Think Before You Share: The Role of Age and Attention/Working Memory in Proliferation of COVID-19 Misinformation on Social Media

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ABSTRACT

In the setting of a global pandemic, COVID-19 misinformation proliferating online has led to profound health-related and societal consequences. Older adults comprise a particularly vulnerable population due to increased risk for both COVID-19 related complications and susceptibility to, as well as sharing of, misinformation on social networking sites. The present study aims were to: 1) investigate whether older adults benefit from a theory-based attentional manipulation to dampen online sharing of COVID-19 misinformation compared to younger adults; and 2) examine whether differences in clinical attention/working memory (WM) help to explain age-related differences in sharing misinformation about COVID-19. One hundred and two adults completed a telephone-based assessment including standardized measures of attention/WM. Participants also completed the Social Media headline-sharing experiment that was modeled after the "News-sharing task" by Pennycook et al. (2020) and involves a simple manipulation at the start of the task (i.e., judging the accuracy of a non-COVID-19-related headline). Results show that older adults are less likely to share both accurate and false information and show greater headline accuracy discernment as compared to younger adults. A repeated measures multivariate analysis of variance test showed no effect of the accuracy judgement manipulation for either younger or older adults. Moreover, individual differences in attention/WM, as measured by Digit Span Total PCA composite, were not associated with age or sharing intentions for accurate and false COVID-19 related information. Effect sizes were small across these null findings. Findings suggest that older age is associated with better accuracy in determining the veracity of COVID-19 news headlines and a reduced likelihood of sharing information online. Attention-based accuracy judgments did not dampen the sharing of false information, which may be due to differences in study design, sample demographics, reproducibility of the original experiment, or timing of data collection. Further research should explore the association between aspects of attention particularly vulnerable to aging, including sustained attention and the central executive component of WM, and sharing likelihood for COVID-19 misinformation.

TABLE OF CONTENTS

Introduction

The rapid development of COVID-19 into a pandemic required people to quickly acquire, evaluate, and apply complex health-related information. In February 2020, the general director of the World Health Organization (WHO) stated that alongside the physical symptoms ranging from asymptomatic to deadly, the new COVID-19 pandemic was accompanied by an ongoing 'infodemic' of misinformation (World Health Organization, 2020). Although pandemics have occurred in the past (e.g., H1N1 in 1918, H2N2 in 1957; CDC, 2018), the COVID-19 pandemic's occurrence in an era in which information access via the internet was widely available resulted in a unique global health crisis. The increase in susceptibility to misinformation among the general public started a dangerous cascade of non-compliance with government-recommended health guidelines about COVID-19 (e.g., wearing masks, social distancing, frequently washing hands), as well as refusal to take the vaccine due to false information and quickly spreading conspiracy theories (e.g., 5G cellular service technology is linked to the cause of COVID-19, the vaccine contains a chip that allows the government to control my body; Roozenbeek et al., 2020). Although misinformation about health, technology and science is neither new nor unique to COVID-19, the impact of the pandemic is highly dependent on adoption of COVID-19 preventative health behaviors, and consequently, the accuracy of the information to which the general population is exposed (Roozenbeek et al., 2020).

Unfortunately, COVID-19 misinformation has proliferated, especially online (e.g., mainstream social media), with examples ranging from the propagation of damaging health advice, such as ingesting bleach and coconut oil killing the virus, to false conspiracy theories that the virus was bioengineered in a lab in Wuhan (Andersen et al., 2020; Cohen et al., 2020; Frenkel, Alba & Zhong, 2020; Russonello, 2020; Zarocostas, 2020). Indeed, COVID- 19 misinformation can profoundly distort the public's perception of risk associated with the virus (Krause et al., 2020). These effects are problematic because risk perception is related to whether the public is adhering to preventative health behaviors (Dryhurst et al., 2020). Specifically, belief in conspiracies about the virus (e.g., that the virus is bioengineered) has been associated with a propensity to reject information from expert authorities (e.g., Uscinski et al., 2020), an increase in vaccine hesitancy (e.g., Freeman et al., 2020), and lower self-reported adherence with public health guidelines (e.g., staying at home; Imhoff and Lamberty, 2020). Misinformation about the virus has also been linked to mass poisonings, mob attacks (Depoux et al., 2020), and vandalism (Spring, 2020). For example, false conspiracy theories about 5G masts causing or exacerbating COVID-19 symptoms resulted in people setting fire to over 50 phone masts in the UK (BBC News, 2020), which aligns with findings that belief in the 5G conspiracy is linked to violent intentions (Jolley and Paterson, 2020).

It is becoming increasingly clear that misinformation about COVID- 19 has gained enough traction to become a wide-spread public health problem. For example, a recent poll in the UK found that almost half (46%) of the population reported exposure to fake news about COVID-19 (Ofcom, 2020). Similarly, 48% of participants from a largescale U.S. survey had been exposed to at least some false news or misinformation related to the virus(Mitchell & Oliphant, 2020). Amongst those exposed, nearly two-thirds (66%) reported seeing COVID-19 misinformation daily, which is problematic as repeated exposure is known to increase belief in fake news (Pennycook, Cannon & Rand, 2018). An analysis of the most viewed COVID-19 YouTube videos found that over 25% of the top videos contained misleading information and totaled 62 million views worldwide (Li et al., 2020). One example is the conspiracy film "Plandemic", which appeared online in May of 2020, acquiring millions of views, and quickly becoming one of the most widespread examples of COVID-19 related misinformation (Cook et al., 2020). The video promotes dangerous health advice, for example, falsely suggesting that wearing a mask actually "activates" COVID-19.

Although mass endorsement of conspiracy theories about the virus is not yet widespread, a substantial number of citizens (typically about a third of the sample) in the UK and U.S. report to believe that the virus is either manmade or produced on purpose by powerful organizations (Freeman et al., 2020; Roozenbeek et al., 2020b; Uscinski et al., 2020). Indeed, a YouGov survey found that about 28% of Americans (and 50% of Fox News viewers) believe that Bill Gates is planning to use the COVID- 19 vaccine to implement microchips in people (Sanders, 2020). With these concerns in mind, the overarching aim of the present study is to investigate the unique and combined effects of age and attentional manipulation, as well as individual differences in attention/working memory (WM) on people's sharing decisions regarding misinformation about COVID-19. In the following sections, I present theoretical frameworks behind misinformation susceptibility and proliferation online in the context of COVID-19.

Social Media and COVID-19 Misinformation

The Internet has revolutionized the availability of information; however, it has also facilitated the spread of misinformation because it often lacks use of conventional "gate-keeping" mechanisms, such as peer review and professional editors. In recent years, internet users have moved from being passive consumers of information to actively creating content on Web sites such as Twitter, YouTube, and blogs. In Europe and North America, nine out of ten adults use the Internet daily and the rate increases to nearly all individuals between 18 and 50 years old (Mitchell & Oliphant, 2020). In parallel, the growth rate of social media and social network sites (SNSs) has been extraordinary. Facebook opened to the public in 2006 and by the first quarter of 2018, reported 185 million U.S. and Canadian 'daily active users', which is roughly the 85% of the population between 18 and 69 years old (Facebook, 2018). Today, Facebook has over 2.7 billion monthly active users and is the most popular SNS, though Instagram is rapidly catching up (particularly among adolescents and young adults), with over one billion monthly active users. Worldwide, people spend on average more than two hours on SNSs each day, sharing billions of messages (Clement, 2019). SNSs are a subcategory of social media, which are characterized by three features (Ellison & Boyd, 2013). Specifically, SNSs allow users to: 1) create a personal profile, 2) generate a list of online connections, and 3) navigate a stream of frequently updated information (e.g., Facebook's News Feed). Many SNSs combine these features with a range of other functions, allowing their users to play games, chat, purchase goods, join groups, or advertise. Despite the countless benefits that the diffusion of Internet and social media provide (e.g., cultivating connection during social isolation), there is an increasing fear that this online social platform with limited oversight can facilitate the spread of misinformation, hoaxes, and false or 'fake' news. For example, it has been reported that in the lead-up to the 2016 U.S. Presidential election, the 20 most popular fake news stories got over 1.3

million more Facebook shares, reactions, and comments than the 20 most popular legitimate stories (Silverman, 2016).

The growth of the Internet has made it easier for people to find news sources that support their existing views, a phenomenon known as selective exposure (e.g., Guess, Nyhan & Reifler, 2018). When people have more media options to choose from, they are more biased toward like-minded media sources. The emergence of the Internet, and SNSs in particular, has resulted in formation of “echo chambers” (in which individuals are exposed only to information from people with similar viewpoints) and “filter bubbles” (in which content is selected by algorithms according to a viewer’s previous behaviors), which lack attitude-challenging content (Bakshy, Messing, & Adamic, 2015; Barberá et al., 2015; Pariser, 2011; Flaxman, Goel & Rao, 2013). This tendency of consuming information within like-minded ‘echo chambers’ on SNSs is highly problematic for combating COVID-19 misinformation and conspiracy theories. Moreover, this disruptive potential of continuous exposure to misinformation is exacerbated by the finding that COVID-19 conspiracies form a ‘monological belief system’, where belief in one conspiracy about the virus predicts belief in others (Georgiou, Delfabbro & Balzan, 2020; Miller, 2020; Swami et al., 2011).

Indeed, SNSs, such as Facebook or Instagram, have become a major source of misinformation spread in recent years, mostly due to the ease of creating an account, posting information, and even promoting content and starting “groups”, which allow misinformation to spread quickly and effectively (Brennen et al., 2020). Even outlandish headlines (e.g., Hillary Clinton operating a child sex ring out of a pizza shop) have collectively received millions of shares on social media (Silverman, 2016). Recent studies and reports show that people who believe in conspiracy theories are more likely to encounter fake news (including about COVID-19) via social media (Allen et al., 2020; Duffy & Allington, 2020). This is consistent with recent research showing that being exposed to information about the virus on social media is associated with higher susceptibility to misinformation (Johnson et al., 2020). For example, large-scale system-level analyses of Facebook data on attitudes towards vaccination found that although anti-vaccination groups are currently in the minority, they have become central in terms of the positioning within the main online network, whereas pro-vaccination clusters are more peripheral (Johnson et al., 2020). This same study found that the projected growth in anti-vaccination views is expected to dominate online discourse within a decade without intervention. Likewise, groups focused on disseminating conspiracy-related content on social media – frequently framed as trying to inform people of news not covered by the mainstream news – tend to be more active than groups focused on disseminating scientifically informed content (Bessi et al., 2015).

Social media platforms have made attempts to control the spread of the misinformation by rapidly removing false social media posts or providing a retraction by labeling the post as being misleading or containing misinformation. However, a wide range of posts remain up and continue to mislead the general user. One study found that 59% of posts rated as false on Twitter by fact-checkers remain active. Meanwhile, 27% stay active on YouTube, and 24% of false-rated content in their sample stays up on Facebook without any warning labels (Brennen et al., 2020). This finding is in line with research on the diffusion of information online, which consistently finds that misinformation diffuses faster and reaches broader audiences than correct information and fact-checks (del Vicario et al., 2016; Vosoughi et al., 2018), making it difficult for fact-checking to be effective. Facebook's fact-checking efforts, for example, did little to prevent COVID-19 conspiracies from being shared widely in private groups on the platform (Scott, 2020).

Misinformation is not limited to statements that are blatantly true or false and rarely comes with a forewarning. This is especially true regarding misinformation about COVID-19. Insights into causes, treatments and risks surrounding the virus continue to develop over time, which can seriously hinder the ability to differentiate between accurate and false statements. For example, hydroxychloroquine has gained a lot of popularity in 2020 as a potential treatment and "cure-all" for COVID-19. Although the harms and benefits of hydroxychloroquine as a potential treatment are indeed being studied, there is currently no scientific consensus on its effectiveness and yet the mixed messages about its benefits and risks continue to appear in popular media (Geleris et al., 2020; Meyerowitz et al., 2020). Notably, reliance on misinformation differs from ignorance (i.e., absence of relevant knowledge; Lewandowsky et al., 2012). Ignorance can adversely impact decision making such as sharing posts online, but the impact of misinformation seems to be more severe than the impact of ignorance, especially on a societal scale. This is because when a person has no knowledge on a specific topic, they often turn to simple heuristics when making decisions. For example, mere familiarity with an object often permits people to make accurate guesses about it (Goldstein & Gigerenzer, 2002; Newell & Fernandez, 2006). Moreover, people typically have relatively low levels of confidence in decisions made solely based on such heuristics (De Neys, Cromheeke, & Osman, 2011; Glöckner & Bröder, 2011). Consequently, people tend to be less convicted of their stance on a subject that they are admittingly ignorant about as compared to subjects that they are misinformed about. For example, individuals that tend to reject scientific evidence most strongly for climate change are the same people who believe they are best informed about the topic (Leiserowitz, Maibach, Roser-Renouf, & Hmielowski, 2011). As such, societal consequences of widespread misinformation are tough to ignore, and call for an analysis of its origins and proliferation.

Theoretical Models of the Continued Influence Effect (CIE) of Misinformation

Below, I review the relevant literature on theoretical accounts of the continued influence effect (CIE) of misinformation, as well as the cognitive mechanisms that contribute to the pervasiveness of misinformation, including mental models, dual processing theory, the impact of the information's source and of fluency and familiarity as well as the role of attention/WM.

When misinformation proliferates through media (e.g., SNSs, television, newspapers), the logical first step is a retraction and correction. Unfortunately, these retractions are often posted sometime after the original misinformation, allowing the impact of misinformation to spread in the meantime, and can also be difficult to find. Moreover, as a large body of literature has repeatedly shown, people continue to believe misinformation after it has been debunked, even in cases when people believe, understand, and later remember the retraction (e.g., Ecker, Lewandowsky, & Apai, 2011; Ecker et al., 2011; Ecker, Lewandowsky, & Tang, 2010; Gilbert, Tafarodi, & Malone, 1993; Johnson & Seifert, 1994, 1998, 1999; van Oostendorp, 1996; van Oostendorp & Bonebakker, 1999; Wilkes & Reynolds, 1999). This failure of corrections is known as the continued influence effect (CIE) and it persists even if misinformation is retracted immediately and within the same narrative (Johnson & Seifert, 1994). Recent studies focusing on CIE addressed the effective ways to correct misinformation (Ecker, Lewandowsky & Tang, 2010; Ecker, Hogan & Lewandowsky, 2017; Ecker et al., 2011; Eslick et al., 2011; Rich & Zaragoza, 2016) and found that better correction could be achieved by providing a detailed alternative explanation rather than simply negating misinformation (Ecker, Lewandowsky & Tang, 2010; Johnson & Seifert, 1994; Swire, Ecker & Lewandowsky, 2017). For instance, Swire, Ecker & Lewandowsky (2017) investigated CIE after a brief or detailed retraction. The results indicated that detailed retraction was slightly better at eliciting belief change than brief retraction. However, the wealth of studies on this phenomenon have mostly documented its pervasive effects, showing that it is tremendously difficult to return the beliefs of people who have been exposed to misinformation to the same baseline of people who have never been exposed to it. For example, aggregation of results from 32 studies ($N = 6,527$) in a meta-analytic examination of CIE confirmed that 1) corrective messages were more successful when they are coherent, consistent with the audience's worldview, and delivered by the source of the misinformation itself and 2) corrections were less effective if the misinformation was attributed to a credible source, the misinformation has been repeated multiple times prior to correction, or when there was a time lag between the delivery of the misinformation and the correction (see Walter & Tukachinsky, 2020). However, on average, correction does not entirely eliminate the effect of misinformation ($r = –.05$, $p = .045$; Walter & Tukachinsky, 2020).

The role of mental models in CIE.

Most research to date focuses on the mental-model-updating hypothesis to explain the possible causes of CIE (e.g., Gordon et al., 2017; Lewandowsky et al., 2012; Walter & Tukachinsky, 2020). When a piece of information is encountered for the first time, a situation model of integrated memory representations is built, and this model is continuously updated as new information becomes available (Bower & Morrow, 1990). According to this view, small changes to the model can be integrated incrementally (Bailey & Zacks, 2015), but larger changes require a "global update", which involves discarding the old mental model and creating a new one (Kurby & Zacks, 2012). This requires a lot of cognitive resources (e.g., attention/WM, episodic memory, executive functioning) and people are often quite inadequate at assimilating new information or mapping it onto existing memory representations (van Oostendorp, 2014). Consequently, a retraction invalidating a central piece of information will leave a gap in the model of the event and result in an inconsistent representation of the event. This representation leads to confusion unless the false assertion is maintained. In other words, people may be uncomfortable with gaps in their knowledge of an event and hence prefer an incorrect model over an incomplete model (Ecker, Lewandowsky, & Apai, 2011; Ecker, Lewandowsky & Tang, 2010; Johnson & Seifert, 1994; van Oostendorp & Bonebakker, 1999). As such, people may continue to rely on the original misinformation (i.e., continue using the discredited mental model) when questioned about the event, even though they are aware of the correction when asked about it directly (see Lewandowsky et al., 2012). CIE has been associated with failure of integration and coherence-building mechanisms mediated by the medial parietal and dorsolateral pre-frontal cortex (Gordon et al., 2017). Specifically, fMRI data has indicated that CIE may be due to a breakdown of narrative-level integration and coherence-building mechanisms implemented by the precuneus and posterior cingulate gyrus (Gordon et al., 2017). Consistent with the mental-model notion, misinformation becomes particularly resilient to correction when people are asked to generate an explanation for why the misinformation might be true (Anderson, Lepper, & Ross, 1980). Moreover, the literature on false memory has shown that people tend to fill gaps in episodic memory with inaccurate but congruent information if such information is readily available from event schemata (Gerrie, Belcher, & Garry, 2006).

The mental model hypothesis can also be used explain the phenomenon of *motivated reasoning* (Kunda, 1990), which states that information is more likely to be accepted by people when it is consistent with prior knowledge (for reviews, see McGuire, 1972; Wyer, 1974) and when new information runs counter to prior beliefs, it is likely to be ignored or more critically appraised (Wells, Reedy, Gastil, & Lee, 2009). Based on both the judgement (Wyer, 1974) and cognitive-consistency (Festinger, 1962) perspectives, this resistance is due to having a large amount of accumulated pre-existing evidence for current beliefs as well as the multiple downstream inconsistencies that would arise from rejecting the prior information as false. Thus, if an individual has been consistently exposed to misinformation, the likelihood that new misleading information will be accepted increases and, in turn, the likelihood that misinformation will be successfully corrected, decreases.

Motivated reasoning can be compounded by the formation of ideological "echo-chambers," on SNSs, where misinformation tends to circulate quicker than associated corrections (Shin et al., 2017). Even if a correction reaches the misinformed target audience, simply providing the correct information is inefficient, as continued reliance on misinformation is likely when the misinformation conforms to a person's pre-existing belief system, yet the correction does not (Lewandowsky et al., 2009). Retracting misinformation that runs counter to a person's worldview, or belief system, can ironically even strengthen the to-be-corrected misinformation. This phenomenon is highly prominent when correcting misinformation surrounding contentious issues such as vaccine safety and is known as the *worldview backfire effect* (Nyhan & Reifler, 2015). The individual becomes motivated to defend their worldview, resulting in an increased belief in the inaccurate information (Lewandowsky et al., 2012; Trevors et al., 2016).

Dual Process Theory: The role of strategic and automatic memory processes in CIE.

Previous cognition research has theorized that CIE is associated with memory retrieval failure (Ecker, Lewandowsky, & Tang, 2010; Swire, Ecker, & Lewandowsky, 2017). For example, misinformation effects could be based on source confusion or misattribution (Johnson, Hashtroudi, & Lindsay, 1993). People may correctly recollect a specific detail but incorrectly attribute this information to the wrong source. For example, if someone hears a piece of information about COVID-19 that was later shown to be false, they may recollect the original piece of information, but falsely recollect that this information was from a retraction instead of the original misinformation post.

Additionally, misinformation effects could be due to a failure of strategic monitoring processes (Moscovitch & Melo, 1997). Dual-process theories of memory assume a dichotomy between automatic memory processes, which include familiarity, and strategic memory processes such as recollection and output monitoring (e.g., Brown, 2006; Diana, Yonelinas, & Ranganath, 2007; Rugg & Curran, 2007; Yonelinas, 2002; Yonelinas & Jacoby, 2012; Zimmer & Ecker, 2010). Strategic memory processes are effortful and allow for the controlled recollection of the information's contextual details, which includes qualities such as the information's spatiotemporal context of encoding, source, and veracity (Frithsen & Miller, 2014). Neuroimaging studies commonly show that the left posterior parietal cortex is involved in both recollection and familiarity, with dorsal regions routinely active during familiarity and ventral regions active during recollection (see Frithsen & Miller, 2014).

A person's ability to use strategic memory processes efficiently will depend upon factors such as effort, motivation, the amount of time since encoding, and age (e.g., Herron & Rugg, 2003). In contrast, automatic processes are fast and relatively acontextual, and serve to quickly provide an indication of memory strength or familiarity with an item or notion (Zimmer & Ecker, 2010). It is hypothesized that a failure of strategic monitoring processes can lead to CIE of misinformation (Moscovitch & Melo, 1997). Ayers and Reder (1998) have argued that both valid and invalid memory entries compete for automatic activation, but that contextual integration requires strategic processing. A strategic monitoring process is then required to determine the validity of this automatically retrieved piece of information. If strategic monitoring fails, however, reliance on misinformation may occur. This may be the same monitoring process involved in source attribution (Henkel & Mattson, 2011).

A related view assumes that when a person is questioned or cued about an event, retracted misinformation can be automatically retrieved from memory without any accompanying contextual details, and possibly without even recalling that the information has been retracted in the first place (cf. Ayers & Reder, 1998; Ecker, Lewandowsky & Tang, 2010). In other words, there is some evidence that retractions lead to the "tagging" of misinformation as incorrect (Ecker et al., 2011; Gilbert, Krull, & Malone, 1990). This retraction tag on the information can be lost during memory retrieval (Mayo, Schul, & Burnstein, 2004), allowing the misinformation to unfold its impact without being offset by its retraction. This is especially true when strategic memory processing is impaired, as it can be among older adults (Wilson & Park, 2008) or under high cognitive load (Gilbert, Krull & Malone, 1990).

The role of fluency and familiarity in CIE.

The theories up until this point focused on driving factors behind recalling misinformation or it's retraction, but what factors contribute to CIE when the individual is re-exposed to both types of information? According to cognitive consistency theories, newly presented information that is *not* consistent with current beliefs will provoke negative feelings (Festinger, 1962) and will be processed less fluently than messages that are consistent with existing beliefs (Winkielman et al., 2012).In general, fluently processed information feels more familiar and is more likely to be accepted as true; conversely, disfluency elicits the impression that "this feels wrong" and provokes higher critique of the message (Schwarz et al., 2007; Song & Schwarz, 2008). In other words, thoughts that flow smoothly and mental models that are well-formed and coherent models give little reason for people to question their veracity (Schwarz et al., 2007). This phenomenon is observed even when the fluent processing of a message merely results from superficial characteristics of its presentation. For example, misleading questions are less likely to be recognized as such when printed in an easy-to-read font (Song & Schwarz, 2008). Understandably then, misinformation thrives on SNSs, in which posts and articles are written with catchy, easy-to-read headings.

