

Conversational Agents for Promoting Mental Health and Well-being: A Systematic Review

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Abstract

With the ever-increasing demand for better mental health services, conversational agents (CAs) have shown great promise for improving people's mental health and well-being. However, the mechanisms by which CAs influence mental well-being are under-explored. This systematic review maps out existing studies that examine the relationship between the use of CAs and people's mental health, with the aim of developing a conceptual framework for modeling the mechanisms linking CA to positive mental health and evaluating the role of CAs in mental health care. We present preliminary results based on the full text screening of 639 papers, highlighting a few gaps and limitations in existing research, such as a lack of theoretical framework, limited understanding of user trust towards CAs, and Western-centeredness and a lack of cultural diversity.

Keywords: conversational agent, mental health, systematic review.

1 Introduction

Conversational agents (CAs), or chatbots, are seeping into people's everyday life. Apart from the ubiquitous use of chatbots for customer service, CAs designed to provide users with virtual companionship are gaining traction in recent years, especially during the COVID-19 pandemic [1, 2]. For instance, Replika, an English-speaking AI companion app, has reached over 10 million users worldwide since it was launched in 2017 [3]. Many people find social chatbots to be an empathetic ear and a supportive friend, and thus tend to confide in and seek emotional support from chatbots [4, 5]. This is made possible by the advanced machine learning models that constantly learn and mimic users' behaviors, speech patterns, interests, and personalities. More recently, chatbots are equipped to respond to users by sharing their own thoughts, feelings, and emotions like human beings [1], leading to emotional reciprocity that underpins social interactions and relationship development [6, 7].

As one of the fastest-growing AI technologies, CAs have shown great promise for improving people's well-being. Mounting evidence shows that chatbots can reduce symptoms of depression [9, 10], stress [11] and loneliness [12] by increasing users' self-disclosure [4], perceived social support [8], and psychological well-being. In particular, chatbots have been used to provide psychiatric counseling services, such as cognitive behavioural therapy, to people who are seeking mental health support [13, 14].

While several studies of CAs-based interventions have shown significant improvements in users' mental health [9, 15, 16], a recent systematic review of 13 studies examining CAs for mental health treatment revealed inconsistent results regarding psychological distress ; Among the 13 studies included in the review, five controlled studies reported significant improvements in participants' psychological distress (e.g. depression, anxiety), and four controlled studies found no significant post-treatment differences between the intervention and the control groups. The effect sizes of the five studies that demonstrate CAs' ability to improve mental health vary considerably, from small ($d=-0.24$) to very large ($d=2.0$) [17]. In addition, CAs may also pose certain risks such as privacy violation [18] and social bias [19], yielding unintended negative outcomes. Therefore, it is imperative to understand how and under what conditions CAs can enhance users' mental health and the factors that contribute to the magnitude of such effects. Identifying how varying psychological, social, and technological processes can mediate or moderate the relationship between CAs and people's mental health can help develop and refine current theories regarding human-AI interactions, as well as develop and regulate CAs to enhance people's mental health and well-being in an evidence-based manner.

Therefore, this systematic review aims to: (1) to systematically identify and review studies that have examined the design and use of CAs that are related to

people's well-being and mental health in both clinical and nonclinical populations. We will focus on factors that explain the relationships between CAs and mental health measures, including both specific mental disorders (e.g. depression, anxiety, PTSD) and general mental well-being (e.g. positive affect, mood, life satisfaction) ; (2) to develop a conceptual framework for modeling the mechanisms linking the use of CAs to mental well-being as well as to establish user-centered evaluation approaches to CA use in mental health care.

2 Methods

2.1 Information Sources and Search Strategy

Search Sources

The primary data sources for this review are peer-reviewed journal articles and conference proceedings, as sourced via ACM Digital Library, Scopus, Medline, Ovid Embase, CINAHL, PsycINFO, Web of Science Core Collection and EBSCO Communication Source. The second source of relevant literature includes preprint servers (i.e. EuropePMC and PsyArXiv) and Open Science Framework (i.e. OSF). ProQuest Dissertations & Theses Global are also searched for theses and dissertations. After we compiled the final corpus (through full-text review), ten experts in the field of CA and chatbots were contacted to review the list of included studies, identify omissions, and provide unpublished studies and studies in the press.

