Correction after misinformation:

Does engagement in media multitasking affect attitude adjustment?

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Abstract

Research shows that high levels of media multitasking (either situationally induced or chronic) may be associated with a decreased cognitive function. Since cognitive capacity is required for efficient correction of one's judgment after learning that the judgement base is no longer valid, we expected that high levels of media multitasking would decrease one's ability to adequately update their beliefs. We ran two studies in which participants were asked to form an impression of a target person based on their online profile from a professional networking site. The profile contained either neutral information (control condition) or negative comment from a former supervisor which was later debunked (false information conditions). We additionally manipulated media multitasking demands (in Study 1) or measured participants' frequency of media multitasking (Study 2) and tested whether the level of media multitasking is related to the degree to which the initial attitudes were adjusted after learning that the negative comment was false. We found a significant but rather small effect of manipulation in Study 1 indicating that participants in both multitasking conditions had more negative attitudes after correction compared to the baseline, but not to the mono-tasking condition. Crucially, media multitasking demands did not impact attitude adjustment. Results of Study 2 showed that the relationship between media multitasking frequency measured with a scale and attitude adjustment were non-significant. Overall, the current findings suggest that media multitasking, experimentally manipulated or chronic, plays a negligible role in correction after misinformation.

Keywords: misinformation, media multitasking, correction, attitude adjustment, false information

The spread of misinformation has become a major concern in many societies. Its potential influence on people's attitudes about most important topics – including vaccination, nutrition, elections, political referenda, refugee crisis, and stock values – has been debated (e.g., Allcott & Gentzkow, 2017; Khaldarova & Pantti, 2016; Lazer, Baum, Benkler, et al., 2018). Researchers argue, however, that although spreading false information in order to obtain certain gains is not new, recent technological advancements have considerably changed the informational scenery. The rise of global internet usage and social media platforms, and the resulting transformation of the way people access information and communicate, make the proliferation of misinformation much easier, to an unprecedented scale and with further-reaching consequences (e.g., Allcott & Gentzkow, 2017; Marchi, 2012; Parkinson, 2016; Read, 2016). Indeed, misperceptions, or holding beliefs based on misinformation, is widespread in today's world and corrective information often fails to change such false beliefs: People reject evidence on climate change, believe that vaccines cause autism or are afraid of GMO (for reviews, see Lewandowsky, Ecker, Seifert, Swarz, & Cook, 2012; Flynn, Nyhan, & Reifler, 2017).

The same technological advancements that have been argued to support the spread of misinformation are also considered as the drivers of another growing trend: media multitasking. As other forms of multitasking, media multitasking refers to performing several tasks within the same time period; in case of media multitasking, however, at least one of the tasks is media related (Lang & Chrzan, 2015; Popławska, Osowiecka, & Kramarczyk, 2015; Szumowska et al., 2018; Vega, 2009; Zhang, Jeong, & Fishbein, 2010). Indeed, electronic devices of the present allow for (what seems to be effortless) consumption of multiple media tasks at the same time and switching between ongoing activities (e.g., Courage, Bakhtiar, Fitzpatrick, Kenny, & Brandeau, 2015; Ophir, Nass, & Wagner, 2009). On a single device, one can easily shift between multiple web browser tabs, simultaneously monitor the current weather and news, have a text conversation, and listen to music, to name but a few.

This growing trend, especially among younger generations (Rideout, Foehr, & Roberts, 2010; Van Der Schuur, Baumgartner, Sumter, & Valkenburg, 2015), made researchers express their concerns about how engaging in multitasking, and media multitasking in particular, affects cognitive functioning. The literature is abundant with evidence showing that performing several activities at the same time, or frequently switching between them, leads to more errors, distraction, interference, and lost time as compared to a situation when these activities are performed in separation (see Courage et al., 2015; Monsell, 2003; Pashler, 1994, for overviews).

Similar has been argued for frequent, or chronic, media multitasking. Some have postulated that multitasking has contributed to the way of life based on "attention deficit trait" (Hallowell, 2005) or "breadth-biased cognitive control" (Ophir et al., 2009), while others emphasized the potential long lasting consequences of the habit of multitasking, such as poorer quality of learning and distractibility

(see Courage et al., 2015, for overview). Some even argued that chronic multitasking leads to temporary decrements in one's cognitive ability equivalent to lowering IQ by up to 10 or 15 points (e.g., Ehrlich, 2015; Freedman, 2007; Osif, 2007), thus suggesting that performance outcomes related to frequent media multitasking might resemble those of reduced cognitive capacity (not necessarily assuming a causal link from chronic media multitasking to lower cognitive ability – the reverse relationship is also possible and/or the effects might be due to differences in cognitive orientation rather than long-term deficits, Courage et al., 2015; Ophir et al., 2009).

Recent research shows that cognitive capacity is necessary to update one's judgments after learning that the judgement base is no longer valid, with higher capacity participants being able to adjust their beliefs accordingly, and lower capacity participants holding their beliefs more in line with the invalid piece of information (Brydges, Gignac, & Ecker, 2018; De keersmaecker & Roets, 2017). In the present investigation, we examine whether actual *engaging* in media multitasking as well as reported levels of *chronic* media multitasking, are related to attitude adjustments after learning that the initial attitudes were based on misinformation.

We believe that the results of the current studies might have important implications for understanding people's reduced ability to correct erroneous information, a factor contributing to the proliferation of misperceptions. Given that such misperceptions might influence one's important life choices (as health or voting decisions) or shape one's opinions about the pressing social issues, establishing the conditions that can hinder correction of the misinformation is an important and timely endeavour. Since most of the activities with computers are nowadays multitasked (Zhang & Zhang, 2012) and media multitasking is the new norm of consuming media (Courage et al., 2015), it is likely that one would come across false information in such an environment; therefore, in the article we will focus on such conditions.

Processing false information

Lately, the issue of misinformation spread has become particularly relevant. This is mainly due to the role of the new media and the internet which enable fast and easy information sharing on a large scale (e.g., Allcott & Gentzkow, 2017; Gottfried & Shearer, 2016). To illustrate this, an analysis of the most popular news articles on Facebook in the months leading up to the 2016 U.S. election revealed that the top articles containing false information actually outperformed the top real news articles in terms of shares, likes, and comments (Silverman, Strapagiel, Shaban, & Hall, 2016).

Alarmingly, research has demonstrated that people generally believe misinformation. One of the studies showed that students at every level of education, from middle school through high school to college, found themselves unable to recognize news from sponsored, or biased content (Wineburg,

McGrew, Breakstone, & Ortega, 2016). Another study showed that most people after familiarizing themselves with the headline, tend to view a story as accurate (Silverman & Singer-Vine, 2016). Similar results were found by Pennycook et al. (2018) who also examined the believability of misinformation. Using actual fake news headlines (presented as they were seen on Facebook), the authors showed that even a single exposure increases subsequent perceptions of accuracy, both within the same session and after a week. They argued that this “illusory truth effect” for misinformation occurred even despite a low level of overall believability, and even when the stories were labeled as contested by fact checkers.

