Journal of Experimental Psychology: Applied

ISSN: 1076-898X

2022, Vol. 28, No. 3, 468–485
https://doi.org/10.1037/xap0000426

Aging in an "Infodemic": The Role of Analytical Reasoning, Affect, and News Consumption Frequency on News Veracity Detection

Didem Pehlivanoglu[1], Nichole R. Lighthall[2], Tian Lin[1], Kevin J. Chi[1], Rebecca Polk[1], Eliany Perez[1], Brian S. Cahill[1], and Natalie C. Ebner[1, 3, 4]

[1] Department of Psychology, University of Florida
[2] Department of Psychology, University of Central Florida
[3] Department of Aging and Geriatric Research, Institute on Aging, University of Florida
[4] Florida Institute for Cybersecurity Research, University of Florida

Increasing misinformation spread poses a threat to older adults but there is little research on older adults within the fake news literature. Embedded in the *Changes in Integration for Social Decisions in Aging* (*CISDA*) model, this study examined the role of (a) analytical reasoning; (b) affect; (c) news consumption frequency, and their interplay with (d) news content on news veracity detection in aging. Conducted during the early phase of the COVID-19 pandemic, the present study asked participants to view and evaluate COVID or non-COVID (i.e., everyday) news articles, followed by measures of analytical reasoning, affect, and news consumption frequency. News veracity detection was comparable between young and older adults. Additionally, fake news detection for non-COVID news was predicted by individual differences in analytic reasoning for both age groups. However, chronological age effects in fake news detection emerged within the older adult sample and interacted with the *CISDA*-derived components of analytical reasoning, affect, and news consumption frequency by news content. Collectively, these findings suggest that age-related vulnerabilities to deceptive news are only apparent in very old age. Our findings advance understanding of psychological mechanisms in news veracity detection in aging.

Public Significance Statement

The circulation of false news has dramatically increased in the last decade and was further exacerbated during the coronavirus disease (COVID-19) pandemic, causing an "infodemic" (i.e., overabundance of information involving deliberate attempts to disseminate inaccurate information). Conducted during the early COVID-19 pandemic, this study demonstrates that analytical reasoning, affect, and news consumption frequency interact with news content to determine fake news detection accuracy, particularly in very late adulthood. These findings may inform effective interventions toward reducing misinformation spread in aging.

Keywords: COVID-19, aging, fake news, decision-making, analytical reasoning

Supplemental materials: https://doi.org/10.1037/xap0000426.supp

This article was published Online First May 2, 2022.
Didem Pehlivanoglu https://orcid.org/0000-0002-9082-9976
Nichole R. Lighthall https://orcid.org/0000-0002-8131-8373
Tian Lin https://orcid.org/0000-0003-2615-3577
Kevin J. Chi https://orcid.org/0000-0001-7839-6293
Rebecca Polk https://orcid.org/0000-0002-9675-2287
Eliany Perez https://orcid.org/0000-0001-5443-7652
Brian S. Cahill https://orcid.org/0000-0003-3935-0422
Natalie C. Ebner https://orcid.org/0000-0002-2705-7520

The authors have no conflict of interest to disclose and have complied with APA ethical standards in human subjects research. Data has not been previously distributed. This article was preregistered on the Open Science Framework (OSF; https://osf.io/fp9g8). The full set of materials and data can be found in the OSF repository (https://osf.io/z24nb/).

The authors would like to thank Farha Deceus and Amber Heemskerk for their help with compiling news articles, task preparation, and data collection from the young comparison group. The authors also would like to thank Krupali Patel for help with recruitment of older adults. We appreciate the willingness of our participants to contribute to this research. This research was funded by the Department of Psychology, College of Liberal Arts and Science, University of Florida, and NIH/NIA grant 1R01AG057764.

Didem Pehlivanoglu contributed in conceptualization, data curation, formal analysis, visualization, writing of original draft, writing of review and editing. Nichole R. Lighthall contributed in conceptualization, resources, writing of review and editing, supervision. Tian Lin contributed in conceptualization, formal analysis, writing of review and editing. Kevin J. Chi contributed in conceptualization, writing of review and editing, data curation. Eliany Perez contributed in conceptualization, writing of review and editing. Rebecca Polk contributed in conceptualization, writing of review and editing. Brian S. Cahill contributed in conceptualization, methodology, writing of review and editing. Natalie C. Ebner contributed in conceptualization, methodology, resources, formal analysis, writing of review and editing, supervision, funding acquisition.

Correspondence concerning this article should be addressed to Didem Pehlivanoglu, Department of Psychology, University of Florida, 945 Center Drive, Gainesville, FL 32611, United States. Email: dpehlivanoglu@ufl.edu

The circulation of false and misleading news has grown over the last decade (Lazer et al., 2018; Wang et al., 2019) and has dramatically increased during the coronavirus disease(COVID-19) pandemic (Cuan-Baltazar et al., 2020; Huynh, 2020; Pennycook, McPhetres, et al., 2020). In response, the World Health Organization (2020) has declared COVID-19 not only a pandemic but also an "infodemic" (i.e., an overabundance of information involving deliberate attempts to disseminate inaccurate information). While fake news, defined as "fabricated information that mimics news media content in form but not in organizational process or intent" (Lazer et al., 2018, p. 1094), is not a new occurrence (e.g., tabloid magazines have been around for nearly a century; Murray, 2013), its prominence in and impact on our society have grown.

Recent statistics show that older adults are the age group that shared the most fake news during the 2016 U.S. election on platforms such as Twitter (Grinberg et al., 2019) and Facebook (Guess et al., 2019). While such findings have led to concerns about older adults' vulnerability to fake news and hypotheses about mechanisms that may drive this vulnerability (Brashier & Schacter, 2020), there is presently a dearth of empirical research examining effects of age on fake news detection (Bronstein et al., 2019; Pennycook & Rand, 2019). This gap in the literature, combined with the dramatic increase in fake news dissemination during COVID-19 (Apuke & Omar, 2021; Islam et al., 2020) as well as older adults' high risk for severe complications from COVID-19 and their elevated subjective risk perception during the pandemic (Centers for Disease Control and Prevention, 2020), has created a need to investigate susceptibility to fake news among older adults and identify factors that contribute to news veracity detection in aging.

Theoretical Background and Motivation for the Present Study

Currently, the literature entertains two primary accounts of susceptibility to fake news. The *Motivated System 2 Reasoning* account (Kahan et al., 2017) posits that individuals are more likely to engage in analytical reasoning on issues that are consistent with their preexisting beliefs. This bias magnifies belief polarization and increases the likelihood of believing fake news that aligns with one's ideology (e.g., political orientation, beliefs on climate change). Alternatively, the *Classical Reasoning* account (Pennycook & Rand, 2019) proposes that analytical reasoning predicts the ability to identify fake news, regardless of whether it is consistent with one's ideology. Both these accounts highlight the importance of interindividual differences in analytical reasoning in fake news detection. However, both have primarily been tested in young adults only (Bago et al., 2020; Pennycook & Rand, 2019) and both lack consideration of affective and experience-based mechanisms to news veracity detection. In addition to analytical reasoning, consideration of these additional mechanisms is particularly warranted in the context of aging (Ebner et al., 2022; Frazier et al., 2019; Spreng et al., 2021), given age-related changes in affect (Gutchess & Samanez-Larkin, 2019; Pehlivanoglu & Verhaeghen, 2019) and experience-based knowledge (Löckenhoff & Carstensen, 2007; Mata et al., 2012).

The recently proposed *Changes in Integration for Social Decisions in Aging* (*CISDA*) model (Frazier et al., 2019) posits three empirically derived key component processes that support integration of information during social decision-making in aging: *reasoning*, *affect*, and *experience*. While prior work on social decision-making has focused on decisions based on interpersonal interactions, news entails social communication wherein information is generated by a person or group for another person or group. Decisions about news veracity involve social considerations, such as about the trustworthiness of the sender/source (e.g., the sociopolitical affiliation of the news organization; Van Bavel & Pereira, 2018). *CISDA* specifically offers a conceptual framework to guide research in decision-making that involves social factors in aging, and thus is well suited for an application to research on news veracity detection.

In particular, as put forth in *CISDA*, decisions about deception involve *reasoning* about the intentions of others, requiring theory of mind in one-to-one social interactions (Beadle et al., 2012). Extending this model to social communication via news, analytical reasoning is required when assessing others' true intentions through news media communication (Bronstein et al., 2019; Pennycook & Rand, 2019) and may buffer the impact of age-related decline in other cognitive functions on deception detection (e.g., sensitivity to cues of untrustworthiness; Castle et al., 2012; Frazier et al., 2021). Under *CISDA*, *affect* refers to the interpretation of stimuli and contexts to align with one's affective state and motivational goals; with evidence supporting that aging is associated with prioritization of emotional goals (Carstensen & DeLiema, 2018; Pehlivanoglu & Verhaeghen, 2019). The third key component process proposed in *CISDA*, *experience*, refers to information stored in memory that influences evaluations of social choice options and integration of choice-relevant memories when making decisions; and life experience has been shown to increase with age (Mata et al., 2012). That is, based on the notion that decision-making is a multifaceted and complex process, *CISDA* proposes that reasoning, affect, and experience-based processes show differential age trajectories and serve as evaluative functions for the aging decision-maker to weigh and integrate the value of options before the decision is enacted. The *CISDA* model further acknowledges that the way reasoning, affect, and experience impact social decision-making in aging also depends on contextual factors, such as affective (e.g., positive vs. negative) and familiarity-based (e.g., relevance to the self) properties of stimuli that can selectively capture attention when making decisions, including in deceptive contexts.

