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“She seems more human”: Understanding Twitter users’ credibility assessments of dementia-related information

Fatimah Alhayan^{1,2} [0000-0003-1982-4117]

Diane Rasmussen Pennington^{1,3} [0000-0003-1275-7054]

Ian Ruthven¹ [0000-0001-6669-5376]

¹ University of Strathclyde, 26 Richmond Street, Glasgow, G1 1XH, Scotland

² College of Computer and Information Sciences, Princess Nourah Bint Abdulrahman University, Riyadh 11564, Saudi Arabia

³ Corresponding Author

fatimah.alhayan@strath.ac.uk

diane.pennington@strath.ac.uk

ian.ruthven@strath.ac.uk

Abstract. The presence of incorrect, medically uncorroborated information on social media may be harmful if people believe it. The purpose of this qualitative study was to identify how Twitter users evaluate the credibility of dementia-related information sources. It used a think-aloud protocol via semi-structured interviews with 13 caregivers. It identified main credibility dimensions, including 13 factors. Participants deployed a combination of heuristics to assess information sources, and engaged in intensive systematic content review based on prior knowledge and relevance. The findings contribute to a nuanced understanding of how users evaluate Twitter sources in the health domain. Some of these are discussed in light of the MAIN Model, and prove significant in how practitioners and developers can better understand and help users evaluate information.

Keywords: Credibility, Health Information, Twitter, Dementia, Bot.

1 Introduction

Social media has become a common source of health information [1]. Despite social media promoting better health through increased communication, patient education, and professional development, unintended consequences can include professional image damage, violation of patient boundaries, privacy breaches, medical licensing and legal issues, poor information quality [2], and misinformation [3]. Health misinformation is defined by [4] as ‘a health-related claim of fact that is currently false due to a lack of scientific evidence’. Different factors illuminate information quality, including credibility [5]. There is, however, no consensus on what constitutes credibility, a

complex and intuitive concept involving accuracy, precision, objectivity, believability and informativeness [6].

Research on social media credibility has increased recently [7]. Twitter has emerged as a powerful and effective information dissemination source, but needs the application of credibility assessment methods. Most existing studies on Twitter credibility focus on domains such as news and politics. Health information impacts decision-making, and is therefore considered worthy of exploration [8]. There is growing attention on analyzing the credibility of health-related tweets on crises such as Zika [9] and Covid-19 [10]. However, only a few studies have focused on people's reliability assessments of health-related information on social media [8], as opposed to the many studies on users' assessment of databases and static websites [11] [12]. The aim of this study is to identify factors affecting users' credibility assessment of dementia-related information on Twitter.

2 Background

2.1 Information Credibility Assessment

Social media credibility research has attracted interest from psychology, communication, information science, and human-computer interaction, each with different contexts and scopes [13]. In research at the confluence of computer science and information science, credibility is defined as a filter or qualifier between the impending task and user behavior in the context of information seeking [14]. Credibility is vital in decision-making, since it affects not just people's attitudes, but also how and whether the information or system is used [15].

Research on credibility assessment of social networks can be divided into machine-based and human-based approaches. With machine-based approaches, features such as source and content are used to predict credibility ratings of information, employing techniques like machine learning, encompassing both supervised and unsupervised algorithms. However, the accuracy of results from supervised approaches must rely on available ground truth information [16], which may or may not exist. Another critical component for predicting credibility is the set of features used, which varies among datasets. Human-based approaches employ cognition to assess the credibility of information sources or content and have attracted researchers from communication and information science. Several Twitter studies used a human-based approach to identify factors that influenced users' credibility judgements on either the source (profile) or content (tweets) [17–25].

However, most have used quantitative methods [8], employing surveys and questionnaires as the research instruments. The purpose of these methods is to develop or test theories. Since the constructs used to define credibility have no single definition, and the relation among variables is not clear, it is difficult to generate comprehensive and coherent results [26]. Participants in most existing studies were confined to providing specific answers to given questions. Although qualitative data can be produced by asking open questions to allow participants to express their opinions [27], it will not include all possible real-life influences.

Additionally, most previous studies have used screenshots of manipulated Twitter feeds rather than a live view [28][29]. Viewing either a static view or a live view of the feed could lead to different perceptions [29]. This demonstrates the need to further examine participants' perceptions using live feeds. Also, more qualitative studies are required [26]. Most credibility studies have targeted politics [30] and news [31][23]. Few researchers have looked at the credibility of specific health conditions on Twitter to comprehensively assess its health information credibility.

2.2 Credibility Assessment Frameworks

The main proposed theoretical frameworks for web credibility assessment have been summarized by [32] (Table 1). The frameworks share common aspects; however, the individual theoretical models have unique features depending on the focal point of each. Four major aspects (context, user characteristics, information characteristics, and process) were identified in them. Two emphasize the importance of classifying contextual factors: P-I Theory [33] and the Unifying Model[34]. Given that credibility assessment is based mainly on users' perception, most of the models (except the MAIN Model) consider user characteristics including demographics, user involvement, and information skills to theorize the process of web credibility assessment. Operationalization classifies how each model measures information credibility; namely, the cues that can be pinpointed in terms of source, message, and structural characteristics of web resources. Process classifies whether the framework is 'process-based' or 'judgment-based'. The former illustrates the entire process, whereas the latter focuses on particular factors affecting user perception [35]. Overall, variations in the models meet the needs of credibility operationalizations in various contexts. As new technology and information systems emerge on the web (e.g. social media platforms), there will be a continuous need for understanding credibility cues and heuristics. Most features of these platforms are static as on websites, yet social media are characterized by dynamic features such as numbers of followers.

Table 1. Web credibility assessment theoretical frameworks [32]

Model	Context	User Characteristics	Operationalization	Process
P-I Theory [33]	√	√	√	√
Judgment Model [36]	√	√	√	√
MAIN Model [37]			√	√
Unifying Model [34]	√	√	√	√
Dual Model [38]		√	√	√
Revised-3S Model [39]		√	√	

2.3 Context: Dementia information on Twitter

Two contextual factors have been established to develop models for credibility judgment, namely topic and platform type [40] [41]. This research selected these contexts. The rationale to select dementia as the topic and Twitter as the medium is reviewed here.

The rapid increase in the ageing population makes dementia a major public health concern, with new cases occurring every three seconds, affecting 50 million people worldwide [42]. People with dementia (PWD) access social media like blogs, Facebook, and Twitter to connect with others, seek support and share information [43–45]. Caregivers also take part in decision-making [46] and increasingly turn to the web for information and support. Existing research points to positive conclusions (e.g. increased knowledge, satisfaction, and involvement) among informal caregivers of critically ill patients in 16 out of 31 studies on the impact of social media interventions and tools [47], demonstrating improvement of confidence in technology-enabled interventions, including social media. Some 66% of UK dementia caregivers utilize the internet for dementia information; 76% use social media [48]. Dementia caregivers also use online tools such as blogs to seek and share information and social support [49].