When increased familiarity gives the illusion that information is valid, this is known as the *illusory truth effect* (e.g., Begg, Anas, & Farinacci, 1992). For example, Pennycook, Cannon & Rand (2018) found that simply reading false headlines, including partisan headlines that are extremely implausible and inconsistent with one's political ideology, makes them subsequently seem truer. This experiment further supports the idea that low-level fluency heuristic plays a role in accuracy judgments for even highly implausible and completely made-up news stories. Specifically, they found that the effect of repetition on accuracy judgments persisted even in cases where participants incorrectly forgot having seen the fake news item previously (i.e., the effect does not depend on explicit memory). Moreover, this effect of repetition was present in cases of participants reading political fake news stories that did *not* coincide with their political ideology (i.e., they had additional reason to reject the fake news stories apart from mere implausibility) and explicitly warning participants that fake news stories have been disputed by third-party fact-checkers (an intervention previously used by Facebook to curb fake news; Mosseri, 2016) did not undermine the effect of repetition (Pennycook, Cannon, and Rand, 2018).

Based on the fluency account, misinformation exerts its continued influence by increasing the perceived familiarity and coherence of related material encountered later in time. As a result, retractions may fail, or even cause a *familiarity backfire effect*, such that a correction can ironically increase an individual's belief in the very misconception the correction is aiming to rectify (Ecker, Lewandowsky & Chadwick, 2020; Lewandowsky et al., 2012). Generally, repetition of information strengthens that information in memory and thus strengthens belief in it, simply because the repeated information seems more familiar or is associated with different contexts that can serve as later retrieval cues (e.g., Allport & Lepkin, 1945; Eakin, Schreiber, & Sergent-Marshall, 2003; Ecker et al., 2011; Henkel & Mattson, 2011; Verkoeijen, Rikers, & Schmidt, 2004; Zaragoza & Mitchell, 1996). It follows that when people later reencounter the misinformation, it may be more familiar to them than it would have been without the retraction, leading them to think, "I've heard that before, so there's probably something to it." This impairs the effectiveness of public information campaigns intended to correct misinformation (Schwarz et al., 2007). For example, the U.S. Centers for Disease Control and Prevention offer patient handouts that counter an erroneous health-related belief (e.g., "The side effects of flu vaccination are worse than the flu") with relevant facts (e.g., "Side effects of flu vaccination are rare and mild"). When recipients are tested immediately after reading the handouts, they correctly distinguish between myths and facts, and report behavioral intentions that are consistent with the information provided (e.g., an intention to get vaccinated). However, a 30-minute delay is sufficient to reverse this effect with readers of the handouts identifying more "myths" as "facts" than do people who never received a handout to begin with (Schwarz et al., 2007). Moreover, people's behavioral intentions are consistent with this confusion: they report fewer vaccination intentions than people who were not exposed to the handout.

The role of attention/working memory in CIE.

If CIE arises from integration failure during (or immediately after) encoding of the retraction, then a person's ability to integrate conflicting pieces of information, and transform and update the corresponding mental event model, accordingly, should be predictive of CIE susceptibility. Integration and updating processes are core functions of attention/WM (Brydges et al., 2018; Ecker, Lewandowsky, and Oberauer, 2014; Ecker, Oberauer, and Lewandowsky, 2014). Working memory (WM) is a limited capacity system that is responsible for the storage, manipulation, and updating of information required for ongoing cognition (Baddeley & Hitch, 1974; Oberauer, 2009), whereas short-term memory (STM) refers to just the passive storage of information (Atkinson & Shiffrin, 1968). In other words, STM could be considered a subcomponent of WM, consistent with Baddeley and Hitch's (1974) model of WM where the supporting systems (the phonological loop and the visuospatial sketchpad) are STM constructs, and the central executive is associated with the active manipulation and updating of information (Engle et al., 1999). As such, WM capacity is typically measured with complex-span tasks, whereas more traditional simple-span tasks are thought to measure the storage component only (i.e., STM capacity). Researchers have suggested that the major difference between WM and STM is that WM requires additional attentional control processes for updating, manipulation, and removal of information to occur (e.g., Engle et al. 1999; Kane et al., 2001) Correspondingly, this would help explain why WM capacity often correlates more substantially with executive functions and fluid reasoning, in comparison to STM capacity (Cowan, 2008).

Given that a retraction of misinformation requires information integration and the updating of a mental model, it seems plausible that WM capacity may be more strongly associated with CIE than STM capacity. Brydges, Gignac & Ecker (2018) adopted three complex-span tasks – the spans of symmetry, reading, and operation to measure WM capacity and the spans of forward digit and letter, and Corsi block to measure short-term memory capacity. The misinformation consisted of fictional news and only the WM capacity could negatively predict CIE, which suggested that low WM capacity is a measurable “risk factor” for continued reliance on misinformation. The researchers indicated that this finding at least partly, comes from a failure of integration, manipulation, and updating processes in WM. Likewise, Jia et al. (2020) examined whether individual differences in the central executive function of WM and updating could influence CIE of misinformation with varying relevance. Their results showed that the individual differences in central executive function could significantly affect CIE, especially for the high-relevant misinformation. Whereas the individual differences in the updating ability had a weaker impact on CIE in general, and only negatively related to CIE for the low-relevant misinformation. Results from studies above support the mental model-updating account of CIE and suggest that attention/WM may play an essential role in misinformation susceptibility and CIE.

Misinformation Proliferation on SNSs

The theories and literature above provide detailed accounts for possible reasons behind susceptibility to misinformation and CIE, but as recent research shows, misinformation proliferation can persist even when the individual can accurately discern accurate statements from misinformation. For example, Pennycook et al., (2021) conducted four survey experiments and a field experiment on Twitter to gain insight into proliferation of false and misleading news on social media. Findings from their first survey experiment showed that in a sample of 1,015 American SNS users, participants were more than twice as likely to consider sharing false but politically concordant headlines (37%) as they were to rate such headlines as accurate (18%; Pennycook et al., 2021). In other words, the authors found that even when people *can* tell truth from falsehood, they nonetheless continue to share false and misleading content. For example, 16% of Republican participants in that study rated the headline “Over 500 ‘Migrant Caravaners’ Arrested with Suicide Vests” as accurate but 51% of Republican participants said they would consider sharing it.

One explanation for this finding is a “preference-based” account in which the public places little value on accuracy, and thus people knowingly share misinformation on SNSs (D’Ancona, 2017; Davies, 2016; Hochschild & Einstein, 2016; Keyes, 2004; L. McIntyre, 2015; Petersen, Osmundsen, & Arceneaux, 2018). By this account, people are explicitly aware of the non-veracity of misleading content, but do not place a substantial amount of weight on veracity when making sharing decisions. However, the same study by Pennycook et al. (2021) argued against this view with the finding that people generally wish to avoid spreading misinformation, which was evidenced by the majority of their sample responding that "only sharing content that is accurate on social media is extremely important" and only 7% of their sample answering that "only sharing content that is accurate on social media not at all important". The authors found a similar pattern of responses in their second survey experiment of 401 U.S. participants who rated accuracy as substantially more important for social media sharing than any of the other content dimensions (i.e., that the content is politically aligned, surprising, funny, interesting, or accurate).

Inattention as The Driving Factor Behind Information Proliferation

In survey experiments three and four, Pennycook et al. (2021) subtly induced people to think about accuracy, which the preference-based account predicts should have no effect whereas the inattention-based account predicts should increase the accuracy of content that is shared. In the control condition of each experiment, participants were shown 24 news headlines (balanced on veracity and partisanship, as in study one) and asked how likely they would be to share each headline on Facebook. In the treatment condition, participants were asked to rate the accuracy of a single non-partisan news headline at the outset of the study (ostensibly as part of a pretest for stimuli for another study). They then went on to complete the same sharing intentions task as in the control condition, but with the concept of accuracy more likely to be salient in their minds. Results showed that sharing discernment (defined by the authors as the difference in sharing intentions for true versus false headlines) was 2.0 times larger in the treatment relative to the control group in study three, and 2.4 times larger in study four. Further, there was no evidence of a backfire effect, as the treatment effect was significantly larger for politically concordant headlines than for politically discordant headlines. Notably, the authors did not find a significant difference between conditions in responses to a post-experimental question about the importance of sharing only accurate content (Pennycook et al., 2021). The authors were able to replicate these results in survey experiment 5, in which they generalized the sample to 1,268 participants that were quota-sampled to match the distribution of American residents on age, gender, ethnicity and geographical region (Pennycook et al., 2021). In study 7, the authors aimed to generalize their findings to natural social media use settings (rather than laboratory experiments), actual (rather than hypothetical) sharing decisions, and misinformation more broadly (rather than just blatant ‘fake news’) by conducting a digital field experiment on Twitter. Consistent with survey experiments, the authors found that the single accuracy message made users more discerning in their subsequent sharing decisions (see Pennycook et al., 2021). Lastly, the authors conducted a set of follow-up survey experiments in which they successfully replicated the findings from study one (i.e., a disconnect between accuracy and sharing judgments) and findings from studies three, four and five (i.e., the effect of treatment increasing sharing discernment) using headlines about COVID-19 with quota-matched American samples. Specifically, they found that a simple accuracy reminder at the beginning of the study (i.e., judging the accuracy of a non-COVID-19-related headline) nearly tripled the level of truth discernment in participants’ subsequent sharing intentions (see Pennycook et al., 2020).

Overall, these results provide substantial evidence for the inattention account for sharing misinformation, which suggests the idea that sharing accuracy may be overshadowed by other (often social) motives in the context of social media sharing (Brady, Crockett, & Bavel, 2019; Kümpel, Karnowski, & Keyling, 2015). In other words, external motives such as the desire to attract and please followers/friends (Marwick & Boyd, 2011), signal one’s group membership (Donath & Boyd, 2004), or engaging with emotionally or morally evocative content (Brady et al., 2017) may distract people from attending to headlines' veracity when deciding what to share. Thus, even people with a strong regard for the truth may wind up sharing inaccurate headlines because they fail to consider accuracy when making their sharing decisions. This distraction-based account stands in stark contrast to the “a preference-based” account whereby people are aware of veracity but explicitly choose not to prioritize it when making sharing decisions.

This research further highlights an important avenue by which social media fosters the spread of misinformation. In addition to the phenomenon of echo chambers and filter-bubbles (Bakshy, Messing, & Adamic, 2015; Stewart et al., 2019), social media platforms may discourage people from reflecting on accuracy (Goldhaber, 1997). These platforms are designed to encourage users to rapidly scroll and spontaneously engage with feeds of content and mix serious news content with emotionally engaging content where accuracy is not a relevant feature (e.g., TikTok challenges or videos of puppies chasing their tail). Social media platforms also provide immediate quantified social feedback (e.g., number of likes, shares, etc.) on users' posts and are a space which users come to relax rather than engage in critical thinking. These factors imply that the actual design of SNSs may sway the individual's attention away from considering accuracy in the decision to post. For example, the 'share' feature on SNSs such as Facebook hardly requires an active role from the individual wanting to spread information, besides a motivation to share it (e.g., Acerbi, 2016).

Individual Differences in Susceptibility to Misinformation and CIE

COVID-19 misinformation may cause the public to turn to harmful remedies and possibly either overreact (e.g., hoarding toilet paper and other goods) or, more dangerously, underreact (e.g., engage in risky behavior and inadvertently spread the virus to vulnerable populations; Jolley & Paterson, 2020). Consequently, it is crucial to understand what factors may contribute to people's belief in false information and conspiracy theories and, in turn, people's willingness to disseminate misinformation through the internet (e.g., SNSs).

Relevant psychosocial factors that have been associated with higher susceptibility to misinformation include gender, ethnicity, education, and health literacy. For example, a 2020 Pew Research Center survey found gender differences in belief of COVID-19 related conspiracy theories (i.e., women were slightly more likely than men (29% vs. 21%) to see at least some truth in the conspiracy theory that powerful people planned the outbreak) and ethnic differences (i.e., 33% of Black and 34% of Hispanic adults say the theory is probably or definitely true, compared with 22% of white adults and 19% of Asian Americans) (Schaeffer, 2020). Other researchers also reported an association between self-reported minority status and belief in conspiracy theories (e.g., Freeman et al. 2020; Goertzel, 1994; Roozenbeek et al., 2020) and argue that "feelings of deprivation lead marginalized minority members to perceive the social and political system as rigged, stimulating belief in both identity- relevant and irrelevant conspiracy theories" (Van Prooijen et al., 2018). Educational attainment has been shown to be an especially important factor when it comes to perceptions of the conspiracy theory. Around half of Americans with a high school diploma or less education (48%) says the theory is probably or definitely true, according to the Pew Research Center survey. That compares with 38% of those who have completed some college but have no degree, 24% of those with a bachelor's degree and 15% of those with a postgraduate degree. This finding is in line with a growing literature reporting that education (e.g., Georgiou, Delfabbro & Balzan, 2020; van Prooijen, 2017) and both basic (e.g., numeracy skills; Roozenbeek et al., 2020) and higher order (e.g., analytical thinking) aspects of health literacy, as well as 'intuitive' versus 'reflective' thinking styles (often assessed via the cognitive reflection test; (CRT; Frederick, 2005) all play important roles in processing misinformation (e.g., Bago, Rand & Pennycook, 2020; Bronstein et al., 2019; De Keersmaecker et al., 2017; Guess, Nagler & Tucker, 2019; Kahan et al., 2012).

Moreover, there are several important motivational factors as predictors of belief in misinformation including lower trust in science and scientists (Lewandowsky, Gignac & Oberauer, 2013; Lewandowsky & Oberauer, 2016; Iyengar & Massey, 2018; Plohl & Musil, 2020; Roozenbeek et al., 2020), rejection of science and endorsement of pseudoscience (Lobato et al., 2014; van der Linden, 2015; Lobato & Zimmerman, 2019), a general attitude toward science as lacking credibility (Hartman et al., 2017), as well as lower trust in journalists and the mainstream media (van der Linden et al., 2020) and lower trust in government (Freeman et al. 2020; Kim & Cao, 2016; Einstein & Glick, 2015). This distrust of authority is so pervasive in conspiracy ideation that people inclined to believe conspiracies will accept mutually exclusive conspiracy theories more than the official account of a major socio-cultural event (Wood et al., 2012). It has been shown that belief in conspiracies correlates with political ideology, specifically conservatism (Basol, Roozenbeek & van der Linden, 2020; Guess, Nagler & Tucker, 2019; Grinberg et al., 2016; Lobato et al. 2020; van der Linden et al., 2020; Rothgerber et al., 2020; Roozenbeek & van der Linden, 2019). For example, Rothgerber et al. (2020) found that political conservatism inversely predicted compliance with behaviors aimed at preventing the spread of the

COVID-19 after controlling for key demographic characteristics, as well as psychological variables, including belief in science and COVID-19-related anxiety.

The Role of Aging in Misinformation Susceptibility and Proliferation

In terms of demographics, being older has generally been associated with higher susceptibility to misinformation and a strong predictor of political fake news dissemination on social media (Allen et al., 2020; Grinberg et al., 2019; Guess, Nagler & Tucker, 2019). For example, Guess, Nagler & Tucker (2019) found that being older than 65 was the largest predictor of sharing political fake news online. This finding is in line with theoretical accounts of CIE including dual processing theory and the impact of fluency and recognition. Namely, older adults have less efficient strategic memory processes than young adults, whereas automatic processing such as familiarity-detection remains relatively age-invariant (e.g., Prull et al., 2006). Older adults seem to become less efficient at binding item and context information (Naveh-Benjamin, 2000); therefore, the mnemonic link between a statement and its veracity could be weaker in older adults. Moreover, source memory is particularly susceptible to the effects of ageing (e.g., Glisky, Rubin, & Davidson, 2001). Consistent with this notion, Skurnik et al., (2005) found that older adults were particularly likely to misremember myths as facts after repeated retractions (compared with single retractions) after a 3-day retention interval (but not after 30-min, and not in younger adults). Likewise, Swire, Ecker & Lewandowsky (2017) examined the role of familiarity in correcting inaccurate information and found that older adults over the age of 65 were worse at sustaining their post correction belief that myths were inaccurate. Likewise, because recollective memory shows more age-related impairment than familiarity-based memory does (Jacoby, 1999), older adults are particularly vulnerable to the familiarity backfire effect because they are more likely to forget the details of a retraction and retain only a sense of familiarity about it (Bastin & Van Der Linden, 2005; Jacoby, 1999). Hence, they are more likely to accept a statement as true after exposure to explicit messages that it is false (Skurnik et al., 2005; Wilson & Park, 2008). Thus, it is reasonable to believe that older adults will be more likely to believe and disseminate COVID-19 misinformation online as opposed to younger adults.

However, recent studies and reports focusing on COVID-19 misinformation find the opposite pattern of results. For example, Roozenbeek et al. (2020) explored susceptibility to COVID-19 misinformation in five countries around the world including the UK, Ireland, Spain, U.S., and Mexico. The authors found that being older was significantly associated with lower susceptibility to misinformation in all countries except in Mexico. Importantly, it should be noted that in prior studies, the context is different (e.g., politics versus health; since older people are more vulnerable to COVID-19, they may be allocating a higher degree of cognitive resources to evaluate the truthfulness of COVID-19 related information). Moreover, veracity of shared content is not the same as discerning whether content is accurate or not and no studies to date have examined online sharing behaviors for COVID-19 content in younger vs. older adults. Thus, it may also be possible that even if older individuals are less susceptible to COVID-19 misinformation, they still share more fake news, for motivations and reasons other than accuracy (e.g., inattention, political gain, and social consensus).

Neurocognitive Aging and Attention/WM

The literature above highlights the role of aging and the impact of attention/WM on both CIE of misinformation/susceptibility and proliferation of misinformation. As discussed below, a large body of literature has shown that aging is commonly associated with changes in attention and WM, which serves as further evidence behind older adults being uniquely vulnerable to CIE of misinformation, especially when it is transmitted online.

Age-related changes in the brain, particularly declines in the volume and weight, are observed as early as age 40 and have been shown to continue occurring at a rate of 5% per decade (Burke & Barnes, 2006; Drachman, 2006). Structural (e.g., volume, weight), and functional (e.g., cerebral blood flow) changes are most consistently observed in cortical grey matter and are largely thought to be due to neuronal cell death (Anderton, 2002). White matter atrophy is also observed, though follows a different trajectory and is thought to result from both changes to, and loss of, white matter (Bartzokis, 2004; Giorgio et al., 2010; Peters, 2002). Other structural changes associated with asymptomatic aging typically include a moderate reduction in regional cerebral blood flow, regional cerebral metabolic rate of oxygen utilization and grey matter blood volume (Raz, 2000). Functional changes that have been well established in the literature include decreased hemodynamic response (D'Esposito et al., 1999), disrupted functional connectivity (Sala-Llonch, Bartés-Faz, & Junqué, 2015), and alterations in task-related activation patterns (Goh, 2011). The functioning of cholinergic and dopaminergic systems is also affected by advancing age (Volkow et al., 1998). Cholinergic systems are important for modulation of other neurotransmitters whereas the dopaminergic systems primarily control reward processing and is associated with cognitive functions such as attention, decision making, and learning (Marie et al., 1999*)*.

In the setting of generalized age-related brain changes, certain areas of the brain tend to be more sensitive than others. Both structural and functional imaging studies support a preferential decline in older adults in volume and function of the prefrontal cortex, followed closely by the striatum. The temporal lobe, cerebellar vermis, cerebellar hemispheres, and hippocampus also exhibit differentiation in reduction with age (Scahill et al., 2003; Troller & Valenzuela, 2001). The occipital and parietal regions, in comparison, appear to be least affected (Raz et al., 2004). This pattern of differential vulnerability reflects the array of cognitive consequences conferred by the aging process. One direct consequence of age-associated alterations in structure and function in the brain is decline in cognitive ability. Cognitive aging refers to changes in thinking skills that progressively worsen with increasing age, often starting in the 50s and 60s in the normal population. Cognitive domains such as WM, attention, executive functions, episodic memory, information processing speed and motor speed are all susceptible to age related declines (Charness & Boot, 2009; Wecker et al., 2000), while vocabulary appears relatively stable into later adulthood (e.g., Alwin & McCammon, 2001).

Models of attention and effects of cognitive aging.

Attention is not a unitary term, and instead recent models have made attempts to compartmentalize this domain into several separate, interacting components (e.g., Dove et al., 2000; Mirsky et al., 1991; Rubia et al., 1999; Shimamura, 1995). Although details of these models remain controversial, it is generally agreed that attention is subsumed by an integrated neuroanatomical system.

Any disruption to this system has been argued to be likely to result in deficits in one or more aspects of attention (Mirsky et al., 1991; Mirsky, 1996; Stuss et al., 1995). This notion is in line with current brain-behavior models, which frequently argue that aspects of cognition are underpinned by distributed neural networks. Based on mainly behavioral data, this system has been argued to incorporate the brain stem, aspects of the subcortex and posterior cortical regions, and prefrontal cortex, with a critical role for the right hemisphere (Mirsky et al., 1991; Posner & Petersen, 1990; Stuss et al., 1995; Woods & Knight, 1986). Brain imaging work, using samples with impaired attention (e.g., ADHD, focal frontal lesions), has provided supporting evidence for such a distributed neural basis for attention (Castellanos et al., 2001; Sowell et al., 2003; Stuss et al., 2002, 1999; Stuss, 2006). Definitions and operationalization of the attentional system remain problematic, but several separate, interdependent components are consistently identified. Sustained attention refers to the ability to maintain attention for prolonged periods to stimuli which occur at a low and often unpredictable rate. Selective attention is defined as the capacity to attend to, and focus on, relevant stimuli, while filtering out extraneous information or to identify salient stimuli and perform motor responses in the presence of background distraction (see Mirsky et al., 1991; Posner & Petersen, 1990).

Recent research has identified the prefrontal cortex as critical for effective attention because of its rich connections with many cerebral regions and its unique role in efficient executive function. The prefrontal cortex is argued to be critical to all aspects of the system, but primarily higher-order components of the attentional system, including shifting and divided attention (Dove et al., 2000; Mesulam, 1981; Mirsky et al., 1991; Shimamura, 1995; Stuss et al., 1995, 1999). The ability to shift attentional focus relates to mental flexibility or the capacity to shift attention from one aspect of a stimulus to another in a flexible, efficient manner, and as such, is thought to be subsumed by the prefrontal cortex, including the anterior cingulate gyrus (Mirsky et al.,1999; Stuss, 2006). Divided attention refers to the capacity to simultaneously attend to multiple tasks/stimuli and is generally argued to be a function of the prefrontal regions of the brain (Stuss et al., 1995). Several studies have now been reported which support the involvement of these regions in effective divided attention (Anderson et al., 2005; Stuss et al., 1999, 2000). The ability to inhibit prepotent responses, or to suppress impulsive responses, has also been linked with frontal lobe function (Barkley, 1997, 2000). Many researchers in the past several decades have pointed to a difficulty of older adults to focus their attention to relevant information and to disregard irrelevant or distractive information (e.g., Rabbit, 1965; Plude & Hoyer, 1986; Plude & Doussard-Roosevelt, 1989). This is not surprising, since the prefrontal cortex is the first to decline in older adults in volume and function (Scahill et al., 2003; Troller & Valenzuela, 2001). Similarly, many investigators have claimed that less effective selection of information in older adults may represent a decline in inhibitory functioning in the selective processing of information (e.g., McDowd and Oseas-Kreger, 1991; Tipper, 1991; Dempster, 1992; Kane et al., 1994; Kramer et al., 1994; McDowd et al., 1995; West, 1996).