The present study specifically examined *CISDA* model predictions about the role of (a) analytical reasoning, (b) affect, and (c) news consumption frequency on news veracity detection in older adults. Furthermore, the COVID-19 pandemic, as a major public health crisis which disproportionately affects older adults, provided us with a unique opportunity to examine the extent to which (d) COVID-related *news content* (e.g., risk factors associated with the disease; economic situation during the pandemic) versus topics frequently encountered in everyday news (e.g., crime, racism) moderated the impact of analytical reasoning, affect, and news consumption frequency on news veracity detection. The present study is the first to delineate the role of analytical reasoning, affect, and news consumption frequency on news veracity detection in older adults, across a broad chronological age range as well as in direct comparison to young adults. Thus, the current investigation goes significantly beyond previous work on fake news which almost exclusively focused on analytical reasoning in young adults. Additionally, while previous studies typically examined news headlines only, we employed full-length news articles, which provide rather rich contextual information and a larger set of diagnostic cues (e.g., coherence in storyline, writing, and grammatical style), and are therefore particularly well suited for the study of mechanisms driving news veracity detection.

The Role of Analytical Reasoning in News Veracity Detection

In line with predictions from the *CISDA* model, processes related to reasoning about others' intentions have been shown crucial in deceptive contexts (e.g., seeing through the friendly con artist). Extending this model to misinformation via news articles, analytical reasoning is required when assessing others' true intentions through news media communication (Bronstein et al., 2019; Pennycook & Rand, 2019). In fact, supporting this interpretation, Ziv et al. (2011) reported a link between analytical reasoning and the ability to determine false beliefs in others. In the context of news veracity detection, research has consistently shown that the detection of fake news relies on analytic reasoning ability (Bronstein et al., 2019; Pennycook & Rand, 2019). According to *Dual-Process Theory* (De Neys, 2012; Kahneman, 2011; Stanovich, 2009), individuals engage in two main routes of information processing: a quick, intuition-based route and a slow, deliberate route. While the intuition-based route leads to faster decision-making, it is associated with low analytical reasoning and relies on cognitive heuristics. The slower route, in contrast, is associated with high analytical reasoning and allows deliberation of information, often leading to less error prone decision-making. Consistent with *Dual-Process Theory*, studies with young adults have found that individuals who scored high on analytical reasoning (e.g., Cognitive Reflection Test [CRT]; Frederick, 2005) were better at detecting fake news than individuals low on analytical reasoning (Bronstein et al., 2019; Pehlivanoglu et al., 2021; Pennycook & Rand, 2020; Ross et al., 2021). The role of analytical reasoning on news veracity detection has not been examined in older adults yet. Based on evidence of a role of analytical reasoning on fake news detection in young adults, we predicted that greater analytical reasoning would be associated with more accurate detection of real and particularly fake news in older adults (Hypothesis 1).

The Role of Affect in News Veracity Detection

Aligning with predictions from the *CISDA* model, affective processes have been shown to impact deception detection, though the direction of these effects is still somewhat unclear and varies by valence (Ebner et al., 2020; Forgas & East, 2008; see also Ebner et al., 2022, for a summary). For example, individuals with greater feelings of sadness and distress (dysphoric mood) compared to nondysphoric individuals were better at lie detection (Lane & Depaulo, 1999). Similarly, negative affect increased, while positive affect decreased skepticism, deception detection, and ambiguity (Matovic et al., 2014; but see LaTour & LaTour, 2009). To date only one study examined the role of affect on news veracity detection specifically and found that heightened emotionality (in the form of both increased positive and negative affect) predicted reduced detection of fake (but not real) news (Martel et al., 2020).

In the context of aging, it has been reported that older adults who experience greater negative affect showed improved deception detection, whereas positive affect decreased older adults' skepticism and their ability to detect deception (Forgas & East, 2008). Also, lower positive affect was associated with greater susceptibility to deceptive messages (phishing) in individuals aged 75 years and older (Ebner et al., 2020). Finally, the strength of older adults' memory errors was associated with increased positive affect (Hess et al., 2012). Taken together, the existing evidence supports the role of affect on deception detection. However, to date, no study has specifically tested the role of affect on news veracity detection in older adults.

Although aging is typically associated with less self-reported negative affect (Reed et al., 2014), shelter-in-place orders issued when COVID-19 cases began to increase in the U.S. (around March/April, 2020) raised concerns of increased loneliness and social isolation among older adults (Wu, 2020). Indeed, Krendl and Perry (2021) reported high levels of pandemic-related depression and loneliness among older adults since the onset of the pandemic and subsequent lockdown (see also Gao et al., 2020). The impact of affect on information processing and situationally enhanced (e.g., COVID-19 related) negative consequences of physical restrictions on older adults' well-being may have impacted news veracity detection. In particular, it is possible that negative affect relies on slower, deliberative processing, leading to greater elaboration (Bless, 2001; Schwarz & Clore, 2003), and thus possibly enhances new veracity detection. Positive affect, in contrast, engages quick, intuition-based decision-making, leading to less elaborate processing, and thus lowers new veracity detection. We therefore predicted that lower positive and higher negative affect (indexed by Positive and Negative Affect Schedule [PANAS], respectively; Röcke et al., 2009; Watson et al., 1988) would be associated with more accurate detection of real and particularly fake news in older adults (Hypothesis 2).

The Role of News Consumption Frequency in News Veracity Detection

A third *CISDA*-derived key component process of social decision-making is experience—a crucial factor that, surprisingly, has received close to no attention yet in research on fake news. One proxy of experience-based processes in news veracity detection is news consumption frequency (see a brief review by Sindermann et al., 2020 on need for examining news consumption in the context of fake news). News consumption frequency refers to the amount of time an individual engages in consuming news, including via diverse communication channels (e.g., newspaper, television, radio, internet), contributing to specific experience with news content, news outlets, the process of news intake, etc.

There is evidence that older adults are more likely than young adults to consume news to gather information and opinions (Lee, 2013). Traditional news media use increases with age (Holt et al., 2013), while older adults use the internet less than young adults (Anderson et al., 2019) and show less digital literacy (Schreurs et al., 2017). Although evidence is limited and mixed, news consumption frequency may impact news veracity detection via experience-based processes. Thus, and in line with predictions from the *CISDA* model, we hypothesized that higher news consumption frequency would be associated with more accurate detection of real and particularly fake news in older adults (Hypothesis 3).

Impact of News Content on News Veracity Detection

In an adult U.S. sample (age range 18–90 years), greater analytical reasoning was associated with more accurate detection and reduced sharing of COVID fake news (Pennycook, McPhetres, et al., 2020). What is still unknown, however, is the extent to which COVID-19-related news content compared with everyday news content that is not related to COVID-19 moderates real and fake news detection. Also, it is currently unclear whether news content (COVID vs. non-COVID) influences the effects of analytical reasoning, affect, and news consumption frequency on news veracity detection. The present study specifically addressed these research questions.

In particular, we expected that the effects of analytical reasoning, affect, and news consumption frequency on real and fake news detection outlined above (Hypotheses 1–3) would be moderated by the news content (Hypothesis 4). This prediction was based on evidence that emotionally salient, arousing information attracts attention and correspondingly enhances binding of constituent features (Mather, 2007). COVID news may be particularly self-relevant for older adults, given their increased disease-related risk perception and their higher likelihood for developing complications from COVID-19. Thus, it is possible that the impact of analytical reasoning, affect, and news consumption frequency on news veracity detection would be more pronounced for COVID than non-COVID (i.e., everyday) news. Alternatively, however, based on evidence that emotional arousal either impairs, or has no effect, on binding of information with context (Sutherland et al., 2017), it is also possible that the effects of analytical reasoning, affect, and news consumption frequency on real and fake news detection would be less pronounced for COVID than non-COVID news.

Age Effects on News Veracity Detection

During the 2016 U.S. election, older adults' Twitter feeds contained the most fake news and users over 50 ("supersharers") were responsible for sharing 80% of all fake news (Grinberg et al., 2019). Also, compared with young Facebook users, Facebook users over 65 years shared more links to fake news domains (Guess et al., 2019). While this finding may suggest age-related impairment in fake news detection, some evidence speaks against this possibility. For example, Allcott and Gentzkow (2017) found an age-related increase in the ability to distinguish fake from true news headlines related to the 2016 U.S. election. Similarly, in their reanalysis of two experiments by Pennycook and Rand (2019), Brashier and Schacter (2020) reported better discernment of fake from real news headlines with age. That is, evidence is rather mixed at this point on age effects in fake news detection.