The above shows that people are not always good at detecting misinformation. Furthermore, even after misinformation is retracted, people may still rely on this information in their inferential reasoning (i.e. continued influence effect, see Lewandowsky et al., 2012). De keersmaecker and Roets (2017) examined whether this continued influence effect for social impressions is moderated by cognitive ability. Their results showed that although people generally adjust their attitudes after they learn that their initial evaluation was based on incorrect information, the degree to which they correct their assessment depended on their cognitive ability. In particular, individuals with lower levels of cognitive ability adjusted their attitudes to a lesser extent than individuals with higher levels of cognitive ability. Importantly, for those with lower levels of cognitive ability, even after the explicit disconfirmation of the false information, adjusted attitudes remained biased and significantly different from the attitudes of the control group who was never exposed to the incorrect information. By contrast, the adjusted attitudes of high cognitive ability participants were similar to those of the control group.

The study thus demonstrated the role cognitive resources play in determining one’s ability to correct their initial judgement after learning that the judgment base was incorrect (see also, Brydges et al., 2018). These results are also in line with other research showing that insufficient resources can undermine correcting one’s judgement based on a given cue – for example, research on dispositional inference showed that cognitive busyness prevented participants from making a situational correction thus increasing the correspondence bias (e.g., Gilbert & Osborne, 1989; Gilbert, Pelham, & Krull, 1988; see also Chen & Chaiken, 1999; Epstein & Pacini, 1999; Martin, Seta, & Crelia, 1990). In the next section we will argue that (chronic) engagement in media multitasking might be one of the sources of decreased cognitive function.

Media multitasking and cognitive function

Recent studies show that multitasking has become ubiquitous, not only among adults, but is also invading the lives of the young (e.g., Baumgartner, Weeda, van der Heijden, & Huizinga, 2014;

Livingstone, Haddon, Görzig, & Olafsson, 2011; Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013; Rideout et al., 2010; Van Der Schuur, Baumgartner, Sumter, & Valkenburg, 2015). The data shows that for those growing up today, nearly eight hours each day (Rideout et al., 2010) or more (Cardoso-Leite, Green, & Bavelier, 2015) is spent consuming media. Importantly, however, many of multiple media streams are consumed simultaneously, which results in consumption of more media content than it would be the case if the media streams were consumed separately. In line with that, a recent survey showed that nearly 99% of U.S. consumers under the age of 33 engage in at least one other task (e.g., surfing the web, emailing, texting) while watching television, doing on average four other activities (Deloitte Development, 2016). This, still rising trend, spurred scientific interest, and the studies on the consequences of multitasking followed. Now, a series of adverse effects of multitasking have been identified.

There is a vast body of evidence, ranging from classical cognitive experiments to applied settings studies, showing that engaging in several simultaneous tasks negatively impacts immediate performance. Research shows that juggling tasks produces interference, distraction, slower reaction times, and ultimately results in more errors (see Courage et al., 2015; Monsell, 2003; Pashler, 1994; Salvucci & Taatgen, 2011; for overviews). Numerous experiments on divided attention (e.g., Kahneman, 1973; Navon & Miller, 2002), dual-task performance (e.g., Pashler, 1994), and task switching (e.g., Monsell, 2003) suggest that human information processing system has a limited capacity and that performing concurrent tasks is subject to processing bottlenecks. In other words, sharing resources among tasks usually comes at a cost for performance and productivity. Such effects were found not only in the laboratory settings, but are also well known in everyday activities such as learning and driving a car (e.g., Sana, Weston, & Cepeda, 2013; Strayer, Watson, & Drews, 2011). In the latter context, research shows that engagement in an additional task, for example, dialling a cell phone or text-messaging, create a potential level of distraction equivalent to intoxication with a blood-alcohol level of .08% weight/volume (Strayer, Drews, & Crouch, 2006).

There is also evidence showing that engagement in multitasking affects the way information is processed and remembered. In a functional neuroimaging study, Foerde, Knowlton, and Poldrack (2006) asked participants to perform a task involving practicing and learning categorical information (a weather prediction task) either in a single task scenario or accompanied by the simultaneous performance of a demanding secondary task (counting high tones in a stream of high- and low-pitched tones). The researchers were interested in whether there were differences in neural basis for learning and memory in the two scenarios. They found that although dual-task condition did not reduce the accuracy, it reduced the amount of declarative learning about the task. An analysis of fMRI data showed that medial temporal lobe activity was associated with single-task performance, whereas the dual-task condition showed greater striatal activity (memory relying on medial temporal lobe is

declarative and flexibly accessible, whereas memory relying on striatum is more habitual and rigid). This suggests that even if multitasking does not decrease the overall level of learning, it can result in the acquisition of knowledge that can be applied less flexibly and can be more resistant to change. In line with that, college students who studied science material with background television showed relatively poorer recall but not poorer recognition of the material than those who studied without distraction (Armstrong & Chung, 2000). Interestingly, recent study showed that even such popular activity as listening to the background music reduces creativity (Threatgold, Marsh, McLatchie, & Ball, 2019).

Impaired cognitive performance under multitasking was also evidenced in multitasking with the media. For example, Lang and Chrzan (2015) reviewed studies which tested the relationship between task performance and media multitasking. They analyzed 41 tests of the difference between the single compared to multitask conditions, in which the measures of performance were memory accuracy, task accuracy and time to completion. Poorer performance in the multitask compared to the single task condition was found in 25 out of the 41 tests. Also, Jeong and Hwang (2016) meta-analyzed results of 49 studies that measured the effects of the media-multitasking on the various cognitive outcomes (attention, interest, comprehension, recall and task performance), and found evidence for the medium effect ($d = -.71$), with multitasking decreasing cognitive performance.

Similar detrimental consequences have been argued for chronic media multitasking. Ophir et al. (2009), for instance, examined the effects of frequent media multitasking on cognitive abilities. They tested college students who had self-identified as light or heavy media multitaskers with a battery of tests measuring cognitive abilities. The results showed that heavy, compared to light, media multitaskers were less able to filter out distractions and irrelevant information from working memory and performed more poorly on a standard measure of task switching. This led to a surprising conclusion that those who multitask more often are worse at a typical task measuring multitasking ability, *i.e.*, task switching (but see Minear, Brasher, McCurdy, Lewis, & Youbggren, 2013). Consistent with this finding, Sanbonmatsu et al. (2013) asked college students to rate their frequency of engaging in multitasking and perceived ability to do so effectively, and then measured their multitasking ability. The results showed that those high in real world multitasking had lower multitasking ability (as measured with the Operation Span task), despite the fact that their perceived multitasking ability was still high.

Other studies too have showed that higher levels of chronic media multitasking are related to poorer academic performance (Bellur, Nowak, & Hull, 2015; Junco, 2012; Rosen, Carrier, & Cheever, 2013), longer reading time (Bowman et al., 2010), and greater distractibility (Hallowell, 2006). These differences in attention have been termed “overall diffuse attentional state” (Gorman & Green, 2016), “continuous partial attention” (Friedman, 2006) or “attention deficit trait” (Hallowell, 2005). In line

with this, a cross-sectional brain imaging study showed that frequent and chronic (as opposed to low) engagement in media multitasking is associated with structural differences in the brain. Specifically, using MRI, Loh and Kanai (2004) showed that individuals who frequently engage in media multitasking had smaller gray matter density in the anterior cingulate cortex, a brain region involved in cognitive control.