Models of WM and effects of cognitive aging.

Akin to findings from the literature to date on attention, the studies on neuroanatomical correlates of WM also suggests that WM likely depends upon intact volume in a wide variety of structures across the brain. For example, Salat et al. (2002) reported that better WM was seen in older adults with smaller orbitofrontal volumes, and Gunning- Dixon & Raz (2003) did not find a significant association between WM and either prefrontal or fusiform cortex volume. In a longitudinal study, Raz et al. (2007) found that shrinkage of the fusiform gyrus over five years predicted WM decline. Moreover, most volume-cognition studies have used WM performance as a mediating factor in predicting age-related differences in other domains of cognition such as visuospatial mental imagery (Raz et al., 1999). For example, WM has been found to be a significant mediator of episodic memory and perseverative errors, respectively, and in both cases, WM was mediated by PFC volume (Head et al., 2009). WM was also a salient mediator of implicit measures of priming and skill learning performance in many of our studies (e.g., Raz et al., 2010; Kennedy & Raz, 2005; Kennedy et al., 2009; Raz et al., 1999).

The role of cognitive aging and attention/WM in SNS use.

Lower neurocognitive capacity in the domains of attention/WM is also a unique risk factor for concurrent functional declines (e.g., Belchior et al., 2019; Tuokko, Morris & Ebert, 2005) in older adults. One key behavior that may enable real-world identification of daily function is computer and Internet use. Older adults may be particularly vulnerable to declines in Internet-based activities due to age-related changes of both the prefrontal cortex (e.g., Fortin, Godbout, & Braun, 2003) which support higher-order components of the attentional system and manipulation of information, and the hippocampus (Haug & Eggers, 1991) that facilitates information storage. This is important because although Internet use is more common among younger generations, older adults are one of the fastest growing groups of web users. In fact, recent reports suggest that Internet usage among adults ages 65 and older has tripled since 2010 (Perrin, 2015). Moreover, SNS use among internet users ages 50 and older has drastically increased over the past decade with 64% of individuals aged 50–64 years of age and 37% of individuals 65 years and older using SNSs in the United States, with Facebook being the primary site of choice (Pew Research Center, 2018).

There are several reasons to believe that attention/WM play a critical role in internet everyday activities, such as using SNSs. Sharing an online post requires one to discriminate, understand, and use information – in addition to basic computer skills and error monitoring. Simply operating a computer alone involves a combination of complex behaviors: motor function to operate the keyboard and move the mouse; language processing to comprehend, select, retrieve, and generate appropriate words; and attention/WM to focus, sustain and shift attention in meaningful and efficient ways (Austin, Hollingshead, & Kaye, 2017). For example, older adults experience difficulties quickly and accurately using a transit website to plan transportation routes (e.g., Tierney et al., in press). Moreover, studies examining online navigation skills have found that attention/WM has medium sized associations with online navigation and search skills (e.g., Czaja et al., 2013; Dommes et al. 2011; Tierney et al., in press). In summary, older adults are increasingly using the internet, as well as SNSs, and are vulnerable to experiencing problems doing so due to cognitive aging and its effects on domains upon which internet navigation skills depend.

The Current Study

The existing literature on proliferation of COVID-19 misinformation online has mainly focused on factors contributing to individual differences in misinformation susceptibility and proliferation, as well as theoretical accounts behind CIE and how it may apply to COVID-19 misinformation. Nevertheless, there are numerous gaps that have yet to be addressed. First, the question remains about the most pragmatic approach to minimize the spread of misinformation, and further, how the quality of freely available information can be better regulated on social media platforms. Although both scientific and public interest in misinformation about COVID-19 are at a peak, no comprehensive study has systematically examined this concept in vulnerable populations, such as older adults who are at a much greater risk of requiring hospitalization or mortality after a diagnosis of COVID-19 (World Health Organization, 2020) and are also more susceptible to misinformation (Grinberg et al., 2019; Allen et al., 2020; Guess, Nagler & Tucker, 2019).

Debunking misinformation has been proven to be largely ineffective due to the evidence that corrections may actually increase the belief in the original misinformation (i.e., familiarity backfire effect; Swire, Ecker & Lewandowsky, 2017; Lewandowsky et al., 2012). Moreover, fact-checking on SNSs has been failing to keep up with the amount of misinformation proliferating online, especially during the pandemic (del Vicario et al., 2016; Vosoughi et al., 2018; Scott, 2020). Thus, other approaches beyond debunking have been explored. One of these approaches had been driven by the “inattention account” and involves subtle prompts that nudge people to consider accuracy. For example, Van Bavel et al. (2020) suggested for SNSs to use this preventative approach by periodically asking users to rate the accuracy of randomly selected posts.

Second, though the reviewed literature has provided some valuable information about the role of attention/WM in the role of spreading misinformation online, no studies have examined the interaction effect of age and individual differences in attention/WM on the likelihood of sharing COVID misinformation. As discussed above, age-related changes in attention/WM can lead to increased vulnerability of older adults to CIE of misinformation and in turn, a higher likelihood of sharing misinformation online.

Aims and Hypotheses

With these limitations in mind, the goals of the present study are two-fold. The primary aim of the study is to investigate the unique and combined effects of age and attentional manipulation on people's sharing decisions regarding misinformation about COVID-19.

A1H1: Compared to younger adults, older adults will be more likely to share articles with COVID-19 misinformation on social media, which will be quantified by higher summed scores of sharing likelihood for inaccurate headlines as compared to summed scores of sharing likelihood for accurate headlines.

A1H2: Compared to participants in the control condition, participants in the accuracy priming condition will be less likely to share articles with COVID-19 misinformation on social media, which will be quantified by higher summed scores of sharing likelihood for accurate headlines as compared to summed scores of sharing likelihood for inaccurate headlines.

A1H3: There will be an interaction between age and attentional manipulation effects on COVID-19 misinformation sharing intention, such that the effects of attentional manipulation on the likelihood of sharing articles with COVID-19 misinformation on social media (quantified by higher summed scores of sharing likelihood for inaccurate headlines as compared to summed scores of sharing likelihood for accurate headlines) will be larger among older adult participants.

The secondary goal of the present study is to examine mediating effects of individual differences in attention/WM on the relationship between age and sharing decisions regarding misinformation about COVID-19.

A2H1: The difference in sharing likelihood for inaccurate headlines between older and younger adults will be least partially mediated by individual differences in attention/WM.

A2H2: The difference in sharing likelihood for accurate headlines between older and younger adults will not be mediated by individual differences in attention/WM.

Method

Participants

The data was collected and analyzed in compliance with the Institutional Review Board (IRB) of the University of Houston regulations. The study sample was recruited via word-of-mouth, Facebook Ads and postings including a link to an online screening survey on social media including Facebook, Next Door, and Craigslist. Participants were compensated with a $20 Target gift card after completing the study. Participant recruitment began on August 3, 2021, and participant study completion dates ranged from August 9, 2021 to September 17, 2021. Inclusion criteria for all participants was: aged 18 to 35 years or 50 or older, having adequate proficiency in the English language, having capacity to provide consent to participate, and reported use of at least one social media platform at least 1 time per week and at least 1.5 hours per week. Exclusion criteria were: having a history of major neurological (e.g., head injury with loss of consciousness greater than 30 minutes, seizure disorders, multiple sclerosis, etc.) or psychiatric (e.g., bipolar disorder, psychosis) conditions that could potentially interfere with the cognitive measures. Upon completion of study procedures, the participants were compensated with a $20 Target gift card.

Study Design and Procedure

All participants accessed the study via a University of Houston-licensed Qualtrics' secure site. Upon accessing the online screening survey, participants were presented with the consent form that explained the purpose of the study and potential risks and benefits involved in participation. Participants indicated their consent to participate in the study by clicking "Yes" after reading the statement "I have read and understand the consent information and agree to take part in the research study" and then typing their name. A copy of the consent form was also available to download for the participants' records.

Participants then completed a screening questionnaire to ensure that they meet eligibility for the study. The eligibility screener included five yes/no questions about their age, being proficient in English, being currently located in the United States, and not being diagnosed with a neurological or severe psychiatric condition(s). If a response indicated that a participant is ineligible, they were re-directed to the end of the survey and informed that they do not meet eligibility requirements but can contact the research team with any questions. Next, participants were asked whether they use any social media/networking sites (e.g., Facebook, YouTube, WhatsApp, Twitter, Instagram, Weixin/WeChat, Snapchat, TikTok, etc.) and how much time they spend on social media weekly. Specifically, participants were first asked whether they use at least one social media platform at least 1 time per week and at least 1.5 hours per week with the answer choice being in a "Yes/No" format. If they responded "Yes", a follow up question on the usage amount was asked (e.g., 1.5-2 hours, 2-4 hours, 4-6 hours, 6-10 hours, 10-15, or more than 15 hours per week). Participants also completed a demographic questionnaire indicating their gender identity, age, race/ethnicity, primary language, highest level of education, employment status, current zip code/state, political ideology on both social and fiscal issues, as well as Political Party alignment (i.e., Democrat, Republican, Independent, Neither or Other affiliations). Finally, they completed the Health Comorbidity Questionnaire (Sangha et al., 2003), a self-report measure that asks about diagnoses of heart disease, lung disease, diabetes, kidney disease, liver disease, cancer, asthma, and immune disease. If the participant indicated that they have been diagnosed with a condition, they were asked whether they receive treatment for the condition (yes/no) and if it limits their activities (yes/no). Persons that completed the online screening survey and met study criteria were contacted by a research assistant via email to schedule the 90-minute telephone-based assessment, which consisted of the experimental social media news sharing task, COVID-19-related measures, a telephone neurocognitive battery (see Matchanova et al., in press), health literacy measures (see Matchanova et al., 2020), and personality and mood questionnaires.

At their scheduled assessment time, participants were contacted via Google Voice by a research assistant to complete the assessment, which was comprised of two parts: 1) the participant completing the main task and online use questionnaire themselves by using the Qualtrics link provided to them in the email and 2) the research assistant administering the telephone-based battery and the remainder of measures over the phone and entering their responses in real-time into a Qualtrics form. The examiner ensured that the participant was in a quiet, private place to complete the assessment and confirmed that the phone call was not being recorded.

Figure 1 shows that a total of 400 persons accessed the online screening survey. One hundred and eighty-three persons (46%) voluntarily exited out of the screener survey before completing it. Twenty-three people did not pass embedded validity checks and nine people completed the questionnaire but did not meet study inclusion criteria. There were 185 persons who completed the online screening survey and met study inclusion criteria, 83 of whom were not able to be scheduled for a study phone call. Thus, the final sample was 102 eligible participants who completed a 60-to-90-minute phone-based assessment. Study characteristics for the final study sample ($N = 102$) are displayed in Table 1. There was a higher frequency of Hispanic (7%) and Black (29%) participants versus White (61%) and Asian (3%) participants that were eligible for the study but were not assessed. There were no significant differences on age, sex, education, or number of medical comorbidities between participants who completed the study and those that were not assessed (ps > .05)

Measures

Social Media headline-sharing main experiment.

This experiment was modeled after the "News-sharing task" by Pennycook et al. (2020). All participants were randomly assigned into either a control condition (n=50) or into an experimental condition (n=50), evenly across the two age groups. All participants completed the Social Media headline-sharing task, in which they were shown 15 false and 15 true news headlines relating to COVID-19 in random order. The headlines were presented in the format of Facebook posts: a picture accompanied by a headline and lead sentence. The format of Facebook posts was chosen for this task, in part due to this being the format used in the original study by Pennycook et al. (2020), and in part due to Facebook ranking as the most popular social network worldwide as of January 2021, with over 2.7 billion monthly active users (Clement, 2020).

Each participant was asked about their likelihood of sharing each of the headlines on social media: “If you were to see the above on social media, how likely would you be to share it? (i.e., through a status update, direct messaging a friend, Facebook group, text, tweet, etc.)” with answer choices provided on a 6-point scale from 1 (*extremely unlikely*) to 6 (*extremely likely*). The primary outcome was the continuous summed scores of sharing likelihood for accurate and inaccurate headlines, separately, with possible scores ranging from 30 to 180 whereby higher scores indicating a higher likelihood of sharing the headline. As described in Pennycook et al. (2020), some evidence in support of the validity of this self-report sharing-intentions measure comes from Mosleh, Pennycook, and Rand (2020). The false headlines were deemed to be false by authoritative sources (e.g., fact-checking sites such as snopes.com and factcheck.org, health experts such as mayoclinic.com, and credible science websites such as www.livescience.com). The true headlines were extracted from reliable, politically neutral mainstream media sources as ranked by a media bias chart (e.g., AP, Reuters, UPI; Otero, 2021). Two research assistants each independently fact checked the headlines for accuracy. The false and true headlines were matched on reading level and number of words in the headlines to have them be as linguistically matched as possible.

Control Condition. Prior to completing the Social Media headline-sharing task, participants in the control condition (i.e., 23 older adults and 27 younger adults) were asked to count the number of words of a single headline of a social media post that is unrelated to COVID-19. This was the same headline as the one presented in the accuracy priming condition.

Accuracy Priming Condition. Prior to completing the Social Media headline-sharing task, participants in the experimental condition (i.e., 27 older adults and 25 younger adults) were asked to rate the factual accuracy of a single headline. The aim of this exposure is to facilitate consideration of accuracy when deciding whether to share the post on social media. Each participant in this condition was asked the following instructions, which were utilized in the treatment condition in studies/survey experiments 3,4 and 5 by Pennycook et al. (2021) and the "Accuracy induction" condition in Pennycook et al. (2020). "First, we would like to pretest an actual news headline for future studies. We are interested in whether people think it is accurate or not. We only need you to give your opinion about the accuracy of a single headline. We will then continue on to the primary task."

Participants were then shown one of four politically neutral, randomly selected headlines (2 true, 2 false), all unrelated to COVID-19 and matched in number of words and level of literacy and asked: "To the best of your knowledge, is the above headline accurate?" and were given the following response options: 'yes' or 'no'. As discussed in Pennycook et al. (2020; 2021), an advantage of this design is that the manipulation is not explicitly linked to the main task and is subtle, which makes demand characteristics or social desirability bias an unlikely driver of any treatment effect. In other words, it is unlikely that between-condition differences are driven by participants believing that the accuracy question at the beginning of the treatment condition is designed to make them take accuracy into account when making sharing decisions during the main experiment.

Headline Accuracy Post-Task

After completion of the main task and questionnaires, all participants were shown the same 15 false and 15 true news headlines relating to COVID-19 as in the main task and asked to rate the accuracy of each headline. Participants were asked: "To the best of your knowledge, is the above headline accurate?" and were given the following response options: 'yes' or 'no'. Possible scores range from 0 to 30; scores in the current sample ranged from 11 to 27.

WAIS-IV WM Index. This index includes the Digit Span and Arithmetic subtests of the WAIS-IV (Wechsler, 2008) and reflects an individual's ability to take in and hold information in immediate awareness and then perform a mental operation on that information. It also measures the mental manipulation of number operations.

Digit Span subtests of the WAIS-IV. The Digit Span Forward subtest was used to assess basic auditory attention. For WAIS-IV Digit Span Forward, participants were read a sequence of numbers and asked to repeat back the numbers in the same order. Possible scores range from 0 to 16; scores in the current sample ranged from 6 to 16. The Digit Span Backward subtest of the WAIS-IV was used to assess WM. For WAIS-Digit Span Backwards, the participants were read a sequence of numbers and asked to repeat back the numbers in the backwards order. Possible scores range from 0 to 16; scores in the current sample ranged from 5 to 16. Previous studies have utilized WAIS Digit Span subtests in telephone-based neurocognitive assessments (e.g., Unverzagt et al., 2007, Christie et al., 2006) and there is preliminary evidence of reliability between in-person and telephone administration of the WAIS-IV Digit Span subtests (e.g., Taichman et al., 2005; Bunker et al., 2017; Rapp et al., 2012 cf. Mitsis et al., 2010). Reliable Digit Span (RDS; Greiffenstein, Baker, & Gola, 1994) was calculated for each participant by adding their longest span forward and longest span backwards. RDS cutoff score of less than or equal to seven is a well-established embedded measure of performance validity (Boone, 2009; Schroeder et al., 2012). All participants in the current sample had RDS greater than or equal to seven.

Arithmetic subtest of the WAIS-IV. The Arithmetic was also used to assess WM and mental manipulation of number operations. This subtest consists of 22 timed arithmetic problems to be solved without the use of pencil and paper. Possible scores range from 0 to 22; current sample scores ranged from 8 to 22.

Participant Characterization and Covariates

Attitudes on Importance of Accuracy in Sharing Decisions. In line with the methodology used by Pennycook et al., (2020) in survey experiment/study 2, participants were asked the following question after completion of the main task: “When deciding whether to share a piece of content on social media, how important is it to you that the content is...”. They were provided with a response grid in which the columns werelabeled ‘not at all’, ‘slightly’, ‘moderately’, ‘very’, and ‘extremely’, and the rows were labeled ‘accurate’, ‘surprising’, ‘interesting’, ‘aligned with your politics’ and ‘funny’ (See Pennycook et al., 2021). Items on this block of questions were treated as individual responses (See Figure 2). Of note, accuracy was rated as the most important factor in sharing decisions, with 93% of the sample reporting that when deciding whether to share a piece of content on social media, it is very or extremely important that the content is accurate. Only 2 participants rated the importance of accuracy as "slightly important" and no participants rated the importance of accuracy as "not at all".

Online Use Measures

Social Media/Networking site Use Questionnaire. Social media/networking site use was measured utilizing a modified version of the Social Network Sites (SNSs) Usage Questionnaire by Shi and colleagues (2014). The questionnaire includes 13 questions regarding frequency of use and sharing behaviors on SNSs. Participants indicate the rate of frequency for each statement (e.g., "How frequently do you use SNSs?" "How frequently do you update your status?"). In the present study, three additional qualitative questions were asked including "How many SNSs do you actively use?", "Which SNSs do you prefer?" and "What is your main purpose for using SNSs?" See table 3.

Internet Use Questionnaire. General Internet use was measured utilizing an approach outlined and supported by Baggio et al., 2017. In the present study, participants were asked three questions related to how often they used the Internet in the previous 30 days, how much time they spend on the Internet on an average weekday, and how much time they spend on the Internet on an average weekend day. From these responses, a single score that accounted for quantity and frequency was calculated, with possible score range from 0 to 15, with a higher score indicating more frequent use; scores in the current sample ranged from 4 to 15.

Mood and Personality Measures

Geriatric Anxiety Inventory-Short Form. The Geriatric Anxiety Inventory-Short Form (GAI-SF; Byrne & Pachana, 2011) is a five-item self-report measure that assesses common anxiety symptoms. Participants indicate whether they agree or disagree with each statement (e.g., "You worry a lot of the time," "Little things bother you a lot"). Possible total scores range from zero to five, with higher scores indicating more anxiety. Literature suggests that the measure has strong reliability and construct validity (Byrne & Pachana, 2011). In the current sample, total scores ranged from zero to five and the Cronbach's alpha was .73.

Dysphoric mood factor from the Geriatric Depression Scale (GDS-S) The Geriatric Depression Scale (GDS-S; Sheikh & Yesavage, 1986) is a self-report measure of depression in older adults, which was originally developed as a 30-item instrument. Since this version proved both time-consuming and difficult for some patients to complete, a 15-item version was developed. The shortened form (GDS-S) is comprised of 15 items chosen from the Geriatric Depression Scale-Long Form (GDS-L), which were chosen because of their high correlation with depressive symptoms in previous validation studies (Sheikh & Yesavage, 1986). Adams, Matto, & Sanders (2004) conducted a confirmatory factor analysis (CFA) of the original GDS and proposed a final measurement model using 26 of the items from the GDS in five factors and obtained a goodness-of-fit index of .90. The resulting distinct subdimensions Dysphoric Mood, Withdrawal–Apathy–Vigor, Hopelessness, Cognitive, and Anxiety. The authors noted that seven of the items that were selected for the GDS-S fall into this Dysphoric Mood factor. Those seven items were used to measure Dysphoric Mood, which describes depressed mood, sadness, or emptiness as well as a lack of satisfaction with life and a lack of happiness. Possible total scores range from zero to seven, with higher scores indicating more symptoms of depression. In the current sample, total scores ranged from zero to seven and the Cronbach's alpha was .71.

Six-item Cognitive Reflection Test (CRT; Frederick, 2005) The CRT is a measure of one's propensity to reflect on intuitions (Pennycook, Cheyne, Koehler, & Fugelsang, 2016; Toplak, West, & Stanovich, 2011) and has strong test- retest reliability (Stagnaro, Pennycook, & Rand, 2018). The version used for the current study consists of a reworded version of the original three-item test and three items from a nonnumeric version (the "hole" item was excluded; Thomson & Oppenheimer, 2016; Pennycook et al., 2020). All the CRT items are constructed to elicit an intuitive but incorrect response. Consider, for example, the following problem: If you are running a race and pass the person in second place, what place are you in? For many people, the intuitive response of "first place" pops into mind—however, this is incorrect (if you pass the person in second place, you overtake their position and are now in second place yourself). Thus, correctly answering CRT problems is associated with reflective thinking. Possible total scores range from 0 to 6; sample scores ranged from 0 to 6 and the Cronbach's alpha was .65.

General Science-Knowledge Quiz **(**Pennycook et al., 2020) The General Science-Knowledge Quiz is a measure of general background knowledge for scientific issues—that consisted of 17 questions about basic science facts (e.g., "Antibiotics kill viruses as well as bacteria," "Lasers work by focusing sound waves"; Pennycook et al., 2020). Possible total scores range from 0 to 17; sample scores ranged from 5 to 17 and the Cronbach's alpha was .73.

***The Big Five Inventory – 2 Extra-Short Form*.** The Big Five Inventory – 2 Extra-Short Form (BFI-2-XS; Soto & John, 2017) is a measure assessing five personality domains. Participants rated the extent to which they agree with 15 statements describing personality traits on a five-point Likert scale scored from one ("Strongly Disagree") to five ("Strongly Agree"). Domain scores for each of the five personality domains were calculated by summing item scores from three relevant statements for each domain: Extraversion (e.g., "You are someone who tends to be quiet"), Agreeableness (e.g., "You are compassionate, or have a soft heart"), Conscientiousness (e.g., "You are reliable, or can always be counted on"), Negative Emotionality (e.g., "You tend to feel depressed or blue"), and Open-Mindedness (e.g., "You are fascinated by art, music, or literature"). Possible total scores for each domain range from 5 to 15. In the current sample, Cronbach's alpha for each domain ranged from .49 (Extraversion) to .79 (Negative Emotionality); average Cronbach's alpha was .62. These Cronbach alphas were comparable to the alphas calculated in the original development and validation paper for the measure (i.e., range .51 to 72; Soto & John, 2016).

***Health comorbidity total*.** A Health Comorbidity Total was created by summing the number of endorsed medical comorbidities on the Health Comorbidity Questionnaire (Sangha et al., 2003) from the online screening survey. The range in the current sample was 0 to 3.