Also, research that directly compares older versus younger adults is scarce. In fact, while a few studies on fake news detection used relatively more age-diverse samples (Pennycook, Bear, et al., 2020, a sample mean age of 37 years with 84% of the sample above 25 years; Pennycook, McPhetres, et al., 2020, a sample mean of 47 with a total age range of 18–90 years), to date, there are no studies that have systematically investigated the effect of age on news veracity detection and/or the impact of analytical reasoning, affect, and news consumption frequency on this process; a research gap that the present study fills. Under consideration of this limited and rather mixed previous body of work, we explored age moderations on the effects predicted under Hypotheses 1–4, but refrained from formulating specific directional hypotheses pertaining to age effects.[1]

Method

Transparency and Openness

This report was preregistered on the Open Science Framework (OSF; https://osf.io/fp9g8). The full set of materials (i.e., news articles), deidentified data files, and analysis script can be found in the OSF repository (https://osf.io/z24nb/).

Participants

Based on an a priori power analysis outlined in the preregistration, we recruited a total of 281 older adults via different sources (i.e., university contact registries, word of mouth, and distribution of online fliers throughout the U.S.) between May and October 2020. Based on a priori defined exclusion criteria, we removed 38 participants from the final analysis (32 for incomplete news evaluation data; 6 for news article reading times >3 *SD*s of the sample average), resulting in usable data for 243 older participants. The young adult comparison group consisted of 311 undergraduates from the Department of Psychology's SONA system. Data from young adults were collected between March and November 2020. A total of 46 participants were removed from the final analysis (41 had incomplete news evaluation data; 5 for news article reading times >3 *SD*s than the sample average), resulting in usable data for 265 young participants. See Table 1 for characteristics of the older adult and the young adult comparison sample (for more detailed sample characteristics, see Table S1 for older adults and Table S2 for young adults in Supplemental Methods).

Design

We adopted a 2 (news veracity: real vs. fake; within-subject) × 2 (news content: non-COVID vs. COVID; between-subject) mixed-model design in both the older adult sample and the young adult comparison group. We used block randomization to ensure random assignment of approximately equal numbers of participants to the non-COVID ($N = 124$ older; $N = 132$ young) and COVID ($N = 119$ older; $N = 133$ young) condition. In both conditions, participants were asked to evaluate six real and six fake news articles.

Materials

News Articles

Our stimuli in the *news evaluation task* (see detailed description below) were full-length real and fake news articles that comprised a news story along with a headline, as well as a news source. Real news articles were taken from the "true news" archive maintained by Snopes (www.snopes.com/archive/) or from reputable news organizations (e.g., Washington Post, NPR). Fake news articles were taken

[1] The preregistration for this study contained four hypotheses to examine the role of interindividual differences in analytical reasoning, affect, and news consumption frequency, as well as their interaction with news content on news veracity detection in older adults. Analyses pertaining to the young adult comparison group and chronological age within the older adult sample were added upon request during the peer-review process.

Table 1
Characteristics and Inferential Statistics for the Older Adult Sample and the Young Adult Comparison Sample by Non-COVID Versus COVID Condition

	Older adults				Young adults			
	Non-COVID (N = 124)	COVID (N = 119)			Non-COVID (N = 132)	COVID (N = 133)		
Sample characteristics	M (SD)	M (SD)	t	p	M (SD)	M (SD)	t	p
Age (in years)	70.64 (5.48)	71.01 (6.26)	1.05	.29	20.59 (2.16)	19.37 (1.42)	5.4	<.01
Range	61–81	62–87			18–35	18–24		
Gender	Non-COVID (%)	COVID (%)	χ^2	p	Non-COVID (%)	COVID (%)	χ^2	p
Female	59	58	0.01	.93	73	71	0.03	.87
Male	39	41	0.05	.82	25	26	0.02	.89
Other	1	1	0	1	1	2	0.33	.56
Prefer not to answer	1	—	—	—	1	1	0.00	.99

Note. M = mean; SD = standard deviation. Emdash indicates that information was not available for this sample/condition.

from a fact-checking website (e.g., Snopes.com) or websites that routinely publish fake news stories (e.g., World Daily News Report).[2] For the non-COVID condition, we selected real and fake news articles that were not related to COVID-19 (e.g., related to crime, religion, politics; see Supplemental Materials for the full set). For the COVID condition, we selected real and fake news articles related to COVID-19 (e.g., the effect of the pandemic on the economy, COVID-19 contaminated toilet paper; see Supplemental Materials for the full set). The presentation order of news articles was pseudorandomized, with the constraint that the same type of news articles (real vs. fake) was not repeated more than twice in a row. Half of the participants received the reversed pseudorandomized list to counter order effects. Also, both real and fake news articles were systematically paired with either credible (i.e., *NY Times*, *Washington Post*, and *NPR*) or noncredible (*True Pundit*, *Red State*, and *Conservative Daily News*) news sources across participants (between-subject). Note that news source credibility was not further examined here because it is outside the scope of this report.

Measures

News Evaluation Task. During this task, participants were presented with 12 news articles (6 real, 6 fake). Each article was presented on the screen for at least 60 s to ensure sufficient reading time, as determined by an internal pilot study. Beyond the 60-s window, the task was self-paced. After reading each article, participants were prompted with the following questions (in this order): accuracy (*Is this news article real or fake?*; response options: *real* vs. *fake*), confidence (*How confident are you in your decision regarding the authenticity of this news article?*); response options: 1 (*not at all confident*) to 10 (*completely confident*), sharing (*Would you share this news article on social media?*; response options: *yes vs. no*), perceived credibility (*How credible do you find this news article?*; response options: 1 (*not at all credible*) to 10 (*completely credible*), and familiarity (*Have you seen this article before?*; response options: *yes* vs. *no*).[3] Participants were not informed about the total number of articles presented to them to avoid response biases (e.g., 50/50 real vs. fake responses). News veracity detection accuracy was operationalized as categorizing real news as "real" and fake news as "fake" (see Data Analysis for details).

Cognitive Reflection Test. To capture the *CISDA*-derived component of reasoning, we administered the three-item CRT (Frederick, 2005). This task measures a person's tendency to override an incorrect "gut" response and engage in further reflection when solving problems and has been commonly used in the literature as a measure of interindividual differences in analytical reasoning (Liberali et al., 2012; Toplak et al., 2011), including in older adults (Hertzog et al., 2018). For example, one item asks: "A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?" Participants with high analytical reasoning overcome the impulse to give the intuitive answer 10 cents and instead give the correct answer of 5 cents. We calculated sum scores across the three items (Cronbach's α = .72 for both older and young adults), with higher CRT scores reflecting greater analytical reasoning.

The three-item CRT (Frederick, 2005) has been shown to have both adequate reliability (Cronbach's α range: .57–.74; Campitelli & Gerrans, 2014; Morsanyi et al., 2014; Weller et al., 2013), including in older adults (Cronbach's α = .68; Hertzog et al., 2018), and convergent validity (Frederick, 2005; CRT is positively correlated with the Wonderlic Personnel Test [.43], Need for Cognition [.22], Scholastic Achievement Test [.44], and American College Test [.46]). Further, recent work has shown that the original three-item CRT is a unidimensional scale with high discriminative power, in that, the CRT is able to reliably distinguish between individuals with varying levels of the cognitive reflection trait (Primi et al., 2016).

PANAS. To capture the *CISDA*-derived component of affect, we administered the PANAS (Watson et al., 1988), an affect assessment that contains 20 items. We included six additional items to capture hedonic balance (Röcke et al., 2009). For each item,

[2] One of the COVID news articles (a news story about a hospitalization order under Nicolás Maduro) was classified as fake when we collected news articles for the present study during the early stage of the COVID-19 pandemic (early April 2020). However, during our second round of fact checking before data analysis (November 2020), this news article was no longer categorized as fake. To address the change in categorization, we reran the main analyses with this news article excluded and obtained comparable results.

[3] As preregistered, the present article reports findings pertaining to accuracy. However, given evidence that news veracity judgments may relate to sharing intentions (Pennycook & Rand, 2019; but see Pennycook & Rand, 2021), we report findings regarding sharing in Supplemental Results.

participants were asked To what extent do you feel *[emotion adjective]* right now? and used a scale from 1 (*very slightly or not at all*) to 5 (*extremely*) to evaluate each adjective (e.g., *excited, happy, afraid, alert*; 13 positive and 13 negative adjectives). We calculated sum scores across positive adjectives (Cronbach's $\alpha = .93$ and .92, for older and young adults, respectively) and negative adjectives (Cronbach's $\alpha = .91$ and .90, for older and young adults, respectively), with higher scores reflecting more positive affect and more negative affect, respectively.

