)	87
Number of active years (NAY)	19 1/2
Productivity per active year (PAY)	6.63
Panel B. Citation information	Results
Total citations (TC)	2231
Average citations per publication (TC/TP)	17.70
h index	25
g index	44
Panel C. Authorship information	
Number of contributing authors (including repetition) (NCA)	428
Number of unique authors (excluding repetition) (NUA)	391
Authors of single-authored publications (ASA)	13
Authors of co-authored articles (ACA)	378
Single-authored publications (SA)	15
Co-authored publications (CA)	111
Collaboration index (CI=NCA-TP÷TP)	3.14
Panel D. Document information	
Article (empirical)	117
Reviews (non-empirical)	9
References	7365
Keywords	420

Note: Period of coverage = 2003 – May 2022.

Engineering, Computer Networks, Computational Linguistics, European Conference on Information Systems). While CS and IS are traditionally considered different fields, there is an increasing need for interdisciplinary research in developing and implementing AI technologies for companionship. By catering to interdisciplinary audiences from marketing, philosophy, computer science, social science and information science the study aims to contribute to a more comprehensive understanding of the subject matter, which can have implications for the advanced design of CAs capable of establishing relational bonds with users in range of disciplines(Bracken and Oughton, *2006;* Keestra, *2017;* MacLeod, *2018)*.

4.3. Top publications for SC with CAs (RQ2)

The top ten publications on SC with CAs' based on the highest number of citations are presented in Table 4. However, citation counts alone are insufficient to evaluate any published work's research quality. Therefore, the current study goes beyond the number of citations and checks other research quality indexes such as solidity and plausibility, originality and novelty, scientific value, and societal value and relevance (Aksnes et al., 2019). The table indicates Araujo's (2018) experimental study with chatbots is the most impactful publication with the highest number of citations (222) in the field. The study is also the most influential publication, with the highest average citations per year of 44.40, which found that social presence mediates the effect of anthropomorphic design cues on the emotional connection established with the users (Araujo, 2018). For solidity and plausibility, we checked the quality of citing journals. We found that they are journals of repute like the *Journal of the Academy of Marketing Science*, *Journal of Management Information Systems, International Journal of Human Resource Management, Electronic Markets, Journal of Business Research, Journal of Retailing and Consumer Services, Psychology & Marketing, and Journal of Service Management*. In terms of originality and novelty, the study emphasizes the novel concept of anthropomorphic design in chatbots and its significance in business, which is in triangulation with the evolution of AI companions explained in the prior sections of the current paper. Regarding scientific value, we confirmed that the authors citing the study are established academicians and researchers. We used alternative metrics through "PlumX" to assess the societal value and relevance of the article and found that the study captured the attention of 889 readers

Table 3
Top sources for SC with CAs.

Journals	TC	h	g	TP	Start_PY	C/Y
Computers in Human Behaviour	286	4	5	5	2018	57.20
Frontiers of Information Technology and Electronic Engineering	206	1	1	1	2018	41.20
International Journal of Human-Computer Studies	151	3	4	4	2019	37.75
Computer Networks	116	1	1	1	2013	11.60
Computational Linguistics	94	1	1	1	2020	31.33
Electronic Markets	64	1	1	1	2021	32
Conferences						
Conference on Human Factors in Computing Systems - Proceedings	137	5	5	5	2004	7.21
Proceedings of Conference on Human Information Interaction and Retrieval	92	1	1	1	2018	18.40
Lecture Notes in Computer Science	63	2	7	7	2011	5.25
European Conference on Information Systems	62	2	2	2	2018	12

Abbreviations: C/Y, citations per year; g, g-index; h, h-index; Start_PY, the start of publication year; TC, total citations; TP, total publications.

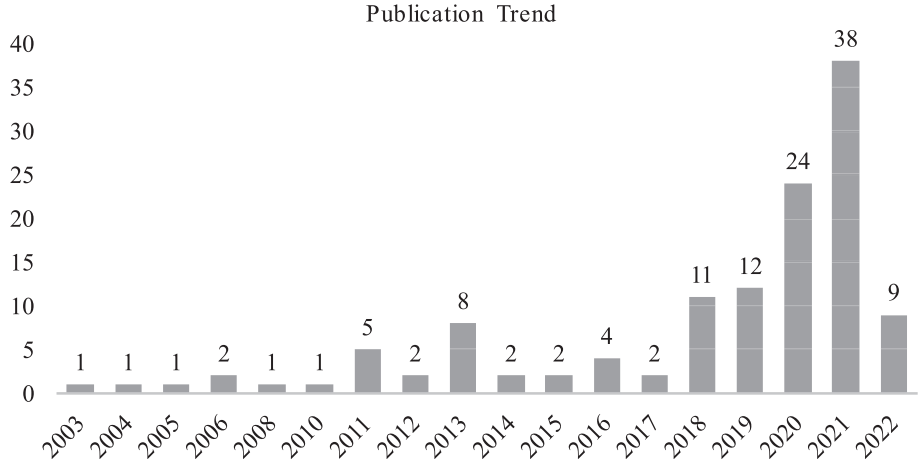

Fig. 3. Annual publication trend of SC with CAs' research.

Table 4
Top publications for research on SC with CAs.

Title	Authors	Year	TC	C/Y
Living up to the chatbot hype: the influence of anthropomorphic design cues and communicative agency framing on conversational agent and company perceptions	Araujo	2018	222	44.40
From Eliza to XiaoIce: challenges and opportunities with social chatbots	Shum et al.	2018	206	41.20
A taxonomy of social cues for conversational agents	Feine et al.	2019	123	30.75
Design and analysis of a social botnet	Boshmaf et al.	2013	116	11.60
The design and implementation of Xiaoice, an empathetic social chatbot	Zhou et al.	2020	94	31.33
Personification of the Amazon Alexa: BFF or a mindless companion?	Lopatovska and Williams	2018	92	18.40
AI-based chatbots in customer service and their effects on user compliance	Adam et al.	2021	64	32.00
Towards caring machines	Bickmore and Picard	2004	64	3.37
Faster is not always better: understanding the effect of dynamic response delays in human-chatbot interaction	Gnewuch et al.	2018	50	10.00
Relational agents improve engagement and learning in science museum visitors	Bickmore et al.	2011	50	4.17

Note: Abbreviations: C/Y, citations per year, TC, total citations.

from different parts of the globe.

Shum et al. (2018) paper is the second most impactful and influential publication, with (206) total citations and an average of 41.20 per year. The authors presented the development of chatbots, starting from the first chatbot Eliza (1966), to the latest and most advanced social chatbots like Siri (2011) and XiaoIce (2014). The authors also found XiaoIce as an empathetic chatbot that can recognize human emotions and engage users for longer. The paper is cited by publications in various journals of repute, such as the *Journal of the Academy of Marketing Science*, *Journal of Business Research, International Journal of Consumer Studies, and Knowledge-Based Systems*, which ensures the solidity and plausibility of the study. In terms of originality and novelty, the study emphasizes the novel concept of empathetic chatbots and their design using affective computing techniques, again in the triangulation with the evolutions of the AI companions. The study is cited by numerous practitioners in the field due to the orientation of the study towards futuristic technology and thus ensures its scientific value. Alternative metrics from PlumX indicates that the study has one patent family, once mentioned in a news article, tweeted two times on twitter, and has captured 797 reading attentions throughout the globe, which ensures the societal value and relevance of the article.