Notably, there is also evidence questioning the existence of the link between *chronic* media multitasking and cognitive functioning. In a recent meta-analysis, Wiradhany and Nieuwenstein (2017), for instance, found a small, positive association between media multitasking and distractibility ($d = .17$), which turned out to be statistically non-significant after correction for reporting bias. However, other studies, not included in the meta-analysis (e.g., Magen, 2017; Van Der Schuur et al., 2015) suggest that media multitasking might impair some cognitive functions and work in a similar manner as having decreased cognitive resources would (if not due to long-lasting cognitive deficits, as the evidence for this is rather scarce, then due to different way of allocating attention in cognitive tasks). We thus hypothesize that experimentally induced engagement in media multitasking, as well as chronic media multitasking, would be related to one's decreased ability to correct their judgment after having learnt that the initial information on which the judgment was based is not correct.

Overview of the studies

We conducted two studies. In each study, we examined to what extent participants corrected their initial judgement after informing them that crucial information on which their initial judgment was based is in fact incorrect. To that aim, we adopted the procedure used by De keersmaecker and Roets (2017). Participants, based on an initial story, form an impression of a target person. In the control condition, the story contains neutral information about the target. In the experimental condition(s), also some negative information is added. The target person is then rated on several dimensions. Next, in the experimental condition(s), participants are informed that the negative information they were provided with is false. At this point, the target is rated again. Participants in the control condition rate the target only once. The evaluation after the correction is compared to the initial evaluation and the baseline (i.e., evaluation in the control condition).

In the first study, we used a modified procedure of De keersmaecker and Roets (2017). In order to increase its ecological validity, we presented the information about the target person as a profile on a professional networking site. We focused on the moderating role of media multitasking. To that end, we manipulated engagement in media multitasking while processing the correction. In the control condition, participants viewed a neutral profile of the target person, without the negative information, and rated her once. This was the baseline condition. In the false information conditions, participants

first saw the profile of the target person, including the negative information, and then rated her for the first time. Next, participants in the experimental condition were presented with filler tasks, and then the correction. After viewing the correction, they were asked to rate the target person again. There were, however, three experimental conditions, containing false information differing by how the correction was provided. In the mono-tasking condition, it was presented as a single task. In the multiple tasks condition, it was presented as one of several tasks (open in separate browser windows) between which a person was switching. In the simultaneous tasks condition, the correction was presented while participants were at the same time performing other tasks (listening to an audio and monitoring email). We expected impaired adjustment after correction in the multiple task condition and simultaneous task condition compared to the single-task condition.

In the second study, instead of manipulating media multitasking, we measured participants' media multitasking frequency. We assumed that high media multitasking frequency would have a similar effect to that of manipulated media multitasking. That is, we expected that participants who frequently engage in media multitasking would adjust their attitudes to a lesser extent than those who do so less infrequently.

Study 1

The aim of the study was to test whether engagement in media multitasking affects the way in which judgements based on false information are adjusted after viewing correcting information. We manipulated engagement in media multitasking by including two multitasking conditions, i.e., a multiple task condition in which participants were asked to switch between tasks, and simultaneous tasks condition in which participants performed two tasks in parallel. Thus, our study design comprised four conditions: 1) control, 2) false information mono-tasking, 3) false information with multiple tasks, and 4) false information with simultaneous tasks (similar approach was used in other studies, see Segijn, Xiong, & Duff, 2018).

We expected that engagement in additional tasks while reading the correcting information about a target person (vs. reading the information as a single task) would be related to a lesser correction after learning that the initial information was false. Specifically, we predicted:

H1) Smaller adjustment after correction, i.e., in the second rating, in the multitasking conditions (both multiple tasks and simultaneous tasks) than in the mono-tasking condition:

H1.1) More negative attitudes after correction in the multitasking conditions in comparison to the control and the single tasking condition.

H1.2) Similar attitudes after correction in the mono-tasking condition in comparison to the control condition.

Method

Participants

A priori power analysis showed that a sample of at least 232 participants would be necessary to obtain statistical power of 90% for a medium effect of $f = .25$ for a one-way ANOVA with four conditions (G*Power 3.1, Erdfelder, Buchner, & Lang, 2009). Since there are no existing studies on the effects of engagement in multitasking on processing of false information power calculations were based on an effect of medium size; however, we strived for a higher power than the minimal acceptable 80% (Cohen, 1992).

To anticipate data losses, we recruited 240 participants. They were students who have answered a study announcement on the university website and social networking portals. They received monetary compensation of 15 PLN (around 3 EUR) for their participation. The study was conducted in line with the local Faculty Ethics Committee with written informed consent from all subjects.

Exclusion criteria

There were three exclusion criteria. First, only participants with complete data were included in the analyses (data for one participant were excluded based on this criterium) and although not pre-registered, we removed responses from the same subject if given more than once ($N = 4$). Second, we planned to exclude participants who failed to follow the instructions, e.g., did not switch between tasks in the multitasking condition or did not summarize the videos. However, all the participants in our sample followed the instructions; therefore, there were no exclusions based on this criterium. Additionally, at the end of the study we asked participants about their seriousness of responding (Aust, Diedenhofen, Ullrich, & Musch, 2012). The wording of the question was the following: "It would be very helpful if you could tell us at this point whether you have taken part seriously, so that we can use your answers for our scientific analysis?" Participants were asked to select one of two answers: "I have taken part seriously" or "I have just clicked through the study, please throw my data away." They were told that their answer would not affect their compensation. All participants declared serious participation but we did not record data for this item for 5 subjects. We, nevertheless, decided to keep them in the analysis. The final sample comprised 238 people (181 women, 51 men) with the mean of age $M = 21.60$ years ($SD = 2.90$). All study materials, data, and scripts are available at <https://osf.io/xu6qd/>.

Procedure

Participants were invited to participate in a laboratory study simulating the tasks of professional recruiters. On their arrival to the laboratory, they were asked to sign an informed consent form and

were then randomly assigned to one of the four conditions: 1) control, 2) false information mono-tasking, 3) false information with multiple tasks, and 4) false information with simultaneous tasks.

Participants were then presented with a cover story saying that they would perform tasks similar to those of professional recruiters. Specifically, they were informed that apart from formal application documents, recruiters often view candidates' profiles on social media, both professional (such as LinkedIn) but also private (such as Facebook or Instagram). They were thus asked to view and rate one of the candidates based on the information on their professional profile site. Here the target person's (Nathalie) profile was presented. The profile contained a general description of Nathalie and her picture displayed in the form of what might resemble a typical professional LinkedIn profile. In the description, it reads that Nathalie works as a nurse in a hospital. Additionally, participants in the three false information conditions read the following information in the comments section: "Nathalie was arrested because of stealing drugs from the hospital. She has been stealing drugs and selling them on the black market for about 2 years. The money earned she spent on buying expensive clothes" signed as posted by Thomas J., Head of the Human Resources at the Provincial Hospital and a former supervisor of Nathalie (see Supplementary Figure S1). After participants have viewed the profile, they were asked to rate Nathalie on several dimensions.

Next, participants in the false information conditions were presented with the following information that was added to Nathalie's profile : "The comment has been removed due to a violation of the site policy. Unfavorable information was not true and turned out to be defamation." Participants then rated Nathalie again on the same set of dimensions. Crucially, between the false information conditions, we manipulated the manner of how the corrective information was presented.