Search Terms

Search terms were constructed based on previous systematic reviews [20, 21, 22]. We used several search term combinations to search the titles and abstracts of the articles. The search is designed to return articles with any combination of the following mental health and well-being measures (mental illness, mental disorder, affective disorder, psychotic disorder, post-traumatic stress disorder, distress, depress, anxiety, bipolar, schizophrenia, psychosis, mental health, mental wellness, well-being, happiness, positive affect, negative affect, positive emotion, negative emotion, mood, life satisfaction) and a CA involvement (*robot, social bot, dialogue system, conversational agent, conversational bot, conversational system, conversational interface, chatbot, chatterbot, smartbot, virtual coach, virtual agent, embodied agent, relational agent, avatar, virtual character, animated character, virtual human, virtual assistant, digital assistant, counseling agent*). The exact search strings for each data source can be found in Appendix 1.

Study Selection

A list of all retrieved studies was downloaded as excel files, then the studies included in the final corpus were uploaded to Zotero reference management software. Two team members screened all records identified from the database searches. First, titles and abstracts of articles returned from initial searches were

screened based on the eligibility criteria outlined above, and unmet records were excluded. Second, full texts were examined in detail and screened for eligibility. For title and abstract identification, two team members first independently screened the same set of 5% of the records as the training datasets to establish inter-rater reliability, resulting in a Kappa of 0.90, which indicates almost perfect agreement (McHugh, 2012). The remaining records were then evenly divided and independently screened by two researchers. Disagreements were resolved by rigorous discussion, or if necessary, with a third reviewer. A flow diagram (see Fig.1) following the PRISMA guidelines for reporting systematic reviews illustrated the selection processes and the number of studies included and excluded at each stage.

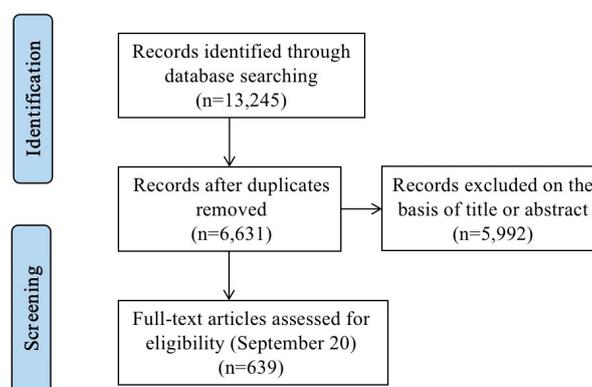


Fig. 1. PRISM flow diagram describing the different phases of this systematic review (current stage is full-text screening).

2.2 Eligibility Criteria

We selected all empirical studies (excluding editorials, systematic/literature review and meta-analysis) that examined the use of CAs and its association with people's mental health and well-being. Only English language studies were considered for inclusion. After identifying records through database searching, studies were evaluated for inclusion in the current review on the basis of four criteria.

Criteria 1: The articles must involve a CA with unconstrained conversational capabilities.

We define CAs as software agents or bots that are designed to converse with humans in natural language. This can be text or/and speech-based CAs, either embodied or non-embodied, operating as standalone systems/software, working via a web browser or integrated into messaging applications, such as Facebook

Messenger and Slack. CAs that are part of virtual reality, augmented reality, embodied agents, and robots will also be included. We will exclude studies involving CAs with the following characteristics as constrained conversational abilities: 1) A CA based on a finite-stage dialogue management system that restricts user input to predetermined choices (e.g., clicking or tapping predefined words, phrases, or figures); 2) The output of CAs was not based on what they received from human users (e.g., predefined messages); 3) question-answer type interactions; 4) “Wizard of Oz” methods, in which the dialog is generated by a human operator rather than by a CA.

Criteria 2: The articles must involve user interaction with the CA. As the focus of this review lies on the interaction between the user and the CA, with particular attention to the human-side of such interaction, the CAs should be studied with reference to people who interacted with it. This criterion is defined to ensure the articles did not focus solely on the design, algorithm, architecture and development of CAs regardless of empirically testing the interactions between human users and CAs. We consider both nonclinical and clinical populations as eligible, and therefore include papers that involve either people with mental disorders and the general population.