Feine et al. (2019), with 123 total citations, is the third most-cited paper, with an average of 30.75 citations per year. The authors converged the diversified literature on social cues (such as gender, age, gesture, etc.) that trigger humans to react while interacting with chatbots and classified them into four main categories (verbal, auditory, visual, and invisible) and ten sub-categories. The paper is cited by publications in various journals of repute, such *as the International Journal of Information Management, Decision Support Systems, Journal of Retailing and Consumer Services, Electronic markets*, *Journal of Management Information Systems, and Psychology & Marketing* etc., which ensures the solidity and plausibility of the study. The study summarizes the novel concept of social capabilities (using social cues in the chatbot design) in terms of originality and novelty. Authors from diverse disciplines, including established and new, cite the study in their work, thus ensuring its scientific value. Alternative matrices from PlumX indicates that the study has captured 452 reading attentions throughout the globe, 42 attentions on Facebook, and five tweets on Twitter, ensuring the article's societal value and relevance. The other top publications in Table 4 deal with designing and implementing various empathetic chatbots and caring machines that can establish a close relationship with humans. These include research studies by Boshmaf et al., 2013, Zhou et al., 2020, and Bickmore and Picard, 2004. Additionally, some publications in the list highlight using social chatbots to improve customer service (Adam et al., 2021; Bickmore et al., 2011; Lopatovska and Williams, 2018; Gnewuch et al., 2018). As mentioned for the top three, the authors have check the research quality indexes for each top publication in the table.

4.4. Top authors for SC with CAs' research (RQ2)

The top 10 authors in the field of SC with CAs are listed in Table 5. The table indicates Bickmore as the most prolific author with (4) publications and (180) total citations starting from 2004. The list also contains four authors with three publications (Broadbent E, Loveys K, Wilks Y, and Clavel C) and 5 authors with two publications. Li D (TC: 300) and Shum HY (TC: 300) are the most-cited authors in the field, followed by Bickmore T (TC: 180), Gnewuch U (TC: 173), Maedche A (TC: 173), and Morana S (TC: 173). However, citation counts, and related traditional metrics limits the view of overall impact of authors on an emerging field of research. Thus, the current study also investigates, into the profiles of authors and finds that, top authors in the list come from diversified workplaces such as academics (e.g., Bickmore T, Broadbnet E, Loveys K, Wilks K, Clavel C, Gnewuch U, Maedche A, Morana) and practice (e.g., Li D and Shum HY). Moreover, most of the authors in the list are from Western and European countries (e.g., the United States (4), New Zealand (2), Germany (3)). The current study can be considered an extension of Lim et al. (2022) study on conversational commerce research. The findings align with the previous survey that western countries contribute more to research on SC with CAs.

5. Theoretical foundations of SC with CAs (RQ3)

Table 6 lists theories used in the literature when addressing SC with CAs. The table indicates that research on SC with CAs has adopted theories from disciplines such as

- *Theories from Psychology*: Balance theory, foot-in-the-door technique, uncanny valley theory, self-perception theory, self-disclosure theory,

Table 5
Top authors for SC with CAs.

Authors	Author affiliations	NP	TC	PY_start	C/Y
Bickmore T	Northeastern University, United States	4	180	2004	9.47
Broadbent E	University of Auckland, New Zealand	3	15	2019	3.75
Loveys K	University of Auckland, New Zealand	3	15	2019	3.75
Wilks Y	Florida Institute for Human-Machine Cognition, United States	3	13	2005	0.72
Clavel C	Polytechnic Institute of Paris, France	3	8	2013	0.8
Li D	Microsoft Corporation, United States	2	300	2018	60
Shum HY	Microsoft Corporation, United States	2	300	2018	60
Gnewuch U	Karlsruhe Institute of Technology, Germany	2	173	2018	34.6
Maedche A	Karlsruhe Institute of Technology, Germany	2	173	2018	34.6
Morana S	Karlsruhe Institute of Technology, Germany	2	173	2018	34.6

Abbreviations: C/Y, citations per year; Start_PY, the start of publication year; TC, total citations.

Table 6
Theories in SC with CAs' research.

Year	Field	Theory	Origin	Example
Psychology				
1946	Psychology	Balance Theory	Heider (1946)	Rapp et al. (2021)
1966	Psychology	Foot in the Door Technique (FITD)	Freedman and Fraser (1966)	Adam et al. (2021)
1970	Psychology	Uncanny Valley Theory	Mori (1970)	Ta et al. (2020)
1972	Psychology	Self-Perception Theory	Bem (1972)	Adam et al. (2021)
1978	Psychology	Theory of Mind	Premack and Woodruff (1978)	Lee et al. (2020a)
1987	Psychology	Self-Disclosure Theory	Derlaga and Berg (1987)	Lee et al. (2020c)
1987	Psychology	The Functionalist Theory of Emotions	Barrett and Campos (1987)	Crolic et al. (2022)
1988	Psychology	Expectancy Violation Theory	Burgoon and Hale (1988)	Croes and Antheunis (2021)
1988	Psychology	Cognitive Load Theory	Sweller (1988)	Potdevin et al. (2021)
1996	Psychology	Theory of Relational Satisfaction	Cole and Bradac (1996)	Bickmore et al. (2011)
2000	Psychology	Self Determination Theory	Ryan and Deci (2000)	Sinoo et al. (2018)
2001	Psychology	Commitment-Consistency Theory	Cialdini (2001)	Adam et al. (2021)
2002	Psychology	Perception-Action Model (PAM)	Preston and De Waal (2002)	Gama et al. (2011)
2006	Psychology	Emotional Response Theory	Mottet et al. (2006)	Potdevin et al. (2021)
2007	Psychology	Three-Factor Theory of Anthropomorphism	Epley et al. (2007)	Pradhan et al. (2019)
Sociology				
1958	Sociology	Social Exchange Theory	Homans (1958)	Tassiello et al. (2021)
1973	Sociology	Social Penetration Theory	Altman and Taylor (1973)	Skjuve et al. (2021)
1980	Sociology	ABCDE Model of Relationship Development	Levinger (1980)	Croes and Antheunis (2021)
1980	Sociology	Bourdieu's social theory	Bourdieu (1980)	Possati (2022)
1991	Sociology	Time Interaction and Performance (TIP) Theory of Groups	McGrath (1991)	Wang et al. (2021)
1994	Sociology	Social Response Theory	Nass et al. (1994)	Gnewuch et al. (2018)
1999	Sociology	Social Role Theory	Eagly and Wood (1999)	Rhee and Choi (2020)
2000	Sociology	Computers are Social Actors (CASA)	Nass and Moon, 2000	Gnewuch et al. (2018)
2009	Sociology	Aristotle's Theory of Friendship	Aristotle (2009)	Bosch et al. (2022)
2011	Sociology	Theory of Companions	Krämer et al. (2011)	Payr (2011)
Media and communication				
1986	Media and Communication	Media Richness Theory	Daft and Lengel (1986)	Hsieh and Lee (2021)
1992	Media and Communication	Social Information Processing Theory	Walther and Burgoon (1992)	Lee et al. (2020a)
1992	Media and Communication	Domestication Theory	Silverstone and Hirsch, 1992	Brause and Blank (2020)
2003	Media and Communication	Speech Act Theory	Smith (2003)	Porra et al. (2020)
2006	Media and Communication	Interpersonal Communication Theory	McCroskey et al. (2006)	Lei et al. (2021)
2008	Media and Communication	Communication Privacy Management Theory	Petronio and Durham (2008)	Ha et al. (2021)
Marketing and computer science				
1989	Marketing	Agency Theory	Eisenhardt (1989)	Cheng and Jiang (2020)
1997	Marketing	Brand Personality Theory	Aaker (1997)	Youn and Jin (2021)
1998	Marketing	Technology Paradox Theory	Mick and Fournier (1998)	Wilson-Nash et al. (2020)
1998	Computer Science	Affective Computing Theory	Lisetti (1998)	Mensio et al. (2018)

expectancy violation theory, the functionalist theory of emotions, theory of relational satisfaction, self-determination theory, commitment-consistency theory, theory of mind, perception-action model, emotional response theory, three-factor theory of anthropomorphism, and cognitive load theory.

- *Theories from Sociology*: Bourdieu's social theory, social penetration theory, social exchange theory, relationship development theory, social role theory, time interaction and participation TIP theory of groups, social response theory, computers are social actors' theory, Aristotle's theory of friendship, and theory of companions.
- *Theories from Media and communication*: Communication privacy management theory, interpersonal communication theory, speech act theory, media richness theory, social information processing theory, domestication theory,
- *Theories from Marketing*: Agency theory, brand personality theory, technology paradox theory and computer science (e.g., affective computing theory)

The earliest theory stems from psychology in 1946 (i.e., balance theory) and the latest theory from sociology in 2011 (i.e., theory of companions). A significant percentage (68 %) of theoretical foundations comes from the psychology and sociology domain, indicating the significance of psychology and sociology in social companionship. Future researchers may use theories from communications to develop futuristic models for chatbot companions.