On Twitter, dementia is among the top five most discussed health conditions [50]. PWD use it for fundraising, lobbying, increasing awareness, educating, providing support, challenging stigma [45], sharing their lived experiences, and advocating for social change. Caregivers use Twitter to expand their social networks, obtain support, learn about support structures [51], and share their caregiving experience [52]. Findings of [53, 54] emphasized stakeholder engagement, from patients to physicians, in the Twitter dementia community.

Prior studies have found caregivers use Twitter for various purposes, and it impacts the quality of available information regarding health and care of older adults, potential misinterpretation [53], and associated economic burden. Therefore, research is required to better understand how PWD and their caregivers use it. This research investigated the factors dementia caregivers employ to assess the credibility of dementia-related information sources on Twitter.

3 Methods

Data were collected through think-aloud protocols followed by semi-structured interviews.

3.1 Think-aloud protocol

Participants engaged in an approximately 15-minute think-aloud session that entailed assessing Twitter profiles. This method is popular for exploring the thoughts and cognitive processes of participants during a task [55]. It is a non-directive technique in which participants are instructed only before the initiation of the task and only interrupted when participants stop verbalising [56]. The purpose is to gather the participants' immediate thoughts in real time, which allows greater richness in descriptions of user

experience. Participants are not required to remember how they felt throughout the experience, but rather express themselves in real time [57]. It is commonly used to reveal possible factors influencing the credibility judgment of health-related information on websites and during online search [11, 58–61].

3.2 Post-task interviews

Participants next completed a semi-structured interview to further elaborate on their statements made during the think-aloud session to increase the depth of understanding about the participants' think-aloud experience. The participants were asked for their assessments of the profiles they did not select and what they felt constituted a credible source generally (e.g. In your opinion, what do you think about other accounts that you didn't select? Can you explain in your own words what a credible source is on Twitter?) Interviews lasted 15-20 minutes. Think-aloud sessions and interviews were recorded.

3.3 Participants

The researchers recruited a purposive sample of dementia caregivers aged 21 and older who live in the UK and use Twitter. The sample included six formal and seven informal caregivers for PWD at different stages: 12 females and 1 male, with ages ranging between 21-35 (3), 36-50 (2), and 51+ (7). Education levels spanned undergraduate (5), college (6), and postgraduate (2). Twelve participants had used Twitter for over a year. Their usage frequency was 8 daily, 1 weekly, 2 monthly, 1 occasionally, 1 not sure.

3.4 Recruitment

The researchers posted a flyer on Twitter with a link to the study registration form. UK dementia organizations were invited to share the flyer by retweeting or sharing by email. Participants read the information sheet, signed the consent form, and provided their preferred interview time and contact details. They received a confirmation email within 24 hours, containing the interview date, time, and a secure Zoom link. Participants received a £20 e-gift voucher after completing the interview; this was later increased to £40 to encourage participation. Participants were recruited until data saturation was reached; the last two participants did not reveal new insights [62]. Rich and in-depth data are the focus of think-aloud studies, and sample sizes are fairly small [57].

3.5 Procedures

Participants received a link to an online questionnaire as well as Zoom interview instructions by email a day before the interview. The questionnaire gathered basic demographics, frequency of Twitter and other social media usage, and general questions regarding the profiles and information types usually read on Twitter.

Prior to the interviews, participants received a five-minute video with instructions on computer requirements and Zoom screen sharing. In each interview, the researcher

first initiated discussion about the participant's questionnaire responses about their preferred Twitter sources, categories (e.g., organizations, professionals), and information types. The interviewer started the think-aloud task by sending a link via the chat box with a description of the task and instructions (Appendix 1). Participants then read the task scenario and instructions for a 15-minute session that entailed assessing live views of Twitter profiles and had a chance to ask questions. Participants then shared their screen in order for the researcher to observe their interactions with the profiles.

The researchers had previously selected six profiles to ensure that 1) most tweets were dementia centric, as two independent assessors had already determined, and 2) there were two publically available profiles from each of the following categories: *Organizations*, *Professionals*, and *Individuals*. The researchers chose these because they embody the primary user types that tweet about dementia [54]. As self-identified in their profile descriptions, *Organizations* contained two dementia-related organizations, *Professionals* featured two dementia researchers, and two partners/caregivers of PWD comprised *Individuals*. In each category, one profile had an extremely high bot score and the other had an extremely low bot score as calculated by the BotOrNot API¹ [63]. Accounts with high bot scores mostly included automatically generated tweets or re-tweets. While some sources were reputable, other sources' posts had misleading information; for instance, how certain fruits or a particular exercise can prevent the risk of dementia or memory loss. Providing a chosen list of webpages is common in think-aloud web studies; for example, [60] selected eight search engine results page (SERP) listings (four credible, four non-credible) to study judgements of three controversial topics. The research presented in [58] also used SERP listings, representing either correct or incorrect information.

A sample screenshot of tweets from an individual profile with a high bot score appears in Appendix 2. BotOrNot computes scores that indicate the likelihood of a Twitter account being a bot: high scores for likely-bot, and low scores for likely-human accounts [63]. BotOrNot had been employed because an objective of the larger study is to determine individuals' perceptions surrounding the credibility of dementia-related bot profiles. This paper focuses only on how people assessed the credibility of dementia information, regardless of source.

All six profiles contained a biography, profile photos, location, the year the user joined Twitter, and dementia-related tweets. Participants were asked to think-aloud while assessing the pair of profiles in each category, potentially choosing one of the accounts as credible, and providing reasons supporting their choice. Participants were free to navigate the profile content without time constraints, reading as many tweets as they preferred, and going back to profiles whenever they wanted. The longest think-aloud session was about 15 minutes. Participants were also asked to rate each account's credibility on a Likert scale, with 1 being the least credible, and 7 the most credible, to align their justification with the rating to determine their confidence in choosing a profile.

¹ <https://github.com/IUNetSci/botometer-python>

3.6 Data Analysis

Data collected through the think-aloud sessions and semi-structured interviews were transcribed and analyzed using conventional qualitative content analysis, in which coding categories are gained directly from the text [64]. One researcher checked Zoom's automatically generated transcripts to ensure accuracy. The next step was open coding, and then lists of categories were grouped under higher level headings. Open coding started with four transcripts. Next, another researcher independently coded the four transcripts, and then they held a meeting to discuss the coding and reach a consensus on the main categories. Based on the discussion, both researchers used the scheme to code the four transcripts, reading each transcript line by line, and refined the coding scheme by discussing opinions immediately when any disagreements or discussion points emerged. They iterated this process until they agreed on the themes and codes [65]. Finally, they used the resulting scheme to code all the interviews. They made slight modifications to some codes' definitions, and added new sub-categories as they related to the evidence and variation under each category.