In the mono-tasking condition, after reading the initial information about Nathalie (including the negative information) and rating her for the first time, participants were asked to perform five tasks consecutively. The tasks included: 1) watching a video (lasting 4:29¹) on how to prepare for a job interview; 2) correcting typos in a draft of a job announcement (presented in a Google Word document with a disabled spelling check option); 3) watching a second video (lasting 5:24²) on how to prepare for a job interview (participants were told they would need to summarize both videos at the end of the study); 4) checking email for new mail (there was in fact a new message in the inbox with a link to a profile of Nathalie with the corrected information); and 5) viewing corrective information and rating Nathalie again. After that, in line with the instructions presented at the beginning of the study, participants were asked to summarize the two videos in the form of a 5-point guide. So, in this

¹ <https://www.youtube.com/watch?v=gGRfIQp937g>

² <https://www.youtube.com/watch?v=TRrFyP0O36M>

condition a sequential manner was forced and participants read the correction when not engaged in anything else at the moment.

In the multiple tasks condition, participants were presented with the same tasks. This time, however, the web browser had opened several tabs, one tab per task. Participants were encouraged to frequently switch between open tabs. One of the tasks involved monitoring email, as participants were warned that some additional task could be sent to them during the session. Indeed, at a given point (the same for all participants and pretested based on the average time needed to complete the tasks 1 to 3 in the mono-tasking condition), they got an email with a link to corrective information. They were asked to open the link and rate Nathalie again. In this condition, corrective information was thus presented as one of the tasks participants interleaved.

In the simultaneous tasks condition, participants were presented with the same tasks. Like in the multiple tasks condition, the tasks were open in separate browser tabs. This time, however, participants were told that they could listen to the audio only when engaged in some other tasks. Therefore, they were asked to perform the spelling checking task while listening to the first video (task 1 in the mono-tasking condition) and read the correction and rate Nathalie while listening to the second video (task 3 in the mono-tasking condition).

To ensure that participants in the multiple tasks condition did in fact multitask, we told them that the task was designed to resemble a typical Internet session of a busy professional and since most of the activities in the Internet are multitasked, we asked participants to frequently (every several minutes) switch between open tabs. Participants in the simultaneous tasks condition were also told that the task was designed to resemble a typical Internet session of a busy professional, therefore, they needed to perform the tasks in parallel and listen to the videos only when engaged in something else. Additionally, while participants were working, their number of switches between tabs was recorded with the use of a special Google Chrome plug-in (Kus, 2014; Szumowska et al., 2018). This was done to check whether the participants in fact worked in a multitasking manner.

There were 61 participants in the control condition, 62 in the false information with mono-tasking, 55 in the false information with multitasking, and 60 in the false information with simultaneous tasks.

Measures

To assess participants' ability to correct evaluation after finding out that the initial information was not true, we used the same approach as De keersmaecker and Roets (2017). Specifically, we treated participants' evaluation in the control condition as baseline and checked whether the

evaluation of participants in the experimental condition was similar to the baseline, after the presentation of the corrective information.

To measure evaluation of the target person, we asked participants to indicate how they felt towards Nathalie on the following dimensions: *negative* versus *positive*, *cold* versus *warm*, *hostile* versus *friendly*, and *unfavorable* versus *favorable*. Additionally, participants were also asked to rate Nathalie on four more specific dimensions: *untrustworthy* versus *trustworthy*, *insincere* versus *sincere*, *contemptuous* versus *respectful*, and *unintelligent* versus *intelligent* (these items were used by De keersmaecker & Roets, 2017). We also added the following dimensions: *incompetent* versus *competent*, *unconfident* versus *self-confident*, *helpless* versus *resourceful*, and *submissive* versus *assertive*. As such, we had an equal representation of communion/warmth and agency/competence traits (e.g., Abele & Wojciszke, 2018), and tested the hypotheses separately for the two dimensions (see the Exploratory Analyses section). All ratings were given using sliders ranging from 0 to 100.

The scores on the eight dimensions used in the study by De keersmaecker & Roets (2017) were averaged (overall attitude). For exploratory purposes, we created two separate indices: evaluation of warmth, i.e. the average evaluation on the following traits: *cold* versus *warm*, *hostile* versus *friendly*, *untrustworthy* versus *trustworthy*, *insincere* versus *sincere*, *contemptuous* versus *respectful*; and evaluation of competence, i.e., the average evaluation on the following traits: *unintelligent* versus *intelligent*, *incompetent* versus *competent*, *unconfident* versus *self-confident*, *helpless* versus *resourceful*, and *submissive* versus *assertive*.

Cronbach's alphas in the first rating were the following: $\alpha = .95$ for overall attitude, $\alpha = .95$ for warmth, and $\alpha = .71$ for competence; and in the second rating: $\alpha = .95$ for the overall attitude, $\alpha = .94$ for warmth, and $\alpha = .88$ for competence in the second rating. The results for overall attitude are presented in the Preliminary analysis and Hypothesis testing sections. The results for warmth and competence ratings are presented in Exploratory analysis section.

Results

We used R (R Core Team, 2019) and RStudio (RStudio Team, 2019) with readxl (Wickham & Bryan, 2019), tidyverse (Wickham, 2019), ez (Lawrence, 2016), lmer (Bates et al., 2015), lmerTest (Kuznetsova et al., 2017), emmeans (Lenth, 2019), sjPlot (Lüdtke, 2018) packages to clean, analyse, and visualize the data in both Study 1 and Study 2.

Preliminary analysis

Before the main analysis, we tested whether the attitudes towards the target person were different depending on the presented information. Specifically, we ran a one-way ANOVA with 4 conditions: rating in the control condition versus first ratings in the false information conditions (mono-

tasking, multiple tasks, and simultaneous tasks; Tukey correction for multiple comparisons was applied). We found a significant effect of condition, $F(3, 234) = 103.59, p < .001$, generalized eta square (η^2) = 0.57. As expected, the evaluation of a target (Nathalie) was significantly more positive in the control condition compared to each false information condition: mono-tasking, mean difference $b = 38.28, SE = 2.80, t(234) = 13.66, p < .001$; multiple tasks, $b = 42.11, SE = 2.89, t(234) = 14.57, p < .001$; and simultaneous tasks, $b = 41.42, SE = 2.83, t(234) = 14.66, p < .001$. The average scores per condition are presented in Table 1 and in Figure 1.

Next, we compared the first and second evaluation in the false information conditions to check whether informing participants that the negative information was false changed their attitudes. To that aim, we ran a repeated measure ANOVA on the evaluation before and after the correction. We found more positive evaluations after the negative information was debunked, $F(1,176) = 399.15, p < .001, \eta^2 = 0.54$.

Table 1
Descriptive statistics of the main variables (Study 1)

	Control		False information					
	M	SD	Mono-tasking		Multiple tasks		Simultaneous tasks	
	M	SD	M	SD	M	SD	M	SD
First overall attitudes	73.81	13.18	35.53	16.37	31.70	16.98	32.39	15.49
First warmth rating	72.40	13.36	32.71	17.69	28.57	18.73	29.13	15.78
First competence rating	71.87	13.63	61.78	15.65	59.97	15.49	61.10	12.44
Second overall attitude			68.89	13.46	65.60	15.64	66.34	18.45
Second warmth rating			67.22	13.51	63.49	16.55	65.12	19.13
Second competence rating			75.15	13.37	69.04	15.14	69.59	15.11
Number of switches			23.17	7.62	157.48	62.86	60.03	23.75

Figure 1. Average overall attitude per conditions in Study 1. Error bars represent 95% CI.