6. Intellectual structure analysis

The intellectual structure reveals the underlying themes and constructs building the research domain. Techniques like co-occurrence analysis and bibliographic coupling discern the domain's past, present, and future research directions.

6.1. Keyword co-occurrence analysis (RQ4)

Keyword co-occurrence analysis reveals themes converging the

research domain (Donthu et al., 2021a; Zupic and Cater, 2015; Callon et al., 1983). Fig. 4 presents the co-occurrence network of keywords emerged from VOS viewer analysis. Five thematic clusters emerged, wherein cluster 1 denotes personification of conversational agents, cluster 2 encapsulates artificial companions and Socialbots, cluster 3 captures human relations with conversational agents, cluster 4 reflects enablers of conversational agents, and cluster 5 signifies AI as social companions. Co-occurrence network parameters include occurrence (OC), degree (DG), average publication year (APY), and average citation (AC), as represented in Table 7, to derive an objective assessment of each thematic cluster

Where OC denotes the frequency of a keyword, DG signifies the number of connections that a node (keyword) of the network has with other nodes, APY reflects the hotness (more recent) and coldness (less recent) of a keyword, and AC denotes the average impact of that keyword on the field (Donthu et al., 2021a; Lim et al., 2022; Chandra et al., 2022).

6.1.1. *Cluster 1: personification of conversational agents*

The first cluster comprises keywords pointing at personification capabilities of conversational agents. The cluster highlights AI agents in various forms, such as "Amazon Alexa", "Amazon Echo", and "embodied conversational agents". The highest explored keyword in this cluster is "embodied conversational agents" (OC: 8), followed by "affective computing" (OC: 6), and "personification" (OC: 3). The keyword with the highest links and citations in the cluster is "personification" (DG: 8; AC: 57.33), which signifies that most AI agents are designed with human-like features such as name, gender, voice, etc. Another keyword in the cluster, "amazon echo", received high citations (AC: 55.66) signify preference for echo as a companion over other AI agents. Personification is hot and trending topic of the cluster (APY: 2018.33–2019.67).

6.1.2. *Cluster 2: artificial companions and social bots*

The second cluster, artificial companions and social bots, projects AI as a companion in the form of social chatbot, such as "conversational agents," and "social bots". The keyword with the highest connections

Table 7
Thematic Structure of Keyword Co-occurrence Network.

Themes and keywords	DG	OC	APY	AC
Cluster 1 (Red): personification of conversational agents				
Embodied conversational agent	5	8	2014.13	31.25
Affective computing	6	6	2011.83	17.33
Personification	8	3	2018.33	57.33
Amazon Echo	7	3	2018.33	55.66
Amazon Alexa	7	3	2019.67	34
Cluster 2 (green): artificial companions and social bots				
Conversational agents	23	15	2019.73	9.2
Human-computer interaction	10	6	2020.5	5.66
User experience	7	3	2020.33	17
Mobile phone	5	3	2020.67	14
Socialbots	1	3	2019	12.66
Cluster 3 (blue): human relations with conversational agents				
Artificial companions	4	7	2015	13.57
Robots	6	5	2018.8	9.6
Loneliness	10	5	2020.2	2.6
Older adults	6	4	2020.25	15.5
Friendship	5	3	2020.33	11.66
Cluster 4 (yellow): enablers of conversational agents				
Chatbot	25	16	2020.13	26.43
Anthropomorphism	25	10	2020.5	37.2
Trust	14	7	2020.71	8.28
Social presence	11	6	2019.83	63.66
Self-disclosure	10	6	2020.33	13.5
Voice assistants	9	5	2020.6	10.2
Cluster 5 (purple): AI as social companions				
Artificial intelligence	36	24	2019.71	18.79
Socialbots	2	3	2016.33	42.66
Social support	7	3	2020	13
Companion	3	3	2018.67	4.33
Machine learning	6	3	2019	2

Abbreviations: DG: degree; OC: occurrence; APY: average publication year; AC: average citation.

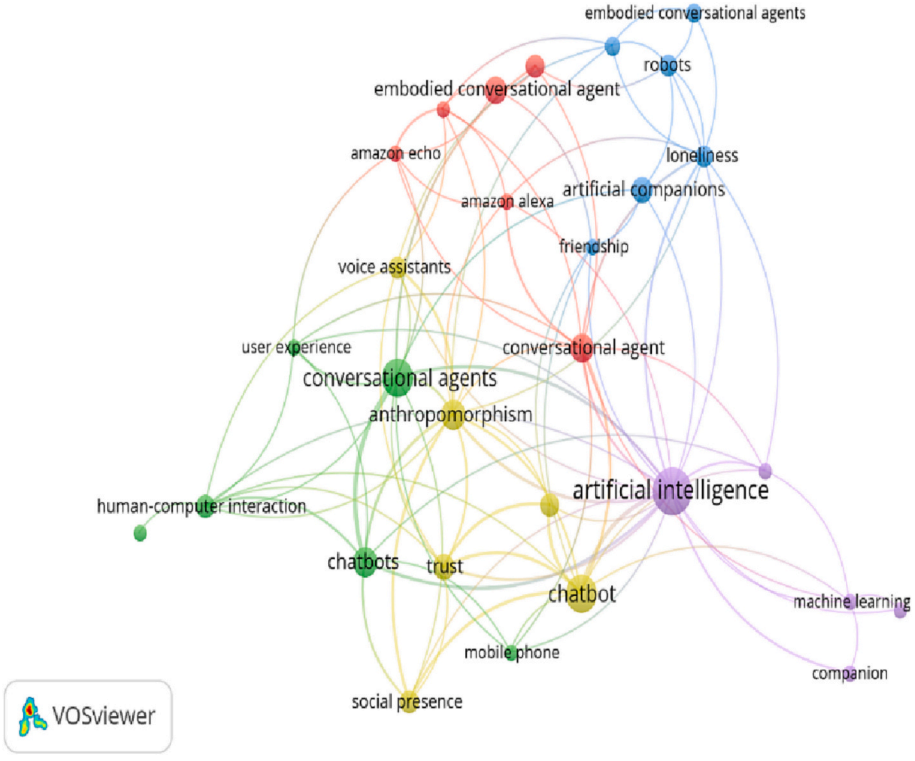

Fig. 4. Co-word network of SC with CAs' research.
Notes: Cluster 1 (Red) = Personification of conversational agents.
Cluster 2 (Green) = Artificial Companions and Social Bots.
Cluster 3 (Blue) = Human relations with conversational agents.
Cluster 4 (Yellow) = Enablers of conversational agents.
Cluster 5 (Purple) = AI as social companions

and frequency in this cluster is "conversational agents" (DG: 23; OC: 15) followed by "human-computer interaction" (DG: 10; OC: 6), "user experience" (DG: 7; OC: 3), "mobile phone" (DG: 5; OC: 3), and "Socialbots" (DG: 1; OC: 3). However, in terms of the average citations "user experience" scored highest (AC: 17) followed by "mobile phone" (AC: 14) and "social bot" (AC: 12.66). The cluster emphasized the enhanced user experience with computers capable of interacting with humans. According to the average publication year index, all the keywords in this cluster are hot and trending (APY: 2019 – 2020.67).