Table 2 displays the participants' credibility ratings. Significantly, a comparatively high number of profiles were rated from 3-5, indicating indecision. Fourteen human-likely profiles were rated as credible, and only 7 bot-likely profiles were rated credible.

Table 2. Participants' Credibility Ratings

Profile Type	Ratings		
	Unsure (1-2)	Indecisive (3-5)	Sure (6-7)
Bot-likely	8	24	7
Human-likely	7	18	14

4 Findings

The analysis resulted in three main categories of credibility assessment dimensions: source, content, and user, as well as 13 subcategories that support different main categories. Fig. 1 shows the proposed model based on this analysis.

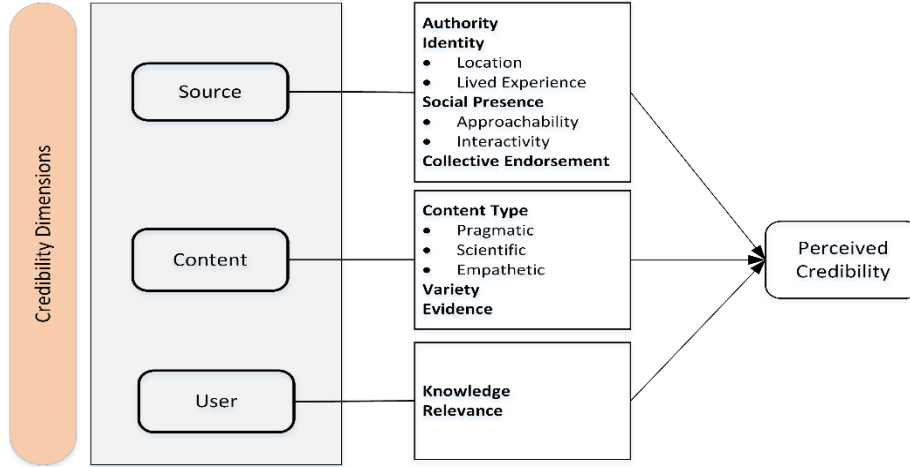


Fig. 1. Proposed Model

4.1 Source

This category captures participants' assessment criteria for determining the credibility of the source as described in the sub-sections. *Source* refers to the Twitter profile based on features such as profile description, location and picture, the profile owner choosing which information to share publicly. A *source* can author tweets, retweet, quote other users' tweets, reply to tweets, follow others' accounts, be @mentioned in tweets, and be grouped into lists.

Authority

Ten participants considered the source as credible if they recognized the author of the tweets as an authoritative source. Participants expressed *authority* as subject-related experts with a scientific background and/or qualification, or an official entity; a well-recognized public account, including the blue badge or verified feature assigned by Twitter which validates an account of public interest as authentic. Some points of view on authority from participants were as follows. The + or – denoted after each quote indicates whether the related statement positively or negatively affected the participants' perception.

"I would find that less credible than someone with a qualification or a recognized organization." +(P6)

"If it has a blue tick, then it's a credible account" +(P7)

"Just to make sure that it was all credible. What their qualifications were. What they'd studied" +(P10)

In general, authority had a positive effect on source credibility assessment.

Identity

Participants discussed *identity* when the source declared geographic location as well as lived personal experience as patient or caregiver.

Location is declared either in the source's profile or posts. The participants identified the account holder's location as an identity cue when they browsed a profile. Nine participants believed that profiles of individuals and organizations from the same country are more credible.

"It seems credible source, but because it's not the UK. Wouldn't probably follow it." + (P8)

"I wouldn't be interested in that because that was in the USA" (P6)

"I would be more inclined to go for a UK based one" + (P10)

A second type of identity cue is *lived personal experience*, defined as a caregiver or a PWD stated either in profile descriptions or posts. Six participants showed an interest in finding people with the same situation, either living with dementia or caring for a person with dementia.

"just because she seems to be dealing more with what I deal with on a daily basis" + (P3)

"I think perhaps in terms of experiences, personal experiences, I might go with it, who either has lived experience and has done something with that?" + (P5)

Collective Endorsement

Participants considered how other people view the source. It was measured by the number of followers the source has, who the followers are, the number of likes on the source's posts, if they have mutual friends, or even through a recommendation suggested by a trusted person offline. The endorsement could be from one user or a group of people:

"I think the more followers you have probably the more credible, the more reliable source" + (P1)

"Number of followers is a factor. It's a conscious factor I should say that." + (P5)

"If I go back a step, this profile followed by [redacted]. [Redacted] is a dementia expert by experience. He has dementia and I've followed him and attended some conferences he's spoken at prior to covid so that immediately I like in terms of reliability" + (P5)

Social Presence

Participants expressed the *social presence* of the source in two different ways: approachability and interactivity. *Approachability* is the feeling that the source is human and there is a possibility of direct interaction with the source. During think-aloud session, participants experienced greater feelings of social presence while evaluating a source in the *professional* category who was more likely to be perceived as a social actor. Some of the profile posts included their contact details (e.g. telephone number). Six participants shared consensus via comments while assessing that source:

"Okay, so she's posting things that make her more human." + (P5)

“it's it sounds more friendly ... she said, you know, you can call you can chat. Which I think is good, whereas the others no. I didn't get that impression of the others.” + (P9)

“I like her approach. I like the fact that she was actually asking for experiences. It was much more tailored to the needs of someone caring for someone with dementia” + (P4)

Interactivity is expressed in terms of constant tweeting activity, either writing one's own tweets or only retweeting. One participant felt stronger social presence when evaluating a user who tweets more than retweets:

“She seems more human. The other one a lot of retweets and not really about him, as such ... Can see human behind feed whereas other link has no personal feel ... whereas there further wasn't enough evidence of the human behind any of those accounts and that might suggest that it's a bot or not an actual human being and have a good thing about people that only retweet. I like people that give their own opinion” - (P11)

In contrast, another participant did not sense a strong social presence from someone who tweets more than retweets:

“wouldn't say is particularly good because it's not taking into account like of a wide range of people's opinions.” - (P2)

“Uses fellow colleges and alike as well as himself, not self-involved and purely wants good information out there ... It's not self-involved. So, it's, it seems more like actual information output rather than a personal account that's kind of trying to like glorify themselves.” + (P2)

Other two participants experienced greater feelings of user presence from one who constantly tweets:

“Yet they haven't posted since June and July. So, I want to be kept up to date. They're not active, they're not recent” - (P7)

“A more credible account. Even though it was in Z. They are actively sharing information daily.” + (P8)

4.2 Content

The posts on profiles were also valued and provide meaningful insight from the participants' credibility perspective. *Content* is the source timeline, or aggregated stream of tweets, retweets, replies, and tweets quoted by a user. A tweet is a message with a maximum text length of 280 characters, and may also contain photos or videos.

Content Type

Scientific, pragmatic, and empathetic *content types* contributed to source credibility assessment. Six participants showed interest in sources providing scientific information. In other words, most of the source's tweets included medical or scientific research findings. Generally, these tweets include links to external websites or cite information on external platforms.