Data Analyses

Prior to conducting analyses, visual inspection and screening of the data was used to ensure accuracy and identify outliers and other abnormal data points (Van der Broeck, Cunningham, Feckels, & Herbst, 2005). All missing value, correlation, MANOVA, regression and mediation analyses were conducted using SPSS (version 26.0). Determination of appropriate sample size for each proposed analysis was performed using G*Power (Faul, Erdfelder, Buchner, & Lang, 2009). Critical alpha was set to .05 for all statistical analyses. The normality assumption for MANOVA was tested using Shapiro-Wilk test. The homogeneity of variance assumption of MANOVA was tested using Brown-Forsyth test (Brown and Forsythe, 1974).

The primary aim of the study was to investigate the unique and combined effects of age and attentional manipulation on people's sharing decisions regarding misinformation about COVID-19.

A1H1: Compared to younger adults, older adults will be more likely to share articles with COVID-19 misinformation on social media, which will be quantified by higher summed scores of sharing likelihood for inaccurate headlines as compared to summed scores of sharing likelihood for accurate headlines.

A1H2: Compared to participants in the control condition, participants in the accuracy priming condition will be less likely to share articles with COVID-19 misinformation on social media, which will be quantified by higher summed scores of sharing likelihood for accurate headlines as compared to summed scores of sharing likelihood for inaccurate headlines.

A1H3: There will be an interaction between age and attentional manipulation effects on COVID-19 misinformation sharing intention, such that the effects of attentional manipulation on the likelihood of sharing articles with COVID-19 misinformation on social media (quantified by higher summed scores of sharing likelihood for inaccurate headlines as compared to summed scores of sharing likelihood for accurate headlines) will be larger among older adult participants.

A repeated measures multivariate analysis of variance (MANOVA) test was used to evaluate main and interactive effects of age and attentional manipulation on group differences in sharing intentions for accurate and false COVID related information. Given the small sample size and the large number of potential covariates, I used a data-driven confound model to guide covariate selection to avoid over-fitting the final model (e.g., Field-Fote, 2019). Specifically, I included only those variables in Tables 1-3 that were significantly and independently related to each of the variables in the model (i.e., age, attentional manipulation, and sharing intentions for accurate and inaccurate COVID related information at a critical alpha of 0.05). Note that, most of the dependent variables were non-normal per Shapiro-Wilk W test ($ps < .05$). However, each primary analysis was evaluated at the univariable level to ensure that the results did not change meaningfully when non-parametric statistics were used. Planned post-hoc analyses were conducted using independent-samples t-tests (Tukey HSD) and were accompanied by Cohen's *d* effect size estimates. A power analysis conducted using the program *G*Power* (version 3.1.9.6; Faul, Erdfelder, Lang, & Buchner, 2009) revealed that given a hypothesized medium-to-large sized effect (f^2 =.33, Cohen, 1977), α error probability = .05, using the proposed four groups and 100 participants total, I would achieve a power of 0.78 for the interaction term and 0.84 for the simple mean effects.

The secondary goal of the present study was to examine mediating effects of individual differences in attention/WM on the relationship between age and sharing intentions for accurate and false COVID related information.

A2H1: The difference in sharing likelihood for inaccurate headlines between older and younger adults will be least partially mediated by individual differences in attention/ WM.

A2H2: The difference in sharing likelihood for accurate headlines between older and younger adults will not be mediated by individual differences in attention/ WM.

First, a principal component (PCA) data analytic tool in SPSS (version 26) software was used to develop an attention/WM composite score for subsequent mediation analyses. PCA is a data reduction technique which can make the metrics measured more meaningful and help uncover the underlying structure of original variables by analyzing common/shared variance across variables (Costello & Osborne, 2005; Gorsuch, 1988). Factor loadings ≥ 0.40 was considered significant for individual items (Floyd & Widaman, 1995) and eigenvalues ≥ 1.0 was considered significant for a factor (Kaiser, 1960). To help determine the best number of components, the scree plot and parallel analysis were used to compare the components to simulated chance values (O'Connor, 2000; Glorfeld, 1995). Data was inspected prior to the analysis to ensure that the following assumptions are met: (1) univariate normality within the data must be observed; (2) each factor should at least be comprised of 3 variables; (3) the ratio of respondents to variables should be at a minimum 5:1; (4) the correlation (r) between the variables should be 0.30 or greater; (5) if data are missing, it should be in a random pattern; and (6) there should be an absence of multicollinearity and singularity (Yong & Pearce, 2013; Field, Miles & Field, 2012).

Next, two separate mediation models were conducted using the mediation method proposed by Hayes, Montoya, & Rockwood (2017). Conditional process modeling (PROCESS) was used to assess the hypothesized mediating effects of attention/ WM on the relationship between age and headline sharing likelihood. The limited available resources for collecting sufficient sample sizes informed the use of a multiple regression approach as opposed to the latent variable analysis or structural equation modeling. Nevertheless, the PROCESS macro in SPSS offers advantages over other approaches (e.g., Baron and Kenny, 1986) in the utilization of bootstrapping techniques to test indirect effects. Moreover, the bootstrapping method allows for non-normal data to be included in the mediation model. PROCESS uses an observed variable ordinary least squares regression-based path analyses and is comparable to structural equation modeling, producing nearly identical results (Hayes, Montoya, & Rockwood, 2017). I used the same data-driven confound model to guide covariate selection as for the analyses for Aim 1 (e.g., Field-Fote, 2019). Specifically, I included only those variables in Tables 1-3 that were significantly and independently related to each of the variables in the model (i.e., age, attention/WM composite score, and sharing intentions for accurate and inaccurate COVID related information at a critical alpha of 0.05).

Age was operationalized as age group (i.e., older adult versus younger adult). Attention/WM was operationalized as Attention/WM (i.e., the previously described composite score). Two models were examined: one with the sharing intention for false information as the outcome variable (i.e., as quantified by a summed score of sharing likelihood for inaccurate headlines) and one with the sharing intention for accurate information (i.e., as quantified by a summed score of sharing likelihood for accurate headlines). Effect size of the mediation was represented as the percent mediation (P_M), which was interpreted as the percent of the total effect (c-path) that is accounted for by the indirect effect (a x b). If the direct effect (c'-path) is larger than the total effect, the absolute value of the total value of the direct path was used to calculate effect size.

Determination of the sample sized for the proposed mediation was performed using the method outlined in Fritz & MacKinnon (2008). For the proposed mediation for A2H1, given medium effect size of α, a medium effect size of ß, a c' value of .14 (which indicates a partially mediated model), the sample size required to conduct a mediational analysis with .8 statistical power is 78 participants, so my sample of 100 participants is more than adequate in this regard.

Results

Association Between Age, Individual Attention/Working Memory and Social Media Headline-Sharing Experiment Outcome Measures

Descriptive statistics for participant performance on the main task were reported in Table 4. See Table 5 for univariate correlations between the dichotomous age, WAIS-IV working memory index measures (i.e., digit span forward and backward and arithmetic subtests of WAIS-IV) and the social media headline-sharing experiment outcome measures (i.e., condition type, sharing likelihood of accurate and false information and headline accuracy post-task). Dichotomous age was significantly associated with sharing likelihood of accurate (p=.003) and false (p=.005) information, as well as with the headline accuracy post-task (p=.05), but not with digit span total, arithmetic, or condition type (ps >.05). Specifically, the younger adult group was more likely to share both accurate and false information as compared to the older adult group. Additionally, the younger adult group performed worse on the headline accuracy post-task as compared to the older adult group. Likelihood of sharing accurate information was significantly associated with likelihood of sharing false (p<.001) information, and both likelihood of sharing accurate and false information were significantly associated with the headline accuracy post-task (ps<.001). Arithmetic total was significantly associated with likelihood of sharing accurate and false information and headline accuracy post-task (ps<.001). Digit span total and condition type were not significantly associated with any of the measures included in the correlation matrix (ps >.05).

Main And Interactive Effects of Age and Attentional Manipulation on Group Differences in Sharing Intentions for Accurate and False COVID Related Information

Table 6 shows the repeated-measures MANOVA that was conducted to examine the effects of age (i.e., two levels; younger adults and older adults; between subjects) and study condition (i.e., two levels; accuracy priming vs control; between subjects) on sharing intention for false and accurate information (i.e., two levels; as quantified by a continuous summed score of sharing likelihood for accurate headlines and a continuous summed score of sharing likelihood for inaccurate headlines). None of the variables in Tables 1-3 met the covariate selection procedures detailed above. The main within-subjects effect of headline accuracy was significant ($p<.001$) with accurate information being shared more than false information (Cohen's $d=.435$). There was also a significant main effect of age ($p=.003$). In contrast, the effect of study condition on sharing intentions was not significant ($p>.05$).

Individual Differences in Attention/WM Composite Score

Principal Components Analysis (PCA) using SPSS (version 26.0; see Table 2) was utilized to derive a continuous Attention/WM composite score. Digit Span Forward and Digit Span Backward subtests of WAIS-IV both loaded onto a single component in the PCA analysis, which accounted for 56.2% of the total variance (Eigenvalue 1.69). Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy for COVID-19 Knowledge was 0.52, suggesting slightly inadequate sampling and utility of the PCA, but still acceptable for the purposes of the analysis (Kaiser, 1974). Bartlett's test of sphericity was significant, approximately X^2 (3) = 55.5, p <.001, suggesting sufficient relation between variables to detect an underlying component structure (Snedecor & Cochran, 1989). However, the Arithmetic subtest did not load on to the first factor, which is further evidenced by the lack of a significant correlation between Digit Span Total and Arithmetic Total at the univariable level (r_s = .121, p=.226). The Digit Span subtest of WAIS-IV is the most robust and widely used non-contextual measure of attention and has shown good psychometric properties in both telephone-based and in-person neurocognitive batteries (e.g., Unverzagt et al., 2007, Christie et al., 2006) and there is preliminary evidence of reliability between in-person and telephone administration of the WAIS-IV Digit Span subtests (e.g., Taichman et al., 2005;

Bunker et al., 2017; Rapp et al., 2012 cf. Mitsis et al., 2010). As such, Digit Span total score was used for further analyses.

Mediating Effects of Individual Differences in Attention on the Relationship between Age and Sharing Intentions for Accurate and False COVID Related Information

None of the variables in Tables 1-3 met the covariate selection procedures detailed above. As shown in Figure 3A, Digit Span total was not a significant mediator of the relationship between age and sharing intention for accurate information. That is, the 95% CI for the indirect effect of Digit Span total contained zero, $b = -.024$, 95% CI [-.110, .041], $p > .05$. The direct effect of age on sharing intention for accurate information remained significant when Digit Span total was included as a mediator, $b = 12.271$, 95% CI [4.703, 19.839], $p=.002$. Likewise, Digit Span total was not a significant mediator of the relationship between age and sharing intention for false information. The 95% CI for the indirect effect of Digit Span total contained zero, $b = -.018$, 95% CI [-.098, .038], $p > .05$. The direct effect of age on sharing intention for accurate information remained significant when Digit Span total was included as a mediator, $b = 11.833$, 95% CI [3.867, 19.799], $p=.004$ (See figure 3B).

Discussion

The emergence of SNSs and wide availability of user-provided content online has created a direct path from producers to consumers of content and permanently changed the way people become informed and, in turn, form their opinions, world views and narratives. This disintermediated environment has revolutionized the availability of information, but also facilitated a rapid and effective spread of misinformation (Brennen et al., 2020), which diffuses faster and reaches broader audiences than correct information and fact-checks (del Vicario et al., 2016; Vosoughi et al., 2018). In the setting of a global pandemic, COVID-19 misinformation spreading on SNSs has already led to profound consequences, including distortion of the public's perception of risk associated with the virus and decreased adherence to preventative health behaviors (Krause et al., 2020) (Dryhurst et al., 2020). Importantly, the population that is at an increased risk for complications, requiring hospitalization or mortality after a diagnosis of

COVID-19 (i.e., older adults; World Health Organization, 2020) is also the population that is more susceptible to misinformation (Grinberg et al., 2019; Allen et al., 2020; Guess, Nagler & Tucker, 2019). Several studies to date began to explore individual and systematic factors involved in susceptibility and proliferation of COVID-19 misinformation online, including focusing on the "inattention account", which involves subtle prompts that nudge people to consider accuracy (Pennycook et al., 2018, 2020, 2021; Van Bavel et al., 2020). However, to my knowledge, this topic has not been studied in older adults or other vulnerable populations. The current study therefore investigates whether older adults benefit from a theory-based attentional manipulation to dampen online sharing of COVID-19 misinformation compared to younger adults. Moreover, I aimed to examine whether differences in attention/working memory help to explain age-related differences in sharing misinformation about COVID-19.

Effects of Age on Headline Accuracy and Sharing intentions

A large body of literature has shown that being older is associated with higher susceptibility to misinformation and older age is a strong predictor of fake news dissemination on SNSs (Allen et al., 2020; Grinberg et al., 2019). For example, Guess, Nagler & Tucker (2019) found that being older than 65 was the largest predictor of sharing political fake news online. However, findings from the current study show the opposite and interesting pattern of results. Specifically, age showed small to medium negative associations with sharing likelihood for accurate and false information, as well as headline accuracy discernment. Intriguingly, in the current sample, older adults were less likely to share both accurate and false COVID-19 information on SNSs as compared to younger adults. These findings were not confounded by relevant factors including social media use and content sharing frequency and overall experience with SNSs.

Further, older adults were also more accurate than younger adults in discerning fake headlines from accurate headlines. However, it is important to note that older adults chose to share less news in general, including accurate headlines, so it is possible that older adults simply choose to share less content on SNSs as compared to younger adults. This would make sense since older adults have historically been perceived as "passive" users on social media who consume content rather than actively posting content

(Brewer et al., 2021; Hampton et al., 2011). Another possible explanation is that when people are more informed about COVID-19, they are more hesitant to share COVID-19 related content in general. The information surrounding the pandemic progression, guidelines and beliefs has been rapidly evolving and as new evidence emerges, it becomes more difficult to discern accurate from false news (e.g., the symptoms associated with the most common COVID-19 strain at the time). Thus, it's possible that the individuals who are most informed, are also the most hesitant in sharing information on SNSs. In fact, in the current study, headline accuracy discernment was negatively associated with sharing likelihood for both accurate and false information at medium to large effect sizes in the full sample (see Table 5).

There are a number of potential reasons as to why the results from the current study differ from the large body of literature to date. First, the majority of studies conducted on susceptibility to, and dissemination of, fake news on SNSs has been focused on political news (e.g., Allen et al., 2020; Grinberg et al., 2019; Guess, Nagler & Tucker, 2019). Conversely, a recent report focusing specifically on susceptibility to COVID-19 misinformation in five countries showed that being older was significantly associated with lower susceptibility to misinformation in four of the five countries including U.S. (see Roozenbeek et al., 2020). The authors suggested that the context of the misinformation may play a large role in explaining this discrepancy in findings. Since older adults are more vulnerable to complications and mortality due to COVID-19, they may be allocating a higher degree of cognitive resources to evaluate the truthfulness of COVID-19 related information. In this way, the current study extends the prior findings by Roozenbeek et al. (2020) in showing that older individuals may be less susceptible to COVID-19 misinformation and share less fake news as compared to younger adults. The present findings also support the well-established positive association between age and crystallized intelligence, as well as wisdom (Horn & Cattell, 1966; Schaie, 1996; Hartman, 2000; Wink & Helson, 1997). Future studies should examine whether crystallized intelligence can act as a moderator in the relationship between age and sharing intentions for misinformation.

Attitudes Toward Sharing COVID-19 Information of SNSs

In line with findings from Pennycook et al. (2021), the current sample of participants rated accuracy as the most important content dimension (i.e., more important than whether the content is surprising, interesting, politically aligned, or funny) when considering whether to share a COVID-19 headline (See Figure 2). This finding did not differ by age and provides further support towards the inattention-based account over the preference-based account of sharing information online (D'Ancona, 2017; Davies, 2016; Hochschild & Einstein, 2016; Keyes, 2004; L. McIntyre, 2015; Petersen, Osmundsen, & Arceneaux, 2018).

Main Effect of Attentional Manipulation on Sharing Intentions

In contrast to the findings from Pennycook et al. (2021) survey experiments three, four, five, and follow up experiment using COVID-19 information, there was no effect of the pre-task accuracy judgment on headline sharing intensions. In other words, regardless of age, subtly inducing participants to think about accuracy of a single headline did not impact their likelihood of sharing false or accurate information. Additionally, treatment condition was also not significantly related to headline accuracy discernment in the current sample. These null findings were accompanied by small effect sizes.

There are several possible reasons why the results of this study diverged from the COVID-19 "Accuracy-Nudge Intervention" study, which showed that a simple accuracy reminder at the beginning of the experiment (i.e., judging the accuracy of a non-COVID-19-related headline) nearly tripled the level of truth discernment in participants' subsequent sharing intentions (Pennycook et al., 2021). First, the current study may not have been optimally powered to detect treatment condition effects. The current study used a much smaller sample size than each of the seven original studies that utilized this experiment (i.e., sample sizes ranged from 710 to 1,268 participants; Pennycook et al., 2021). Although it is possible that small sample size may have increased Type II error, the current study was powered to detect medium-to-large size effects, which is consistent with literature to date utilizing this experiment. On the other hand, the demographics of my sample may have impacted the findings. The current sample was largely comprised of white, fairly well-educated women with a preference for the Democratic party, which is different from the original Pennycook et al. (2021) sample that was quota matched to the U.S. population on age, gender, ethnicity, and region and therefore may be considered to be more nationally representative.

Second, although the current experiment was modeled after the original “News-sharing task” by Pennycook and colleagues (2020; 2021), several notable changes were made that may have impacted the results. For example, in the control condition of the original task, participants simply began the news-sharing task right away. In contrast, for the current study, all participants were shown a single headline (unrelated to COVID-19) before beginning the news-sharing task. The participants in the control condition simply counted the number of words in the headline instead of reading it and judging its accuracy. This change was made in order to ensure that any treatment effect was not an artifact of simple attention or differential demands across groups. Thus, it is possible that the treatment condition of the original experiment was measuring simple attention instead of actively considering accuracy, which impacted its reproducibility. Future studies utilizing this experiment should implement a separate control condition (e.g., counting number of words) in a larger sample to further elucidate the reproducibility of the original findings.

The current study also utilized this experiment as part of a larger 1.5-hour telephone-based neurocognitive battery. As discussed in Pennycook et al. (2020; 2021), an advantage of this experimental design is that the manipulation is not explicitly linked to the main task and is subtle, which makes demand characteristics or social desirability bias an unlikely driver of any treatment effect. Although numerous steps were taken to minimize these external drivers (i.e., having participants complete this task first and online instead of having the examiner stay on the phone with them), it is still possible that having the examiner call the participant at the start and end of the task resulted in increased risk for demand characteristics or social desirability bias. Another potential important change was the headlines chosen for the current study. Due to the rapid progression of the COVID-19 pandemic (and subsequent available information) over the past two years, the available news headlines are constantly evolving with some information becoming more misleading rather than false and other information no longer being relevant.

As such, the current study utilized new and current COVID-19 related headlines, which may have also impacted the results and potentially speaks to generalizability of the original experiment findings to other COVID-19 related headlines.

Likewise, the timing of data collection may have had a direct impact on the level of public knowledge and willingness to share information regarding COVID-19. Pennycook and colleagues (2021) collected data in the very early stages of the pandemic (i.e., March of 2020) when much less information was available. The current data was collected over a year after the Pennycook study and over 1.5 years since the pandemic began. At this point, much more information has become available, but the level of public confusion and criticism towards COVID-19 news from elected officeholders and public health officials has only continued to rise (Tyson & Funk, Pew Research Center, 2022).

In fact, in the current study, the repeated-measures MANOVA showed a main within-subjects effect of headline accuracy, such that accurate information was being shared more than false information (Cohen's *d*=.435). Moreover, there was a higher rate of accuracy discernment in the current sample (i.e., 70% in full sample) as compared to the original COVID-19 experiment by Pennycook et al. (2021) (i.e., 49% in full sample), further suggesting that people may be more knowledgeable of COVID-19 related information but are more hesitant to share it on SNSs. For example, since the initial phase of the COVID-19 pandemic, there has been a dramatic increase of overt politicization of health behaviors in the U.S. (Stroebe et al., 2021), which may have impacted the likelihood and frequency of people sharing COVID-19 information on SNSs. Longitudinal studies utilizing this experiment and targeting the assessment of COVID-19 related knowledge over time may be warranted to inform misinformation reduction initiatives while keeping pace with the evolving nature of the pandemic.

Effects of Individual Attention on Headline Accuracy and Sharing Intentions

A large body of literature has shown that older adults experience age-related declines in attention/WM (e.g., Rabbit, 1965; Plude & Hoyer, 1986; Plude & Doussard-Roosevelt, 1989), with the central executive component of WM reported to be particularly vulnerable to aging (Fisk & Warr, 1996). Older age is also a significant predictor of political fake news dissemination on social media (Allen et al., 2020; Grinberg et al., 2019; Guess, Nagler & Tucker, 2019). However, to my knowledge, no study to date has explored individual differences in attention/WM as a possible avenue for the positive relationship between age and likelihood of sharing misinformation online. As such, a secondary aim of the present study was to examine mediating effects of individual differences in attention/WM on the relationship between age and sharing intentions for accurate and false COVID-19 related information. For the purposes of the current study, Digit Span Forward and Backward subtests from the WAIS-IV were used to measure attention/WM. These measures comprise the WMI of WAIS-IV (Wechsler, 2008), have been used extensively as simple clinical measures of attention/WM (see Lezak, 1995), and have been argued to represent numerous aspects of attention/WM including the phonological loop (Baddeley, 2000), visuospatial sketchpad (Wechsler, 1997) and central executive function due to the additional requirement of manipulation of information within temporary storage (Groeger et al., 1999; Lezak, 1995).

Contrary to my hypotheses, age was not significantly associated with either WAIS-IV Digit Span Total or Arithmetic Total raw scores in the current study (r_s = -0.08-0.17; *p*s>.05). Some potential reasons for the lack of this association are that the current study was underpowered to detect an effect due to a relatively small sample size or that these telephone-based measures did not adequately capture age-related differences in attention/WM. Although it is possible that small sample size may have increased Type II error, the current study was powered to detect medium-to-large size effects which is consistent with the effect sizes reported in literature on aging effects in attention/WM (Barr & Giambra, 1990; Klein et al., 1997; Cohn, Dustman, & Bradford, 1984; Comalli, Wapner, & Werner, 1962). On the other hand, the specific measures chosen to study this effect may not have been optimal. Specifically, although Digit Span subtest of WAIS-IV is the most robust and widely used non-contextual measure of attention and has shown good psychometric properties in both telephone-based and in-person neurocognitive batteries (e.g., Unverzagt et al., 2007, Christie et al., 2006), previous findings comparing forward, and backward digit spans have yielded mixed results. In agreement with the current findings, some studies have shown no age effects on Digit Span performance (e.g., Salthouse & Saklofske, 2010), while others show significant age-related declines on just the backward subtest of Digit Span (e.g., Sliwinski and Buschke, 1999), and others still found significant effects for both Digit Span forward and backward subtasks (e.g., Bopp & Verhaeghen, 2005; Hester, Kinsella, Ong, 2005). The literature exploring age effects on the Arithmetic subtask is substantially more limited, but several studies show a significant negative association between older age and performance on the Arithmetic subtest on the WAIS-III and WAIS-IV (e.g., Ardilla, 2007; Bangma et al., 2017). Based on the mixed literature to date and the current null findings, it is possible that the Digit Span and Arithmetic subtests did not contribute sufficient complexity to be sensitive measures of age effects on attention/WM in the current sample. Future studies should include other well validated measures of attention and WM, including tasks that use visual presentations of stimuli, which have been shown to produce a greater attentional load than auditory presentations (Goolkasian & Foos, 2005).