6.1.3. Cluster 3: human relations with conversational agents

The third cluster, human relations with conversational agents, includes five significant keywords. The cluster encapsulates the nature of the relationship between AI and humans. It is made up of keywords such as "artificial companions," "robots," "loneliness," "older adults," and "friendship." In terms of frequency, "artificial companions" has gained the highest (OC: 7), followed by "robots" (OC: 5), "loneliness" (OC: 5), "older adults" (OC: 4), and "friendship" (OC: 3). Moreover, "older adults" revealed highest average citations (AC: 15.5) which indicates that authors are more inclined towards the relationship between older adults and artificial companions. Also, the keyword "loneliness" has the highest connections in the cluster (DG: 10). The cluster emphasizes the role of AI companions in mitigating the effects of loneliness in older adults. In terms of average publication year, all the keywords of this cluster are hot and trending (APY: 2015–2020.33).

6.1.4. Cluster 4: enablers of conversational agents

The fourth cluster, user experience with conversational agents, combines six keywords. The cluster highlights the features offered by AI companions, such as "anthropomorphism," "self-disclosure," "trust," and "social presence." The most frequently explored keyword in this cluster is "chatbot" (OC: 16), followed by "anthropomorphism" (OC: 10), "trust" (OC: 7), social "presence" (OC: 6), "self-disclosure" (OC: 6), and "voice assistant" (OC: 5). In addition, this cluster holds the highest cited keyword of the entire dataset, which is the "social presence" (AC: 63.66). Also, keywords with the highest connections in the cluster are "chatbot" (DG: 25) and "anthropomorphism" (DG: 25). Researchers see "social presence" and "anthropomorphic design cues" as mandatory features to attain SC. A chatbot can become a companion for its users if it behaves like humans and reflects social presence. In terms of average publication year, all the keywords of this cluster are hot and trending (APY: 2019.83–2020.71).

6.1.5. Cluster 5: AI as social companions

The fifth cluster, AI as social companions, comprises five significant keywords. The cluster focuses on designing artificial intelligence and machine-learning-based CAs that can play the role of companions, providing social support to its users. Keywords enlisted in the cluster are "artificial intelligence," "Socialbots," "social support," "companion," and "machine learning." The highest frequency in the cluster is of "artificial intelligence" (OC: 24), followed by "Socialbots" (OC: 3), "social support" (OC: 3), "companion" (OC: 3), and "machine learning" (OC: 3). In terms of average citations, the "social bot" has achieved the highest score in the cluster (AC: 42.66). "Artificial intelligence" as a keyword has the highest linkages in the entire dataset (DG: 36), as it is the primary enabler for designing AI agents. Indeed, the research on SC with CAs is a new and emerging field of study. In terms of average publication year, all the keywords of this cluster are hot and trending (APY: 2016.33–2020).

6.2. Bibliographic coupling analysis (RQ4)

This section deals with the bibliographic coupling of themes in SC with CAs. The current study attempts to triangulate the clusters in keyword co-occurrence analysis in the previous section with the bibliographic coupling themes (Goodell et al., 2021). The bibliographic coupling technique uses documents for network analysis (Donthu et al., 2021b; Kessler, 1963). Despite having alternative techniques such as co-citation analysis, the current study opts for bibliographic coupling (which groups "citing" publications) and keyword co-occurrence analysis (which groups "current" keywords) to reflect current trends existing in the field of SC with CAs (Lim et al., 2022; Donthu et al., 2021a). Noteworthily, the results revealed five significant thematic clusters discussed in the following subsections. Table 8 lists the top ten articles of each cluster based on total citations.

6.2.1. Cluster 1: artificial companions and Socialbots

The first cluster encapsulates research on artificial companions and AI-powered social bots. The top ten most cited articles in this cluster are Boshmaf et al. (2013), Floridi (2008), Elyashar et al. (2013), Orabi et al. (2020), Biundo et al. (2016), Hepp (2020), Porra et al. (2020), Portela and Granell-Canut (2017), Siourti et al. (2018), and Portacolone et al. (2020) with 116, 45, 37, 34, 19, 15, 15, 13, 12 and 9 citations respectively. Boshmaf et al. (2013), the cluster's most cited article (TC: 116), found that social media networks can be easily exploited with the help of social bots' infiltration campaigns with a success rate of up to 80 %. Elyashar et al. (2013) advocated the use of programmable social bots by organizations on social media to build personal relations with users. However, data privacy programs should check infiltration campaigns. Orabi et al. (2020) reviewed the literature on detection methods and found that designing a bot detector is challenging when botmasters keep evolving with new infiltration techniques.

The second shade of the cluster emphasizes on the emergence of artificial companions. Floridi (2008) identifies three important roles of artificial companions in the future, as a partner, information-based server, and a memory steward that could simulate human life. Moreover, the author observed that the moral aspects of AI companions are still unexplored. Porra et al. (2020) argued that feelings, the substance of humanness, must be reserved only for human interaction. AI companions can transform human behaviour and actions. Biundo et al. (2016) invites cross-disciplinary researchers to develop companion applications in robotics, health, and elderly care, etc. The cluster also includes studies on AI companions such as Portela and Granell-Canut (2017), Siourti et al. (2018), and Portacolone et al. (2020) that investigated user experience, user acceptance, and user behaviour with artificial companions, respectively.

6.2.2. Cluster 2: personification of conversational agents

The second cluster focuses on the personification of CAs. The top ten most cited articles in this cluster are Lopatovska and Williams (2018), Pradhan et al. (2019), Gao et al. (2018), Cho et al. (2019), Ta et al. (2020), Skjuve et al. (2021), Crolic et al. (2022), Brause and Blank (2020), Kim and Choudhury (2021), and Wilson-Nash et al. (2020) with 92, 42, 38, 37, 31, 12, 10, 9 and 9 citations respectively. Lopatovska and Williams (2018) found that Alexa's personification behaviour characterize as mindless politeness, is the most cited article (TC: 92) in the cluster. However, some evidence reveals that people consider Alexa, an associate partner. For example, Gao et al. (2018) observed that users do personify the echo as an assistant, friend, family member, wife, and girlfriend. The findings also revealed that users who personify echo tend to develop more positive emotions with Alexa than those who treat it as a speaker. Another study by Brause and Blank (2020) identified various use genres for smart speakers: companionship, sleep aid, peace of mind, self-control and productivity, increased accessibility, health care and support, convenience, and entertainment. Pradhan et al. (2019) found that participants fluidly moved between objectifying and personifying echo instead of categorizing it straightforwardly. A similar investigation on older adults by Kim and Choudhury (2021) reveals some benefits (such as enjoyment and convenience) and challenges (functional errors and limited speech technology) of using smart speakers. Anthropomorphic design cues can lead to better engagement.

Crolic et al. (2022) found anthropomorphism negatively affects

Table 8
Bibliographic coupling themes in SC with CAs.