News Consumption Frequency. To capture the *CISDA*-derived component of experience, we developed a brief measure of news consumption frequency. This measure contained five items (adapted from Maksl et al., 2015) to assess the amount of news consumed via different media sources (e.g., TV, radio, internet). In particular, participants indicated (a) on a typical day, how many hours do you spend reading a daily print newspaper?; (b) on a typical day, how many hours do you watch the news or any news programs on television?; (c) on a typical day, how many hours do you listen to the news or any news programs on radio?; (d) on a typical day, how many hours do you spend getting news online through the internet?; and (e) overall, how many hours per week do you spend listening/reading/watching the news? We calculated the mean across these five items for each participant to index news consumption frequency (in hours; Cronbach's $\alpha = .74$ and .72, for older and young adults, respectively). Supplemental Methods (Table S3) provides additional detail on the specific news media source participants consumed.

Table 2 presents descriptive and inferential statistics for real and fake news detection accuracy, analytical reasoning, positive and negative affect, and news consumption frequency, by non-COVID versus COVID condition for the older adult sample as well as the young adult comparison group. Note that older adults ($M = 1.16$, $SD = 1.11$) did not differ from young adults ($M = 1.12$, $SD = 1.16$) in analytical reasoning, $t(506) = 0.38$, $p = .71$, $d = 0.034$. Older adults ($M = 1.27$, $SD = 0.81$) reported significantly higher news consumption frequency (in hours) than young adults ($M = 0.61$, $SD = 0.88$), $t(506) = 8.76$, $p < .001$, $d = 0.778$). Data for positive and negative affect were not available for young adults in the non-COVID condition and thus age-group analyses were not conducted for positive and negative effects.

Procedure

All study procedures were approved by the University of Florida Institutional Review Board. Participants completed the study remotely through Qualtrics (https://www.qualtrics.com/). All participants consented electronically to participate and completed a brief demographic form (see Table 1).

Next, participants completed (in this order) the news evaluation task, the news consumption frequency measure, the CRT, and the PANAS. Participants were then thanked and debriefed. Study duration was approximately 90 min for older adults (due to additional cognitive screening conducted in the older sample) and 60 min for the young adult comparison group. Older adults were compensated with a $25 electronic gift card; young adults participated in return for course credit.

Data Analysis

We used multilevel random intercept models (Gelman & Hill, 2006; Hox, 2010) to accommodate for the nested data structure. Specifically, we conducted cross-random effects analyses with cross-classification of news articles and participants and a nesting structure for repeated observations within participants. This approach allows evaluations made by the same participant to be correlated across different news articles as well as accounts for

Table 2

Descriptive and Inferential Statistics for Real News Detection Accuracy, Fake News Detection Accuracy, Analytical Reasoning, Positive/Negative Affect, and News Consumption Frequency, by Non-COVID and COVID Condition in the Older Adult Sample and the Young Adult Comparison Sample

	Older adults					Young adults				
	Non-COVID	COVID				Non-COVID	COVID			
Measures	*M* (*SD*)	*M* (*SD*)	*t*	*p*	*d*	*M* (*SD*)	*M* (*SD*)	*t*	*p*	*d*
News Veracity Detection										
Real news (%)	72 (25)	81 (20)	3.23	.01	0.42	68 (24)	81 (20)	4.54	.01	0.56
Fake news (%)	85 (18)	77 (17)	3.44	.01	0.44	83 (20)	74 (21)	3.61	.01	0.44
Analytical reasoning	1.18 (1.17)	1.13 (1.13)	0.29	.78	0.04	1.08 (1.18)	1.15 (1.15)	0.47	.64	0.06
Affect										
Positive affect	3.38 (0.73)	3.37 (0.82)	0.12	.91	0.02	—	2.37 (0.84)	—	—	—
Negative affect	1.43 (0.53)	1.40 (0.58)	0.49	.63	0.06	—	1.76 (0.67)	—	—	—
Experience										
News consumption frequency	1.31 (0.81)	1.22 (0.81)	0.95	.35	0.12	0.62 (0.53)	0.59 (1.13)	0.23	.82	0.03

Note. M = mean; SD = standard deviation. Em dash indicates that information was not available for this sample/condition. Analytical reasoning was measured via the Cognitive Reflection Test (CRT). Scores ranged from 0 to 3 and sum scores were calculated. Positive and negative affect were measured via the Positive and Negative Affect Schedule (PANAS). Ratings ranged from 1 to 5 and mean scores for positive affect and negative affect, respectively, were calculated. Note that PANAS data was not available for the non-COVID young adult comparison sample. News consumption frequency was assessed in hours (per typical day/week) across five items (mean score). Real news accuracy was greater in the COVID versus non-COVID condition. Fake news accuracy was greater in the non-COVID versus COVID condition. Participants did not differ in CTR, PANAS, or news consumption frequency across the non-COVID versus COVID condition (all $ps > .05$).

dependencies of evaluations of the same news article made by different participants.

News veracity detection *accuracy* was computed as a binary variable (0 = wrong, 1 = correct), separately for real and fake news articles, and served as the primary outcome in our multilevel logistic regression models. Our analysis approach comprised three parts:

1. First, and foremost, we conducted three separate models on the older adult sample, one with analytical reasoning, one with affect, and one with news consumption frequency; with the following interaction terms in each model to test our four study hypotheses: News veracity × Analytical reasoning (Hypothesis 1); News veracity × Positive affect and News veracity × Negative affect (Hypothesis 2); News veracity × News consumption frequency (Hypothesis 3); and the interaction of these two-way interactions with news content (i.e., non-COVID vs. COVID; Hypothesis 4). In all three models, we also entered the random intercepts of accuracy for news articles and participants to estimate the variability of accuracy across news articles and participants, respectively. Additionally, we entered news familiarity ("*Have you seen this article before?*"; response options: *yes* vs. *no)*, news presentation order (i.e., counterbalancing order), gender (*"gender identity"*; response options: *female*, *male*, or *other*), political affiliation ("*Do you consider yourself: republican, democrat, or other?*"), news reading time, and news word count as covariates.[4]

2. Second, we added data from the young adult comparison group and entered age as a categorical variable (older adults vs. young adults) in the models specified under (#1). This set of analyses allowed us to explore moderation effects of age group on the predicted effects (Hypotheses 1–4).

3. Third, we entered chronological age (in years) for the older adult sample as a continuous variable in the models specified under (#1). The normally distributed, wide chronological age range in the older adult group (61–87 years; with a skewness of 0.44 and a kurtosis of −0.64; see Appendix B for details) provided an ideal ground to examine moderation effects of chronological age within the older adult sample on our predicted effects (Hypotheses 1–4).

Results

Analytical Reasoning

The News veracity × Analytical reasoning interaction was not significant, $\chi^2(1) = 0$, $p = .984$. Thus Hypothesis 1 that greater analytical reasoning would be associated with more accurate detection of real and particularly fake news was not supported.

The News veracity × News content interaction was significant, $\chi^2(1) = 10.62$, $p = .001$, indicating better detection accuracy for non-COVID fake compared to real news, but comparable accuracy for COVID real and fake news (see Figure A1 in Appendix A for this interesting but not a prior predicted result). Qualifying this effect, we observed a significant News veracity × Analytical reasoning × News content interaction, $\chi^2(1) = 7.2$, $p = .007$. As shown in Figure 1A, detection accuracy for non-COVID fake news increased with higher analytical reasoning ($z = 2.13$, $p = .033$), while non-COVID real news accuracy was not influenced by analytical reasoning ($z = 0.25$, $p = .801$). In contrast, as depicted in Figure 1B, detection accuracy for COVID real and fake news did not vary by analytical reasoning ($zs < 1.85$, $ps > .064$). This finding was in line with Hypothesis 4 of a moderation of COVID news content on the effect of analytical reasoning on news veracity detection. No other effects were significant, χ^2s < 0.17, $ps > .682$.

Age group did not moderate any of these effects. When entering the continuous variable *chronological age* into the analysis within the older adult sample, the News veracity × Analytical reasoning × News content × Age interaction was significant, $\chi^2(1) = 7.33$, $p = .007$. In particular, while chronological age did not moderate the effect of analytical reasoning on real news detection accuracy, neither for non-COVID ($zs < 0.89$, $ps > .369$) nor COVID ($zs < 1.95$, $ps > .059$) articles, and also not on non-COVID fake news detection accuracy ($zs < 1.77$, $ps > .077$), greater chronological age was associated with reduced detection accuracy for COVID fake news among older adults with lower analytical reasoning ability ($zs > 2.61$, $ps < .001$). For details of age-related effects see Appendix B.

Affect

Neither the News veracity × Positive affect, $\chi^2(1) = 2.88$, $p = .089$, nor the News veracity × Negative affect, $\chi^2(1) = 1.58$, $p = .209$, interactions were significant. Thus, Hypothesis 2 that lower positive and higher negative affect would be associated with more accurate detection of real and particularly fake news was not supported.