“He would be the more credible source. He seems to be sharing, you know, this is sharing more of studies ... The other one just raising awareness.” + (P12)

Contrary to pure scientific information in articles, seven participants showed interest in sources' pragmatic information. This means practical ideas or tips that can be usefully applied in caregivers' everyday lives.

"Account offers more practical ways of making life more bearable for people living with dementia" +(P7)

"Appears to share more practical information and tweets about own experience which may be more helpful than seeing scientific papers in second link" +(P11-T)

Participants also viewed sources providing empathetic contents as more credible. Empathetic content conveys expressions of emotion or feeling including caring, helping, appreciating, and supporting, as well as faith-based support.

"Going to assume an accredited account of course everything they have to say matters to me as a caregiver and especially because they are offering support for their carers" +(P7)

"We're here to help carry the burdens that would be brilliant" +(P10)

"the faith based one I liked, but I wasn't sure how applicable it would be to me because we have Christians and think that I would like a faith-based support, but what there isn't a Christian tradition" +(P4)

Variety. Variety in the content refers to topic diversity, whether focused on one or several aspects. Two different points of view emerged about the content's variety. One participant showed interest in accepting an information source as credible if it is focused only on one topic rather than discussing a range of topics.

"I would pick him because it tends to be more of a focus on actual dementia." +(P12).

However, other participants expected a wide range of information from a source and rated the source as credible if the content covered different topics such as drugs and medicines or research articles.

"It just seems to focus on the one drug, and it doesn't seem to sort of focus on too many you know, other things" -(P10)

Evidence. Another criterion referred to evidence for scientific claims: if available within the content, the information source is deemed credible. Evidence refers to links (URLs) to other references supporting the information.

"Credible source showing links to other sources" +(P13)

"If someone's just saying, like, fruit can help prevent dementia. Well, I need to know why that you're saying that what's your rationale behind its kind of thing, where have they got this information from because the Internet is not reliable at all" +(P12)

Another group of participants questioned the quality and reliability of the provided references and links, believing that information based on authentic, reliable, high-quality sources, could be credible.

"She's posting information or links to information that looked like it would be very useful and that from reliable sources as well. So, I see University of [redacted], I recognize that name Centre for Dementia Studies, Alzheimer's Society. I know. So, I'm drawn to this" + (P5)

“links they are sharing and go to the links and see what the quality information that they were receiving; were the links they're sharing from credible sources?” +(P10)

Participants also mentioned that if the contents include links from the same source or website then these could not be trusted.

“Kind of links they have are from the same website...because if it's from the same websites. It's most likely the same people who are writing articles... It doesn't seem like a bad organization, in any way; it just seems as not as reliable as something else would be. I probably would not use it” -(P2)

4.3 User

This refers to the participant who has been asked to assess the profile; in this study, the users were the caregivers. Some characteristics related to the users were found as factors influence user assessment during the credibility, including relevance and prior knowledge. Relevance refers to the participant's interest in the content provided by the source. Relevance was frequently mentioned during profile assessments.

“They're that just too medical they're not they're not something that I'm that interested in to be honest. As I said, I am more interested about the care and support that one might need after diagnosis” -(P4)

Prior knowledge refers to the participant's ability to understand and interpret the content provided by the source.

“Interesting material that I have some knowledge of and can understand” +(P5)

Lack of knowledge was mentioned as a reason for not being able to understand the information; for example, scientific terms used in most of a profile's tweets:

“I wouldn't follow user I purely and simply because I wouldn't have a clue what he's talking about and to be honest, I don't have the time to go in and look it up” -(P5)

“I would have difficulty making a decision whether that's credible ... it looks way above anything that I intellectually could understand” -(P13)

5 Discussion

The aim of this study was to understand factors that people employ to assess the credibility of health-related information sources on Twitter. The qualitative approach and think-aloud method enhance experimental studies by providing results that expand understanding of credibility assessments regarding health-related sources on social media.

Most source-related heuristics – authority, identity, collective endorsement, and social presence – were in line with the agency affordance heuristics provided in the MAIN model [37]. The MAIN model proposes four classes of technological affordances that can trigger cognitive heuristics which affect credibility judgments: Modality (M), Agency (A), Interactivity (I), and Navigability (N). Modality deals with the medium through which data is presented, Interactivity implies both interaction and activity with devices, and Navigability focuses on interface cues helping with navigation in cyberspace. The agency affordance deals with the source of information on digital media such as websites, a poll of friends on social media, or a person having a profile on any

online platform. However, as the role of contents in credibility assessment and user characteristics are complementary to technological affordances in the MAIN Model [37], it is necessary to incorporate all these facets in order to understand participants' evaluations. Participants in this study identified a source as an authority when the source was a domain expert or an official entity [37]. This aligns with the general finding among credibility literature showing that authority impacts credibility evaluation [66][67].

According to the MAIN Model [37], the identity heuristic is likely to be triggered whenever the user is able to express oneself through manipulating content. The user interface of social media platforms can be designed to generate different verifications of identity, and potential followers may use these for their own evaluation of a profile [37]. People can evaluate a source's name, place, profile photo, or other identifiers to verify the identity of a profile owner. Various identity-related parameters for credibility assessment have been used in prior research for different contexts, such as profile pictures for evaluating online news comments [68] and LinkedIn profiles [69]. Another identity cue, nationality, is used during online shopping; if someone from their own country has provided a review, it is trusted more than someone from a different nationality [70]. This study further showed identity was perceived in two forms: source location, and personal experience as a caregiver or PWD. All participants were UK residents, and they evaluated sources located outside of the UK as not credible.

Social presence as a concept means feeling the presence of other people irrespective of technology use [71]. Feeling social presence of other entities (human or machine) develops trust in the system [72][73]. Social presence heuristics, triggered by agency cues, may provoke feeling the presence of another entity [37]. Prior studies demonstrated different cues of social presence on Twitter influencing users' credibility perceptions. During disaster situations, [74] identified Twitter account age as a cue for social presence. Other research investigated dynamic features, such as the relationship between levels of the source's timeline interactivity, as social presence cues: a high-interactivity source's timeline (a political figure) expressed by the number of replies provided to followers, resulted in greater social presence [75]. Dialogic retweets, or retweets of users who @mentioned the organization, produced a higher level of social presence compared to monologic or "one-way" tweets from the organization [76].

A key finding of this study was participants' use of social presence to detect human characteristics. It has extended past research by incorporating different perspectives on a source's profile interactivity and adding approachability as another lens for social presence. Interactivity involved frequent tweeting. Contradictory perceptions towards sources' tweeting interactivity were also revealed. For some participants, the source who tweeted more than retweeted generated a greater sense of social presence for some participants, whereas they did not for other participants. These varied perceptions of social presence should be further explored because bots can be set to retweet as well as automatically reply to tweets, pretending to be real people. Bots spreading false information could potentially negatively affect healthcare.