Themes and top articles	Authors	Citations
Cluster 1: artificial companions and social bots		
Design and analysis of a social botnet	Boshmaf et al. (2013)	116
Artificial intelligence's new frontier: artificial companions and the fourth revolution	Floridi (2008)	45
Homing Socialbots: intrusion on a specific organization's employee using Socialbots	Elyashar et al. (2013)	37
Detection of Bots in social media: a systematic review	Orabi et al. (2020)	34
Companion-technology: an overview	Biundo et al. (2016)	19
Artificial companions, social bots, and work bots: communicative robots as research objects of media and communication studies	Hepp (2020)	15
Can computer-based human-likeness endanger humanness?" – A philosophical and ethical perspective on digital assistants expressing feelings they can't have	Porra et al. (2020)	15
A new friend in our smartphone? Observing interactions with chatbots in the search of emotional engagement	Portela and Granell-Canut (2017)	13
The CaMeLi framework—A multimodal virtual companion for older adults	Siourti et al. (2018)	12
Ethical issues raised by the introduction of artificial companions to older adults with cognitive impairment: a call for interdisciplinary collaborations	Portacolone et al. (2020)	9
Cluster 2: personification of conversational agents		
Personification of the Amazon Alexa: BFF or a mindless companion	Lopatovska and Williams (2018)	92
"Phantom friend" or "just a box with information": personification and ontological categorization of smart speaker-based voice assistants by older adults	Pradhan et al. (2019)	42
Alexa, my love: analyzing reviews of Amazon Echo	Gao et al. (2018)	38
Once a kind friend is now a thing: understanding how conversational agents at home are forgotten	Cho et al. (2019)	37
User experiences of social support from companion chatbots in everyday contexts: thematic analysis	Ta et al. (2020)	31
My chatbot companion - a study of human-chatbot relationships	Skjuve et al. (2021)	12
Blame the Bot: anthropomorphism and anger in customer–chatbot interactions	Crolic et al. (2022)	10
Externalized domestication: smart speaker assistants, networks and domestication theory	Brause and Blank (2020)	10
Exploring older adults' perception and use of smart speaker-based voice assistants: A longitudinal study	Kim and Choudhury (2021)	9
Introducing the socialbot: a novel touchpoint along the young adult customer journey	Wilson-Nash et al. (2020)	9
Cluster 3 user experience with conversational agents		
Living up to the chatbot hype: the influence of anthropomorphic design cues and communicative agency framing on conversational agent and company perceptions	Araujo (2018)	222
AI-based chatbots in customer service and their effects on user compliance	Adam et al. (2021)	64
Faster is not always better: understanding the effect of dynamic response delays in human-chatbot interaction	Gnewuch et al. (2018)	50
Effects of personalization and social role in voice shopping: an experimental study on product recommendation by a conversational voice agent	Rhee and Choi (2020)	29
The impact of chatbot conversational skills on engagement and perceived humanness	Schuetzler et al. (2020)	25
"In A.I., we trust?" The effects of parasocial interaction and technician versus luddite ideological views on chatbot-based customer relationship management in the emerging "feeling economy."	Youn and Jin (2021)	23
Millennials' attitude towards chatbots: an experimental study in a social relationship perspective	De Cicco et al. (2020)	21
Perceiving a mind in a chatbot: effect of mind perception and social cues on co-presence, closeness, and intention to use	Lee et al. (2020a)	20
How do AI-driven chatbots impact user experience? examining gratifications, perceived privacy risk, satisfaction, loyalty, and continued use	Cheng and Jiang (2020)	15
How chatbots' social presence communication enhances consumer engagement: the mediating role of parasocial interaction and dialogue	Tsai et al. (2021)	8
Cluster 4: social cues of conversational agents		
A taxonomy of social cues for conversational agents	Feine et al. (2019)	123
Towards caring machines	Bickmore and Picard (2004)	64
Relational agents improve engagement and learning in science museum visitors	Bickmore et al. (2011)	50
Tinker: a relational agent museum guide	Bickmore et al. (2013)	41
Modalities for building relationships with handheld computer agents	Bickmore and Mauer (2006)	25
Friendship with a robot: children's perception of similarity between a robot's physical and virtual embodiment that supports diabetes self-management	Sinoo et al. (2018)	24
Can software agents influence human relations? - Balance theory in agent-mediated communities	Nakanishi et al. (2003)	24
Effectiveness of an empathic chatbot in combating adverse effects of social exclusion on mood	De Gennaro et al. (2020)	21
The impact of interpersonal closeness cues in text-based healthcare chatbots on attachment bond and the desire to continue interacting: An experimental design	Kowatsch et al. (2018)	12
Can we be friends with Mitsuku? A longitudinal study on the process of relationship formation between humans and a social chatbot	Croes and Antheunis (2021)	11
Cluster 5: artificial intelligence with emotional quotient		
From Eliza to XiaoIce: challenges and opportunities with social chatbots	Shum et al. (2018)	206
The design and implementation of XiaoIce, an empathetic social chatbot	Zhou et al. (2020)	94
When chatbots meet patients: one-year prospective study of conversations between patients with breast cancer and a chatbot	Chaix et al. (2019)	42
I hear you, I feel you": encouraging deep self-disclosure through a chatbot	Lee et al. (2020c)	32
How should my chatbot interact? A survey on social characteristics in human–chatbot interaction design	Chaves and Gerosa (2021)	23
Effects of cognitive styles on an MSN virtual learning companion system as an adjunct to classroom instructions	Hsieh (2011)	16
The human side of human-chatbot interaction: a systematic literature review of ten years of research on text-based chatbots	Rapp et al. (2021)	14
Designing a chatbot as a mediator for promoting deep self-disclosure to a real mental health professional	Lee et al. (2020b)	14
The rise of emotion-aware conversational agents: threats in digital emotions	Mensio et al. (2018)	8

(*continued on next page*)

Table 8 (*continued*)

Themes and top articles	Authors	Citations
Chatbot to improve learning punctuation in Spanish and enhance open and flexible learning environments	Vázquez-Cano et al. (2021)	6

customer satisfaction because of lofty expectations from a humanlike chatbot and suggested empathetic chatbots can tackle human emotions (Crolic et al., 2022). Smart speaker usage decreases over time and loses its presence at home (Cho et al., 2019). Notably, most studies examined user behaviour with Alexa or Google Home, however, advanced CAs provide more emotional and social support to their users. For example, Replika interacts with its users to fulfil their emotional desires. Ta et al. (2020) examined 1854 user reviews and interviewed sixty-six of Replika users and found that Replika can mitigate the feelings of loneliness in users. Skjuve et al. (2021) echoed Ta et al. (2020) work and identified key characteristics of Replika that are the non-judgmental, understanding and accepting nature of the chatbot.

6.2.3. Cluster 3: user experience with conversational agents

The third cluster captures research on user experience with CAs. The top ten most cited articles in this cluster are Araujo (2018), Adam et al. (2021), Gnewuch et al. (2018), Rhee and Choi (2020), Schuetzler et al. (2020), Youn and Jin (2021), De Cicco et al. (2020), Lee et al. (2020a), Cheng and Jiang (2020), Tsai et al. (2021) with 222, 64, 50, 29, 25, 23, 21,20,15, and 8 citations respectively. The most cited article (TC: 222) in the cluster, Araujo (2018), revealed that anthropomorphic design cues influence consumers' emotional connection with the organization with a mediating role of social presence. AI-driven chatbots offer utilitarian, hedonic, technology, and social gratifications that lead to customer satisfaction, customer loyalty, and continued use (Cheng and Jiang, 2020). The purpose of anthropomorphism is to offer a human-like interaction experience to consumers. Gnewuch et al. (2018) found that chatbots' dynamic delayed responses increased perceived humanness and customer satisfaction. A similar study by Adam et al. (2021) found that both anthropomorphism and consistent staying of the chatbot can significantly increase user compliance on chatbot requests. Schuetzler et al. (2020) demonstrated that the conversational skill of the chatbot leads to anthropomorphism and social presence.

Moreover, instead of an assistant, a friend role played by the chatbot positively influences consumer engagement. De Cicco et al. (2020) showed that instead of being task-oriented, social-oriented interaction style of chatbot positively influences user's perception of social presence. Also, the social role played by chatbots and personalized interaction influence customer attitudes towards the product recommended by the conversational agent (Rhee and Choi, 2020). When interacting with media characters, the user's interpersonal involvement represents parasocial interaction. Perceived parasocial interaction mediates the influence of social presence on consumer engagement outcomes (Tsai et al., 2021). Additionally, Youn and Jin (2021) found that a friend chatbot can build stronger parasocial interactions with consumers compared to an assistant chatbot.

6.2.4. Cluster 4: social cues of conversational agents

The fourth cluster highlights research on the social cues of conversational agents. The top ten most cited articles in this cluster are Feine et al. (2019), Bickmore and Picard (2004), Bickmore et al. (2011), Bickmore et al. (2013), Bickmore and Mauer (2006), Sinoo et al. (2018), Nakanishi et al. (2003), De Gennaro et al. (2020), Kowatsch et al. (2018), and Croes and Antheunis (2021) with 123, 64, 50, 41, 25, 24, 24, 21, 12, and 11 respectively. Feine et al. (2019) review segmented forty-eight social cues into four categories (verbal, visual, auditory, and invisible). Kowatsch et al. (2018) identified closeness cues (such as visual, verbal, quasi-nonverbal, and relational) that can influence the attachment bonds of the users with healthcare chatbots. Agent output modalities also affect the human-computer relationship status. Bickmore and Mauer (2006) identified four different modalities (text with no image, text with a static image, animated and animated with nonverbal speech) and found that embodied and animated agents formed stronger social bonds with the users. This cluster also highlights the role of AI in combating loneliness and social exclusion. Interestingly, empathetic chatbots can now mitigate the effects of social exclusion on mood and feelings (De Gennaro et al., 2020). Bickmore and Picard (2004) demonstrate that computers can significantly impact users' perception of care. Bickmore et al. (2011) and Bickmore et al. (2013) found increased engagement of museum visitors when interacting with a virtual anthropomorphic robot. However, a study on diabetic children by Sinoo et al. (2018) revealed that physical robots established a stronger friendship with children than virtual avatars. Contrarily, Croes and Antheunis (2021), a study on user relations with "Mitsuku", found that participants experienced low feelings of friendship with the bot; also, the social process decreased after each interaction.