Hypothesis testing

To test the study hypotheses, we ran a one-way ANOVA with conditions (control, false information mono-tasking, false information with multiple tasks, and false information with simultaneous tasks) as independent variable and the final target evaluation as the dependent variable. To re-iterate, the only evaluation in the control condition and the second evaluation in the false-information conditions served as a final rating. Results revealed a significant effect of condition, $F(3,234) = 3.49$, $p = .016$, $\eta^2 = 0.04$. As expected, compared to the control condition, participants in the multiple tasks condition, $b = 8.20$, $SE = 2.84$, $t(234) = 2.883$, $p = .022$, and the simultaneous tasks condition, $b = 7.46$, $SE = 2.78$, $t(234) = 2.68$, $p = 0.04$, evaluated the target person more negatively, which is in line with Hypothesis 1.1. Moreover, in line with Hypothesis 1.2 the adjusted attitudes of participants in the mono-tasking condition did not significantly differ from participants' attitudes in the control condition, $b = 4.92$, $SE = 2.76$, $t(234) = 1.78$, $p = .284$. However, the adjusted attitudes between the three false information conditions did not differ significantly (in all cases $t < 1.16$), which is contrary to what we expected (Hypothesis 1.1).

Next, we tested whether the within-subject adjustment between the first and the second evaluation in the false information conditions depended on multitasking demands. To that aim, we conducted a 2 (time of evaluation: before vs. after correction; within-subject factor) x 3 (multitasking

demands: single tasking vs. multiple task vs. simultaneous tasks conditions; between-subject factor) repeated measures ANOVA. We found a main effect of the time of evaluation, $F(1,174) = 393.88$, $p < .001$, $g = 0.52$, but the effect of multitasking demands, $F(2,174) = 1.60$, $p = .205$, $g = 0.01$, and the interaction of the two factors, $F(2,174) = 0.01$, $p = .987$, $g < 0.01$, were not statistically significant. Overall, despite the difference between multitasking conditions and the control condition, the results do not provide sufficient support for the hypothesized effects of media multitasking on correction after misinformation.

Exploratory analysis

Number of switches. We ran exploratory analysis in which we tested whether the number of switches³ is related to the correction. We thus analyzed only the data for the two multitasking conditions ($N = 102$) and checked whether the number of switches moderated the magnitude of the change in evaluation after (vs. before) the correction. Apart from the effect of time (before vs. after the correction), $b = 34.46$, $SE = 2.39$, $t(200) = 14.42$, $p < .001$, neither the effects of the number of switches, $b = -0.02$, $SE = 0.03$, $t(200) = -0.85$, $p = 0.395$, nor the interaction between number of switches and time, $b = 0.01$, $SE = 0.04$, $t(200) = 0.19$, $p = 0.852$, were significant. More details on this analysis is presented in Supplementary Table S1.

Additionally, since the distribution of the number of switches was highly skewed, we log-transformed the number of switches and repeated this analysis to verify whether a skewed distribution could be the reason for the failed analysis (this analysis was not pre-registered). The main effects as well as the interaction effect involving the number of switches were similar as with non-transformed data. The model details are presented in the Supplementary Table S2.

Warmth and competence. Since there are two main dimensions on which people are usually evaluated (e.g., Fiske, Cuddy, & Glick, 2007; Wojciszke, Abele, & Baryl, 2009): warmth/morality and competence/agency, we additionally tested the influence of the negative information and the correction of perception of the target on the two dimensions separately. Oftentimes the fabricated political information pertains to one's ethical misconduct, i.e., morality. We, thus, believe it is useful to examine whether evaluation on warmth/morality generalizes to the other dimension (competence/agency) as well. Therefore, we reran our analyses for warmth and competence ratings.

For the preliminary analysis, we found the effect of condition on warmth ratings, $F(3,234) = 100.07$, $p < .001$, $g = 0.56$; and, although somewhat weaker, for competence ratings, $F(3,234) = 8.86$,

³ The number of switches indicated by the plug-in decreased by the number of tabs minus 1 (there were 6 tabs). We excluded from this analysis 13 participants for whom due to an equipment failure, we did not record the number of switches.

$p < .001$, $ges = 0.10$. For warmth, the evaluation of the target was higher in the control condition compared to false information conditions with mono-tasking, $b = 39.69$, $SE = 2.97$, $t(234) = 13.37$, $p < .001$; multiple tasks, $b = 43.84$, $SE = 3.06$, $t(234) = 14.319$, $p < .001$; and simultaneous tasks, $b = 43.27$, $SE = 2.99$, $t(234) = 14.46$, $p < .001$. For competence, the evaluation of a target was more positive in the control condition compared to false information conditions with mono-tasking, $b = 10.09$, $SE = 2.59$, $t(234) = 3.90$, $p = .001$, multiple tasks, $b = 11.90$, $SE = 2.67$, $t(234) = 4.46$, $p < .001$, and simultaneous tasks, $b = 10.77$, $SE = 2.61$, $t(234) = 4.13$, $p < .001$. We present the average evaluations in Supplementary Figures S1 (warmth) and Figure S2 (competence). For a repeated measure ANOVA of the evaluation before and after the correction, we found more positive evaluations after the negative information was debunked both for warmth, $F(1,176) = 377.70$, $p < .001$, $ges = 0.52$, and for competence, $F(1,176) = 80.07$, $p < .001$, $ges = 0.11$. Again, the effects for competence ratings, although significant, were rather modest.

One-way ANOVA with four conditions and the final target evaluation as the dependent variable, i.e., the only evaluation in the control condition and the second evaluation in the false-information conditions for warmth revealed a significant effect of a condition, $F(3,234) = 3.57$, $p = .014$, $ges = 0.04$. There was a difference between the control condition and multiple tasks condition, $b = 8.91$, $SE = 2.93$, $t(234) = 3.04$, $p = .014$, but the difference between the control and simultaneous tasks condition was only marginally significant, $b = 7.29$, $SE = 2.87$, $t(234) = 2.54$, $p = .056$, and the difference between the control and mono-tasking condition was non-significant, $b = 5.19$, $SE = 2.84$, $t(234) = 1.82$, $p = .265$. The analysis for competence showed a non-significant effect of condition, $F(3,234) = 2.25$, $p = .082$, $ges = 0.03$.

For warmth, a 2 (time of evaluation: before vs. after correction; within-subject factor) $\times$ 3 (multitasking demands: single tasking vs. multiple task vs. simultaneous tasks conditions; between-subject factor) repeated measures ANOVA revealed the main effect of the time of evaluation, $F(1,174) = 372.74$, $p < .001$, $ges = 0.52$, but the effect of condition, $F(2,174) = 1.73$, $p = .181$, $ges = 0.01$, and their interaction, $F(2,174) = 0.06$, $p = .941$, $ges < 0.01$, were not significant. For competence, we found the main effect of the time of evaluation, $F(1,174) = 79.54$, $p < .001$, $ges = 0.11$, but again the effects of condition, $F(2,174) = 1.70$, $p = .186$, $ges = 0.01$, and their interaction, $F(2,174) = 1.83$, $p = .163$, $ges = 0.01$, were non-significant.