Another potential reason for these null findings is that the older adult cut-off age in the present study was set at 50 years old. Much of the literature showing significant age effects in attention is focused on adults aged 65 and older (Klein et al., 1997; Cohn, Dustman, & Bradford, 1984; Salthouse & Saklofske, 2010). Therefore, the current sample may have been limited in examining age effects in attention/WM. Notably, restricting the sample to exclude participants between ages 50-65, did not change the null age finding. However, this restriction only left fifteen older participants, which increases Type II error and significantly limits the power to detect an effect. Future studies should include a larger lifespan sample with a focus on older adults aged 65 and older to examine this association. Intriguingly, Arithmetic, but not Digit Span, showed medium size associations with both sharing likelihood for false and accurate information in the full sample (*p*s <.01; See Table 5). Specifically, higher scores on Arithmetic were associated with less sharing intentions for accurate and false COVID-19 related information in the full sample and this finding did not differ by age. This finding also supports the idea that, regardless of age, individuals with stronger attention/WM skills are more hesitant to share COVID-19 related information on SNSs.

Despite the null association between age and attention/WM, the present study examined whether individual differences in attention/WM play a mediating role between age and sharing likelihood for false and accurate information online. According to Baron and Kenny (1986), the starting point to a mediation analysis is to establish a significant zero-order effect between the variables of interest, which has been labeled the “effect to be mediated” (Collins, Graham, and Flaherty 1998; Judd and Kenny 1981; Kenny, Kashy, and Bolger 1998; Preacher and Hayes 2004). However, the assumption that without direct effects, there is no purpose in investigating whether the effect of X on Y is mediated by M, has been thoroughly disputed (Zhao, Lynch Jr & Chen, 2010). In other words, there are some instances when despite a null primary simple effect, mediation may still be an operation and show an effect. However, in the present study, the mediation analyses confirmed that individual differences in attention/WM did not mediate the relationship between age and sharing likelihood for false and accurate information on SNSs.

Future studies should explore the association between aspects of attention particularly vulnerable to aging, including sustained attention and the central executive component of WM, and sharing likelihood for COVID-19 misinformation. Since fact-checking has failed to keep up with the vast amount of false information produced on SNSs and corrections may actually increase belief in the original misinformation (Swire, Ecker & Lewandowsky, 2017; Lewandowsky et al., 2012), other approaches beyond debunking are needed. As such, this line of research may be crucial in limiting the amount of misinformation circulating online and reducing susceptibility to misinformation.

Limitations and Conclusions

Throughout the above discussion, I have articulated, where relevant, the various limitations of the current design, sample, and measurements. In addition, there are additional limitations of the current study that are important to consider. First, the current sample was largely comprised of white, fairly well-educated women with a preference for the Democratic party, which limits the external validity and generalizability of findings to persons with different sociodemographic characteristics. Moreover, the current sample was significantly different from the quota matched U.S. population sample used by Pennycook et al. (2021) which may also have impacted the findings and reproducibility of the original experiment. Future studies should examine the interaction between aging and the COVID-19 “Accuracy-Nudge Intervention” on headline sharing intentions in a larger, nationally representative, lifespan sample. Second, the present study utilized a cross-sectional design and therefore causal inferences cannot be isolated. Although I sought to include variables that are known to be important factors in shaping people's belief in misinformation in my models, I note that these results are exploratory and correlational. As such, future studies using a prospective research design are needed to clarify the complex systems that dictate the interplay between age, individual differences in attention/WM, and functional outcomes such as information susceptibility and sharing on SNSs.

Overall, the current work uniquely extends past research by evaluating the role of aging and attention/WM in sharing intentions for accurate and false information on SNSs. Encouragingly, results suggest that as the pandemic progresses, truth discernment regarding COVID-19 information has increased. Moreover, in line with reports on increased public confusion and criticism towards COVID-19 news (Tyson & Funk, Pew Research Center, 2022), people are less likely to share information on SNSs. This effect was stronger among older adults, which suggests that this vulnerable population may be allocating a higher degree of cognitive resources to evaluate the truthfulness of COVID-19 related information. Further research should explore how cognition and health literacy interventions may impact how (mis)information is received, processed, and shared, and how they can be leveraged to improve resilience against misinformation on a societal level.

Figure and Tables

Figure 1 Study flow diagram.

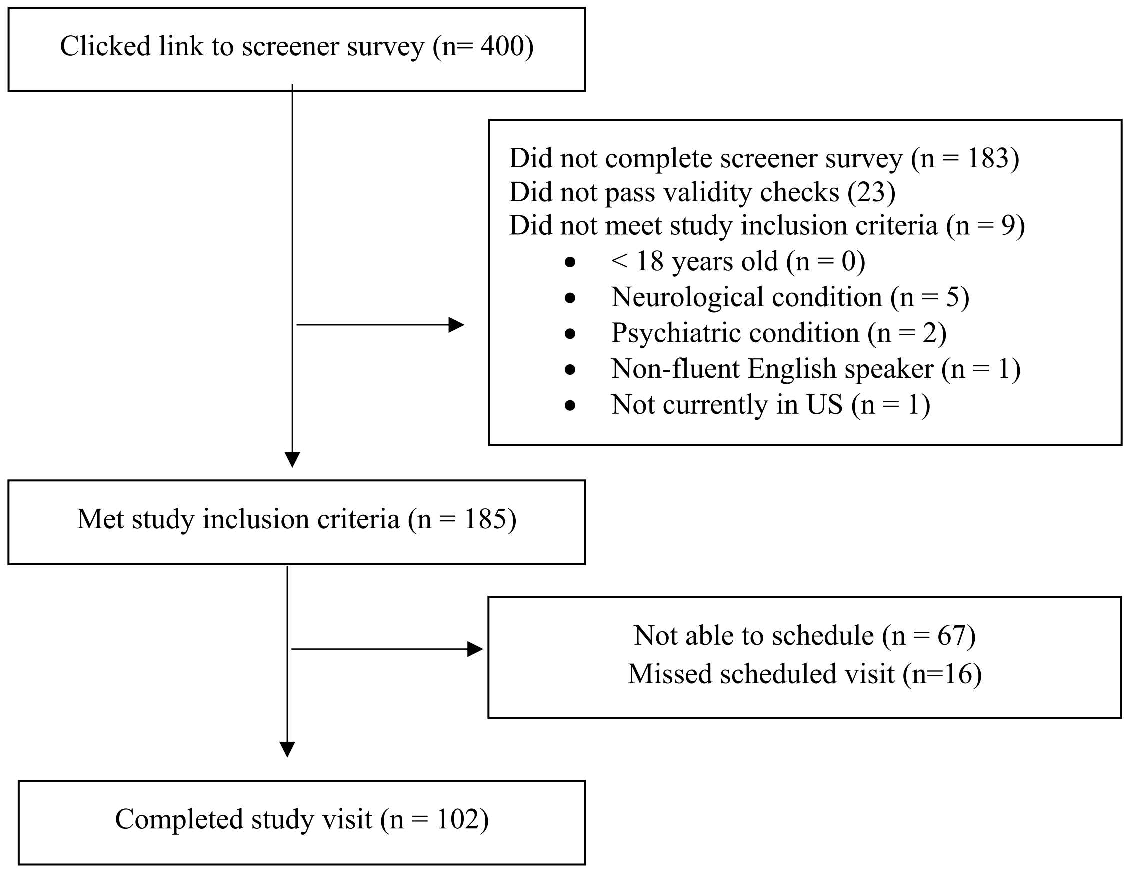

Figure 2 Attitudes Toward Sharing COVID-19 Information of SNSs.

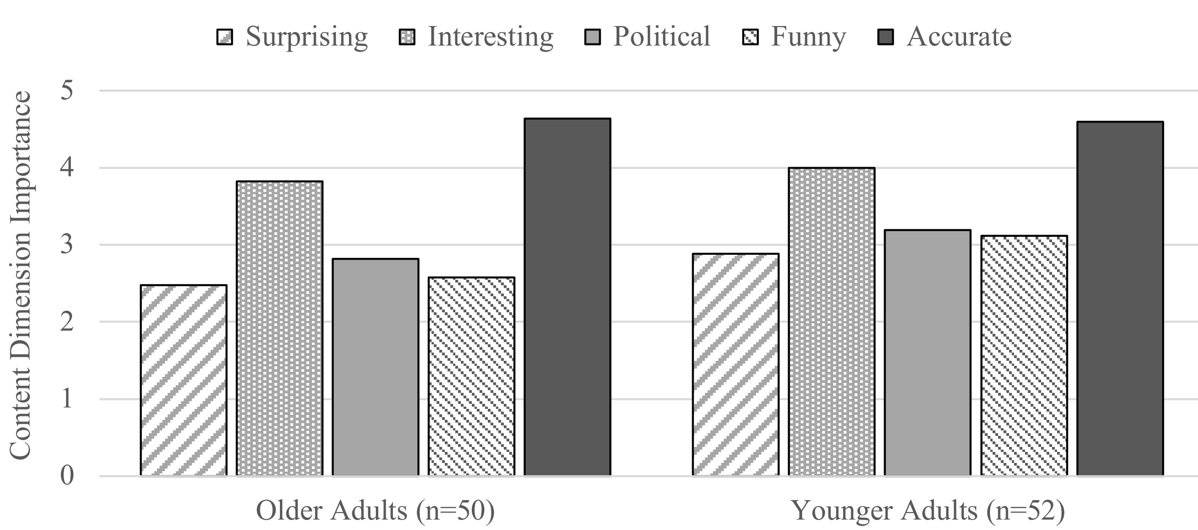

Figure 3A Mediating effects of individual differences in attention/WM on the relationship between age and sharing intentions for accurate COVID related information.

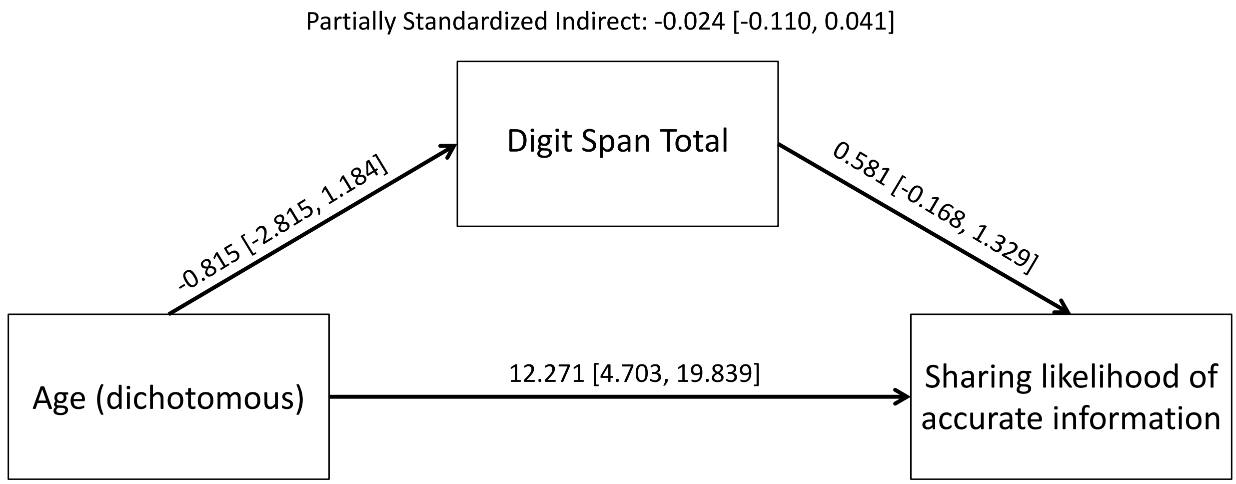

Figure 3B Mediating effects of individual differences in attention/WM on the relationship between age and sharing intentions for false COVID related information.

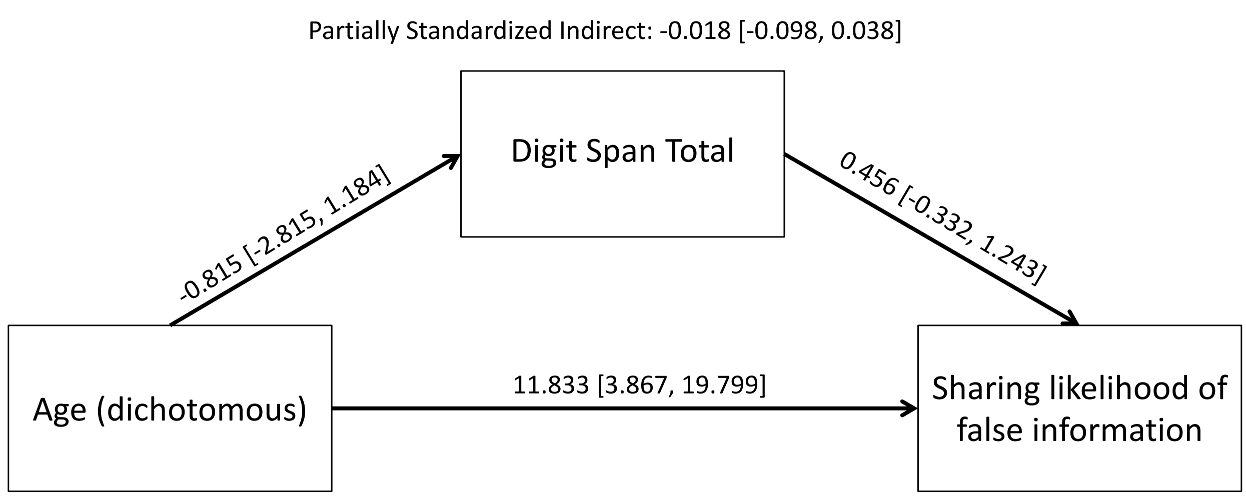

Table 1 Sociodemographic Information for Younger and Older Adults

Variable	Younger Adults (n = 52)	Older Adults (n = 50)	*p*
Age (years)	26.5 (4.5) (18-35)	60.6 (7.6) (50-79)	**<.001**
Gender (% women)	50.0	82.0	**<.001**
Race/Ethnicity (%)			**.011**
Asian	11.5	2.0	
Black	32.7	14.0	
Hispanic	2.0	2.0	
White	50.0	82.0	
Other	3.8	0.0	
Education (%)			.108
High School or Equivalent	11.5	16.0	
Community College/Vocational School	2.0	10.0	
Four-Year College/University Degree	50.0	30.0	
Professional Degree/Graduate School	36.5	44.0	
Political Position			**.015**
Democrat	80.8	54.0	
Republican	7.7	18.0	
Independent	11.5	28.0	
Number of Medical Conditions (of 8)	0.8 (0.3) (0-1)	0.5 (0.7) (0-3)	**<.001**

Note. Data represent *M* (*SD*) (Range) or valid population % values.

Table 2 Psychological Factors for Younger and Older Adults

Variable	Younger Adults (n = 52)	Older Adults (n = 50)	*p*
GAI-SF (of 5)	2.5 (1.6) (0-5)	2.0 (1.8) (0-5)	.090
GDS-S (Dysphoric mood factor; of 7)	1.1 (1.2) (0-4)	1.3 (1.8) (0-7)	.663
Big Five Personality Domains			
Extraversion (of 15)	10.3 (2.1) (5-13)	9.6 (2.3) (4-13)	.063
Agreeableness (of 15)	11.0 (2.1) (6-15)	11.1 (2.2) (4-15)	.610
Conscientiousness (of 15)	11.4 (2.2) (7-15)	11.4 (2.3) (6-15)	.962
Negative Emotionality (of 15)	8.2 (2.8) (3-15)	8.0 (2.8) (3-14)	.758
Open-Mindedness (of 15)	11.2 (2.1) (5-15)	11.5 (2.5) (5-15)	.313
CRT Total (of 6)	2.4 (1.6) (0-6)	1.4 (1.4) (0-5)	**.001**
General Science Knowledge Total (of 17)	12.3 (2.9) (6-17)	11.3 (3.5) (5-17)	.162

Note. Data represent *M* (*SD*) (Range) or valid population % values.
GAI-SF = Geriatric Anxiety Inventory – Short Form; GDS-S= Geriatric Depression Scale– Short Form; CRT=Six-item Cognitive Reflection Test

Table 3 Internet and Social Media Use for Younger and Older Adults

Variable	Younger Adults (n = 52)	Older Adults (n = 50)	*p*
Internet Use Total (of 15)	13.8 (2.0) (4-15)	11.8 (2.4) (6-15)	**<.001**
Social Media Use Total (of 9)	4.5 (1.1) (2-7)	2.5 (1.3) (1-5)	**<.001**
Social Media Use Frequency (%)			.238
Weekly	3.9	4.0	
Multiple times per week	1.9	2.0	
Daily	13.5	30.0	
Multiple times per day	80.7	64.0	
Time Spent on Social Media (per session) (%)			.134
1 minute-30 minutes	51.9	68.0	
31 minutes-2 hours	21.2	20.0	
More than 2 hours	26.9	12.0	
Content Categories Shared Total (of 14)	3.0 (1.5) (0-5)	2.6 (1.3) (0-6)	.139
Frequency of Social Media Activity (%)			
Sharing Content			.114
Never/Yearly	7.7	8.0	
Monthly	11.5	12.0	
Weekly	30.8	52.0	
Daily	50.0	28.0	
Direct Messaging			**.009**
Never/Yearly	1.9	4.0	
Monthly	5.8	16.0	
Weekly	26.9	48.0	
Daily	65.4	32.0	
Status Update			**<.001**
Never/Yearly	21.1	52.0	
Monthly	30.8	14.0	
Weekly	13.5	28.0	
Daily	34.6	6.0	
Comment			.066
Never/Yearly	9.6	2.0	
Monthly	15.4	4.0	
Weekly	34.6	48.0	
Daily	40.4	46.0	

Note. Data represent *M* (*SD*) (Range) or valid population % values.

Table 4 Primary Outcome Measures for Younger and Older Adults

Variable	Younger Adults (n = 52)	Older Adults (n = 50)	*p*
Sharing likelihood of accurate information			
Accuracy Condition (of 90) [a]	47.2 (24.9) (15-90)	40.4 (16.0) (15-73)	.492
Control Condition (of 90) [b]	53.7 (19.9) (15-85)	36.8 (14.7) (15-68)	**.003**
Sharing likelihood of false information			
Accuracy Condition (of 90) [a]	40.0 (26.1) (15-85)	33.3 (17.5) (15-76)	.588
Control Condition (of 90) [b]	42.9 (21.3) (15-86)	26.1 (13.6) (15-67)	**.004**
Headline Accuracy Post-Task (of 30)	20.4 (3.7) (12-27)	21.8 (3.4) (11-27)	**.042**
Headline Accuracy Post-Task (% accurate)	68.1 (12.2) (40-90)	72.8 (11.5) (37-90)	**.042**
Individual Differences in Attention/WM			
Digit Span Total [c]	22.9 (5.0) (14-32)	23.7 (5.2) (13-32)	.299
Arithmetic Total	15.9 (3.4) (8-22)	14.8 (3.1) (8-20)	.061

Note. Data represent *M* (*SD*) (Range) or valid population % values.
[a] 52 Participants were in the accuracy condition: 25 younger adults and 27 older adults
[b] 50 Participants were in the control condition: 27 younger adults and 23 older adults
[c] Total score based on Digit Span Forward and Digit Span Backward subtests of WAIS-IV

Table 5 Correlations between Main Predictors and Outcome Variables

Main Predictor and Outcome Variables	1	2	3	4	5	6
1. Dichotomous Age	–	–	–	–	–	–
2. Digit Span Total [a]	-.081	–	–	–	–	–
3. Arithmetic Total	.169	.121	–	–	–	–
4. Condition Type (Accuracy vs. Control)	-.059	-.034	-.083	–	–	–
5. Sharing likelihood of accurate information	.295**	.103	-.295**	-.055	–	–
6. Sharing likelihood of false information	.275**	.073	-.404**	.032	.872**	–
7. Headline Accuracy Post-Task	-.195*	.021	.401**	-.025	-.412**	-.642**

Note: Table values indicate Spearman's rho. For univariable correlations with a continuous and a dichotomous variable, values in this table reflect point-biserial correlations.
** indicates correlation is significant at $p < .01$ level.
* indicates correlation is significant at $p < .05$ level.
[a] Total score based on Digit Span Forward and Digit Span Backward subtests of WAIS-IV

Table 6 Repeated measures MANOVA results for age, attentional manipulation and sharing intentions for accurate and false COVID related information.

Source	*df*	F	*p*
Between-Subjects Effects			
Age	1	9.60	.003
Study Condition	1	0.01	.923
Study Condition x Age	1	1.77	.187
Within-Subjects Effects			
Headline Accuracy	1	77.1	<.001
Headline Accuracy x Age	1	0.00	.950
Headline Accuracy x Condition	1	3.00	.086
Headline Accuracy x Condition x Age	1	0.00	.986

Note. Headline Accuracy refers to sharing likelihood of accurate vs. false information

Appendix 1:

False Headlines:

1) Man Dies Hours After Receiving COVID Shot- Police Not Revealing Which Version of Vax He Received.
This headline is misleading because the cause of death was not revealed, and experts believe it was probably not related to the vaccine. Here is the direct link to another article explaining this: https://www.wreg.com/news/investigation-underway-after-man-died-hours-after-getting-covid-19-vaccine/

2) Is Colloidal silver a cure for coronavirus? – Film Daily
This headline is false, and the FDA has openly stated that this is false. Here is the direct link to the FDA's view on this: https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-federal-judge-enters-temporary-injunction-against-xephyr-llc-doing

3) "We have successfully Cured 114 COVID-19 Cases through Healing, We got 10 this week" – Bishop Oyedepo Boasted
This headline is very misleading and could lead someone to believe there is a cure for Covid-19. The claim in the headline is alleged and has not been proven. Here is the direct link to another article stating this: https://www.pulse.ng/news/metro/we-have-recorded-114-covid-19-healing-testimonies-we-got-10-this-week-winners-chapel/v39n09e

4) Coconut oil's history in destroying viruses, including Coronaviruses
This headline implies that coconut oil does destroy the coronavirus, when this is not the case. Scientists are still studying if coconut oil does destroy the coronavirus. Here is the direct link to an article stating this: https://www.dailysabah.com/life/science/filipino-scientists-claim-coconut-oil-can-destroy-coronavirus

5) Governor Cuomo Signs Law Using Coronavirus as an Excuse to Take 'Temporary' Dictatorial Powers – Blunt Force Truth
This headline is misleading, and other sources cite Cuomo as having expanded authority rather than dictatorial powers. Here is the direct link to an article addressing this: https://www.wsj.com/articles/new-law-expands-cuomos-power-during-coronavirus-outbreak-11583269075

6) Major Study Shows Rand Right, Fauci Wrong – No Benefit From Vaccine If You've Already Had COVID
This headline is false and has been disproven on factcheck.org. Here is the direct link to article: https://www.factcheck.org/2021/04/scicheck-vaccines-benefit-those-who-have-had-covid-19-contrary-to-viral-posts/

7) Vatican confirms Pope Francis and two aides test positive for the Coronavirus
This has been proven false on a fact checking website. Here is the direct link to the article: https://www.politifact.com/factchecks/2020/mar/02/youtube-videos/false-video-says-pope-francis-has-coronavirus/

8) Florida hospital reports a Coronavirus 'infestation' with multiple confirmed patients.