6.2.5. Cluster 5: artificial intelligence with emotional quotient

The fifth cluster concentrates on emotion-aware chatbots that can understand human feelings. The top ten cited articles in this cluster are Shum et al. (2018), Zhou et al. (2020), Chaix et al. (2019), Lee et al. (2020c), Chaves and Gerosa (2021), Hsieh (2011), Rapp et al. (2021), Lee et al. (2020b), Mensio et al. (2018), and Vázquez-Cano et al. (2021) with 206, 94, 42, 32, 23, 16, 14, 14, 8, 6 respectively. Shum et al. (2018) review of chatbot evolution from Eliza (1960) to Xiaoice (2014), which demonstrated how XiaoIce could engage humans for long conversations through recognizing their emotions, has received the highest citations (TC: 206) in the cluster. Another study on XiaoIce by Zhou et al. (2020) measured the chatbot's effectiveness using conversation turns per session (CPS) and found that the chatbot achieved an average CPS of 23, higher than any other chatbot or even humans. Chatbots' self-disclosure can trigger humans to disclose their personal feelings and thoughts (Lee et al., 2020c). "Confucius", a virtual learning companion, significantly benefited field-dependent learners (Hsieh, 2011). Even in the field of language learning, students value chatbots as it provides greater support and companionship in the learning process (Vázquez-Cano et al., 2021). All humans need an understanding and supporting associate everywhere, irrespective of the field (teaching, health and support, entertainment, etc.). Empathetic conversational agents can now do the needful with the help of an inbuilt emotional quotient. Chaix et al. (2019) conducted a study on 4797 cancer patients and observed that 88 % of participants felt that "Vik", a social chatbot helped and supported them in tracking their treatment. A similar study by Lee et al. (2020b) found that participants revealed more information to a chatbot than a mental health professional. Considering the development of conversational agents to an emotional awareness level, Mensio et al. (2018) questioned the understanding of chatbots towards human values.

7. Towards a conceptual framework (RQ5)

The current study presents the triangulation of major themes in SC with CAs using keyword co-occurrence analysis and bibliographic coupling analysis (Table 9). Extant literature is scant in presenting a holistic view on social companionship with AI. Thus, this study proposes a conceptual framework that has emerged from the content analysis of the articles used for conducting the current review. The framework details the antecedents, mediators, moderators, and outcomes of establishing SC with CAs presented in Fig. 5, which provides foundational knowledge to future researchers and scholars in SC with CAs. Noteworthily, although the framework presents a comprehensive view of SC with CAs, this should not be considered as specific or all-inclusive; rather, it should be viewed as a source of elemental knowledge that practitioners, designers, managers, business owners, and future researchers can utilize to expand the existing boundaries of the domain.

Table 9
Summary of research on SC with CAs.

Performance analysis	Keyword co-occurrence analysis	Bibliographic coupling	Conceptual framework
• Field performance • Bibliometric information	• Body of knowledge • Author keywords	• Body of knowledge • Citing publication	• Body of knowledge • Based on factors
Performance	Themes	Themes	Factors Antecedents of SC with CA
Publication activity: a total of 126 articles were published between 2003 and May 2022.	Cluster1: personification of conversational agents: embodied conversational agent, affective computing, personification, Amazon Echo, Amazon Alexa	Cluster 1: artificial companions and Socialbots	Conversational capability: conversational skill, humour and voice, interaction style, response time, self-expressive Functional capability: information and entertainment Social capability: role of chatbot, anthropomorphic design, media richness and mind perception
Top sources • Most citations: computers in human behaviour (TC: 286 citations) • Most publications: lecture notes in computer science (NP: 7 publications)	Cluster 2: artificial companions and Social Bots: conversational agents, human-computer interaction, user experience, mobile phone, Socialbot	Cluster 2: personification of conversational agents	Mediators for SC with CAs: perceived dialogue, trust attitude, product involvement, perceived intelligence, perceived anthropomorphism, social presence, parasocial interaction, privacy concern, task and social attraction, closeness, love, passionate desire to use AI
Top publications: Araujo, 2018 (222 citations)	Cluster 3: human relations with conversational agents: artificial companions, robots, loneliness, older adults, friendship	Cluster 4: social cues of conversational agents	
Top authors • Most citations: Shum HY and Li D (three hundred citations each) • Most publications: Bickmore T (four publications)	Cluster 4: enablers of conversational agents: Chatbot, anthropomorphism, trust, social presence, self-disclosure, voice assistants	Cluster 3: user experience with conversational agents	Moderators for SC with CA situational characteristics: (brand involvement, mood - angry or calm)
	Cluster 5: AI as social companions: artificial intelligence, Socialbots, social support, companion, machine learning	Cluster 5: artificial intelligence with emotional quotient.	User characteristics: psychographic characteristics (experience with chatbot, consumer innovativeness, ideological views Demographic characteristics: age, gender
			Outcomes of SC with CA: intention to use, user engagement, perceived humanness, user experience, loneliness reduction, emotional connection, continued use, service loyalty

7.1. Antecedents

Antecedents are determinants of the outcomes, and their effects on the outcome variables can be mediated and moderated by intervening variables. The current research broadly buckets antecedents of SC with CAs into three categories, conversational capability and functional capability. *Conversational capability* reflects the aspects related to skills of artificial intelligence to communicate and interact with humans, such as conversational skill (Schuetzler et al., 2020), humour and voice (Moussawi and Benbunan-Fich, 2021), interaction Style (De Cicco et al., 2020), the response time (Gnewuch et al., 2018) and self-expressivity (Ramadan, 2021). *Functional capability* refers to the aspects related to the skills of AI to perform various tasks for the users, such as providing information (Cheng and Jiang, 2020) and entertainment (Cheng and Jiang, 2020). *Social Capability* reflects the aspects related to skills of AI to provide social support and connection to the users such as the role of chatbot (Youn and Jin, 2021), anthropomorphic design cues (Araujo, 2018), media richness (Hsieh and Lee, 2021), mind perception (Lee et al., 2020a).

7.2. Mediators

Mediators are intervening factors that define the nature of relationship between antecedents and outcomes. The study identified mediators such as perceived dialogue (Tsai et al., 2021), trust (Pitardi and Marriott, 2021), attitude (Hsieh and Lee, 2021), product involvement (Rhee and Choi, 2020), perceived intelligence (Moussawi and Benbunan-Fich, 2021), perceived anthropomorphism (Moussawi and Benbunan-Fich, 2021), social presence (Adam et al., 2021), parasocial Interaction (Youn and Jin, 2021), privacy Concern (Bawack et al., 2021), task and social attraction (Lei et al., 2021), closeness (Lee et al., 2020a), love (Hernandez-Ortega and Ferreira, 2021), and passionate desire to use AI (Ramadan, 2021).

7.3. Moderators

Moderators influence the degree of relationship between antecedents and outcomes; antecedents and mediators; and mediators and consequences. Two moderators play the foremost role in defining social companionship with conversational agents: situational factors and user characteristics. Situational characteristics reflect the environmental influence, such as brand involvement (Hasan et al., 2021) and customer mood (angry or Calm) (Crolic et al., 2022), while user characteristics reflect the individual's psychographic factors, such as past experience (Kowatsch et al., 2018), consumer innovativeness (Kasilingam, 2020), and ideological views on technology (Youn and Jin, 2021), as well as demographic characteristics of individuals such as their age (Pradhan et al., 2019) and gender (Bergen, 2016).