Criteria 3: The articles have to report at least one measure of mental health or general well-being. Self-report measures using validated questionnaires (e.g. PHQ-9 depression scale) or interviews and objective measures based on passive sensing systems (e.g., unobtrusively collected audio or visual biomarkers of mental well-being) will all be included. In our study, mental health measures include common mental disorders identified by WHO [22], examples are depression, anxiety, PTSD and schizophrenia. General well-being measures include both short-term emotions/moods (positive and negative) and long-term well-being measures such as life satisfaction. A study will be excluded if it does not include a mental health or well-being measure (e.g., a study that focuses solely on health behaviors, such as weight loss or smoking cessation).

Criteria 4: The articles have to be full-text, including peer-reviewed articles, conference proceedings and theses and dissertations. Non-empirical studies, for example, reviews, commentaries, conference abstracts, proposals and editorials will be excluded. To identify as many studies as possible, there are no restrictions regarding academic discipline, study setting, publication date or status, or country of publication.

2.3 Data Synthesis

We will develop a data extraction form based on the Cochrane Handbook for Systematic Reviews of Interventions [23] and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) strategy [24]. The data extraction form includes domains of 1) study characteristics (e.g., author, published year, study design, setting, duration, sample size, theory); 2) participant characteristics (e.g., age, gender, education, race, socio-economic status, health

status); 3) CA characteristics (e.g., dialogue system features, media, level of anthropomorphism, engagement features, features of relational capacity, features of persuasive conversational capacity); 4) mental health/well-being measures (e.g., self-report and/or objective mental health and well-being measures); 5) mechanisms and moderators or mediators; 6) therapy approach (e.g., cognitive behavioral therapy); 7) context of interactions (e.g., elderly care, education, psychotherapy) and 8) safety and ethical assessment. If there is any missing data, we may contact study authors to obtain the data. One author will use Zotero software to extract the seven data items specified above. A second reviewer will cross-check the accuracy of the extracted data. The data items to be extracted will be pilot tested using a template spreadsheet and a sample of potential studies obtained through the initial iterative search process.

We will provide a qualitative synthesis of the findings of the included studies (i.e., characteristics of CAs, characteristics of individual users, study designs, and assessment of health outcomes/indicators, evaluation of user experience, and indicators for mechanisms of changes). The synthesis's overarching objective is to pinpoint research gaps and offer suggestions for future research agendas. Tables will be used to display the synthesis, graphs will show the summary statistics, and tables will show the specific data for each study. We will also provide a quantitative synthesis of the findings of the included studies if applicable.

3 Preliminary Results

In the process of performing full-text screening, we identified a number of gaps in the literature on CAs and mental health.

3.1 Lack of Theoretical Framework in Guiding the Design and Evaluation of CAs for Mental Health

One major limitation of the current literature is the lack of exploration of more diverse mechanisms underlying CAs' effects on mental health and wellbeing. Studies have focused primarily on the therapy approach (e.g. Fitzpatrick et al., 2017) and behavior change techniques (e.g. Greer et al., 2019) delivered by CAs and overlook other potential mediators or moderators involved in the interactions, such as CA's characteristics (e.g. anthropomorphic cues, personalization levels), users' backgrounds (e.g. prior experiences and attitudes toward AI, social networks, self-efficacy), interaction features (e.g. communication accommodation, person centeredness) as well as broader socio-cultural contexts. While some of these mechanisms or moderators have been tested in general human-AI interactions, their role in CAs for mental health and well-being has received less theoretical and empirical attention. This absence parallels the lack of consideration for the broader and longer-term effects of CAs on the well-being of users.

In addition, further exploration of the boundaries within which CAs can be supportive is crucial to understanding when we need CA support and when we need

that help from humans. On this basis, the impacts of CAs on users' broader social context, such as their offline social networks and their perceptions of human-human interactions and relationships, can be better recognized.