This headline has been disproven by a fact checking website. Here is the direct link to the article: https://www.politifact.com/factchecks/2020/mar/02/yourcontent/false-news-site-publishes-unproven-story-about-flo/

9) Coronavirus in China: 23 million quarantined, 2.8 million infected, 112,000 dead.
This headline has been disproven by a fact checking website. The numbers were not accurate, as stated by this article: https://www.indiatoday.in/fact-check/story/fact-check-bloated-casualty-figures-linked-to-coronavirus-leave-netizens-in-panic-1643257-2020-02-04

10) Vitamin C protects against Coronavirus.
This medical website disproves this headline, stating that no supplement will cure or prevent disease. Here is the direct link to the article: https://www.healthline.com/nutrition/vitamin-c-coronavirus

11) University of Tennessee scientists may have found coronavirus cure
This headline is misleading because there is currently no cure for coronavirus. Here is the direct link to an article explaining this: https://www.britannica.com/story/is-there-a-cure-for-coronavirus

12) Unbelievable – Gates Foundation Predicted 65 Million Deaths Via Coronavirus 3 Months Ago!!!
This headline has been disproven by a fact checking website. Here is the direct link to the article: https://www.factcheck.org/2020/01/new-coronavirus-wasnt-predicted-in-simulation/

13) FEMA Proposes Martial Law to Contain Coronavirus | New World Order | Before It's News
This headline has been disproven by a fact checking website. Here is the direct link to the article: https://apnews.com/article/fact-checking-8443220001

14) COVID-19 is Now Mutating Into Something Indescribable That is Now Found in Brazil!
This headline was cited as being misinformation in a study. Here is the link to the research article mentioning this headline: https://misinforeview.hks.harvard.edu/wp-content/uploads/2021/05/epstein_toolkit_covid_19_misinformation_20210518.pdf

15) People with albinism are being blamed for the spread of the coronavirus in Africa because of their 'whiteness'
This headline is misleading because when you read the actual article, it explains further in detail what they mean by 'whiteness'. Here is the direct link to the article: https://africa.businessinsider.com/politics/people-with-albinism-are-being-blamed-for-the-spread-of-the-coronavirus-in-africa/rjm97z1.amp

True Headlines:

1) These twins are 5 years old. They lost both parents to covid-19.
This headline is real and has been mentioned by another reputable source. Here is the direct link to the article: https://www.seattletimes.com/nation-world/these-twins-are-5-years-old-they-lost-both-parents-to-covid-19/

2) Anti-vaccine groups used Telegram to send 'apparent death threats' to BBC journalists, report says

This information has been published by another reputable source. Here is the direct link to the article: https://finance.yahoo.com/news/anti-vaccine-groups-used-telegram-141854941.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAACpC3E7hseKHQsA9h0biydqQ3OPFAasarjxi2eJpnrDs1orejGDyi4Pn4p6FwB8Jr1tVylxc8ZEkETBYgWxawmmEZP5K_Syt8Hv_16v6x-vfHaESvvyAbsk4l-TJgSTWI9rfNgSys5HbP6xTD4Y2b8JWv73hTdl-EwX4N5uo2y4V

3) China, Other Asian Countries Vaccinate Against Covid-19 Faster Than Ever
This information has been stated by another reliable news source. Here is the direct link to the article: https://www.kyivpost.com/world/wall-street-journal-china-other-asian-countries-vaccinate-against-covid-19-faster-than-ever.html

4) Why airport screening won't stop the spread of coronavirus
True, confirmed by live science. Links: https://www.livescience.com/can-airport-screening-stop-coronavirus.html https://www.mdpi.com/1660-4601/16/23/4638

5) Merck signs $1.2 billion deal with US government for experimental COVID treatment
This is true, there are several news reporting this. Links are below.
https://www.cnbc.com/2021/06/09/us-to-buy-about-1-point-7-million-courses-of-mercks-covid-19-treatment-for-1-point-2-billion.html
https://www.reuters.com/business/healthcare-pharmaceuticals/merck-says-us-govt-buy-about-17-mln-courses-cos-covid-19-drug-2021-06-09/

6) Unpaid Caregivers Were Already Struggling. It's Only Gotten Worse During The Pandemic.
True they cite a source and specialist. Here is the link to the study.
https://www.cdc.gov/mmwr/volumes/70/wr/mm7024a3.htm?s_cid=mm7024a3_w__;!!Iwwt!A4kAqpoG0UKcS20Ro5w7xI-cK7bTEuRX-FRaMmxYCkt7Gs5Gxk83kcnBqkL1ajM$

7) Regeneron antibody 'cocktail' can save lives in hospitalized Covid patients, study finds.
This is true, they cite a study and it is also published on other news companies. The links are below.
https://www.cnbc.com/2021/06/16/regeneron-antibody-cocktail-can-save-lives-in-hospitalized-covid-patients.html
https://investor.regeneron.com/news-releases/news-release-details/regeneron-announces-encouraging-initial-data-covid-19-antibody

8) Israel declares 14 day quarantine for all arrivals.
True, several news companies reported this. Links: https://www.cnn.com/asia/live-news/coronavirus-outbreak-03-09-20-intl-hnk/h_dfd7a7aab578a6ad67af95d4b07fcab9
https://www.timesofisrael.com/israel-orders-all-arrivals-from-abroad-into-two-week-quarantine/
https://www.washingtonpost.com/world/middle_east/israel-announces-that-anyone-coming-from-abroad-will-be-quarantined-for-14-days/2020/03/09/f133dd9a-61f6-11ea-8a8e-5c5336b32760_story.html

9) Coronavirus poses tough challenge for economic policymakers.

True, several news companies have reported this. Links:
https://apnews.com/article/554496eeac896f4aa69872e7b2c914bf
https://www.usnews.com/news/business/articles/2020-02-25/coronavirus-poses-tough-challenge-for-economic-policymakers?context=amp

10) Houston hospital suspends 178 employees who refused covid-19 vaccination
This is true, several news has reported this.
Links below: https://abc13.com/health/178-houston-methodist-workers-suspended-over-vaccine-requirement/10767264/
https://www.npr.org/2021/06/10/1005117832/clock-is-ticking-in-vaccine-standoff-between-houston-hospital-and-178-employees
https://www.usatoday.com/story/news/health/2021/06/09/houston-methodist-hospital-workers-refuse-covid-vaccine-get-suspended/7616446002/

11) corona virus: we need to start preparing for the next viral outbreak now.
This is misleading, there is no source or other journal-news paper that published this, but the authors of the article are professors from Harvard in the department Chan school of public health.

12) more young adults than expected have reported heart inflammation following covid 19 vaccination
This is true, and the CDC have made a statement about this. Link below.
https://www.cdc.gov/coronavirus/2019-ncov/vaccines/safety/myocarditis.html

13) Biden administration to buy 500 million pfizer coronavirus vaccine doses to donate to the world
-This is true, the white house website and other news sites have published news about this. Links bellow: https://www.cbsnews.com/news/covid-vaccine-pfizer-global-distribution-biden-administration/
https://www.whitehouse.gov/briefing-room/statements-releases/2021/06/10/fact-sheet-president-biden-announces-historic-vaccine-donation-half-a-billion-pfizer-vaccines-to-the-worlds-lowest-income-nations/

14) Dr. Fauci: How we'll know when we've reached herd immunity with Covid
This is true, Dr. Fauci was interviewed by dr. Mike MD and mentions this. Attached is the link.
https://www.youtube.com/watch?v=eIS2K0g9-U0

15) Police in the us spread a false claim that meth is contaminated with coronavirus
This is true, CNN and the Washington post shared this news. Also the Merril police department Facebook page made a publication regarding this. Link below:
https://www.facebook.com/222853377744637/posts/3265362686827009
https://www.cnn.com/2020/03/01/us/coronavirus-police-test-drugs-trnd/index.html
https://www.washingtonpost.com/nation/2020/02/28/coronavirus-meth-police-hoax/

References

Acerbi, A. (2016). A cultural evolution approach to digital media. *Frontiers in human neuroscience*, *10*, 636.

Adams, K. B., Matto, H. C., & Sanders, S. (2004). Confirmatory factor analysis of the geriatric depression scale. *The Gerontologist*, *44*(6), 818-826.

Allen, J., Howland, B., Mobius, M., Rothschild, D., & Watts, D. J. (2020). Evaluating the fake news problem at the scale of the information ecosystem. *Science Advances*, *6*(14), eaay3539.

Allport, F. H., & Lepkin, M. (1945). Wartime rumors of waste and special privilege: Why some people believe them. *The Journal of Abnormal and Social Psychology*, *40*(1), 3.

Alwin, D. F., & McCammon, R. J. (2001). Aging, cohorts, and verbal ability. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *56*(3), S151-S161.

Andersen, K. G., Rambaut, A., Lipkin, W. I., Holmes, E. C., & Garry, R. F. (2020). The proximal origin of SARS-CoV-2. *Nature medicine*, *26*(4), 450-452.

Anderson, C. A., Lepper, M. R., & Ross, L. (1980). Perseverance of social theories: the role of explanation in the persistence of discredited information. *Journal of personality and social psychology*, *39*(6), 1037.

Anderson, V., Jacobs, R., & Harvey, A. S. (2005). Prefrontal lesions and attentional skills in childhood. *Journal of the International Neuropsychological Society: JINS*, *11*(7), 817

Anderton, B. H. (2002). Ageing of the brain. *Mechanisms of Ageing and Development*, *123*(7), 811-817.Ardila, A. (2007). The impact of culture on neuropsychological test performance. *International handbook of cross-cultural neuropsychology*, *23*, 44.

Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. In *Psychology of learning and motivation* (Vol. 2, pp. 89-195). Academic Press.

Austin, J., Hollingshead, K., & Kaye, J. (2017). Internet Searches and Their Relationship to Cognitive Function in Older Adults: Cross-Sectional Analysis. *Journal of medical Internet research*, *19*(9).

Ayers, M. S., & Reder, L. M. (1998). A theoretical review of the misinformation effect: Predictions from an activation-based memory model. *Psychonomic Bulletin & Review*, *5*(1), 1-21.

Babicz, M. A., Woods, S. P., Matchanova, A., Medina, L. D., Podell, K., Walker, R., ... & Morales, Y. (Preprint). How Did Individual Differences in Neurocognition and Health Literacy Influence the Initial Uptake and Use of Health-related Information about COVID-19?.

Baddeley, A. D., & Hitch, G. (1974). Working memory. In *Psychology of learning and motivation* (Vol. 8, pp. 47-89). Academic press.

Baddeley, A. (2000). The episodic buffer: a new component of working memory?. *Trends in cognitive sciences*, *4*(11), 417-423.

Baggio, S., Iglesias, K., Berchtold, A., & Suris, J. C. (2017). Measuring internet use: comparisons of different assessments and with internet addiction. *Addiction Research & Theory*, *25*(2), 114-120.

Bago, B., Rand, D. G., & Pennycook, G. (2020). Fake news, fast and slow: Deliberation reduces belief in false (but not true) news headlines. *Journal of experimental psychology: general*.

Bailey, H. R., & Zacks, J. M. (2015). Situation model updating in young and older adults: Global versus incremental mechanisms. *Psychology and aging*, *30*(2), 232.

Bakshy, E., Messing, S., & Adamic, L. A. (2015). Exposure to ideologically diverse news and opinion on Facebook. *Science*, *348*(6239), 1130-1132.

Bangma, D. F., Fuermaier, A. B., Tucha, L., Tucha, O., & Koerts, J. (2017). The effects of normal aging on multiple aspects of financial decision-making. *PloS one*, *12*(8), e0182620.

Barberá, P., Jost, J. T., Nagler, J., Tucker, J. A., & Bonneau, R. (2015). Tweeting from left to right: Is online political communication more than an echo chamber?. *Psychological science*, *26*(10), 1531-1542.

Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions: constructing a unifying theory of ADHD. *Psychological bulletin*, *121*(1), 65.

Barkley, R. A. (2000). Genetics of childhood disorders: XVII. ADHD, Part 1: The executive functions and ADHD. *Journal of the American Academy of Child & Adolescent Psychiatry*.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, *51*(6), 1173.

Barr, R. A., & Giambra, L. M. (1990). Age-related decrement in auditory selective attention. *Psychology and Aging*, *5*(4), 597.

Bartzokis, G. (2004). Age-related myelin breakdown: a developmental model of cognitive decline and Alzheimer's disease. *Neurobiology of Aging*, *25*(1), 5-18

Basol, M., Roozenbeek, J., & van der Linden, S. (2020). Good news about bad news: Gamified inoculation boosts confidence and cognitive immunity against fake news. *Journal of cognition*, *3*(1).

Bastin, C., & Van der Linden, M. (2005). The effects of aging on the recognition of different types of associations. *Experimental aging research*, *32*(1), 61-77.

BBC News (2020). *Ofcom: Covid-19 5G Theories are "Most Common" Misinformation. Www.Bbc.Co.Uk.* Available online at: https://www.bbc.co.uk/news/technology-52370616 (accessed April 1, 2021).

Begg, I. M., Anas, A., & Farinacci, S. (1992). Dissociation of processes in belief: Source recollection, statement familiarity, and the illusion of truth. *Journal of Experimental Psychology: General*, *121*(4), 446.

Belchior, P., Yam, A., Thomas, K. R., Bavelier, D., Ball, K. K., Mann, W. C., & Marsiske, M. (2019). Computer and Videogame Interventions for Older Adults' Cognitive and Everyday Functioning. *Games for health journal*, *8*(2), 129-143.

Benedict, R. H., Schretlen, D., Groninger, L., & Brandt, J. (1998). Hopkins Verbal Learning Test–Revised: Normative data and analysis of inter-form and test-retest reliability. *The Clinical Neuropsychologist*, *12*(1), 43-55.

Bessi, A., Coletto, M., Davidescu, G. A., Scala, A., Caldarelli, G., & Quattrociocchi, W. (2015). Science vs conspiracy: Collective narratives in the age of misinformation. *PloS one*, *10*(2), e0118093.

Boone, K. B. (2009). The need for continuous and comprehensive sampling of effort/response bias during neuropsychological examinations. *The Clinical Neuropsychologist*, *23*(4), 729-741.

Bopp, K. L., & Verhaeghen, P. (2005). Aging and verbal memory span: A meta-analysis. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *60*(5), P223-P233.

Bower, G. H., & Morrow, D. G. (1990). Mental models in narrative comprehension. *Science*, *247*(4938), 44-48.

Brady, W. J., Crockett, M. J., & Van Bavel, J. J. (2020). The MAD model of moral contagion: The role of motivation, attention, and design in the spread of moralized content online. *Perspectives on Psychological Science*. Advance online publication. doi:10.1177/1745691620917336

Brady, W. J., Wills, J. A., Jost, J. T., Tucker, J. A., & Van Bavel, J. J. (2017). Emotion shapes the diffusion of moralized content in social networks. *Proceedings of the National Academy of Sciences*, *114*(28), 7313–7318. https://doi.org/10.1073/pnas.1618923114

Brandt, J., & Benedict, R. H. B. (2001). Hopkins Verbal Learning Test-Revised (HVLT-R) Psychological Assessment Resources. *Lutz, FL, USA*.

Brennen, J. S., Simon, F., Howard, P. N., & Nielsen, R. K. (2020). Types, sources, and claims of COVID-19 misinformation. *Reuters Institute*, *7*, 1-13.

Brewer, R. N., Schoenebeck, S., Lee, K., & Suryadevara, H. (2021). Challenging passive social media use: Older adults as caregivers online. *Proceedings of the ACM on Human-Computer Interaction*, *5*(CSCW1), 1-20.

Bronstein, M. V., Pennycook, G., Bear, A., Rand, D. G., & Cannon, T. D. (2019). Belief in fake news is associated with delusionality, dogmatism, religious fundamentalism, and reduced analytic thinking. *Journal of applied research in memory and cognition*, *8*(1), 108-117.

Brown, M. W. (2006). Associations and dissociations in recognition memory systems.

Brown, M. B., & Forsythe, A. B. (1974). Robust tests for the equality of variances. *Journal of the American Statistical Association*, *69*(346), 364-367.

Brydges, C. R., Gignac, G. E., & Ecker, U. K. (2018). Working memory capacity, short-term memory capacity, and the continued influence effect: A latent-variable analysis. *Intelligence*, *69*, 117-122

Bunker, L., Hshieh, T. T., Wong, B., Schmitt, E. M., Travison, T., Yee, J., ... & Inouye, S. K. (2017). The SAGES telephone neuropsychological battery: correlation with in-person measures. *International journal of geriatric psychiatry*, *32*(9), 991-999.

Burke, S. N., & Barnes, C. A. (2006). Neural plasticity in the ageing brain. *Nature Reviews Neuroscience*, *7*(1), 30.

Byrne, G. J., & Pachana, N. A. (2011). Development and validation of a short form of the Geriatric Anxiety Inventory-the GAI-SF. *International Psychogeriatrics*, *23*(1), 125.

Castellanos, F. X., Giedd, J. N., Berquin, P. C., Walter, J. M., Sharp, W., Tran, T., ... & Rapoport, J. L. (2001). Quantitative brain magnetic resonance imaging in girls with attention-deficit/hyperactivity disorder. *Archives of general psychiatry*, *58*(3), 289-295.

Centers for Disease Control and Prevention. Past Pandemics. (2018, August 10). Retrieved January 07, 2021, from https://www.cdc.gov/flu/pandemic-resources/basics/past-pandemics.html

Centers for Disease Control and Prevention (2013). CDC health disparities and inequalities reports – United States, 2013, *Morbidity and Mortality Weekly Report, 62*(3).

Center for Disease Control and Prevention. (2020, May 13). *Coronavirus Disease 2019 (COVID- 19): Symptoms of Coronavirus.* Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html

Centers for Disease Control and Prevention. (2020, June 25). *Coronavirus Disease 2019 (COVID-19): People who are at increased risk for severe illness*. Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-at-increased-risk.html

Charness, N., & Boot, W. R. (2009). Aging and information technology use: Potential and barriers. *Current Directions in Psychological Science*, *18*(5), 253-258

Chew, L. D., Bradley, K. A., & Boyko, E. J. (2008). Chew LD, Griffin JM, Partin MR, Noorbaloochi S, Grill JP, Snyder A, et al. Validation of screening questions for limited health literacy in a large VA outpatients population. *Journal General Internal Medicine, 23*, 561-566.

Christie, J. D., Biester, R. C. P., Taichman, D. B., Shull Jr, W. H., Hansen-Flaschen, J., Shea, J. A., & Hopkins, R. O. (2006). Formation and validation of a telephone battery to assess cognitive function in acute respiratory distress syndrome survivors. *Journal of Critical Care*, *21*(2), 125-132.

Chung, S. Y., & Nahm, E. S. (2015). Testing reliability and validity of the eHealth Literacy Scale (eHEALS) for older adults recruited online. *Computers, Informatics, Nursing: CIN*, *33*(4), 150-156.

Clement J. Daily time spent on social networking by internet users worldwide from 2012 to 2018. Statista, August 14, 2019.

Clement, J. (2020). Global social networks ranked by number of users 2020. *Statista. Com*

Cohen, R., Moffatt, K., Ghenai, A., Yang, A., Corwin, M., Lin, G., ... & Gray, L. (2020). Addressing Misinformation in Online Social Networks: Diverse Platforms and the Potential of Multiagent Trust Modeling. *Information*, *11*(11), 539.Cohn, N. B., Dustman, R. E., & Bradford, D. C. (1984). Age-related decrements in stroop color test performance. *Journal of clinical psychology*, *40*(5), 1244-1250.

Collins, L. M., Graham, J. J., & Flaherty, B. P. (1998). An alternative framework for defining mediation. *Multivariate Behavioral Research*, *33*(2), 295-312.

Comalli Jr, P. E., Wapner, S., & Werner, H. (1962). Interference effects of Stroop color-word test in childhood, adulthood, and aging. *The Journal of genetic psychology*, *100*(1), 47-53.

Cook, J., van der Linden, S., Lewandowsky, S., & Ecker, U. K. H. (2020). Coronavirus,"Plandemic" and the Seven Traits of Conspiratorial Thinking. *The Conversation. Available online at: https://theconversation. com/coronavirusplandemic-and-the-seven-traits-of-conspiratorial-thinking-138483 (accessed May 15, 2020)*.

Cornwall, W. (2020). Officials gird for a war on vaccine misinformation. *Science* 369, 14–15.

Costello, A. B., & Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research, and Evaluation*, *10*(1), 7.

Cowan, N. (2008). What are the differences between long-term, short-term, and working memory?. *Progress in brain research*, *169*, 323-338.

Czaja, S. J., Sharit, J., Lee, C. C., Nair, S. N., Hernández, M. A., Arana, N., & Fu, S. H. (2013). Factors influencing use of an e-health website in a community sample of older adults. *Journal of the American Medical Informatics Association*, *20*(2), 277-284.

D'Ancona, M. (2017). *Post truth: the new war on truth and how to fight back*. Ebury Press.

D'Esposito, M., Zarahn, E., Aguirre, G. K., & Rypma, B. (1999). The effect of normal aging on the coupling of neural activity to the bold hemodynamic response. *Neuroimage*, *10*(1), 6-14.

Davies, W. (2016, September 24). The Age of Post-Truth Politics. *The New York Times*. Retrieved from https://www.nytimes.com/2016/08/24/opinion/campaign-stops/the-age-of-post-truth-politics.html

De Keersmaecker, J., Onraet, E., Lepouttre, N., & Roets, A. (2017). The opposite effects of actual and self-perceived intelligence on racial prejudice. *Personality and Individual Differences*, *112*, 136-138.

De Neys, W., Cromheeke, S., & Osman, M. (2011). Biased but in doubt: Conflict and decision confidence. *PloS one*, *6*(1), e15954.

Del Vicario, M., Bessi, A., Zollo, F., Petroni, F., Scala, A., Caldarelli, G., ... & Quattrociocchi, W. (2016). The spreading of misinformation online. *Proceedings of the National Academy of Sciences*, *113*(3), 554-559.

Delis, D. C., Kaplan, E., & Kramer, J. H. (2001). Delis-Kaplan executive function system.

Dempster, F. N. (1992). The rise and fall of the inhibitory mechanism: Toward a unified theory of cognitive development and aging. *Developmental review*, *12*(1), 45-75.

Depoux, A., Martin, S., Karafillakis, E., Preet, R., Wilder-Smith, A., & Larson, H. (2020). The pandemic of social media panic travels faster than the COVID-19 outbreak. *J. Travel Med.* 27:taaa031.

Diana, R. A., Yonelinas, A. P., & Ranganath, C. (2007). Imaging recollection and familiarity in the medial temporal lobe: A three-component model. *Trends in Cognitive Sciences, 11*, 379–386.