In addition, neither the News veracity × Positive affect × News content, $\chi^2(1) = 3.58$, $p = .059$, nor the News veracity × Negative affect × News content, $\chi^2(1) = 2.04$, $p = .153$, interactions were significant. Thus, results were not in line with Hypothesis 4, that COVID news content would moderate the impact of affect on news veracity detection. As in the model on analytical reasoning, the News veracity x News content interaction was significant, $\chi^2(1) = 10.33$, $p = .001$. No other effects were significant, χ^2s < 0.48, $ps > .489$

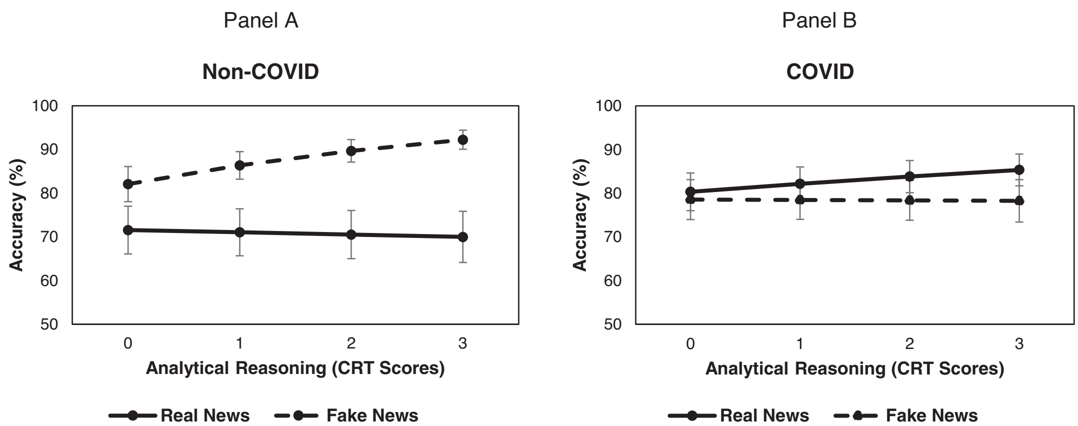
When entering the continuous variable *chronological age* into the analysis within the older adult sample, the interaction between News veracity × News content × Positive affect × Age was significant, $\chi^2(1) = 13.12$, $p < .001$. In particular, while chronological age did not moderate the effect of positive affect on real news detection accuracy, neither for non-COVID ($zs < 1.32$, $ps < .188$) nor COVID ($zs < 0.79$, $ps < .432$) articles, and also not on COVID fake news detection accuracy ($zs < 01.19$, $ps < .233$), greater chronological age was associated with reduced accuracy for non-COVID fake news detection accuracy among older adults with higher positive affect ($z = 3.87$, $p < .001$). For details of age-related effects see Appendix B.[5]

[4] See Supplemental Methods (Table S4) for descriptive and inferential statistics regarding familiarity, reading time, and word count of non-COVID versus COVID news articles.

[5] The young adult comparison group in the non-COVID condition did not have PANAS data. Therefore, we were not able to conduct age-group comparisons for positive and negative affect.

Figure 1

Percent Detection Accuracy for Real (Solid Line) and Fake (Dashed Line) News Articles Across Levels of Analytical Reasoning (Continuous; Indexed by CRT Scores) in the Non-COVID (Panel A) and COVID (Panel B) Conditions



Note. CRT = Cognitive Reflection Test. Error bars denote standard errors for accuracy across CRT scores. The *x*-axis reflects the possible range of CRT scores (0–3). The *y*-axis start point reflects the 50% chance level.

News Consumption Frequency

The News veracity × News consumption frequency, $\chi^2(1) = 1.64$, $p = .199$, was not significant. Thus, Hypothesis 3 that higher news consumption frequency would be associated with more accurate detection of real and particularly fake news was not supported.

In addition, the News veracity × News content × News consumption frequency interaction was not significant, $\chi^2(1) = 0.11$, $p = .742$, thus not supporting Hypothesis 4 that COVID news content would moderate the effect of news consumption frequency on news veracity detection. Again, as in the models for analytical reasoning and affect, the News veracity × News content interaction was significant, $\chi^2(1) = 17$, $p < .001$. No other effects were significant, χ^2s < 0.25, *p*s > .617.

Age group did not moderate any of the effects. When entering the continuous variable *chronological age* into the analysis within the older adult sample, the interaction between News veracity × News consumption frequency × Age was significant, $\chi^2(1) = 6.05$, $p = .014$. In particular, while chronological age did not moderate the effect of news consumption frequency on real news detection accuracy (*z*s < 1.28, *p*s > .198), greater chronological age was associated with reduced fake news detection accuracy among older adults with more frequent news consumption (*z*s > 3.36, *p*s < .002). For details of age-related effects see Appendix B.[6]

Discussion

Conceptually embedded within the *CISDA* framework (Frazier et al., 2019) and informed by prior work on fake news susceptibility, this study is the first to systematically examine the role of *analytical reasoning*, *affect*, and *news consumption frequency* on news veracity detection among older adults. We further investigated the impact of these psychological factors in the context of the COVID-19 pandemic by examining their interactions with *news content*, that is in regard to news veracity detection of everyday (i.e., non-COVID) news versus news related to COVID-19. Finally, in addition to determining these effects among older adults, we explored age effects by conducting direct comparison to young adults as well as across a broad chronological age range within the older adults.

The study yielded three key results. First, at the group level, overall news veracity detection was comparable between young and older adults. Second, our results replicated and extended prior research, indicating that analytical reasoning plays a key role in fake news detection for everyday (non-COVID) news content, with this effect present in both age groups. Third, although we did not find age-related differences in news veracity detection, results indicated reduced fake news detection with greater chronological age within the older adult group, depending on levels of analytical reasoning, affect, and news consumption frequency and in interplay with news content. Collectively, these latter findings suggest that age-related vulnerabilities to deceptive news depend on both psychological (i.e., analytical reasoning, affect, news consumption frequency) and contextual (i.e., news content) factors in very old age. The theoretical and practical implications of these central findings are presented below.

Age-Group Similarities in News Veracity Detection

As noted above, evidence of age effects on news veracity detection is limited and mixed. For instance, a reanalysis of existing data indicated better discernment of fake from real news headlines with age (Brashier & Schacter, 2020). Also, while a few empirical studies on fake news included relatively more age-diverse samples (Pennycook, Bear, et al., 2020; Pennycook, McPhetres, et al., 2020), none of this previous work directly tested differences in news veracity detection between young and older adults. Our study

[6] To ensure that our results were not confounded by response bias, based on signal detection theory (Macmillan & Creelman, 2004), we computed response bias ($c = -0.5[z$ (Hit rate) $+ z$ (False alarm rate)]) for each participant and entered this variable as covariate in control analyses. Findings from these control analyses were comparable to those reported in the text.

is the first to systematically examine age-group differences in news veracity detection.

The present study found no evidence for age differences between young and older adults in overall news veracity detection. This finding seems to contrast survey data that older adults were the demographic group that shared the most fake news on social media (Grinberg et al., 2019; Guess et al., 2019). However, there is a growing body of work that suggests a disconnect between believing versus sharing fake news (see Pennycook & Rand, 2021, for a review). The age-equivalency in news veracity detection we report in the present study supports the notion that young and older adults may not differ in news veracity detection ability; while they may differ in spreading fake news (Grinberg et al., 2019; Guess et al., 2019) or misinformation (e.g., framed as WhatsApp messages in Vijaykumar et al., 2021) as well as in detection of deception more generally (e.g., in emails; Ebner et al., 2022; Spreng et al., 2021, for recent overviews).

Furthermore, while our findings suggested that detection performance was comparable between young and older adults regardless of whether the news content was related to COVID-19 or not, these results do not align with recent evidence that older compared to young adults believed fewer COVID-19 misperceptions (Druckman et al., 2021; Vijaykumar et al., 2021). Contrasting findings may have resulted from methodological differences between studies. In particular, participants in the present study evaluated the veracity of full-length news articles rather than information presented as stand-alone statements (Druckman et al., 2021) or embedded within short WhatsApp messages (Vijaykumar et al., 2021). Although speculative, it is possible that compared to stand-alone statements or short WhatsApp messages, full-length news articles contain more contextual detail, which may have eliminated age group differences in veracity detection. Future studies could investigate this possibility by systematically manipulating the amount of contextual detail provided as well as the route by which misleading information is presented (e.g., text message, news article, emails).

As discussed more below, our results also suggest comparable associations between news veracity detection and interindividual difference measures of psychological factors across the young and older adults.

Analytical Reasoning Enhanced Non-COVID Fake News Detection Across Age Groups

In particular, for everyday news articles (i.e., articles that did not specifically relate to COVID), older adults were better at determining that fake news was "fake" ($M = 90\%$) than determining that real news was "real" ($M = 74\%$). Additionally, greater analytical reasoning was associated with this improved non-COVID fake news detection in our older adult sample. This result is consistent with previous evidence in young adults showing more accurate fake news detection with higher analytical reasoning (Bronstein et al., 2019; Pehlivanoglu et al., 2021; Pennycook & Rand, 2019, 2020; Ross et al., 2021) and extends this evidence to older adults—a population previously understudied in fake news research (see Brashier & Schacter, 2020). Importantly, findings from our direct age-group comparison suggested that news veracity detection and its association with analytical reasoning ability was similar between young and older adults.