7.4. Outcomes

Outcomes are the factors that results from the influence of antecedents and intervening variables like mediators and moderators. Social companionship with conversational agents lead to intention to use chatbots (Lee et al., 2020a), user engagement (Tsai et al., 2021), perceived humanness (Gnewuch et al., 2018), user experience (Bawack

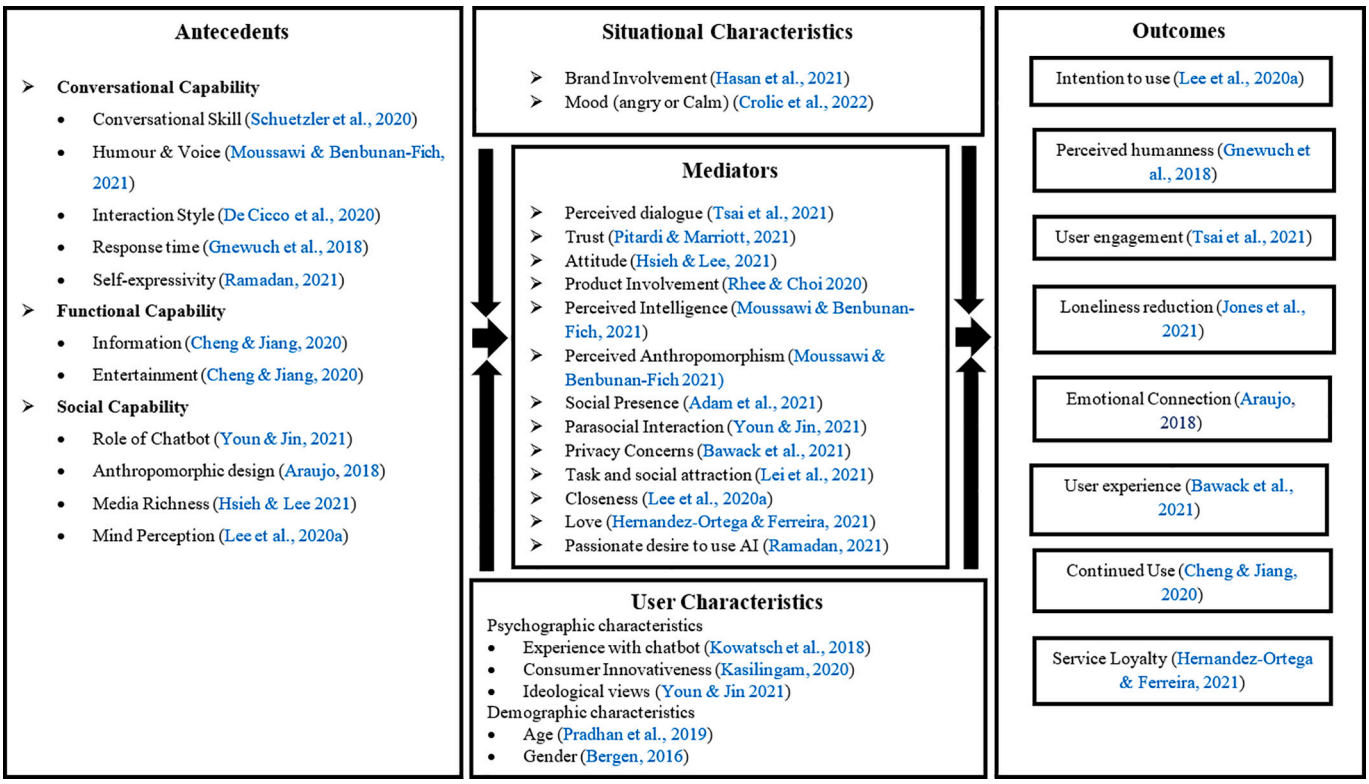

Fig. 5. Conceptual framework for antecedents, mediators, moderators, and outcomes of SC with CAs.

et al., 2021), loneliness reduction (Jones et al., 2021), emotional connection (Araujo, 2018), continued use (Cheng and Jiang, 2020), and service Loyalty (Hernandez-Ortega and Ferreira, 2021).

The proposed conceptual framework unfurls three foundational capabilities in a conversational AI that intends to form a relational bond with the users: Conversational Capabilities, Functional Capabilities and Social Capabilities. Future researchers are guided to investigate each capability and its significance in enabling CA designs to achieve elevated companionship levels. As the framework emerges from the extant literature, one notable observation is that there can be an addition to capabilities beyond what is already in the literature, such as emotional, motivational, and educational capabilities. This opens immense opportunities for practitioners to design AI companions with multiple capabilities. The framework also proposes that the more capable a CA is, the stronger the companionship it can develop with the user.

8. Disscussion

The present study offered a state-of-the-art literature review encompassing science mapping and intellectual structure analysis. Science mapping entail performance analysis of scientific actors like sources, authors and documents in the research domain. Intellectual structure analysis entail keyword co-occurrence and bibliographic coupling analysis. Intellectual structure analysis also discerns major theories, themes and conceptual framework encompassing antecedents, mediator, moderators, and outcomes of social companionship with conversational commerce.

The science mapping reveals the growing interest in the research domain, and the spurt indicates the relevance of the topic in the contemporary times. The study identified 126 articles on SC with CAs published between 2003 and May 2022 (RQ1). The publication trend of the field indicated that about 66 % of articles have appeared only in the last three years (2019–2022). The recent emergence of the topic is due to the technological advancement through AI in the fourth industrial revolution that gave rise to several AI applications in the market. Businesses are now developing AI agents to form emotional connections with humans. The multifold applications make the conversational commerce vital and futuristic warranting academicians and practitioners' attention.

In terms of the source performance, review found that Computers in Human Behaviour is the preferred avenue for publication with the highest citations (286). Majorly the top sources published in the field belongs to computer science, communication, human-computer interaction, and psychology, highlighting the multidisciplinary scope for research on SC with CAs. Regarding the author's performance, the study found that Shum and Li are the most cited (300 citations) authors in the field. However, Bickmore has the highest number of articles (4). The top authors come from both practice and academics. Moreover, significant contributions come from western countries, which suggests more investigation and research are required in other parts of the globe to promote higher diversity and inclusivity in the field. The study has also revealed a plethora of theories used in SC with CAs. Theories are from varied disciplines such as sociology, psychology, media and communication, marketing, and computer science, with the earliest theory from the field of psychology in 1946 (i.e., balance theory) and the latest theory from the field of sociology in 2018 (i.e., actor-network theory). Noteworthily, psychology and sociology are prominent as the area is primarily associated with human psychology and relationship development. Future researchers are encouraged to use communication theories, morality and ethics, and theories from human relations, which can help develop and examine more advanced AI companions.

8.1. *Theoretical contributions and implications*

The present study's theoretical contributions align with the guidelines for advancing theories with the help of bibliometric research (Mukherjee et al., 2022). The study draws three essential and notable contributions. The first contribution appears to promote the objective discovery of the field's knowledge clusters, namely artificial companions and Socialbots, personification of conversational agents, user experience

with conversational agents, social cues of conversational agents, and artificial intelligence with emotional quotient. The knowledge clusters enrich the understanding of research design and philosophy along with the major streams. The objective discovery also helps strengthen and develop the domain's theoretical foundations. More importantly, future researchers can identify and explore the research stream to fill the existing research gaps discussed in a later section of this paper. The second contribution appears to deliver a nomological clarity of constructs and the network that maps them together through co-occurrence analysis of author keywords. Finally, the third contribution comes through the development of the conceptual framework (Fig. 5), along with enlisting the theories in SC with CAs (Table 6). The proposed holistic conceptual framework reflects the field's antecedents, mediators, moderators, and outcomes, unfolding numerous opportunities for theoretical developments to the current understanding of the domain.