Dommes, A., Chevalier, A., & Lia, S. (2011). The role of cognitive flexibility and vocabulary abilities of younger and older users in searching for information on the web. *Applied Cognitive Psychology*, *25*(5), 717-726.

Donath, J., & Boyd, D. (2004). Public displays of connection. *BT technology Journal*, *22*(4), 71-82.

Dove, A., Pollmann, S., Schubert, T., Wiggins, C. J., & Von Cramon, D. Y. (2000). Prefrontal cortex activation in task switching: an event-related fMRI study. *Cognitive brain research*, *9*(1), 103-109

Drachman, D. A. (2006). Aging of the brain, entropy, and Alzheimer disease. *Neurology*, *67*(8), 1340-1352.

Duffy B, Allington D. 2020 Covid conspiracies and confusions: the impact on compliance with the UK's lockdown rules and the link with social media use. London, UK: The Policy Institute, King's College. See https://www.kcl.ac.uk/ policy-institute/assets/covid-conspiracies-and- confusions.pdf.

Dryhurst, S., Schneider, C. R., Kerr, J., Freeman, A. L., Recchia, G., Van Der Bles, A. M., ... & van der Linden, S. (2020). Risk perceptions of COVID-19 around the world. *Journal of Risk Research*, *23*(7-8), 994-1006.

Eakin, D. K., Schreiber, T. A., & Sergent-Marshall, S. (2003). Misinformation effects in eyewitness memory: the presence and absence of memory impairment as a function of warning and misinformation accessibility. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *29*(5), 813.

Ecker, U. K., Hogan, J. L., & Lewandowsky, S. (2017). Reminders and repetition of misinformation: Helping or hindering its retraction?. *Journal of Applied Research in Memory and Cognition*, *6*(2), 185-192.

Ecker, U. K., Lewandowsky, S., & Oberauer, K. (2014). Removal of information from working memory: A specific updating process. *Journal of Memory and Language*, *74*, 77-90.

Ecker, U. K., Lewandowsky, S., & Tang, D. T. (2010). Explicit warnings reduce but do not eliminate the continued influence of misinformation. *Memory & cognition*, *38*(8), 1087-1100.

Ecker, U. K., Lewandowsky, S., & Apai, J. (2011). Terrorists brought down the plane! —No, actually it was a technical fault: Processing corrections of emotive information. *Quarterly Journal of Experimental Psychology*, *64*(2), 283-310.

Ecker, U. K., Lewandowsky, S., & Chadwick, M. (2020). Can corrections spread misinformation to new audiences? Testing for the elusive familiarity backfire effect. *Cognitive Research: Principles and Implications*, *5*(1), 1-25.

Ecker, U. K., Lewandowsky, S., Swire, B., & Chang, D. (2011). Correcting false information in memory: Manipulating the strength of misinformation encoding and its retraction. *Psychonomic Bulletin & Review*, *18*(3), 570-578.

Ecker, U. K., Oberauer, K., & Lewandowsky, S. (2014). Working memory updating involves item-specific removal. *Journal of Memory and Language*, *74*, 1-15.

Einstein, K. L., & Glick, D. M. (2015). Do I think BLS data are BS? The consequences of conspiracy theories. *Political Behavior*, *37*(3), 679-701.

Eslick, A. N., Fazio, L. K., & Marsh, E. J. (2011). Ironic effects of drawing attention to story errors. *Memory*, *19*(2), 184-191.

Ellison NB, Boyd D. Sociality through social network sites. In: Dutton WH (ed). The Oxford handbook of Internet studies. Oxford: Oxford University Press, 2013:151-72.

Engle, R. W., Tuholski, S. W., Laughlin, J. E., & Conway, A. R. (1999). Working memory, short-term memory, and general fluid intelligence: a latent-variable approach. *Journal of experimental psychology: General*, *128*(3), 309.

Facebook (2018), 'Facebook reports first quarter 2018 results', available at: https://investor.fb.com/investor-news/press-release-details/2018/ Facebook-Reports-First-Quarter-2018-Results/default.aspx.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149-1160.

Festinger, L. (1962). *A theory of cognitive dissonance* (Vol. 2). Stanford university press.

Field-Fote, E. (2019). Mediators and moderators, confounders and covariates: Exploring the variables that illuminate or obscure the "active ingredients" in neurorehabilitation. *Journal of Neurologic Physical Therapy*, *43*(2), 83-84.

Field, A., Miles, J., & Field, Z. (2012). *Discovering statistics using R*. Sage publications.

Fisk, J. E., & Warr, P. (1996). Age and working memory: the role of perceptual speed, the central executive, and the phonological loop. *Psychology and aging*, *11*(2), 316–323. https://doi.org/10.1037//0882-7974.11.2.316

Flaxman, S., Goel, S., & Rao, J. M. (2013). Ideological segregation and the effects of social media on news consumption. *Available at SSRN*, *2363701*.

Floyd, F. J., & Widaman, K. F. (1995). Factor analysis in the development and refinement of clinical assessment instruments. *Psychological assessment*, *7*(3), 286.

Fortin, S., Godbout, L., & Braun, C. M. (2003). Cognitive structure of executive deficits in frontally lesioned head trauma patients performing activities of daily living. *Cortex*, *39*(2), 273-291.

Frederick, S. (2005). Cognitive reflection and decision making. *Journal of Economic perspectives*, *19*(4), 25-42.

Freeman, D., Loe, B. S., Chadwick, A., Vaccari, C., Waite, F., Rosebrock, L., ... & Lambe, S. (2020). COVID-19 vaccine hesitancy in the UK: the Oxford coronavirus explanations, attitudes, and narratives survey (Oceans) II. *Psychological medicine*, 1-15.

Frenkel, S., Alba, D., & Zhong, R. (2020). Surge of virus misinformation stumps Facebook and Twitter. *The New York Times*.

Fritz, M. S., & MacKinnon, D. P. (2008). A graphical representation of the mediated effect. *Behavior research methods*, *40*(1), 55-60.

Frithsen, A., & Miller, M. B. (2014). The posterior parietal cortex: Comparing remember/know and source memory tests of recollection and familiarity. *Neuropsychologia*, *61*, 31-44.

Geleris, J., Sun, Y., Platt, J., Zucker, J., Baldwin, M., Hripcsak, G., ... & Schluger, N. W. (2020). Observational study of hydroxychloroquine in hospitalized patients with Covid-19. *New England Journal of Medicine*, *382*(25), 2411-2418.

Gerrie, M. P., Belcher, L. E., & Garry, M. (2006). 'Mind the gap': False memories for missing aspects of an event. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, *20*(5), 689-696.

Georgiou, N., Delfabbro, P., & Balzan, R. (2020). COVID-19-related conspiracy beliefs and their relationship with perceived stress and pre-existing conspiracy beliefs. *Personality and individual differences*, *166*, 110201.

Gilbert, D. T., Krull, D. S., & Malone, P. S. (1990). Unbelieving the unbelievable: Some problems in the rejection of false information. *Journal of personality and social psychology*, *59*(4), 601.

Gilbert, D. T., Tafarodi, R. W., & Malone, P. S. (1993). You can't not believe everything you read. *Journal of personality and social psychology*, *65*(2), 221.

Giorgio, A., Santelli, L., Tomassini, V., Bosnell, R., Smith, S., De Stefano, N., & Johansen-Berg, H. (2010). Age-related changes in grey and white matter structure throughout adulthood. *Neuroimage*, *51*(3), 943-951.

Glisky, E. L., Rubin, S. R., & Davidson, P. S. (2001). Source memory in older adults: An encoding or retrieval problem?. *Journal of experimental psychology: learning, memory, and cognition*, *27*(5), 1131.

Glöckner, A., & Bröder, A. (2011). Processing of recognition information and additional cues: A model-based analysis of choice, confidence, and response time. *Judgment and Decision Making*, *6*(1), 23.

Glorfeld, L. W. (1995). An improvement on Horn's parallel analysis methodology for selecting the correct number of factors to retain. *Educational and psychological measurement*, *55*(3), 377-393.

Goertzel, T. (1994). Belief in conspiracy theories. *Political psychology*, 731-742.

Goh, J. O. (2011). Functional dedifferentiation and altered connectivity in older adults: Neural accounts of cognitive aging. *Aging and Disease*, *2*(1), 30.

Goldhaber, M. H. (1997). The attention economy and the net. *First Monday*, *2*(4).

https://doi.org/10.5210/fm.v2i4.519

Goldstein, D. G., & Gigerenzer, G. (2002). Models of ecological rationality: the recognition heuristic. *Psychological review*, *109*(1), 75.Goolkasian, P., & Foos, P. W. (2005). Bimodal format effects in working memory. *The American journal of psychology*, *118*(1), 61-78.

Gordon, A., Brooks, J. C., Quadflieg, S., Ecker, U. K., & Lewandowsky, S. (2017). Exploring the neural substrates of misinformation processing. *Neuropsychologia*, *106*, 216-224.

Gorsuch, R. L. (1988). Exploratory factor analysis. In *Handbook of multivariate experimental psychology* (pp. 231-258). Springer, Boston, MA.

Greiffenstein, M. F., Baker, W. J., & Gola, T. (1994). Validation of malingered amnesia measures with a large clinical sample. *Psychological Assessment*, *6*(3), 218.

Grinberg, N., Joseph, K., Friedland, L., Swire-Thompson, B., & Lazer, D. (2019). Fake news on Twitter during the 2016 US presidential election. *Science*, *363*(6425), 374-378.

Groeger, J. A., Field, D., & Hammond, S. M. (1999). Measuring memory span. *International Journal of Psychology*, *34*(5-6), 359-363.

Guess, A., Nagler, J., & Tucker, J. (2019). Less than you think: Prevalence and predictors of fake news dissemination on Facebook. *Science advances*, *5*(1), eaau4586.

Guess, A., Nyhan, B., & Reifler, J. (2018). Selective exposure to misinformation: Evidence from the consumption of fake news during the 2016 US presidential campaign. *European Research Council*, *9*(3), 4.

Gunning-Dixon, F. M., & Raz, N. (2003). Neuroanatomical correlates of selected executive functions in middle-aged and older adults: a prospective MRI study. *Neuropsychologia*, *41*(14), 1929-1941.

Hampton, K. N., Goulet, L. S., Rainie, L., & Purcell, K. (2011). *Social networking sites and our lives* (Vol. 1, pp. 1-85). Washington, DC: Pew Internet & American Life Project.

Hartman, R. O., Dieckmann, N. F., Sprenger, A. M., Stastny, B. J., & DeMarree, K. G. (2017). Modeling attitudes toward science: development and validation of the credibility of science scale. *Basic and Applied Social Psychology*, *39*(6), 358-371.

Haug, H., & Eggers, R. (1991). Morphometry of the human cortex cerebri and corpus striatum during aging. *Neurobiology of aging*, *12*(4), 336-338.

Hayes, A. F., Montoya, A. K., & Rockwood, N. J. (2017). The analysis of mechanisms and their contingencies: PROCESS versus structural equation modeling. *Australasian Marketing Journal (AMJ)*, *25*(1), 76-81.

Head, D., Kennedy, K. M., Rodrigue, K. M., & Raz, N. (2009). Age differences in perseveration: cognitive and neuroanatomical mediators of performance on the Wisconsin Card Sorting Test. *Neuropsychologia*, *47*(4), 1200-1203.

Henkel, L. A., & Mattson, M. E. (2011). Reading is believing: The truth effect and source credibility. *Consciousness and cognition*, *20*(4), 1705-1721.

Herron, J. E., & Rugg, M. D. (2003). Retrieval orientation and the control of recollection. *Journal of Cognitive Neuroscience*, *15*(6), 843-854.

Hester, R. L., Kinsella, G. J., Ong, B., & McGregor, J. (2005). Demographic influences on baseline and derived scores from the trail making test in healthy older Australian adults. *The Clinical Neuropsychologist*, *19*(1), 45-54.

Ho, A. K., Sahakian, B. J., Robbins, T. W., Barker, R. A., Rosser, A. E., & Hodges, J. R. (2002). Verbal fluency in Huntington's disease: A longitudinal analysis of phonemic and semantic clustering and switching. *Neuropsychologia, 40*, 1277–1284

Hochschild, J. L., & Einstein, K. L. (2016). *Do facts matter? : information and misinformation in American politics*. University of Oklahoma Press.

Horn, J. L., & Cattell, R. B. (1966). Refinement and test of the theory of fluid and crystallized general intelligences. *Journal of educational psychology*, *57*(5), 253–270. https://doi.org/10.1037/h0023816

Imhoff, R., & Lamberty, P. (2020). A bioweapon or a hoax? The link between distinct conspiracy beliefs about the Coronavirus disease (COVID-19) outbreak and pandemic behavior. *Social Psychological and Personality Science*, *11*(8), 1110-1118.

Iyengar, S., & Massey, D. S. (2019). Scientific communication in a post-truth society. *Proceedings of the National Academy of Sciences*, *116*(16), 7656-7661.

Jacoby, L. L. (1999). Ironic effects of repetition: measuring age-related differences in memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *25*(1), 3.

Jia, L., Shan, J., Xu, G., & Jin, H. (2020). Influence of individual differences in working memory on the continued influence effect of misinformation. *Journal of Cognitive Psychology*, *32*(5-6), 494-505.

Johnson, H. M., & Seifert, C. M. (1994). Sources of the continued influence effect: When misinformation in memory affects later inferences. *Journal of experimental psychology: Learning, memory, and cognition*, *20*(6), 1420.

Johnson, H. M., & Seifert, C. M. (1998). Updating accounts following a correction of misinformation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *24*(6), 1483.

Johnson, H. M., & Seifert, C. M. (1999). Modifying mental representations: Comprehending corrections. *The construction of mental representations during reading*, 303-318.

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological bulletin*, *114*(1), 3.

Jolley, D., & Paterson, J. L. (2020). Pylons ablaze: Examining the role of 5G COVID-19 conspiracy beliefs and support for violence. *British journal of social psychology*, *59*(3), 628-640.

Johnson, N. F., Velásquez, N., Restrepo, N. J., Leahy, R., Gabriel, N., El Oud, S., ... & Lupu, Y. (2020). The online competition between pro-and anti-vaccination views. *Nature*, *582*(7811), 230-233.

Judd, C. M., & Kenny, D. A. (1981). Process analysis: Estimating mediation in treatment evaluations. *Evaluation review*, *5*(5), 602-619.

Kahan, D. M., Peters, E., Wittlin, M., Slovic, P., Ouellette, L. L., Braman, D., & Mandel, G. (2012). The polarizing impact of science literacy and numeracy on perceived climate change risks. *Nature climate change*, *2*(10), 732-735.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and psychological measurement*, *20*(1), 141-151.

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, *39*(1), 31-36.

Kane, M. J., Bleckley, M. K., Conway, A. R., & Engle, R. W. (2001). A controlled-attention view of working-memory capacity. *Journal of experimental psychology: General*, *130*(2), 169.

Kane, M. J., Hasher, L., Stoltzfus, E. R., Zacks, R. T., & Connelly, S. L. (1994). Inhibitory attentional mechanisms and aging. *Psychology and aging*, *9*(1), 103.Kenny, D., Kashy, D., & Bolger, N. (1998). Data analysis. In *The handbook of social psychology: Vols. 1 and 2,* (pp. 233-265). New York: McGraw-Hill.

Keyes, R. (2004). *The post-truth era: dishonesty and deception in contemporary life*. St. Martin's Press.

Kim, M., & Cao, X. (2016). The impact of exposure to media messages promoting government conspiracy theories on distrust in the government: Evidence from a two-stage randomized experiment. *International Journal of Communication*, *10*, 20.

Klein, M., Ponds, R. W. H. M., Houx, P. J., and Jo lles, J. (1997). Eff ect of test duration on age-related diff erences in Stroop interference. Journal of Clinical and Experimental Neuropsychology 19: 77–82.

Kramer, A. F., Humphrey, D. G., Larish, J. F., & Logan, G. D. (1994). Aging and inhibition: beyond a unitary view of inhibitory processing in attention. *Psychology and aging*, *9*(4), 491.

Krause, N. M., Freiling, I., Beets, B., & Brossard, D. (2020). Fact-checking as risk communication: the multi-layered risk of misinformation in times of COVID-19. *Journal of Risk Research*, *23*(7-8), 1052-1059.

Kümpel, A. S., Karnowski, V., & Keyling, T. (2015). News Sharing in Social Media: A Review of Current Research on News Sharing Users, Content, and Networks. *Social Media + Society*, *1*(2), 205630511561014. https://doi.org/10.1177/2056305115610141

Kunda, Z. (1990). The case for motivated reasoning. *Psychological bulletin*, *108*(3), 480.

Kurby, C. A., & Zacks, J. M. (2012). Starting from scratch and building brick by brick in comprehension. *Memory & cognition*, *40*(5), 812-826.

Lacritz, L. H., Cullum, C. M., Weiner, M. F., & Rosenberg, R. N. (2001). Comparison of the Hopkins Verbal Learning Test-Revised to the California Verbal Learning Test in Alzheimer's disease. *Applied Neuropsychology*, *8*(3), 180-184.

Leiserowitz, A., Maibach, E., Roser-Renouf, C., & Hmielowski, J. D. (2011). Politics & global warming: democrats, republicans, independents, and the Tea party. *Yale University and George Mason University. New Haven, CT: Yale Project on Climate Change Communication*.

Lewandowsky, S., Ecker, U. K., Seifert, C. M., Schwarz, N., & Cook, J. (2012). Misinformation and its correction: Continued influence and successful debiasing. *Psychological science in the public interest*, *13*(3), 106-131.

Lewandowsky, S., Gignac, G. E., & Oberauer, K. (2013). The role of conspiracist ideation and worldviews in predicting rejection of science. *PloS one*, *8*(10), e75637.

Lewandowsky, S., & Oberauer, K. (2016). Motivated rejection of science. *Current Directions in Psychological Science*, *25*(4), 217-222.

Lewandowsky, S., Stritzke, W. G., Oberauer, K., & Morales, M. (2009). Misinformation and the 'War on Terror': When memory turns fiction into fact. *Terrorism and torture: An interdisciplinary perspective*, 179-203.Lezak, M. D. (1995). Executive functions and motor performance. *In neuropsychological assessment*, 650-685.

Li, H. O. Y., Bailey, A., Huynh, D., & Chan, J. (2020). YouTube as a source of information on COVID-19: a pandemic of misinformation?. *BMJ global health*, *5*(5), e002604.

Lobato, E., Mendoza, J., Sims, V., & Chin, M. (2014). Examining the relationship between conspiracy theories, paranormal beliefs, and pseudoscience acceptance among a university population. *Applied Cognitive Psychology*, *28*(5), 617-625.

Lobato, E. J., Powell, M., Padilla, L. M., & Holbrook, C. (2020). Factors Predicting Willingness to Share COVID-19 Misinformation. *Frontiers in psychology*, *11*.

Lobato, E. J., & Zimmerman, C. (2019). Examining how people reason about controversial scientific topics. *Thinking & Reasoning*, *25*(2), 231-255.

Marie, R. M., Barre, L., Dupuy, B., Viader, F., Defer, G., & Baron, J. C. (1999). Relationships between striatal dopamine denervation and frontal executive tests in Parkinson's disease. *Neuroscience Letters*, *260*(2), 77-80.

Marwick, A. E., & Boyd, D. (2011). I tweet honestly, I tweet passionately: Twitter users, context collapse, and the imagined audience. *New Media and Society*, *13*(1), 114–133. https://doi.org/10.1177/1461444810365313

Matchanova, A., Babicz, M., Medina, L. D., Fazeli, P. L., Vance, D. E., & Woods, S. P. (2020). Latent structure of health literacy and its association with health-related management and decision-making in HIV. *Psychology & health*, 1-18.

Matchanova, A., Babicz, M. A., Medina, L. D., Rahman, S., Johnson, B., Thompson, J. L., ... & Woods, S. P. (In Press). Latent Structure of a Brief Clinical Battery of Neuropsychological Tests Administered In-Home Via Telephone. *Archives of Clinical Neuropsychology*.

Mayo, R., Schul, Y., & Burnstein, E. (2004). "I am not guilty" vs "I am innocent": Successful negation may depend on the schema used for its encoding. *Journal of Experimental Social Psychology*, *40*(4), 433-449.

McComb, E., Brewster, P., Chou, P. H., Crossley, M., Simard, M., & Tuokko, H. (2010). Telephone administration of the mental alternation test: Sensitivity to cognitive decline and practice effects across midlife and late life. *Neuroepidemiology, 35*(4), 298–302.

McDowd, J. M., & Oseas-Kreger, D. M. (1991). Aging, inhibitory processes, and negative priming. *Journal of Gerontology*, *46*(6), P340-P345.

McGuire, W. J. (1972). Attitude change: The information processing paradigm. *Experimental social psychology*, 108-141.

McIntyre, L. (2015). *Respecting truth: Willful ignorance in the internet age*. *Respecting Truth: Willful Ignorance in the Internet Age*. Taylor and Francis Inc. https://doi.org/10.4324/9781315713168

Mesulam, M. M. (1981). A cortical network for directed attention and unilateral neglect. *Annals of Neurology: Official Journal of the American Neurological Association and the Child Neurology Society*, *10*(4), 309-325.

Meyerowitz, E. A., Vannier, A. G., Friesen, M. G., Schoenfeld, S., Gelfand, J. A., Callahan, M. V., ... & Poznansky, M. C. (2020). Rethinking the role of hydroxychloroquine in the treatment of COVID-19. *The FASEB Journal*, *34*(5), 6027-6037.

Miller, J. M. (2020). Do COVID-19 conspiracy theory beliefs form a monological belief system?. *Canadian Journal of Political Science/Revue canadienne de science politique*, *53*(2), 319-326.

Mirsky, A. F. (1996). Disorders of attention: A neuropsychological perspective.

Mirsky, A. F., Anthony, B. J., Duncan, C. C., Ahearn, M. B., & Kellam, S. G. (1991). Analysis of the elements of attention: A neuropsychological approach. *Neuropsychology review*, *2*(2), 109-145.

Mitchell, A., & Oliphant, J. B. (2020). Americans immersed in COVID-19 news; Most think media are doing fairly well covering it. *Pew Research Center. Available online at: https://www. journalism. org/2020/03/18/americansimmersed-in-covid-19-news-most-think-media-are-doing-fairly-wellcovering-it/(accessed March 18, 2020)*.

Mitsis, E. M., Jacobs, D., Luo, X., Andrews, H., Andrews, K., & Sano, M. (2010). Evaluating cognition in an elderly cohort via telephone assessment. *International Journal of Geriatric Psychiatry: A Journal of the Psychiatry of Late Life and Allied Sciences*, *25*(5), 531-539.

Moscovitch, M., & Melo, B. (1997). Strategic retrieval and the frontal lobes: Evidence from confabulation and amnesia. *Neuropsychologia*, *35*(7), 1017-1034.

Mosleh, M., Pennycook, G., & Rand, D. G. (2020). Self-reported willingness to share political news articles in online surveys correlates with actual sharing on Twitter. *Plos one*, *15*(2), e0228882.

Naveh-Benjamin, M. (2000). Adult age differences in memory performance: tests of an associative deficit hypothesis. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*(5), 1170.