Notably, we found no age-group differences in CRT scores, indicating similar analytical reasoning abilities across young and older adults in our study. This finding stands in contrast to a previous study (Hertzog et al., 2018) that reported age-group differences in the same three-item CRT measure. This previous study, compared to ours, included a considerably smaller sample, and for young adults found similar CRT scores; however, older adults in our study were relatively higher-performing on the three-item CRT ($M = 1.16$) than older adults in Hertzog et al. ($M = 0.68$). This cross-study difference may stem from the present study's online implementation during the COVID-19 pandemic (e.g., technology use is associated with higher cognition among older adults; Charness & Boot, 2009). Thus, the current findings may be most applicable to higher-functioning older adults. In sum, while further research is required to more definitively determine whether older age is generally associated with lower analytical reasoning, our results support the notion that interindividual differences in analytical reasoning impact fake news detection, both in young and older adulthood.

Based on prior literature, the value of greater analytical reasoning abilities for fake, but not real, news detection may be related to differences in the presence of diagnostic cues in fake versus real news. Specifically, lexical features of real and fake news differ (Choy & Chong, 2018; Rubin et al., 2016). Associated features of biased and misleading information include specific linguistic cues (e.g., subjective intensifiers, hedges, and implicatives; Recasens et al., 2013) and unique lexical features (e.g., unresolved pronouns, overuse of numerals, suspenseful language, and affective language; Chen et al., 2015). Future research could experimentally manipulate lexical features in news articles to determine the extent to which news veracity detection depends on such cues. Such findings also suggest that development of decision-supportive interventions to promote engagement in analytical reasoning may reduce vulnerability to fake news. This proposition is further supported by recent evidence that experimental enhancement of deliberative processing decreased belief in false news (Bago et al., 2020). Training interventions could entail fact-checking strategies and "nudging" to attend to diagnostic features (e.g., news source and content credibility; Pehlivanoglu et al., 2021) and/or to consider news veracity (Pennycook, McPhetres, et al., 2020).

Notably, better detection of fake than real news was not observed for articles with content about COVID-19, with no modulatory effect of analytical reasoning on COVID-related news except among older adults through an interaction with chronological age. The latter effect will be discussed below, but overall, existing research suggests that veracity detection of COVID news requires a level of specialized knowledge in health and/or biological sciences. As demonstrated by Pennycook, McPhetres, et al. (2020), individuals with lower basic scientific knowledge are less able to discern between COVID real and fake news. The present sample was drawn from the general population and the study was conducted in the earlier phase of the COVID-19 pandemic, with data collection for young (March–November 2020) and older (May–October 2020) adults largely overlapping. Thus, it is possible that all of our participants had still limited familiarity with COVID-19, which could have diminished their ability to detect COVID fake news. Non-COVID news, in contrast, referred to topics such as education and civil rights, which have been covered quite regularly and for decades in the public media. Thus, although speculative, it is possible that familiarity with COVID compared to this everyday (i.e., non-COVID) news was overall low. While the present study collected data on news consumption frequency, our measure did not specifically include questions on types of news consumed or on familiarity with COVID-related contents. To advance understanding of the underlying mechanisms between differences in COVID versus non-COVID news veracity detection, future research needs to incorporate more fine-grained measures of news consumption, including questions on different types and content of news consumed as well as frequency and recency of news consumption.

Psychological and Contextual Factors Contribute to Reduced Fake News Detection Among the Oldest-Old

Going beyond previous work on fake news, our study also found that age effects emerged and interacted with the *CISDA*-derived components of analytical reasoning, affect, and news consumption frequency when considering chronological age among older adults in our exploratory analysis. This collection of findings indicates that the oldest-old are at risk for failures in fake news detection, but vulnerabilities are context dependent and ameliorated by protective psychological factors (Ebner et al., 2020; see also Ebner et al., 2022).

In particular, while analytical reasoning moderated news veracity detection for non-COVID fake news irrespective of age within the older group, chronological age-related variation was observed for the detection of COVID-related fake news: Greater chronological age was associated with reduced accuracy for COVID fake news among older adults with lower analytical reasoning. This finding does not only lend further support for our prediction that the effect of analytical reasoning on news veracity detection is moderated by news content (*Hypothesis 4)* but also refines this prediction by suggesting that this effect is isolated to the oldest among the older adults. Given that older age is associated with more severe complications from COVID-19 (Centers for Disease Control and Prevention, 2020), the very old individuals in our sample may have perceived their subjective risk during the pandemic as particularly high (e.g., older adults aged 70 and over reported greater perceived risk of dying from COVID-19; Bruine de Bruin, 2021). Thus, processing of COVID-19 news articles may have triggered self-referential processing (Gutchess et al., 2007), which has been shown to lead to processing errors in aging (Rosa & Gutchess, 2013). Highly self-relevant aspects of COVID news content may have interfered with engagement in analytical reasoning, thus reducing attentional resources to process crucial diagnostic cues involved in fake news with advanced old age. Future research will be able to test this possibility by varying levels of self-referential processing associated with specific news content.

Greater chronological age was also associated with reduced accuracy for non-COVID fake news among older adults with higher positive affect. This finding, consistent with Hypothesis 4 but isolated to the oldest-old adults, aligns with previous evidence that greater positive affect reduces deception detection in older adults (Forgas & East, 2008), and affect modulates deception detection in very old age (Ebner et al., 2020). Previous research has shown that positive affect is associated with engaging quick, intuition-based decision-making, leading to less elaborate processing (Bless, 2001; Schwarz & Clore, 2003). Such findings support the conclusion that higher positive affect in more elderly older adults interacts with age-related decline in cognitive resources (e.g., lower analytical reasoning) to reduce everyday fake news detection (i.e., non-COVID news).

We also found that more frequent news consumption was associated with *less* accurate fake news detection, but again only among elderly older adults. Repeating false information has previously been shown to inadvertently strengthen the perceived accuracy of the information by making it more familiar (Skurnik et al., 2005). This phenomenon is known as an "illusory truth effect" (Dechêne et al., 2010; Hasher et al., 1977) and is more often observed with older age, possibly because familiarity-based memory is largely preserved in aging (see Spencer & Raz, 1995, for a review). Thus, applied to the present context, increased time consuming the news among the elderly older adults may have come at a cost: older adults' more frequent exposure to fake news, may have artificially strengthened their judgment of truth for fake news. To investigate this possibility empirically, future studies could test news familiarity and detection performance in aging by systematically varying the number of repetitions in presentation of real and fake news.

Theoretical Contributions and Implications for Future Avenues

The present study makes unique conceptual and empirical contributions to the processes underlying fake news detection in aging. Our findings not only provide further evidence on the role of analytical reasoning on news veracity detection, but also importantly advance current knowledge by demonstrating affective and experience-based influences on news veracity detection.

Our study is first to examine news veracity detection in aging by leveraging the *CISDA* framework, but it is not without limitations. First, results from our study support the role of analytical reasoning on news veracity detection in aging. Future studies, however, could benefit from incorporating a more comprehensive cognitive battery along with cognitive screening measures to test predictions about the influence of cognitive processes on news veracity detection more broadly in aging as well as on the impact of individual cognitive components such as attentional control, working memory, and episodic memory, which reflect crucial aspects of information processing (Hedden & Gabrieli, 2004; Verhaeghen & Cerella, 2002). Second, in addition to analytical reasoning ability, future research will advance understanding by studying the role of social reasoning (e.g., theory of mind) together with emotion recognition abilities on decisions about the intentions of others during news veracity evaluation. Such studies will further extend *CISDA*'s application to fake news research as well as better delineate sociocognitive processes (e.g., mentalizing, perspective taking) that may underlie misinformation via fake news in aging. In addition, future studies may examine whether the longer seven-item CRT provides even greater sensitivity in determining vulnerability to fake news due to individual differences in analytic reasoning.

Lastly, given that the present study did not vary the political content of the news articles (e.g., pro-Democrat vs. pro-Republican news), it does not allow to test predictions that would dissociate the *Classical Reasoning* (Pennycook & Rand, 2019) from the *Motivated System 2 Reasoning* (Kahan et al., 2017) account. To distinguish between these accounts, future studies could examine the effects of political affiliation and political content, and their interplay, on fake news detection in aging by for example systematically manipulating politically concordant versus discordant news content.

Conclusions

The present study makes various important contributions to the literature. Built on the *CISDA* framework, it is the first study to systematically examine the role of *analytical reasoning, affect*, *news consumption frequency*, and *news content* in their impact on news veracity detection in older adults, by exploring age effects, during the COVID-19 pandemic. We show that news veracity detection was comparable between young and older adults. Additionally, fake news detection for everyday (non-COVID) news was predicted by individual differences in analytic reasoning for both age groups. Age differences, however, were observed when exploring chronological age effects among older adults and revealed that fake news detection among more elderly older adults depended on the *CISDA*-derived components and their interplay with news content. This work provides empirical support for the modulatory role of the psychological factors of analytical reasoning, affect, and news consumption frequency on news veracity detection, particularly in very old age. In fact, findings from this study importantly qualify previous work claiming a particular age-related vulnerability to fake news and deception. Rather, it may only be in very late old age, as the time in life when declines in fluid intelligence (e.g., working memory) cannot be compensated for anymore by gains in crystallized intelligence (e.g., domain-specific knowledge), that individuals become particularly vulnerable to deception via misinformation and fake news. Knowledge gained through this study has the potential to inform recommendations for mechanistic research on news veracity detection in aging; as well as the design of decision-supportive interventions to enhance news communication and reduce misinformation across the adult lifespan and in aging.