Sundar's [37] proposed bandwagon heuristic reflects a group endorsement of the source's reputation, which impacts on its credibility. Collective endorsement has been

observed as a factor affecting credibility perception in news [77] and online health forums [78]. Similarly, endorsement here included the number of followers the source has, who the followers are, the number of likes on the source's posts, and if they have mutual friends; however, one participant included a recommendation suggested by a trusted person offline.

Agency affordances [37] have been extensively utilized in investigations of credibility assessment [67][79] to measure their relationship with source credibility perceptions in different contexts. Similarly, the study demonstrated agency affordance [37] on Twitter's structural properties and helped participants perform source assessment; however, the affordance is perceived by a person's subjective perception and understanding of external cues [80]. Thus, this study identified how these affordances were perceived differently in the context of health-related information. For example, this investigation presents a new understanding of how social presence could be formed in its particular context. It identified how technologies can virtually create and enhanced social realities.

The study found another dimension for credibility evaluation: content features. Participants also evaluated the profile based on content type, verity of content, and evidence. They marked empathetic content as an important cue for evaluation source credibility. Interestingly, faith-based content contributed to enhanced credibility perception. Although empathetic content has been identified as an important aspect in evaluating general web health information sources by studies such as [81], to the best of our knowledge, no work has directly examined the relationship between individual perception assessment of health information and faith-based content or religiosity on social media. Mixed perceptions were observed regarding the variety of contents. Although few participants were only interested in topic-focused information, some showed interest in multiple *types* of information. Participants also assessed content in light of evidence or references provided with the tweet. Some participants did not believe in the contents if they were posted by the same web source.

Users' knowledge and relevance of the contents also play a vital role in assessment. If the contents were related to the participant's needs or experiential background, they identified the source as more credible. This is unlike the results in [82], where knowledge did not impact the participants' credibility perceptions of search engine results, yet it agrees with topic knowledge of many credibility assessment models on the general web [83] and on Wikipedia [84].

Although some of these findings are common in the previously discussed models, this study cannot be directly connected to any one credibility assessment model. Offering participants to evaluate the full 'live' profile and content using the think-aloud methodology provided a means to observe that users do not only rely on source heuristics. The findings demonstrate the importance of qualitative studies that help establish the role of users' prior knowledge and relevance in information processing. It has also shown the necessity of adopting systematic processing metrics for credibility evaluation in health information on social media along with source heuristics. Most existing models and frameworks for credibility assessment have been developed with the perspective of information available through static web resources. The proposed model in

this study can serve as a starting framework for further research on credibility of health information on social media.

6 Limitations

Because all participants were caregivers, the findings are not representative of all Twitter users seeking dementia information, so future studies should examine a greater variety of participants to compare credibility evaluations. Moreover, the potential influence of the participants' location and culture may limit the generalizability of the findings, as these factors influence people's perceptions. Also, the study focuses only on dementia information, so a study of how people evaluate tweets about other chronic health conditions would be useful. A broader understanding of how culture might factor into people's perceptions would be valuable as well. A final limitation is the small sample of profiles shown to the participants; future work should evaluate a broader set of profiles.

7 Conclusions

Despite the limitations, this study contributes to the field of information credibility research in social media significantly. Given the growing popularity of Twitter bots and users' ability to share content without gatekeepers' filters, it is imperative to understand how and why credibility assessments of information sources on social media are made. The study provided a step towards qualitative assessment of user perceptions of social media health information sources, and suggested a direction toward generalizing for other domains.

Appendix 1

Task:

Your partner has been diagnosed with dementia recently. You would like to help by finding out what is generally recommended for people in his /her situation. Six types of Twitter source (users) links are shown below. There are two users from different categories. Explore the users in each category and select which of these options you think will be a reliable source for the task.

Instructions :

- 1- Open both user links in each category.
- 2- Select the user(s) you think will be a reliable source for the task. You can select "None", if you prefer neither.
- 3- Justify your selection for each in the text entry below the user link.
- 4- Rate the credibility of each user 1-7, least to best.
- 5- You are encouraged to think aloud while you are exploring the profiles.

Fig. 2. Study homepage (1)

Category 1

https://twitter.com/User1	https://twitter.com/User2	None
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

User 1							User 2						
1	2	3	4	5	6	7	1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Category 2

https://twitter.com/User1	https://twitter.com/User2	None
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

User 1							User 2						
1	2	3	4	5	6	7	1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Category 3

https://twitter.com/User1	https://twitter.com/User2	None
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

User 1							User 2						
1	2	3	4	5	6	7	1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Fig. 3. Study homepage (2)


Appendix 2

Be mindful of the risk, stay engaged!
Apathy linked to increased dementia risk [mcknights.com/news/clinical-...](#)
[#Alzheimer](#) [#FCKAlzheimers](#) [#No2Alzheimers](#)

Apathy linked to increased dementia risk - Clinical Daily News - McKnig...
A nine-year study found that people with severe loss of interest in daily activities are at a higher risk of dementia. Greater apathy also was tied t...
[mcknights.com](#)

Sep 11
More evidence that proactive healthy steps promote a healthy brain! ***

Multi-focus program cuts lifestyle risk for dementia
[mcknights.com/news/clinical-...](#) [#Alzheimers](#) [#FCKAlzheimers](#)
[#No2Alzheimers](#)



Multi-focus program cuts lifestyle risk for dementia - Clinical Daily New...
Seniors educated on the benefits of a health lifestyle. Mediterranean diet, physical activity and cognitive engagement made enough changes to ...
[mcknights.com](#)

Aug 13
Encouraging news from the Salk Institute on Alzheimer's treatment - [medicalnewstoday.com/articles/promi...](#) [#Alzheimers](#)

Promising new drug candidate may reverse Alzheimer's...
New research finds that a compound called CMC121 improves memory and behavior in mice with ...
[medicalnewstoday.com](#)

Jul 24
More research on factors around a healthy brain - Read in good (brain) health!
Study reveals factors that keep the oldest adults cognitively sharp
[mcknights.com/news/clinical-...](#) [#Alzheimers](#) [#FCKAlzheimers](#)
[#No2Alzheimers](#)

Study reveals factors that keep the oldest adults cog...