8.2. Managerial contributions and implications

The managerial contribution of the current study aligns practice with theory (Mukherjee et al., 2022). First, this review contributes to practice by providing managers with a macroscopic overview of research and development in social companionship with conversational agents. The top publications in Table 4 can help managers know more about artificial companions and their relationships with humans. More specifically, the review allows managers to look at different streams of research on social companionship with AI, namely artificial companions and Socialbots, personification of conversational agents, user experience with conversational agents, social cues of conversational agents, and artificial intelligence with emotional quotient along with top publications of each stream.

Second, this study contributes to practice by presenting the list of top authors in the field of SC with CAs, which can help managers to reach out to the experts in the area for any guidance they require while designing or developing a new artificial companion. Managers and practitioners can contact the top authors to gain an expert opinion on SC with CAs using Table 5. Though experts and leading authors are often busy and are not readily available for casual appointments, they consider good collaboration opportunities offered respectfully depending upon the research model, scope, and interest.

Third, this study contributes to practice by proposing the conceptual framework (Fig. 5) developed through the content analysis of 126 articles that can help managers to look at antecedents, mediators, moderators, and outcomes of SC with CAs. Also, managers are encouraged to consider essential variables while designing companion technology for the marketplace.

8.3. Future research directions (RQ6)

The review suggests several future research agendas for the major themes identified in the study on SC with CAs. The following subsections unfold new and exciting avenues in the domain.

8.3.1. Artificial companions and Socialbots

Empathetic CAs offer companionship to humans. However, social bots may exploit and misuse users' personal information via infiltration on social media platforms such as Facebook and Twitter (Boshmaf et al., 2013; Elyashar et al., 2013). Social bot design advancements challenge bot detection (Orabi et al., 2020). It leads to confusion in the emerging metaverse to figure out whether profiles are of real humans or fake bots. Future researchers need to design efficient socialbot detectors to deal with this confusion. AI companions also bring challenges; for example, the growing influence of such technology in human society will reshape human emotions, decisions, and actions (Floridi, 2008). AI companions may amplify the negative emotions of the user if not programmed morally. Negative emotions may induce depression and suicidal tendencies (Possati, 2022). Trust, is always a concern for users before adopting advanced technologies (Omrani et al., 2022). Future researchers and practitioners must design companions laden with moral values and ethics to trigger positive thoughts in human minds. Thus, the study proposes the following research questions:

FRQ1. *How does social bot infiltration influence consumer behaviour?*

FRQ2. *What are artificial companions' positive and negative impacts on human emotions, decisions, and actions?*

FRQ3. *What factors are responsible for perceiving an artificial companion as moral and ethical?*

8.3.2. Personification of conversational agents

Anthropomorphic chatbot design leads to personification behaviour but, at times, increases user expectations, which may negatively affect customer satisfaction when a customer is angry (Crolic et al., 2022). Future researchers should design empathetic chatbots to understand user emotions before responding to users' needs. Future bots should redirect clients to human executives if they sense furiated customers. Also, AI can help patients and older adults remember the medicines and diet plans to ensure their well-being. Extant literature points at chatbot personality; however, it is silent on the influence of the user's personality on human-computer interaction. Extrovert users find AI agents as talkative and active compared to introverts. Users may lose connection with the smart speakers due to the conversational agent's inability to modify their conversation style based on the user's personality (Cho et al., 2019). Future researchers should work on CAs that assess users' personalities and interact accordingly. Thus, the study proposes the following future research questions:

FRQ4. *What factors are responsible for perceiving an artificial agent with a caring and loving personality?*

FRQ5. *How should conversational agents be designed that support patients' well-being, lonely individuals, and older citizens?*

FRQ6. *What is the impact of user personality on interaction with artificial companions?*

8.3.3. User experience with conversational agents

User experience has always taken center stage whenever technology transforms the business. According to Araujo (2018), the anthropomorphic design of chatbots lead to an emotional connection between the organization and users. The stream highlights research on user perception, satisfaction, and experience with conversational agents based on the perception of social presence and anthropomorphism. However, the literature is scant on the role of SC in influencing the user experience. Factors such as perceived intelligence, anthropomorphism, and social presence are predominant in the literature, while conversational capability's role in building relationships remained unexplored. Schuetzler et al. (2020) found that conversational skill leads to perceived anthropomorphism and social presence. Future researchers should study the determinants of conversational capability and its influence on human-computer relationships. Communication theories could help future researchers design more interesting artificial companions. Therefore, the study proposes the following research questions:

FRQ7. *What is the user experience in a relationship with artificial companions?*

FRQ8. *Does human-computer interaction affect the user's relations with other humans in society?*

FRQ9. *What factors determine the conversational capability of an artificial companion?*

8.3.4. Social cues of conversational agents

Conversational agents display various social cues, such as verbal, visual, auditory, and invisible (Feine et al., 2019). These social cues

create warmth in the conversational agents, making them converse like humans. Bickmore and Mauer (2006) found that embodied and animated relational agents tend to form stronger social bonds with the users than disembodied and non-animated agents. Thus, it would be interesting to know about the social signals responsible for establishing an emotional connection between users and CAs. Croes and Antheunis (2021) found that social processes decrease after interacting with the chatbot. However, studies on chatbots like Tinker and Replika suggest that users can form long-time relationships with AI companions (Bickmore et al., 2011; Bickmore et al., 2013; Ta et al., 2020; Skjuve et al., 2021). The contradictory findings suggest future researchers explore the comparative performance of two or more artificial companions, such as Mitsuku and Replika. Thus, the study proposes the following future research questions:

FRQ10. *Which social signals or cues are responsible for establishing companionship and emotional connection with the conversational agents?*

FRQ11. *What is the comparative performance of two or more artificial companions?*

FRQ12. *How do service settings, socioeconomic status and cultural norms influence the selection of social cues and design of artificial companions?*

8.3.5. Artificial intelligence with emotional quotient

Conversational agents have evolved through the years, from ELIZA (1960) to empathetic chatbots like XiaoIce (2014) (Shum et al., 2018). Empathetic chatbots are conversational agents that can recognize and understand human emotions. Recently, Google's Lambda is believed to have become sentient and developed human-like feelings (that include love, fear, confidence, etc.). Noteworthily the degree of chatbot's self-awareness or emotional awareness is unexplored. It opens new avenues of research on artificial life, artificial consciousness, and artificial beings. There is scope for future research comparing human empathy with AI empathy. Artificial intelligence with an intellectual quotient has snatched several jobs from humans in the market. Would it be acceptable to design AI with an emotional quotient too? And what about humanity, then? Feelings and emotions are humans' assets, making them different from machines. As Porra et al. (2020) questioned the Humanlikliness of AI agents, arguing that feelings, the very substance of humanness, must be reserved only for human interaction. Therefore, the study proposes the following research questions:

FRQ13. *What factors indicate that a conversational agent has feelings, self-awareness, and consciousness like humans?*

FRQ14. *How do individual differences affect their perceived awareness and consciousness of a conversational agent?*

FRQ15. *What are the opportunities, challenges, and threats to human society from artificial intelligence with an emotional quotient?*

9. Conclusion

This study is a comprehensive systematic review of SC with CAs that attempts to reveal the nuances of artificial companions and their relationship with humans. The covid-19 pandemic and other reasons for social exclusion result in feelings of loneliness among individuals, including older adults. The artificial intelligence expertise of human society has overcome this issue by designing advanced artificial companions such as XiaoIce and Replika, which can function as therapeutic resources for their users. The future of human-computer interaction lies in developing AI companions, their capabilities, determinants, social acceptability, and their influence on society. The study highlights the usage of artificial companions in each service sector (hospitality, tourism, education, healthcare, entertainment, etc.). Therefore, AI companions in the customer journey are a paradigm shift in designing the marketing strategies. In such a scenario, this literature review offers a bird's eye view on the emerging field of SC with CAs.

CRediT authorship contribution statement

All authors have contributed to all aspects of this paper.

Declaration of competing interest

There is no conflicts of interest for this manuscript.

Data availability

Data will be made available on request.

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