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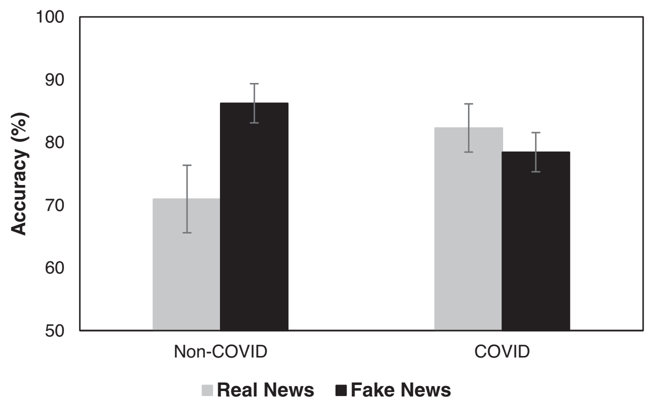
(*Appendices follow*)

Appendix A

Veracity Detection for Non-COVID and COVID News

Figure A1

Percent Accuracy for Real (Gray) and Fake (Black) News Detection for the Non-COVID and the COVID Conditions



Note. Error bars denote standard errors for real and fake news detection accuracy. The *y*-axis start point reflects the 50% chance level. Accuracy for non-COVID fake news was better than for non-COVID real news ($z = 3.67$, $p < .001$), whereas accuracy for COVID real and fake news was not different ($z = 1.64$, $p = .201$). Data shown here refer to the significant News veracity × News content interaction in the model with analytical reasoning as moderator; the results were equivalent in the models with affect and news consumption frequency.

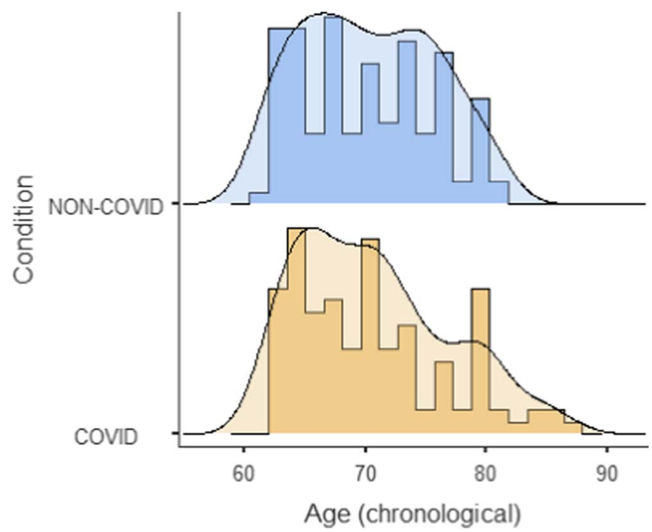
(*Appendices continue*)

Appendix B

Descriptive Statistics for "Chronological Age" Variable

As shown in Table B1, chronological age within the older adults was normally distributed both in the non-COVID (with a skewness of 0.15 and a kurtosis of −1.07) and the COVID (with a skewness of 0.62 and a kurtosis of −0.47) conditions (see also Figure B1). Further, the counts of older adults falling under the 25% (<66 years), 50% (66–75 years), and 75% (>75 years) percentile were comparable across the non-COVID and the COVID conditions.

Figure B1
Histogram of the Distribution of the "Chronological Age" Variable in the Non-COVID and the COVID Conditions



Note. See the online article for the color version of this figure.

Results for Age Effects

Analytical Reasoning

Age group did not moderate any effects, News veracity × Analytical reasoning × Age, $\chi^2(1) = 3.12$, $p = .078$; News veracity × Analytical reasoning × News content × Age, $\chi^2(1) = 0.01$, $p = .934$. Entering *chronological age* into the analysis within the older adult sample resulted in a significant News veracity × Analytical reasoning × News content × Age interaction, $\chi^2(1) = 7.33$, $p = .007$; see Figure B2. No other effects were significant, News veracity × Analytical reasoning × Age, $\chi^2(1) = 1.23$, $p = .267$.

Affect

The young adult comparison group in the non-COVID condition did not have data on the PANAS. Therefore, the *age-group* comparison could not be conducted on positive and negative affect. Entering *chronological age* into the analysis within the older adult sample resulted in significant News veracity × Positive affect × Age, $\chi^2(1) = 4.57$, $p = .033$, and News veracity × Positive affect × News content × Age, $\chi^2(1) = 10.46$, $p = .001$, interactions (see Figure B3). No other effects were significant, News veracity × Negative affect × Age, $\chi^2(1) = 0.06$, $p = .812$; News veracity × Negative affect × News content × Age, $\chi^2(1) = 2.29$, $p = .129$.

News Consumption Frequency

Age group did not moderate any effects, News veracity × News consumption × Age, $\chi^2(1) = 1.69$, $p = .193$; News veracity × News consumption × News content × Age, $\chi^2(1) = 0.07$, $p = .791$. Entering *chronological age* into the analysis within the older sample resulted in a significant News veracity x News consumption frequency x Age interaction, $\chi^2(1) = 6.05$, $p = .014$; see Figure B4. No other effects were significant, News veracity × News consumption frequency × News content × Age, $\chi^2(1) = 0.90$, $p = .342$.

Table B1
Descriptive Statistics for the "Chronological Age" Variable Within the Older Adults in the Non-COVID and the COVID Conditions

Descriptive statistics	Non-COVID (*N* = 124)	COVID (*N* = 119)
Mean (*SD*)	70.3 (5.48)	70.7 (6.23)
Median	70	70
Min–Max	61–81	62–87
Skewness	0.15	0.62
Kurtosis	−1.07	−0.47
Percentile (age in years)	Count	Count
25% (<66)	31	26
50% (66–75)	67	62
75% (>75)	26	28

Note. *SD* = standard deviation.

Sensitivity Analysis

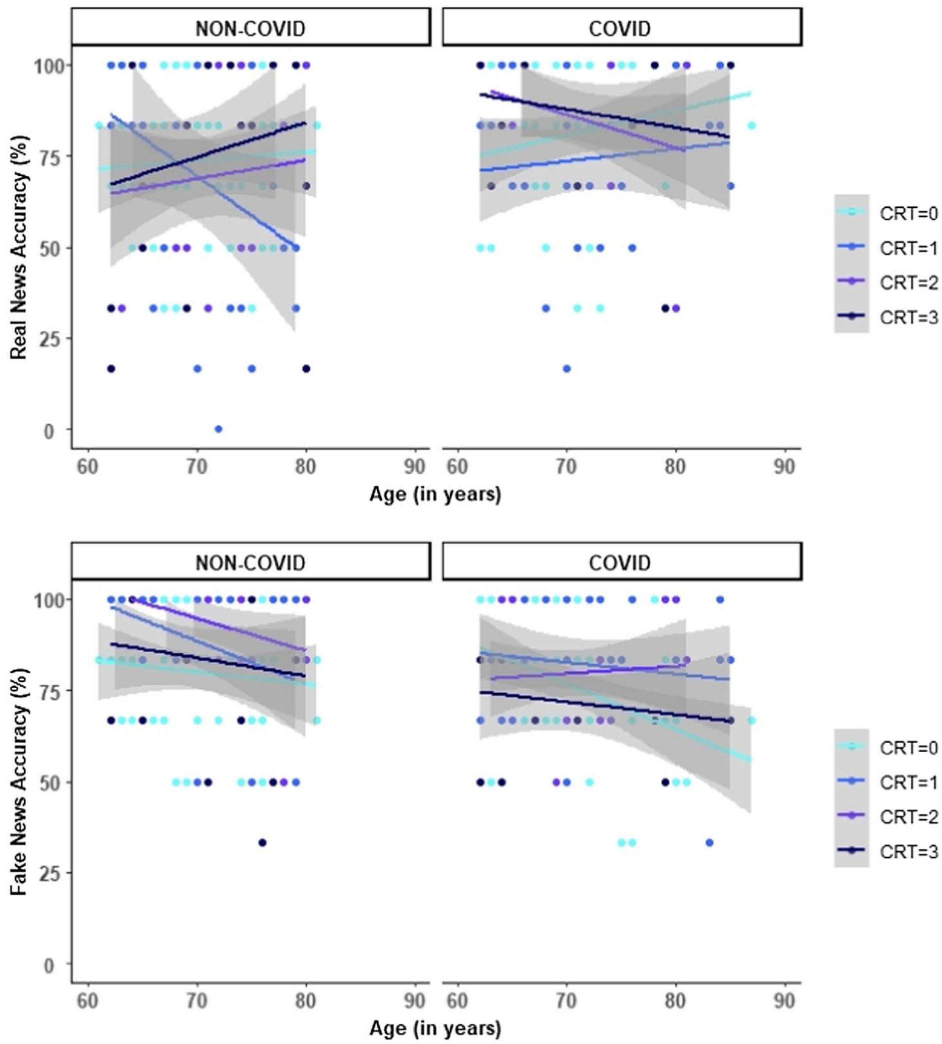
To the best of our knowledge, no software exists that specifically allows to conduct sensitivity analysis (i.e., determination of the smallest effect size a sample can detect at a given α and power level) for multilevel modeling. Instead, we conducted sensitivity analysis on the current sample in a repeated-measures analysis of variance (ANOVA) model using G*Power. This approach is justified as an approximation, given the high similarity between multilevel modeling and repeated-measures ANOVA. Furthermore, as the repeated-measure ANOVA cannot accommodate continuous variables, all continuous variables (i.e., analytical reasoning, affect, news consumption frequency, and chronological age) were treated as categorical variables with four levels in the sensitivity analysis. In our actual multilevel models, however, these variables were treated as continuous variables, which further increased statistical power in the analyses reported.