3.2 Lack of Research Understanding User Trust towards CAs

Although existing research has revealed that people can form trust with CAs and disclose themselves to varying degrees [27], less is known about how humans form trust with CAs and the factors that contribute to it, particularly over the long-term human-CA interactions. Recent studies examining factors driving human trust towards CAs have largely focused on the usability and functionality of CAs, including the CAs' self-disclosure [4] and their nonverbal communicative features, such as the degree of anthropomorphism [28]. Little is known about the role that users play in forming trust in CAs, as well as the interaction patterns and broader social contexts.

Building trust with CAs is essential to establishing and maintaining effective human-CA relationships and yielding positive mental health outcomes. Understanding how and why people trust or distrust CAs is important not only for designing trustworthy AI, but advancing our knowledge about the nuances within the process of trust formation. Since trust may be built over time [29] and can be dynamically affected by various factors in human-CA interactions, future research needs to identify the patterns and factors that determine the conditions under which people form trust in CAs and elaborate on explanations for these outcomes.

3.3 Most Research is Western-Centric and Lacks Cultural Diversity

Most studies about CAs are Western-centric, overlooking the socially embedded nature of mental health management, which might change how a CA should interact with users. This is concordant with the findings of a recent systematic review focusing on CAs in health care, only about 15% of the studies included were conducted in non-Western settings (Japan, Korea and India). Previous research has shown that the way that people understand, perceive, and manage depression are culturally determined, which in turn shape user interaction with technologies, such as online depression communities [30]. Since the efficacy of conventional mental health interventions is culturally contingent and sensitive, it is crucial to increase cultural diversity in examining the effects of CAs-based mental health interventions, especially including ethnic minorities in the research. However, few studies have examined human-CA interaction and how this affects mental health in non-Western contexts. More research on chatbots is warranted to expand cultural diversity and investigate the role of CAs in mediating and contextualizing people's mental health.

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Appendix 1: Search Strategies for eight bibliographic databases used in the study.

Database	Search strings
ACM Digital Library	<p>("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post \-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well \-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat \-bot*" OR "smartbot*" OR "smart bot*" OR "smart \-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*")</p>
Scopus	<p>TITLE (("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*")) OR ABS (("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp")) AND (LIMIT-TO (LANGUAGE , "English"))</p>

<p>MEDLINE via EBSCO</p>	<p>AB (("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*")) OR TI (("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*"))</p>
<p>Ovid Embase</p>	<p>(("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*")).ti,ab.</p>

<p>CINAHL via EBSCO</p>	<p>AB (("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*")) OR TI (("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*"))</p>
<p>PsycInfo via EBSCO</p>	<p>AB (("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*")) OR TI (("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational</p>

	<p>system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*"))</p>
<p>Web of Science Core Collection</p>	<p>TI=("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*")) OR AB=("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*"))</p>

<p>Communication Source via EBSCO</p>	<p>AB (("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*")) OR TI (("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*"))</p>
<p>ProQuest Dissertations & Theses Global</p>	<p>ab(("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*")) OR ti(("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") AND ("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational</p>

	<p>system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*"))</p>
OSF*	<p>title:(+("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life") +("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*"))</p>
PsyArXiv	<p>title-abstract: (("mental illness" OR "mental disorder*" OR "affective disorder*" OR "psychotic disorder*" OR "post-traumatic stress disorder*" OR "PTSD" OR distress OR "depress*" OR anxiety OR bipolar OR schizophrenia OR psychosis OR "mental health" OR "mental wellness" OR wellbeing OR "well-being" OR "SWB" OR happiness OR happy OR "positive affect*" OR "negative affect*" OR "positive emotion*" OR "negative emotion*" OR mood OR "life satisfaction" OR "satisfaction with life")) AND (("robot*" OR "social bot*" OR "dialogue system*" OR "conversational agent*" OR "conversational bot*" OR "conversational system*" OR "conversational interface*" OR "chatbot*" OR "chat bot*" OR "chatterbot*" OR "chatter bot*" OR "chat-bot*" OR "smartbot*" OR "smart bot*" OR "smart-bot*" OR "virtual coach*" OR "virtual agent*" OR "embodied agent*" OR "relational agent*" OR "avatar*" OR "virtual character*" OR "animated character*" OR "virtual human*" OR "virtual assistant*" OR "digital assistant*" OR "counseling agent*"))</p>