Fig. 4. Profile with high bot score (screen name and photo are redacted)

References

1. Zhao, Y., Zhang, J.: Consumer health information seeking in social media: a literature review. *Health Info. Libr. J.* 34, 268–283 (2017). <https://doi.org/10.1111/hir.12192>.
2. Ventola, C.L.: Social Media and Health Care Professionals : Benefits , Risks , and Best Practices. 39, 491–500 (2014).
3. Suarez-Lledo, V., Alvarez-Galvez, J.: Prevalence of health misinformation on social media: Systematic review. *J. Med. Internet Res.* 23, (2021). <https://doi.org/10.2196/17187>.
4. Chou, W.S., Oh, A., Klein, W.M.P.: Addressing Health-Related Misinformation on Social Media. *Am. Sci.* 320, 2417–2418 (2018). <https://doi.org/10.1511/2017.105.6.372>.
5. Stvilia, B., Mon, L., JeongYi, Y.: A Model for Online Consumer Health Information Quality. *J. Am. Soc. Inf. Sci. Technol.* 60, 1781–1791 (2009). <https://doi.org/DOI:10.1002/asi.21115>.
6. Rieh, S.Y.: Credibility and Cognitive Authority of Information. *Encycl. Libr. Inf. Sci.* Third Ed. 1337–1344 (2009). <https://doi.org/10.1081/E-ELIS3-120044103>.
7. Alrubaian, M., Al-Qurishi, M., Al-Rakhami, M., Hassan, M.M., Alamri, A.: Reputation-based credibility analysis of Twitter social network users. *Concurr. Comput.* 29, 1–12 (2017). <https://doi.org/10.1002/cpe.3873>.
8. Keshavarz, H.: Evaluating Credibility of Social Media Information : Current Challenges , Research Directions and Practical Criteria. (2020). <https://doi.org/10.1108/IDD-03-2020-0033>.
9. Sharma, M., Yadav, K., Yadav, N., Ferdinand, K.C.: American Journal of Infection Control Zika virus pandemic — analysis of Facebook as a social media health information platform. *AJIC Am. J. Infect. Control.* 45, 301–302 (2017). <https://doi.org/10.1016/j.ajic.2016.08.022>.
10. AbdElminaam, D.S., Ismail, F.H., Taha, M., Taha, A., Houssein, E.H., Nabil, A.: CoAID-DEEP: An Optimized Intelligent Framework for Automated Detecting COVID-19 Misleading information on Twitter. *IEEE Access.* 4, 1–1 (2021). <https://doi.org/10.1109/access.2021.3058066>.
11. Klawitter, E., Hargittai, E.: Shortcuts to Well Being? Evaluating the Credibility of Online Health Information through Multiple Complementary Heuristics. *J. Broadcast. Electron. Media.* 62, 251–268 (2018). <https://doi.org/10.1080/08838151.2018.1451863>.
12. Liao, Q.V., Fu, W.T.: Age differences in credibility judgments of online health information. *ACM Trans. Comput. Interact.* 21, (2014). <https://doi.org/10.1145/2534410>.
13. Alrubaian, M., Al-Qurishi, M., Alamri, A., Al-Rakhami, M., Hassan, M.M., Fortino, G.: Credibility in Online Social Networks: A Survey. *IEEE Access.* 7, 2828–2855 (2019). <https://doi.org/10.1109/ACCESS.2018.2886314>.
14. Ginsca, A.L., Popescu, A., Lupu, M.: Credibility in Information Retrieval. *Found. Trends® Inf. Retr.* 9, 355–475 (2015). <https://doi.org/10.1561/15000000046>.
15. Manfredi, M.J., Bright, A.D.: A Model For Assessing The Effects of Communication on Recreationists. *J. Leis. Res.* 23, pp.1–20 (1991).
16. Sikdar, S., Adali, S., Amin, M., Abdelzaher, T., Chan, K., Cho, J., Kang, B., Donovan,

- J.O.: Finding True and Credible Information on Twitter. In: 7th International Conference on Information Fusion (FUSION). pp. 1–8. IEEE (2014).
17. Aladhadh, S., Zhang, X., Sanderson, M.: Tweet Author Location Impacts on Tweet Credibility. Proc. 2014 Australas. Doc. Comput. Symp. - ADCS '14. 73–76 (2014). <https://doi.org/10.1145/2682862.2682873>.
 18. Chorley, M.J., Colombo, G.B., Allen, S.M., Whitaker, R.M.: Human content filtering in Twitter: The influence of metadata. 74, 32–40 (2015). <https://doi.org/10.1016/j.ijhcs.2014.10.001>.
 19. Edwards, C., Spence, P.R., Gentile, C.J., Edwards, A., Edwards, A.: How much Klout do you have ... A test of system generated cues on source credibility. Comput. Human Behav. 29, A12–A16 (2013). <https://doi.org/10.1016/j.chb.2012.12.034>.
 20. Jahng, M.R., Littau, J.: Interacting is believing: Interactivity, social cue, and perceptions of journalistic credibility on Twitter. Journal. Mass Commun. Q. 93, 38–58 (2016). <https://doi.org/10.1177/1077699015606680>.
 21. Kang, B., Hölerer, T., O'Donovan, J.: Believe it or not? Analyzing information credibility in microblogs, (2015). <https://doi.org/10.1145/2808797.2809379>.
 22. Morris, M.R., Counts, S., Roseway, A., Hoff, A., Schwarz, J.: Tweeting is Believing? Understanding Microblog Credibility Perceptions. CSCW '12 Proc. ACM 2012 Conf. Comput. Support. Coop. Work. 441–450 (2012). <https://doi.org/10.1145/2145204.2145274>.
 23. Shariff, S.M., Zhang, X., Sanderson, M.: On the credibility perception of news on Twitter: Readers, topics and features. Comput. Human Behav. 75, 785–796 (2017). <https://doi.org/10.1016/j.chb.2017.06.026>.
 24. Westerman, D., Spence, P.R., Van Der Heide, B.: A social network as information: The effect of system generated reports of connectedness on credibility on Twitter. Comput. Human Behav. 28, 199–206 (2012). <https://doi.org/10.1016/j.chb.2011.09.001>.
 25. Yang, J., Counts, S., Morris, M.R., Hoff, A.: Microblog Credibility Perceptions: Comparing the USA and China. Cscw. 575–586 (2013). <https://doi.org/10.1145/2441776.2441841>.
 26. Sbaffi, L., Rowley, J.: Trust and credibility in web-based health information: A review and agenda for future research. J. Med. Internet Res. 19, 1–17 (2017). <https://doi.org/10.2196/jmir.7579>.
 27. Shariff, S.M.: A Review on Credibility Perception of Online Information. Proc. 2020 14th Int. Conf. Ubiquitous Inf. Manag. Commun. IMCOM 2020. (2020). <https://doi.org/10.1109/IMCOM48794.2020.9001724>.
 28. Spence, P.R., Edwards, A., Edwards, C., Jin, X., Spence, P.R., Edwards, C.: ‘ The bot predicted rain , grab an umbrella ’: few perceived differences in communication quality of a weather Twitterbot versus professional and amateur meteorologists meteorologists. 3001, (2019). <https://doi.org/10.1080/0144929X.2018.1514425>.
 29. Edwards, C., Edwards, A., Spence, P.R., Shelton, A.K.: Is that a bot running the social media feed? Testing the differences in perceptions of communication quality for a human agent and a bot agent on Twitter. Comput. Human Behav. 33, 372–376 (2014). <https://doi.org/10.1016/j.chb.2013.08.013>.
 30. Johnson, T.J., Kaye, B.K.: Credibility of social network sites for political information among politically interested internet users. J. Comput. Commun. 19, 957–974 (2014).