We also repeated the analysis with the number of switches using warmth or competence ratings. The effects, similarly to the analysis of the overall attitudes, were statistically non-significant. The details are presented in the Supplementary Table S1 (for raw number of switches) and Table S2 (for log-transformed number of switches).

Discussion

In this study, we examined the attitude adjustment after misinformation and the role engagement in media multitasking plays in this phenomenon. Our preliminary analysis suggests that the misinformation procedure “behaved” as expected: participants who were presented with a negative comment about the target person formed more negative attitudes than those who were in the control condition which did not include such information. Furthermore, when we compared the initial and the second attitude ratings in the false information condition, it turned out that people adjusted their attitudes after the misinformation was debunked. These effects were observed for the overall attitudes, as well for the exploratory analysis of warmth and competence separately.

When we compared the adjusted attitudes of the three false information conditions with the control condition, results revealed that although people changed their attitudes after receiving the correction of negative, false information, the adjusted attitudes of participants who switched between multiple tasks or participants who engaged in simultaneous task performance were still slightly, albeit statistically significantly, more negative compared to individuals who were never exposed to the incorrect information. In contrast, participants who engaged in the tasks in a consecutive manner developed attitudes that were not significantly different from participants in the control condition. Importantly however, results also revealed that the amount of attitude adjustment between the first evaluation and the second evaluation was not significantly affected by multitasking demands, and participants’ adjusted attitudes in the monotasking condition were also not significantly different from those participants who engaged in multitasking. Hence, overall, we conclude that involvement in media multitasking – as manipulated in our study – did not affect attitude adjustment after correction.

As for the exploratory analysis, the results for warmth were similar to those of general attitudes (although the difference between the control condition and false information with simultaneous tasks condition was only marginally significant). The results for competence, although also in a similar direction, yielded smaller effect sizes than these for general attitudes. Finally, the effects of number of task switches in the multiple and simultaneous task conditions did not impact the attitude adjustment.

Study 2

The aim of the study was to test whether the frequency with which participants engage in media multitasking in their daily lives is related to the extent to which they correct their attitudes after misinformation. We thus measured media multitasking frequency of our participants and presented them with a similar impression formation task as in Study 1 but there were only two task conditions: control and false information. We tested whether individual differences in media multitasking frequency interacted with attitude adjustment after debunking misinformation. We expected that:

H1) The higher the media multitasking frequency, the smaller the attitude change after correction (within-subject effect among participants in the false information condition).

H2) Moderating effect of media multitasking frequency on the difference between conditions in the final attitude:

H2.1) For participants who score high on media multitasking, the attitude after correction will be more negative in the false information condition compared to the control condition.

H2.2) For participants who score low on media multitasking, there will be no difference between conditions, i.e., the attitude after correction will not differ significantly from the control (baseline) condition.

Method

Participants

A priori power analysis (conducted with the *pwr* R package, Champely, Ekstrom, Dalgaard, Gill, & De Rosario, 2015) indicates that we need a sample of 390 participants in order to obtain a sufficient power of 80% to detect an effect of $d = 0.30$ for the difference between the conditions and a small effect ($r = 0.20$) of media multitasking on attitude change in the experimental condition.

Participants were recruited through the Prolific research platform⁴. We requested 450 participants, in case some of them fail to pass the attentional checks and were excluded from further analyses. All participants were compensated for completing the study (they received 1.5 USD for participation). The study was conducted in line with the local Faculty Ethics Committee with informed consent from all subjects. All study materials, data and scripts are available at <https://osf.io/xu6qd/>.

Exclusion criteria

There were 452 Prolific users who completed the study. Moreover, participants' seriousness of participation was assessed by directly asking them about it at the end of the study (in the same manner as in Study 1). One person admitted that (s)he did not respond seriously and was removed from further analysis. Additionally, participants were asked three questions which served as screeners and checked their attention in responding in a survey (Berinsky et al., 2013; Thomas & Clifford, 2017). Only participants with at least two correct responses to these questions were included in the final sample.

⁴ Study 2 was run in May 2020, when people in many countries were experiencing lockdown as a response to COVID-19 pandemic. Although our hypotheses were unrelated to this issue, nor instigated feelings of threat, the target person was supposedly a nurse, i.e., a member of a critical workforce. Although it could impact the overall perception of nurses and other key workers, we doubt whether this issue could bias people's correction of false information.

First, we used an instructional manipulation check (e.g., Oppenheimer, Meyvis, & Davidenko, 2009) which read: "Please select "very often" (it is to check your attention) with the response options (1) *never* to (4) *very often*. Next, we used a bogus item which provided an obviously false response option (e.g., Maniaci & Rogge, 2014): "Are you now using a computer or other electronic device?" with the response options (1) *No*; (2) *I am not sure*; (3) *Yes*. Finally, we asked a comprehension question about the experimental material (e.g., Thomas et al., 2014): "What was Nathalie accused of?" with the following response options: 1) stealing drugs from the hospital, 2) incorrect treatment of patients, 3) neglecting her responsibilities, 4) Nathalie was not accused of anything. The correct answer was the first one for participants in the experimental condition and the last one for participants in the control condition. The comprehension question was asked after all rating questions to avoid any influences of this question on participants' attitudes. Nine people did not pass the attention checks. Thus, the final sample comprised $N = 442$ (242 men, 198 women, and 2 other) with the mean of age of $M = 27.60$, $SD = 8.87$.

Procedure

The experiment was conducted online using Prolific platform. Participants were informed that they are taking part in a study aimed at investigating how presentation of information on professional networking sites affects the way people perceive and evaluate others. They were instructed that the study includes filling in a questionnaire and viewing a profile of one, randomly selected, person, and rating it.

Participants were first presented with a profile on a professional networking site which has been allegedly randomly selected for them from a wider selection of profiles (all participants were in fact presented with the same profile of Nathalie as in Study 1). At that stage, participants were also randomly assigned to one of the two conditions and viewed the Nathalie's profile: as in Study 1, the profile in the false information condition had negative comment from Nathalie's former boss, whereas in the control condition, there were no such information. After participants have viewed the profile, they were asked to rate Nathalie on several dimensions. Subsequently, they were asked to fill in the Media Multitasking Questionnaire that included attention checks. Additionally, participants in the experimental condition were presented with the correcting information stating that the comment was a defamation. They were then asked to rate Nathalie again on the same set of dimensions.

At the end of the study, all participants were asked to indicate their gender, age and highest level of education, as well as to answer the seriousness and comprehension question. Finally, they were informed about the true purpose of the study, debriefed, and thanked.

Measures

Correction of false information

To assess participants' ability to correct evaluation after finding out that the initial information was not true, we used the same method as in Study 1, i.e., we asked participants to rate their attitudes using eight dimensions on a 0-100 scale. Cronbach's alphas in the first rating were the following: $\alpha = .96$ for overall attitudes, $\alpha = .94$ for warmth, and $\alpha = .80$ for competence; and in the second rating: $\alpha = .95$ for the overall attitudes, $\alpha = .94$ for warmth, and $\alpha = .88$ for competence. As in Study 1, the results for overall attitude are presented in Preliminary analysis and hypothesis testing section. The results for warmth and competence ratings are presented in Exploratory analysis section.