Newell, B. R., & Fernandez, D. (2006). On the binary quality of recognition and the inconsequentiality of further knowledge: Two critical tests of the recognition heuristic. *Journal of Behavioral Decision Making*, *19*(4), 333-346.

Norman, C. D., & Skinner, H. A. (2006). eHEALS: the eHealth literacy scale. *Journal of Medical Internet Research*, *8*(4), e27.

Nyhan, B., & Reifler, J. (2015). Does correcting myths about the flu vaccine work? An experimental evaluation of the effects of corrective information. *Vaccine*, *33*(3), 459-464.

Oberauer, K. (2009). Design for a working memory. *Psychology of learning and motivation*, *51*, 45-100.

O'connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behavior research methods, instruments, & computers*, *32*(3), 396-402.

Ofcom (2020). *Half of UK Adults Exposed to False Claims about Coronavirus.* Available online at: https://www.ofcom.org.uk/about-ofcom/latest/features-and-news/half-of-uk-adults-exposed-to-false-claims-about-coronavirus (accessed March 18, 2021).

Otero, V. (2018). Media bias chart. *Availabe online at: http://www. allgeneralizationsarefalse. com/(Accessed July 26, 2018)*.

Pariser, E. (2011). *The filter bubble: How the new personalized web is changing what we read and how we think*. Penguin.

Pennycook, G., Cannon, T. D., & Rand, D. G. (2018). Prior exposure increases perceived accuracy of fake news. *Journal of experimental psychology: general*, *147*(12), 1865.

Pennycook, G., Cheyne, J. A., Koehler, D. J., & Fugelsang, J. A. (2016). Is the cognitive reflection test a measure of both reflection and intuition?. *Behavior Research Methods*, *48*(1), 341-348.

Pennycook, G., Epstein, Z., Mosleh, M., Arechar, A. A., Eckles, D., & Rand, D. G. (2021). Shifting attention to accuracy can reduce misinformation online. *Nature*, 1-6.

Pennycook, G., McPhetres, J., Zhang, Y., Lu, J. G., & Rand, D. G. (2020). Fighting COVID-19 misinformation on social media: Experimental evidence for a scalable accuracy-nudge intervention. *Psychological science*, *31*(7), 770-780.

Perrin, A. (2015). Social media usage. *Pew research center*, *125*, 52-68.

Peters, A. (2002). The effects of normal aging on myelin and nerve fibers: a review. *Journal of Neurocytology*, *31*(8-9), 581-593.

Petersen, M. B., Osmundsen, M., & Arceneaux, K. (2018). A "Need for Chaos" and the Sharing of Hostile Political Rumors in Advanced Democracies. *PsyArXiv Working Paper*. https://doi.org/10.31234/OSF.IO/6M4TS

Pew Research Center: Social media use in 2018. 2018.

Piatt, A. L., Fields, J. A., Paolo, A. M., & Tröster, A. I. (1999). Action (verb naming) fluency as an executive function measure: convergent and divergent evidence of validity. *Neuropsychologia*, *37*(13), 1499-1503

Plohl, N., & Musil, B. (2021). Modeling compliance with COVID-19 prevention guidelines: The critical role of trust in science. *Psychology, Health & Medicine*, *26*(1), 1-12.

Plude, D. J., & Hoyer, W. J. (1986). Age and the selectivity of visual information processing. *Psychology and Aging*, *1*(1), 4.

Plude, D. J., & Doussard-Roosevelt, J. A. (1989). Aging, selective attention, and feature integration. *Psychology and aging*, *4*(1), 98.

Posner, M. I., & Petersen, S. E. (1990). The attention system of the human brain. *Annual review of neuroscience*, *13*(1), 25-42.Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior research methods, instruments, & computers*, *36*(4), 717-731.

Prull, M. W., Dawes, L. L. C., Martin III, A. M., Rosenberg, H. F., & Light, L. L. (2006). Recollection and familiarity in recognition memory: adult age differences and neuropsychological test correlates. *Psychology and aging*, *21*(1), 107.

Rabbitt, P. (1965). An age-decrement in the ability to ignore irrelevant information.

Rapp, S. R., Legault, C., Espeland, M. A., Resnick, S. M., Hogan, P. E., Coker, L. H., ... & CAT Study Group. (2012). Validation of a cognitive assessment battery administered over the telephone. *Journal of the American Geriatrics Society*, *60*(9), 1616-1623.

Raz, N. (2000). Aging of the brain and its impact on cognitive performance: Integration of structural and functional findings.

Raz, N., Briggs, S. D., Marks, W., & Acker, J. D. (1999). Age-related deficits in generation and manipulation of mental images: II. The role of dorsolateral prefrontal cortex. *Psychology and aging*, *14*(3), 436.

Raz, N., Ghisletta, P., Rodrigue, K. M., Kennedy, K. M., & Lindenberger, U. (2010). Trajectories of brain aging in middle-aged and older adults: regional and individual differences. *Neuroimage*, *51*(2), 501-511.

Raz, N., Rodrigue, K. M., Head, D., Kennedy, K. M., & Acker, J. D. (2004). Differential aging of the medial temporal lobe a study of a five-year change. *Neurology*, *62*(3), 433-438.

Raz, N., Rodrigue, K. M., Kennedy, K. M., & Acker, J. D. (2007). Vascular health and longitudinal changes in brain and cognition in middle-aged and older adults. *Neuropsychology*, *21*(2), 149.

Rich, P. R., & Zaragoza, M. S. (2016). The continued influence of implied and explicitly stated misinformation in news reports. *Journal of experimental psychology: learning, memory, and cognition*, *42*(1), 62.

Ricker, J. H., & Axelrod, B. N. (1994). Analysis of an oral paradigm for the Trail Making Test. *Assessment*, *1*(1), 47-51.

Roozenbeek, J., Schneider, C. R., Dryhurst, S., Kerr, J., Freeman, A. L., Recchia, G., ... & Van Der Linden, S. (2020). Susceptibility to misinformation about COVID-19 around the world. *Royal Society open science*, *7*(10), 201199.

Roozenbeek, J., & van der Linden, S. (2019). Fake news game confers psychological resistance against online misinformation. *Palgrave Communications*, *5*(1), 1-10.

Rothgerber, H., Wilson, T., Whaley, D., Rosenfeld, D. L., Humphrey, M., Moore, A., & Bihl, A. (2020). Politicizing the COVID-19 pandemic: ideological differences in adherence to social distancing.

Rubia, K., Overmeyer, S., Taylor, E., Brammer, M., Williams, S. C., Simmons, A., & Bullmore, E. T. (1999). Hypofrontality in attention deficit hyperactivity disorder during higher-order motor control: a study with functional MRI. *American Journal of Psychiatry*, *156*(6), 891-896.

Rugg, M. D., & Curran, T. (2007). Event-related potentials and recognition memory. *Trends in Cognitive Sciences, 11,* 251–257.

Sala-Llonch, R., Bartrés-Faz, D., & Junqué, C. (2015). Reorganization of brain networks in aging: a review of functional connectivity studies. *Frontiers in psychology*, *6*, 663.

Salat, D. H., Kaye, J. A., & Janowsky, J. S. (2002). Greater orbital prefrontal volume selectively predicts worse working memory performance in older adults. *Cerebral Cortex*, *12*(5), 494-505.

Salthouse, T. A., & Saklofske, D. H. (2010). Do the WAIS-IV tests measure the same aspects of cognitive functioning in adults under and over 65?. In *WAIS-IV clinical use and interpretation* (pp. 217-235). Academic Press.

Sanders, L. (2020). The Difference between What Republicans and Democrats Believe to be True about COVID-19. *YouGov. Available online at: https://today. yougov. com/topics/politics/articles-reports/2020/05/26/republicans-democrats-misinformation (accessed May 26, 2020)*.

Sangha, O., Stucki, G., Liang, M. H., Fossel, A. H., & Katz, J. N. (2003). The Self-Administered Comorbidity Questionnaire: a new method to assess comorbidity for clinical and health services research. *Arthritis Care & Research: Official Journal of the American College of Rheumatology*, *49*(2), 156-163.

Scahill, R. I., Frost, C., Jenkins, R., Whitwell, J. L., Rossor, M. N., & Fox, N. C. (2003). A longitudinal study of brain volume changes in normal aging using serial registered magnetic resonance imaging. *Archives of neurology*, *60*(7), 989-994.

Schaeffer, K. A look at the Americans who believe there is some truth to the conspiracy theory that COVID-19 was planned. Pew Research Center; July 24, 2020.

Schaie, K. W. (1996). Intellectual development in adulthood. In J. E. Birren, K. W. Schaie, R. P. Abeles, M. Gatz, & T. A. Salthouse (Eds.), *Handbook of the psychology of aging* (pp. 266–286). Academic Press.

Schroeder, R. W., Twumasi-Ankrah, P., Baade, L. E., & Marshall, P. S. (2012). Reliable digit span: A systematic review and cross-validation study. *Assessment*, *19*(1), 21-30.

Schwarz, N., Sanna, L. J., Skurnik, I., & Yoon, C. (2007). Metacognitive experiences and the intricacies of setting people straight: Implications for debiasing and public information campaigns. *Advances in experimental social psychology*, *39*, 127-161.

Scott, M. (2020). Facebook's private groups are abuzz with coronavirus fake news. *Politico. Available online at: https://www. politico. eu/article/facebookmisinformation-fake-news-coronavirus-covid19/(accessed March 30, 2020)*.

Sheikh, J. I., & Yesavage, J. A. (1986). Geriatric Depression Scale (GDS): recent evidence and development of a shorter version. *Clinical Gerontologist: The Journal of Aging and Mental Health*.

Shi, Y., Luo, Y. L., Yang, Z., Liu, Y., & Cai, H. (2014, June). The development and validation of the social network sites (SNSs) usage questionnaire. In *International conference on social computing and social media* (pp. 113-124). Springer, Cham.

Shin, J., Jian, L., Driscoll, K., & Bar, F. (2017). Political rumoring on Twitter during the 2012 US presidential election: Rumor diffusion and correction. *new media & society*, *19*(8), 1214-1235.

Shimamura, A. P. (1995). Memory and frontal lobe function.

Silverman, C. (2016). This analysis shows how viral fake election news stories outperformed real news on Facebook. *BuzzFeed news*, *16*.Sliwinski, M., & Buschke, H. (1999). Cross-sectional and longitudinal relationships among age, cognition, and processing speed. *Psychology and aging*, *14*(1), 18.

Skurnik, I., Yoon, C., Park, D. C., & Schwarz, N. (2005). How warnings about false claims become recommendations. *Journal of Consumer Research*, *31*(4), 713-724.

Smith, A., & Anderson, M. (2018). Social media use in 2018. Pew Research Center [Internet]. *Science & Tech. URl: http://www. pewinternet. org/2018/03/01/social-media-usein-2018/(visited on 04/16/2018)*.

Snedecor, G. W., & Cochran, W. G. (1989). Statistical methods, 8thEdn. *Ames: Iowa State Univ. Press Iowa*, *54*, 71-82.

Song, H., & Schwarz, N. (2008). If it's hard to read, it's hard to do: Processing fluency affects effort prediction and motivation. *Psychological science*, *19*(10), 986-988.

Soto, C. J., & John, O. P. (2017). Short and extra-short forms of the Big Five Inventory–2: The BFI-2-S and BFI-2-XS. *Journal of Research in Personality*, *68*, 69-81.

Sowell, E. R., Thompson, P. M., Welcome, S. E., Henkenius, A. L., Toga, A. W., & Peterson, B. S. (2003). Cortical abnormalities in children and adolescents with attention-deficit hyperactivity disorder. *The Lancet*, *362*(9397), 1699-1707.

Spring, M. (2020). *Coronavirus: The Human Cost of Virus Misinformation. BBC News.* Available online at: https://www.bbc.com/news/stories-52731624 (accessed May 27, 2020).

Stagnaro, M., Pennycook, G., & Rand, D. G. (2018). Performance on the Cognitive Reflection Test is stable across time. *Stagnaro, MN, Pennycook, G., & Rand, DG (2018) Performance on the Cognitive Reflection Test is stable across time. Judgment and Decision Making*, *13*, 260-267.

Stewart, A., Mosleh, M., Diakonova, M., Arechar, A. A., Rand, D. G., & Plotkin, J. (2019). Information gerrymandering and undemocratic decisions. *Nature*, *573*(7772), 117–121.

Stroebe, W., vanDellen, M. R., Abakoumkin, G., Lemay Jr, E. P., Schiavone, W. M., Agostini, M., ... & Leander, N. P. (2021). Politicization of COVID-19 health-protective behaviors in the United States: Longitudinal and cross-national evidence. *PloS one*, *16*(10), e0256740.

Stuss, D. T. (2006). Frontal lobes and attention: processes and networks, fractionation and integration. *Journal of the International Neuropsychological Society: JINS*, *12*(2), 261.

Stuss, D. T., Alexander, M. P., Floden, D., Binns, M. A., Levine, B., McIntosh, A. R., ... & Hevenor, S. I. (2002). Evidence from Focal Lesions in Humans. *Principles of frontal lobe function*, 392-407.

Stuss, D. T., Binns, M. A., Carruth, F. G., Levine, B., Brandys, C. E., Moulton, R. J., ... & Schwartz, M. L. (1999). The acute period of recovery from traumatic brain injury: posttraumatic amnesia or posttraumatic confusional state?. *Journal of Neurosurgery*, *90*(4), 635-643.

Stuss, D. T., Levine, B., Alexander, M. P., Hong, J., Palumbo, C., Hamer, L., ... & Izukawa, D. (2000). Wisconsin Card Sorting Test performance in patients with focal frontal and posterior brain damage: effects of lesion location and test structure on separable cognitive processes. *Neuropsychologia*, *38*(4), 388-402.

Stuss, D. T., Shallice, T., Alexander, M. P., & Picton, T. W. (1995). A Multidisciplinary Approach to Anterior Attentional Functions a. *Annals of the New York Academy of Sciences*, *769*(1), 191-212.

Swami, V., Coles, R., Stieger, S., Pietschnig, J., Furnham, A., Rehim, S., & Voracek, M. (2011). Conspiracist ideation in Britain and Austria: Evidence of a monological belief system and associations between individual psychological differences and real-world and fictitious conspiracy theories. *British Journal of Psychology*, *102*(3), 443-463.

Swire, B., Ecker, U. K., & Lewandowsky, S. (2017). The role of familiarity in correcting inaccurate information. *Journal of experimental psychology: learning, memory, and cognition*, *43*(12), 1948.

Taichman, D. B., Christie, J., Biester, R., Mortensen, J., White, J., Kaplan, S., ... & Hopkins, R. O. (2005). Validation of a brief telephone battery for neurocognitive assessment of patients with pulmonary arterial hypertension. *Respiratory Research*, *6*(1), 1-7.

Thomson, K. S., & Oppenheimer, D. M. (2016). Investigating an alternate form of the cognitive reflection test. *Judgment and Decision making*, *11*(1), 99.

Tierney, S. M., Kordovski, V. M., Rahman, S., Medina, L. D., Damian, R. I., Collins, R. L., & Woods, S. P. (In Press). Neuropsychological aspects of internet-based transit navigation skills in older adults. *Aging, Neuropsychology, and Cognition*, 1-17.

Tipper, S. P. (1991). Less attentional selectivity as a result of declining inhibition in older adults. *Bulletin of the Psychonomic Society*, *29*(1), 45-47.

Toplak, M. E., West, R. F., & Stanovich, K. E. (2011). The Cognitive Reflection Test as a predictor of performance on heuristics-and-biases tasks. *Memory & cognition*, *39*(7), 1275-1289.

Trevors, G. J., Muis, K. R., Pekrun, R., Sinatra, G. M., & Winne, P. H. (2016). Identity and epistemic emotions during knowledge revision: A potential account for the backfire effect. *Discourse Processes*, *53*(5-6), 339-370.

Tuokko, H., Morris, C., & Ebert, P. (2005). Mild cognitive impairment and everyday functioning in older adults. *Neurocase*, *11*(1), 40-47.Tyson, A., & Funk, C. (2022). Increasing Public Criticism, Confusion Over COVID-19 Response in US.

Unverzagt, F. W., Monahan, P. O., Moser, L. R., Zhao, Q., Carpenter, J. S., Sledge Jr, G. W., & Champion, V. L. (2007). The Indiana University telephone-based assessment of neuropsychological status: a new method for large scale neuropsychological assessment. *Journal of the International Neuropsychological Society: JINS*, *13*(5), 799- 806.

Uscinski, J. E., Enders, A. M., Klofstad, C., Seelig, M., Funchion, J., Everett, C., ... & Murthi, M. (2020). Why do people believe COVID-19 conspiracy theories?. *Harvard Kennedy School Misinformation Review*, *1*(3).

Van Bavel, J. J., Baicker, K., Boggio, P. S., Capraro, V., Cichocka, A., Cikara, M., ... & Willer, R. (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nature human behaviour*, *4*(5), 460-471.

Van den Broeck, J., Cunningham, S. A., Eeckels, R., & Herbst, K. (2005). Data cleaning: Detecting, diagnosing, and editing data abnormalities. *PLoS Med*, *2*(10), e267.

Van der Linden, S. (2015). The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model. *Journal of Environmental Psychology*, *41*, 112-124.

van der Linden, S., Roozenbeek, J., & Compton, J. (2020). Inoculating Against Fake News About COVID-19. *Frontiers in Psychology*, *11*, 2928.

van Oostendorp, H. (1996). Studying and annotating electronic text. *Hypertext and cognition*, 137-147.

van Oostendorp, H., & Bonebakker, C. (1999). Difficulties in updating mental representations during reading new reports. *The construction of mental representations during reading*.

van Oostendorp, H. (2014). 11 The Ambivalent Effect of Focus on Updating Mental Representations. *Processing inaccurate information: Theoretical and applied perspectives from cognitive science and the educational sciences*, 223.

van Prooijen, J. W. (2017). Why education predicts decreased belief in conspiracy theories. *Applied cognitive psychology*, *31*(1), 50-58.

van Prooijen, J. W., Staman, J., & Krouwel, A. P. (2018). Increased conspiracy beliefs among ethnic and Muslim minorities. *Applied cognitive psychology*, *32*(5), 661-667.

Verkoeijen, P. P., Rikers, R. M., & Schmidt, H. G. (2004). Detrimental influence of contextual change on spacing effects in free recall. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *30*(4), 796.

Volkow, N. D., Gur, R. C., Wang, G. J., Fowler, J. S., Moberg, P. J., Ding, Y. S., ... & Logan, J. (1998). Association between decline in brain dopamine activity with age and cognitive and motor impairment in healthy individuals. *American Journal of psychiatry*, *155*(3), 344-349.

Vosoughi, S., Roy, D., & Aral, S. (2018). The spread of true and false news online. *Science*, *359*(6380), 1146-1151.

Walter, N., & Tukachinsky, R. (2020). A meta-analytic examination of the continued influence of misinformation in the face of correction: How powerful is it, why does it happen, and how to stop it?. *Communication Research*, *47*(2), 155-177.

Wecker, N. S., Kramer, J. H., Wisniewski, A., Delis, D. C., & Kaplan, E. (2000). Age effects on executive ability. *Neuropsychology*, *14*(3), 409.Wechsler D. (1997). *Wechsler Memory Scale: Administration and Scoring Manual* 3rd Edn. San Antonio, TX: The Psychological Corporation.

Wechsler, D. (2008). Wechsler adult intelligence scale–Fourth Edition (WAIS–IV). *San Antonio, TX: NCS Pearson*, *22*(498), 1.

West, R. L. (1996). An application of prefrontal cortex function theory to cognitive aging. *Psychological bulletin*, *120*(2), 272.

Wilkes, A. L., & Reynolds, D. J. (1999). On certain limitations accompanying readers' interpretations of corrections in episodic text. *The Quarterly Journal of Experimental Psychology Section A*, *52*(1), 165-183.

Wilson, E. A., & Park, D. (2008). Prospective Memory: Cognitive, Neuroscience, Developmental, and Applied Perspectives.

Wink, P., & Helson, R. (1997). Practical and transcendent wisdom: Their nature and some longitudinal findings. *Journal of Adult Development*, *4*(1), 1-15.

Winker, M. A., Flanagin, A., Chi-Lum, B., White, J., Andrews, K., Kennett, R. L., ... & Musacchio, R. A. (2000). Guidelines for medical and health information sites on the internet: principles governing AMA web sites. *JAMA*, *283*(12), 1600-1606.

Winkielman, P., Huber, D. E., Kavanagh, L., & Schwarz, N. (2012). Fluency of consistency: When thoughts fit nicely and flow smoothly. *Cognitive consistency: A fundamental principle in social cognition*, 89-111.

Wood, M. J., Douglas, K. M., & Sutton, R. M. (2012). Dead and alive: Beliefs in contradictory conspiracy theories. *Social psychological and personality science*, *3*(6), 767-773.

Woods, D. L., & Knight, R. T. (1986). Electrophysiologic evidence of increased distractibility after dorsolateral prefrontal lesions. *Neurology*, *36*(2), 212-212.

Woods, S. P., Scott, J. C., Sires, D. A., Grant, I., Heaton, R. K., Troster, A. I., & HIV Neurobehavioral Research Center (HNRC) Group. (2005). Action (verb) fluency: Test- retest reliability, normative standards, and construct validity. *Journal of the International Neuropsychological Society: JINS*, *11*(4), 408.

Woods, S. P., Carey, C. L., Tröster, A. I., Grant, I., & HIV Neurobehavioral Research Center (HNRC) Group. (2005). Action (verb) generation in HIV-1 infection. *Neuropsychologia, 43*(8), 1144-1151.

World Health Organization. (2020). *Considerations for quarantine of individuals in the context of containment for coronavirus disease (COVID-19): interim guidance, 19 March 2020* (No. WHO/2019-nCoV/IHR_Quarantine/2020.2). World Health Organization.

Wyer, R. S. (1974). *Cognitive organization and change: An information processing approach*. Taylor & Francis.

Yonelinas, A. P. (2002). The nature of recollection and familiarity: A review of 30 years of research. *Journal of Memory and Language*, *46*, 441–517. http://doi.org/10.1006/jmla.2002.2864

Yonelinas, A. P., & Jacoby, L. L. (2012). The process-dissociation approach two decades later: Convergence, boundary conditions, and new directions. *Memory & Cognition*, *40*, 663– 680. http://doi.org/10.3758/s13421-012-0205-5

Yong, A. G., & Pearce, S. (2013). A beginner's guide to factor analysis: Focusing on exploratory factor analysis. *Tutorials in quantitative methods for psychology*, *9*(2), 79-94.

Zarocostas, J. (2020). How to fight an infodemic. *The lancet*, *395*(10225), 676.

Zaragoza, M. S., & Mitchell, K. J. (1996). Repeated exposure to suggestion and the creation of false memories. *Psychological Science*, *7*(5), 294-300.

Zhao, X., Lynch Jr, J. G., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of consumer research*, *37*(2), 197-206.

Zimmer, H. D., & Ecker, U. K. H. (2010). Remembering perceptual features unequally bound in object and episodic tokens: Neural mechanisms and their electrophysiological correlates. *Neuroscience & Biobehavioral Reviews*, *34*, 1066–1079. http://doi.org/10.1016/j.neubiorev.2010.01.014