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((((TITLE:"mental illness" OR TITLE:"mental disorder*" OR TITLE:"affective disorder*" OR TITLE:"psychotic disorder*" OR TITLE:"post-traumatic stress disorder*" OR TITLE:"PTSD" OR TITLE:distress OR TITLE:"depress*" OR TITLE:anxiety OR TITLE:bipolar OR TITLE:schizophrenia OR TITLE:psychosis OR TITLE:"mental health" OR TITLE:"mental wellness" OR TITLE:wellbeing OR TITLE:"well-being" OR TITLE:"SWB" OR TITLE:happiness OR TITLE:happy OR TITLE:"positive affect*" OR TITLE:"negative affect*" OR TITLE:"positive emotion*" OR TITLE:"negative emotion*" OR TITLE:mood OR TITLE:"life satisfaction" OR TITLE:"satisfaction with life") AND (TITLE:"robot*" OR TITLE:"social bot*" OR TITLE:"dialogue system*" OR TITLE:"conversational agent*" OR TITLE:"conversational bot*" OR TITLE:"conversational system*" OR TITLE:"conversational interface*" OR TITLE:"chatbot*" OR TITLE:"chat bot*" OR TITLE:"chatterbot*" OR TITLE:"chatter bot*" OR TITLE:"chat-bot*" OR TITLE:"smartbot*" OR TITLE:"smart bot*" OR TITLE:"smart-bot*" OR TITLE:"virtual coach*" OR TITLE:"virtual agent*" OR TITLE:"embodied agent*" OR TITLE:"relational agent*" OR TITLE:"avatar*" OR TITLE:"virtual character*" OR TITLE:"animated character*" OR TITLE:"virtual human*" OR TITLE:"virtual assistant*" OR TITLE:"digital assistant*" OR TITLE:"counseling agent*")))) OR ((ABSTRACT:"mental illness" OR ABSTRACT:"mental disorder*" OR ABSTRACT:"affective disorder*" OR ABSTRACT:"psychotic disorder*" OR ABSTRACT:"post-traumatic stress disorder*" OR ABSTRACT:"PTSD" OR ABSTRACT:distress OR ABSTRACT:"depress*" OR ABSTRACT:anxiety OR ABSTRACT:bipolar OR ABSTRACT:schizophrenia OR ABSTRACT:psychosis OR ABSTRACT:"mental health" OR ABSTRACT:"mental wellness" OR ABSTRACT:wellbeing OR ABSTRACT:"well-being" OR ABSTRACT:"SWB" OR ABSTRACT:happiness OR ABSTRACT:happy OR ABSTRACT:"positive affect*" OR ABSTRACT:"negative affect*" OR ABSTRACT:"positive emotion*" OR ABSTRACT:"negative emotion*" OR ABSTRACT:mood OR ABSTRACT:"life satisfaction" OR ABSTRACT:"satisfaction with life") AND (ABSTRACT:"robot*" OR ABSTRACT:"social bot*" OR ABSTRACT:"dialogue system*" OR ABSTRACT:"conversational agent*" OR ABSTRACT:"conversational bot*" OR ABSTRACT:"conversational system*" OR ABSTRACT:"conversational interface*" OR ABSTRACT:"chatbot*" OR ABSTRACT:"chat bot*" OR ABSTRACT:"chatterbot*" OR ABSTRACT:"chatter bot*" OR ABSTRACT:"chat-bot*" OR ABSTRACT:"smartbot*" OR ABSTRACT:"smart bot*" OR ABSTRACT:"smart-bot*" OR ABSTRACT:"virtual coach*" OR ABSTRACT:"virtual agent*" OR ABSTRACT:"embodied agent*" OR ABSTRACT:"relational agent*" OR ABSTRACT:"avatar*" OR ABSTRACT:"virtual character*" OR ABSTRACT:"animated character*" OR ABSTRACT:"virtual human*" OR ABSTRACT:"virtual assistant*" OR ABSTRACT:"digital assistant*" OR ABSTRACT:"counseling agent*")))) AND (((SRC:MED OR SRC:PMC OR SRC:AGR OR SRC:CBA) NOT (PUB_TYPE:"Review")) OR SRC:PPR)

* The current OSF database only supports title search.