The frequency of media multitasking was assessed with the use of the Short Measure of Media Multitasking (Baumgartner, Lemmens, Weeda, & Huizinga, 2016). In the first part, the questionnaire assesses time spent per day on three different types of activities: watching television, browsing social media (e.g., Facebook, Twitter, Instagram) and sending messages via phone or computer (e.g., emails, SMS, MMS, IM) using a scale from 1 (*never*) to 9 (*more than 5 hours*). In the second part, participants are asked how frequently they use these kinds of media simultaneously with each of the other media types. They rate each of the nine items on a scale from 1 (*never*) to 4 (*very often*). As recommended by Baumgartner et al. (2016), a general score of media multitasking was calculated by the summation of responses to the nine multitasking items in the second part (Cronbach's $\alpha = .84$). Higher scores indicate higher frequency of media multitasking. Media frequency was included as a control variable.

Results

Preliminary analyses

Before the main analysis, we tested whether the attitudes towards the target person differ between the control and false information condition: the overall attitudes were more positive in the control versus the first evaluation in the experimental condition, $F(1,440) = 260.25$, $p < .001$, $ges = 0.37$. The average scores per condition are presented in Table 2 and Figure 2. Next, we compared the first and second ratings in the false information condition to examine whether informing participants that the negative information is not true changes the final evaluation. Not surprisingly, after the negative information was debunked, participants developed more favorable attitudes, $F(1,214) = 162.41$, $p < .001$, $ges = 0.27$. Finally, we tested whether the second evaluation in the experimental group (after correction) differed significantly from the ratings in the control group. We found that ratings in the false information condition, even after correcting it, were significantly lower in comparison to the control condition for the overall attitudes, $F(1,440) = 9.95$, $p = .002$, $ges = 0.02$.

Table 2

Descriptive statistics of the main variables (Study 2)

	Control condition		False Information condition	
	M	SD	M	SD
First overall attitudes	77.57	12.26	50.09	22.36
First warmth rating	77.03	12.56	50.40	22.06
First competence rating	71.47	12.05	65.27	13.35
Second overall attitudes			73.37	15.58
Second warmth rating			72.86	15.70
Second competence rating			70.47	13.32
Media Multitasking	23.65	5.73	23.50	5.88
Media frequency	13.19	3.74	12.93	3.66

Figure 2. Average overall attitudes per conditions in Study 2. Error bars represent 95% CI.

Hypothesis testing

To test the study hypotheses, we examined whether the within-subjects adjustment in attitudes depends on the chronic media multitasking frequency. We therefore ran a linear mixed model with first and second rating nested within participants and media multitasking frequency as the moderator (we also controlled for media frequency). Although, consistently with the preliminary analysis, the effect of rating was significant, $b = 23.35$, $SE = 1.84$, $t = 12.70$, $p < .001$, the effects of media multitasking,

$b = 0.07$, $SE = 0.24$, $t = 0.29$, $p = .773$, as well as their interaction, $b = -0.11$, $SE = 0.31$, $t = -0.35$, $p = .723$, were not significant. The details are presented in Supplementary Table S3.

Finally, we regressed the final evaluation (the only evaluation in the control condition and the second evaluation in the false information condition) on condition, media multitasking frequency, and the interaction term (condition $\times$ media multitasking). Although the two conditions differ from each other, $b = -4.13$, $SE = 1.34$, $t = -3.09$, $p = .002$, the effects of media multitasking frequency, $b = -0.10$, $SE = 0.18$, $t = -0.57$, $p = .570$, and their interaction were not significant, $b = 0.04$, $SE = 0.23$, $t = 0.16$, $p = .876$. The model details are presented in Supplementary Table S4.

Exploratory analyses

In the exploratory analyses, we focused on warmth and competence instead of the overall attitudes. We found that ratings in the false information condition were significantly lower than in the control condition for warmth, $F(1,440) = 246.41$, $p < .001$, $ges = 0.36$, and competence, $F(1,440) = 26.37$, $p < .001$, $ges = 0.06$. Notably, although the difference was significant for both warmth and competence, the differences between the conditions for competence ratings were relatively small. The average scores per condition are presented in Table 2 and Supplementary Figure S4 and Figure S5. After the negative information was debunked, the target was perceived as more warm, $F(1,214) = 153.10$, $p < .001$, $ges = 0.26$, and more competent, $F(1,214) = 35.29$, $p < .001$, $ges = 0.04$. Again, the difference for competence ratings, although significant, was rather modest.

We next tested whether the second evaluation in the experimental group (after correction) differed significantly from the ratings in the control group. We found that ratings in the false information condition, even after debunking it, were significantly lower in comparison to the control condition for warmth, $F(1,440) = 9.53$, $p = .002$, $ges = 0.02$, but not for competence ratings, $F(1,440) = 0.69$, $p = .406$, $ges < 0.01$.

Next, we examined the effects of media multitasking on the attitudes adjustment after debunking misinformation. Similarly as in the main analysis, we did not find a significant interaction between media multitasking neither for warmth or competence. For warmth, the effect of rating was significant, $b = 22.52$, $SE = 1.83$, $t = 12.33$, $p < .001$, the effects of media multitasking, $b = 0.03$, $SE = 0.24$, $t = 0.14$, $p = .888$, as well as their interaction, $b = -0.08$, $SE = 0.31$, $t = -0.26$, $p = .794$, were not significant. For competence, the effect of rating was significant, $b = 5.24$, $SE = 0.88$, $t = 5.95$, $p < .001$, the effects of media multitasking, $b = -0.11$, $SE = 0.17$, $t = -0.67$, $p = .503$, as well as their interaction, $b = -0.03$, $SE = 0.15$, $t = -0.19$, $p = .853$, were not significant. The model details are presented in the Supplemental materials (Table S3).

Finally, we regressed the final evaluation (the first and only evaluation in the control condition and the second evaluation in the experimental condition) on condition, media multitasking frequency, and the interaction term (condition x media multitasking). As in the main analysis for the overall attitudes, we did not find significant interactions between media multitasking and condition neither for warmth or competence. For warmth, although the two conditions differ from each other, $b = -4.08$, $SE = 1.36$, $t = -3.01$, $p = .003$, the effects of media multitasking frequency, $b = -0.04$, $SE = 0.18$, $t = -0.25$, $p = .806$, and their interaction were not significant, $b = -0.02$, $SE = 0.23$, $t = -0.10$, $p = .919$. For competence, the effects of the condition, $b = -1.00$, $SE = 1.21$, $t = -0.83$, $p = .410$, media multitasking frequency, $b = -0.06$, $SE = 0.16$, $t = -0.37$, $p = .713$, and their interaction were not significant, $b = -0.06$, $SE = 0.21$, $t = -0.29$, $p = .773$. The model details are presented in Supplementary Table S4.

Discussion

In this study, we analyzed the role of media multitasking frequency in the attitude adjustment after misinformation. Our preliminary analysis again – but this time in the online environment – showed that that misinformation procedure we used seemed to work as expected: participants who were presented with a negative comment about Nathalie formed more negative attitudes than those who were in the control condition. When we compared the initial and the second attitude ratings in the false information condition, it turned out that people's attitudes became more positive. Similar effects were observed for the overall attitudes as well for the exploratory analysis of warmth and competence, but again, the effects for competence were rather weak.