- <https://doi.org/10.1111/jcc4.12084>.
31. Granskogen, T., Gulla, J.A.: Fake News Detection on Social Media: A Data Mining Perspective. *ACM SIGKDD Explor. Newsl.* 19, 22–36 (2017). <https://doi.org/10.1145/3137597.3137600>.
 32. Choi, W., Stvilia, B.: Web Credibility Assessment: Conceptualization, Operationalization, Variability, and Models. *J. Am. Soc. Inf. Sci. Technol.* 64, 1852–1863 (2015). <https://doi.org/10.1002/asi>.
 33. Fogg, B.J.: Prominence-interpretation theory: Explaining how people assess credibility online. *Conf. Hum. Factors Comput. Syst. - Proc.* 722–723 (2003). <https://doi.org/10.1145/765891.765951>.
 34. Hilligoss, B., Rieh, S.Y.: Developing a unifying framework of credibility assessment: Construct, heuristics, and interaction in context. *Inf. Process. Manag.* 44, 1467–1484 (2008). <https://doi.org/10.1016/j.ipm.2007.10.001>.
 35. Choi, W., Stvilia, B.: Web Credibility Assessment: Conceptualization, Operationalization, Variability, and Models. *J. Am. Soc. Inf. Sci. Technol.* 64, 1852–1863 (2013). <https://doi.org/10.1002/asi>.
 36. Wathen, C.N., Burkell, J.: Believe it or not: Factors influencing credibility on the Web. *J. Am. Soc. Inf. Sci. Technol.* 53, 134–144 (2002). <https://doi.org/10.1002/asi.10016>.
 37. Sundar, S.: The MAIN Model: A Heuristic Approach to Understanding Technology Effects on Credibility. *Digit. media, youth, Credibil.* 73–100 (2008). <https://doi.org/10.1162/dmal.9780262562324.073>.
 38. Metzger, M.J.: Making Sense of Credibility on the Web: Models for Evaluating Online Information and Recommendations for Future Research. *J. Am. Soc. Inf. Sci. Technol.* (2007). <https://doi.org/10.1002/asi.20672>.
 39. Lucassen, T., Muilwijk, R., Noordzij, M.L., Schraagen, J.M.: Topic Familiarity and Information Skills in Online Credibility. *J. Am. Soc. Inf. Sci. Technol.* 64, 1852–1863 (2013). <https://doi.org/10.1002/asi>.
 40. Flanagin, A.J., Metzger, M.J.: The role of site features, user attributes, and information verification behaviors on the perceived credibility of web-based information. *New Media Soc.* 9, 319–342 (2007). <https://doi.org/10.1177/1461444807075015>.
 41. Rieh, S.Y.: Credibility assessment of online information in context. *J. Inf. Sci. Theory Pract.* 2, 6–17 (2014). <https://doi.org/10.1633/JISTaP.2014.2.3.1>.
 42. World Health Organization: 10 facts on dementia, <https://www.who.int/news-room/fact-sheets/detail/dementia>, last accessed 2021/02/01.
 43. Rodriguez, J.: Narrating Dementia : Self and Community in an Online Forum. 23, 1215–1227 (2013). <https://doi.org/10.1177/1049732313501725>.
 44. Strivens, E.: Innovation and Translation Facing the times : A young onset dementia support group : Facebook TM style. *Australas. J. Ageing.* 35, 48–53 (2016). <https://doi.org/10.1111/ajag.12264>.
 45. Talbot, C., O’Dwyer, S., Clare, L., Heaton, J., Anderson, J.: Identifying people with dementia on Twitter. *Dementia.* 1–10 (2018). <https://doi.org/10.1177/1471301218792122>.
 46. Mackie, B.R., Mitchell, M., Marshall, A.P.: Patient and family members’ perceptions of family participation in care on acute care wards. *Scand. J. Caring Sci.* 33, 359–370 (2019). <https://doi.org/10.1111/scs.12631>.

47. Cherak, S.J., Rosgen, B.K., Amarbayan, M., Plotnikoff, K., Wollny, K., Stelfox, H.T., Fiest, K.M.: Impact of social media interventions and tools among informal caregivers of critically ill patients after patient admission to the intensive care unit: A scoping review. *PLoS One*. 15, 1–19 (2020). <https://doi.org/10.1371/journal.pone.0238803>.
48. French, T.: Dementia and digital: Using technology to improve health and wellbeing for people with dementia and their carers. 35 (2016).
49. Anderson, J.G., Hundt, E., Dean, M., Keim-Malpass, J., Lopez, R.P.: “The Church of Online Support”: Examining the Use of Blogs Among Family Caregivers of Persons With Dementia. *J. Fam. Nurs.* 23, 34–54 (2017). <https://doi.org/10.1177/1074840716681289>.
50. Zhang, Z., Ahmed, W.: A comparison of information sharing behaviours across 379 health conditions on Twitter. *Int. J. Public Heal.* 64, 431–440 (2019). <https://doi.org/10.1007/s00038-018-1192-5>.
51. Danilovich, M.K., Tsay, J., Al-Bahrani, R., Choudhary, A., Agrawal, A.: #Alzheimer’s and Dementia Expressions of Memory Loss on Twitter. *Top. Geriatr. Rehabil.* 34, 48–53 (2018). <https://doi.org/10.1097/TGR.000000000000173>.
52. Al-Bahrani, R., Danilovich, M.K., Liao, W.K., Choudhary, A., Agrawal, A.: Analyzing Informal Caregiving Expression in Social Media. *IEEE Int. Conf. Data Min. Work. ICDMW. 2017-Novem*, 342–349 (2017). <https://doi.org/10.1109/ICDMW.2017.50>.
53. Robillard, J.M., Johnson, T.W., Hennessey, C., Beattie, B.L., Illes, J.: Aging 2.0: Health Information about Dementia on Twitter. *PLoS One*. 8, 1–6 (2013). <https://doi.org/10.1371/journal.pone.0069861>.
54. Alhayan, F., Pennington, D.: Twitter as Health Information Source: Exploring the Parameters Affecting Dementia-Related Tweets. *ACM Int. Conf. Proceeding Ser.* 277–290 (2020). <https://doi.org/10.1145/3400806.3400838>.
55. Ericsson, A., Simon, H.: *PROTOCOL ANALYSIS: VERBAL REPORTS AS DATA*. Cambridge, MA: The MIT Press (1984).
56. Eveland, W.P., Dunwoody, S.: Examining Information Processing on the World Wide Web Using Think Aloud Protocols. *Media Psychol.* 2, 219–244 (2000). https://doi.org/10.1207/S1532785XMEP0203_2.
57. Solomon, P.: The think aloud method: A practical guide to modelling cognitive processes. (1995). [https://doi.org/10.1016/0306-4573\(95\)90031-4](https://doi.org/10.1016/0306-4573(95)90031-4).
58. Ghenaï, A., Smucker, M.D., Clarke, C.L.A.: A think-aloud study to understand factors affecting online health search. *CHIIR 2020 - Proc. 2020 Conf. Hum. Inf. Interact. Retr.* 273–282 (2020). <https://doi.org/10.1145/3343413.3377961>.
59. Muntinga, T., Taylor, G.: Information-Seeking Strategies in Medicine Queries: A Clinical Eye-Tracking Study with Gaze-Cued Retrospective Think-Aloud Protocol. *Int. J. Hum. Comput. Interact.* 34, 506–518 (2018). <https://doi.org/10.1080/10447318.2017.1368949>.
60. Kattenbeck, M., Elswelier, D.: Understanding credibility judgements for web search snippets. *Aslib J. Inf. Manag.* 71, 368–391 (2019). <https://doi.org/10.1108/AJIM-07-2018-0181>.
61. Lucassen, T., Muilwijk, R., Noordzij, M.L., Schraagen, J.M.: Topic Familiarity and Information Skills in Online Credibility Evaluation. *J. Am. Soc. Inf. Technol.* 64, 1852–1863 (2013). <https://doi.org/10.1002/asi>.