For models testing the cross-sectional *age group* differences (i.e., young vs. older adults), sensitivity analysis found that with the current sample size ($N = 508$) and $p = 0.5$ as Type-I error threshold, power to detect a small effect (Cohen's $f = 0.09$; Cohen, 2013) was 80% for the four-way interactions (a) News veracity × Analytical reasoning × News content × Age group; (b) News veracity × Affect × News

(*Appendices continue*)

Figure B2

Scatter Plots Showing Percent Accuracy for Real (Top Row) and Fake (Bottom) News Articles Across Levels of Analytical Reasoning (Continuous; Indexed by the CRT Scores) and Across Chronological Age (Continuous) Within the Older Adult Sample in the Non-COVID (Left) and COVID (Right) Conditions

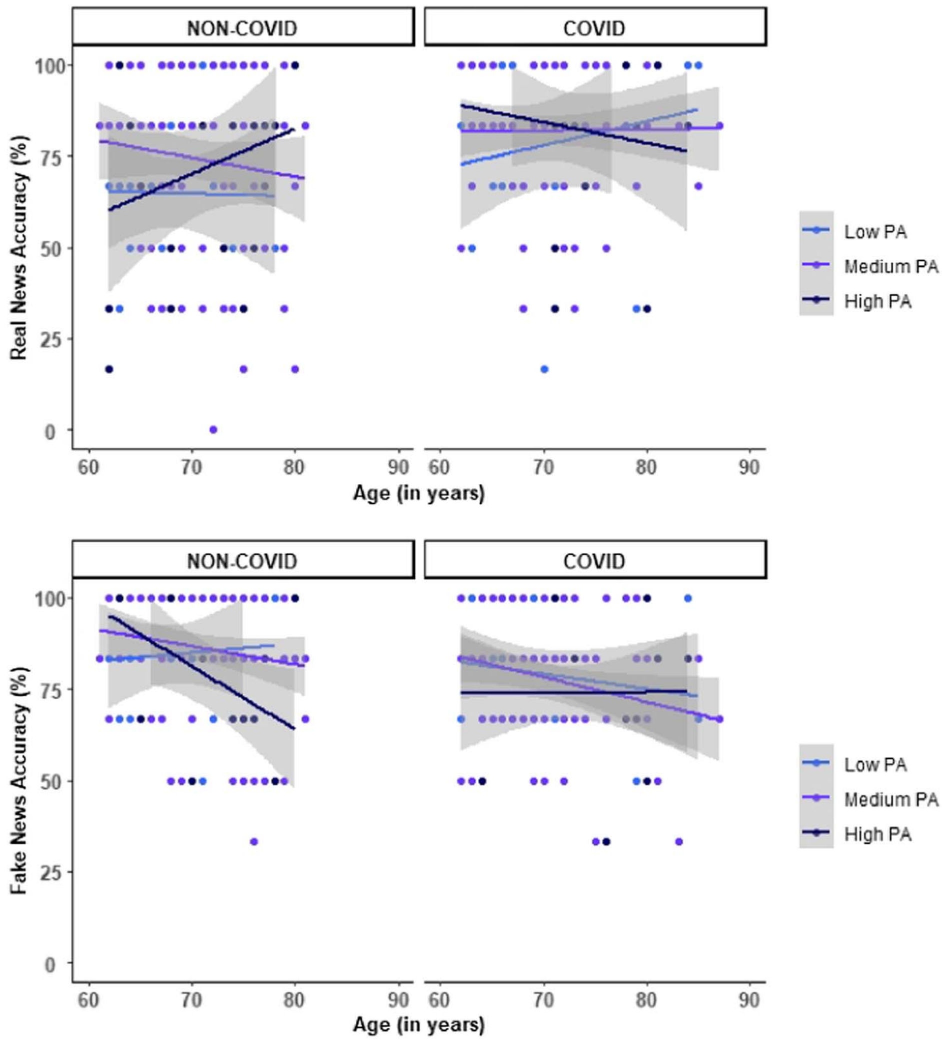


Note. CRT = Cognitive Reflection Test. Gray shaded areas reflect standard errors for accuracy across CRT scores. See the online article for the color version of this figure.

(*Appendices continue*)

Figure B3

Scatter Plots Showing Percent Accuracy for Real (Top Row) and Fake (Bottom Row) News Articles Across Levels of PA (Continuous; Indexed by the Positive and Negative Affect Schedule [PANAS] Scores) and Across Chronological Age (Continuous) Within the Older Adult Sample in the Non-COVID (Left) and COVID (Right) Conditions

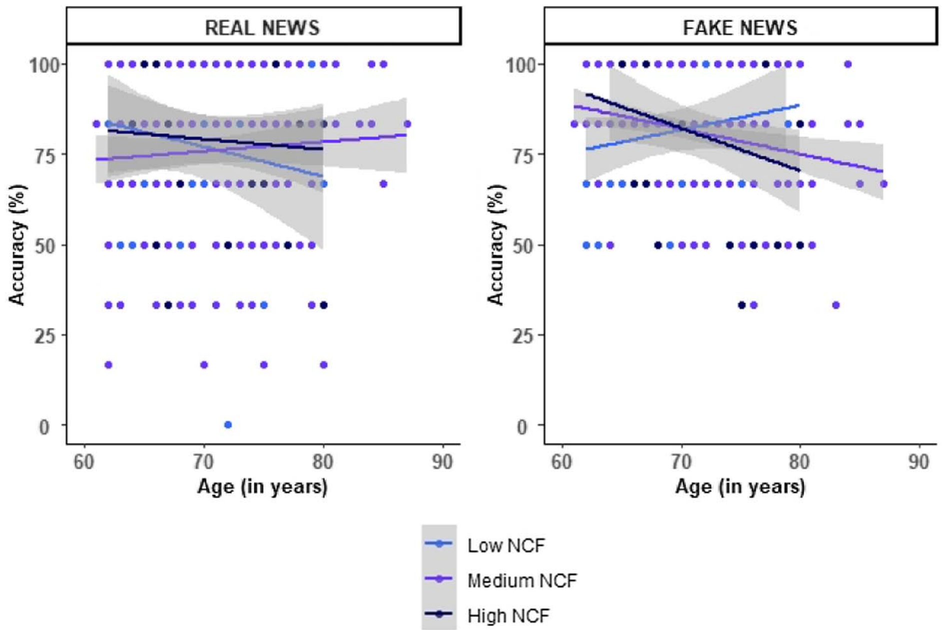


Note. PA = positive affect. The medium PA level indicates the mean PA score in the sample while the low and high levels indicate 1 *SD* below and above the mean PA score, respectively. Gray shaded areas reflect standard errors for accuracy across PA scores. See the online article for the color version of this figure.

(*Appendices continue*)

Figure B4

Scatter Plots Showing Percent Accuracy for Real (Left) and Fake (Right) News Articles Across Levels of NCF (Continuous) and Across Chronological Age (Continuous) Within the Older Adult Sample



Note. NCF = news consumption frequency. The medium NCF level indicates the mean NCF score in the sample while the low and high levels indicate 1 *SD* below and above the mean NCF score, respectively. Gray shaded areas reflect standard errors for accuracy across NCF scores. See the online article for the color version of this figure.

content × Age group; and (c) News veracity × News consumption frequency × News content × Age group.

For models testing the *chronological age* effects within the older adult sample, sensitivity analysis found that with the current sample size ($N = 243$) and $p = 0.5$ as Type-I error threshold, power to detect a small to medium effect (Cohen's $f = 0.17$; Cohen, 2013) was 80% for the four-way interactions (a) News veracity × Analytical reasoning × News content × Chronological age; (b) News veracity × Affect × News content × Chronological age; and (c) News veracity × News consumption frequency × News content × Chronological age.

Received December 1, 2020
Revision received February 8, 2022
Accepted February 10, 2022 ■