Importantly, when we compared the final ratings, i.e., the only rating in the control condition and the second rating in the false information condition, it again turned out that although people changed their attitudes after debunking misinformation, their attitudes were slightly more negative in comparison to the control condition. It suggests that providing corrective information may not override the lingering effects of false information, or slander in this case. This may be especially true in an online (as compared to lab) environment, as in Study 1 those in the false information single tasking condition corrected their evaluations (i.e. their rating did not differ from the control condition). Again, it is only a speculation, but perhaps online studies, by their very nature promote multitasking and divided attention, even in the form of having open multiple browser tabs. However, our main hypothesis regarding the relationship between media multitasking frequency, i.e., a relatively stable trait, and the magnitude of correction was not confirmed.

General Discussion

A large portion of our everyday activities are performed online and the Internet has become a major source of information for many people: many individuals develop their attitudes toward various targets using only online information. This is also via the Internet how misinformation is spread to a large scale, which can have serious social, political and personal consequences (Allcott & Gentzkow, 2017; Bradshaw & Howard, 2018). Correcting false information is thus of vast importance, and many scholars have recently tried to understand what factors play a crucial role in the ability to adjust one's attitudes after receiving false information (Cook, Lewandowsky, & Ecker 2017; van der Linden et al., 2017). Since most computer activities are multitasked (Zhang & Zhang, 2012) and media multitasking is an inevitable property of the technological landscape of today, we have focused on the role media multitasking plays in correction after misinformation. Specifically, we ran two studies in which we focused on how engagement in media multitasking (Study 1) and chronic media multitasking frequency (Study 2) is associated with the attitude adjustment after providing correction of previously presented false information.

Overall, we did not find support for an effect of media multitasking on attitude adjustment. In Study 1, we found that people adjusted their attitudes after being informed that the initial attitudes were based on false information. However, these adjusted attitudes of participants who engaged in multitasking, either engaging in multiple tasks or engaging in different tasks simultaneously, were still significantly more negative than the attitudes of the individuals who were never exposed to the incorrect negative information. On the other hand, the adjusted attitudes of participants in the mono-tasking condition did not significantly differ from the control condition. Crucially however, within-subject analyses revealed that the adjusted attitudes of participants in the mono-tasking condition did not significantly differ from the attitudes of participants in the two multitasking conditions, nor was the amount of attitude change between the initial attitudes and the adjusted attitudes dependent on whether participants engaged in multi-tasking or mono-tasking. In Study 2, we focused on chronic media multitasking and found that it was not related to participants' ability to correct after misinformation either.

The results thus suggest that media multitasking, either manipulated experimentally or measured with a questionnaire, does not relate to the ability to adjust attitudes after misinformation. Therefore, in the present studies, media multitasking does not seem to have a similar effect as low cognitive abilities do. In their study, De keersmaecker and Roets (2017) demonstrated that intelligence moderates the magnitude of the correction after misinformation in the way that only participants with relatively higher levels of cognitive abilities were able to fully adjust their attitudes. Our studies indicate that similar effects are not found in reference to media multitasking. The latter do not mimic the effects of cognitive business on the ability to correct initial attitudes either (see Gilbert & Osborne, 1989; Gilbert, Pelham, & Krull, 1988).

These findings, although “null”, add to the discussion on the effects of media multitasking, especially in the form of chronic or “heavy” involvement in multitasking with media. Research shows that it relates to a variety of negative cognitive outcomes such as distractibility, longer reading time, inability to filter out irrelevant information and noise or poorer ability to switch between tasks (e.g. Bowman et al., 2010; Ophir et al., 2009; Sanbonmatsu et al., 2013). On the other hand, other studies did not confirm these findings (e.g., Minear et al., 2013; see also Wiradhany & Nieuwenstein, 2017). The present results are in line with the latter, as the level of media multitasking frequency (or “heaviness” of simultaneous media use) did not matter for the magnitude of attitude adjustment.

Nevertheless, to the best of our knowledge, the present contribution was the first empirical investigation of the role of media multitasking on attitude adjustment, and we believe it is unwarranted at this stage to conclude that multitasking does not affect attitude adjustment across situations. For example, the continued influence effect is a robust and highly replicable phenomenon in the literature (see e.g., Lewandowsky et al., 2012). However, in the present studies, the continued influence effect was rather small, or even non-significant (see below for more on this issue). This might be the result of the very limited information that was provided about the target person: On the one hand, it minimizes the chance of methodological confounds, but on the other, it makes the attitude adjustment less demanding, regardless of engaging in media multitasking or not. Therefore, we believe that further research is necessary to examine under which circumstances media multitasking might affect attitude adjustment.

As for the ability to correct after misinformation, we did not observe differences between the control condition and the false information monotasking condition in Study 1, which suggests that these participants were able to fully adjust their attitudes after correction. Interestingly, however, in Study 2, there was a difference between control and false information condition. We can only speculate why such differences between Study 1 and Study 2 occurred. Although we did our best to gather high quality data in both studies (e.g. by applying attention and seriousness checks and asking participants not to engage in other tasks in Study 2), it is likely that the participants in the lab environment (Study 1) completed the study with higher levels of attention and in a less distracting environment than the participants on Prolific Academic platform (Study 2).

As for our exploratory analyses, the effects for warmth mimicked the effects of the overall attitudes but the effects for competence were more modest across two studies. It is probably because the false information provided on the target’s profile (stealing) impinged on the morality/communion aspect but not on the competence/agency aspect of person perception. It is worth noting that although to a lesser extent, the current manipulation influenced competence/agency dimension too. This observation is consistent with the negative halo or “horns” effect, where the overall attitudes of a given person are affected by positive or negative perception of that person, even on unrelated traits

(Thorndike, 1920). In our studies, we observed such a spillover effect from morality to agency/competence. The fact that the effects of misinformation on competence ratings was rather small is consistent with previous research (Gräf & Unkelbach, 2016, 2018) showing that the negatives are less densely represented in the cognitive system, which results in weaker inferences from the negative information on one dimension to negative information on the other dimension of social perception. Another possibility is that participants inferred not only negative information on morality (stealing), but also negative information on competence (as she was caught) from the provided false information. In future studies, to increase generalizability of current studies, it might be interesting to test misinformation directed to the agency/competence dimension of social judgement to verify whether information from competence dimension also impacts perception of a target's warmth.

Limitations and future research directions

Our results present an initial attempt to understand the relationship between media multitasking and attitude correction after debunking misinformation. Although we did not find the hypothesized effects of media multitasking, it is possible that some other task combination would yield different results: using different targets and different sets of tasks could be especially fruitful. Regarding the targets, since the participants rated only one target, it would be advisable to include various targets (differing in gender, age, occupation) in future research, e.g., as in the multiple-message design (e.g., Slater, Peter, & Valkenburg, 2015). Also, a set of different tasks one can multitask with could be used: Such tasks could differ in the abilities they require, their content, or relatedness to the main task. Particularly, task demands could play a role. The additional tasks we used in the current research (Study 1) were not very demanding, which might be responsible for the negligible effects of media multitasking we have found. Therefore, more demanding tasks could be used in future studies.

Since the focus of the present investigation was correction of false information, we concentrated on how participants *adjust* their attitudes after receiving a correction. The present investigation is thus ignorant of how media multitasking affects attitude *formation*. This would be an interesting topic to investigate in the future.

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Declaration of Interest Statement

The Authors declare no conflict of interest.

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