62. Reilly, M.O., Parker, N.: ‘Unsatisfactory Saturation’: a critical exploration of the notion of saturated sample sizes in qualitative research. *Qual. Res.* 13, 190–197 (2012). <https://doi.org/10.1177/1468794112446106>.
63. Yang, K.-C., Varol, O., Davis, C.A., Ferrara, E., Flammini, A., Menczer, F.: Arming the public with artificial intelligence to counter social bots. *Hum. Behav. Emerg. Technol.* 1, 48–61 (2019). <https://doi.org/10.1002/hbe2.115>.
64. Hsieh, H.F., Shannon, S.E.: Three approaches to qualitative content analysis. *Qual. Health Res.* 15, 1277–1288 (2005). <https://doi.org/10.1177/1049732305276687>.
65. Gibbs, G.R.: *Analyzing Qualitative Data*, (2007).
66. Rieh, S.Y.: Credibility and Cognitive Authority of Information. *Encycl. Libr. Inf. Sci.* Third Ed. 1337–1344 (2010). <https://doi.org/10.1081/e-elis3-120044103>.
67. Lin, X., Spence, P.R., Lachlan, K.A.: Social media and credibility indicators: The effect of influence cues. *Comput. Human Behav.* 63, 264–271 (2016). <https://doi.org/10.1016/j.chb.2016.05.002>.
68. Lin, X., Kaufmann, R., Spence, P.R., Lachlan, K.A.: Agency Cues in Online Comments: Exploring Their Relationship with Anonymity. *South. Commun. J.* 84, 183–195 (2019). <https://doi.org/10.1080/1041794X.2019.1584828>.
69. Edwards, C., Stoll, B., Faculak, N., Karman, S.: Social Presence on LinkedIn: Perceived Credibility and Interpersonal Attractiveness. *Online J. Commun. Media Technol.* 5, 102–115 (2015).
70. Bracamonte, V., Okada, H.: Impact of Nationality Information in Feedback on Trust in a Foreign Online Store. *J. Socio-Informatics.* 8, 1–12 (2015). https://doi.org/10.14836/jsi.8.1_1.
71. Lee, K.: Presence, Explicated. *Commun. theory.* 14, 27–50 (2004).
72. Kim, K.J., Park, E., Shyam Sundar, S.: Caregiving role in human-robot interaction: A study of the mediating effects of perceived benefit and social presence. *Comput. Human Behav.* 29, 1799–1806 (2013). <https://doi.org/10.1016/j.chb.2013.02.009>.
73. Lu, B., Fan, W., Zhou, M.: Social presence, trust, and social commerce purchase intention: An empirical research. *Comput. Human Behav.* 56, 225–237 (2016). <https://doi.org/10.1016/j.chb.2015.11.057>.
74. Son, J., Lee, J., Oh, O., Lee, H.K., Woo, J.: Using a Heuristic-Systematic Model to assess the Twitter user profile’s impact on disaster tweet credibility. *Int. J. Inf. Manage.* 54, 102176 (2020). <https://doi.org/10.1016/j.ijinfomgt.2020.102176>.
75. Lee, E. J., & Shin, S.Y.: Are they talking to me? Cognitive and affective effects of interactivity in politicians’ Twitter communication. *Cyberpsychology, Behav. Soc. Netw.* 15, (2012).
76. Lim, Y. shin, Lee-Won, R.J.: When retweets persuade: The persuasive effects of dialogic retweeting and the role of social presence in organizations’ Twitter-based communication. *Telemat. Informatics.* 34, 422–433 (2016). <https://doi.org/10.1016/j.tele.2016.09.003>.
77. Xu, Q.: Social recommendation, source credibility, and recency: Effects of news cues in a social bookmarking website. *Journal. Mass Commun. Q.* 90, 757–775 (2013). <https://doi.org/10.1177/1077699013503158>.
78. Jucks, R., Thon, F.M.: Better to have many opinions than one from an expert? Social validation by one trustworthy source versus the masses in online health forums. *Comput.*

- Human Behav. 70, 375–381 (2017). <https://doi.org/10.1016/j.chb.2017.01.019>.
79. Lin, X., Spence, P.R.: Identity on Social Networks as a Cue: Identity, Retweets, and Credibility. *Commun. Stud.* 69, 461–482 (2018). <https://doi.org/10.1080/10510974.2018.1489295>.
 80. Norman, D.A.: *The psychology of everyday things*. Basic Books (1988).
 81. Neal, D.M., McKenzie, P.J.: Putting the pieces together: endometriosis blogs, cognitive authority, and collaborative information behavior. *J. Med. Libr. Assoc.* 99, 127–134 (2011). <https://doi.org/10.3163/1536-5050.99.2.004>.
 82. Unkel, J., Haas, A.: The Effects of Credibility Cues on the Selection of Search Engine Results. *J. Am. Soc. Inf. Sci. Technol.* 64, 1852–1863 (2017). <https://doi.org/10.1002/asi>.
 83. Rieh, S.Y., Belkin, N.J.: Interaction on the Web : Scholars ’ Judgment of Information Quality and Cognitive Authority. In: *Proceedings of the annual meeting-American society for information science*. pp. 25–38. Information Today (2000).
 84. Lucassen, T., Schraagen, J.M.: Factual Accuracy and Trust in Information: The Role of Expertise. *J. Am. Soc. Inf. Sci. Technol.* 64, 1852–1863 (2013). <https://doi.org/10.1002/asi>.