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The effect of cognitive overload on accuracy perception of COVID-19 related misinformation

Name: Miloslava Drazilova
Student ID number: 575592

Supervisor: Dr. Hainguerlot, M.F.M
Second assessor: Dr. Georg Granic
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Abstract

This thesis investigates cognitive overload affecting the accuracy perception of COVID-19 pandemic related fake news. It additionally examines the effect of an intuitive reasoning style on perceiving accuracy and its influence on the extent of the cognitive overload effect. The disruptiveness of COVID-19 strengthened the fast misinformation spread about the novel virus, emphasizing the need to understand why people consider fake news accurate. This thesis explores how cognitive overload, one of the side effects of social media use during a pandemic, distracts society members from correctly perceiving the accuracy of fake news. With a randomized control trial, executed as an online survey, 184 participants, divided into a group with high and low cognitive load, have to rate the accuracy of actual and fake news about COVID-19. After analysing the results with an Ordered Logistic Regression, there is not enough support found for that the increased cognitive load, in the form of a high cognitive load manipulation treatment, influences how people perceive fake news accuracy. However, based on the results from the Cognitive Reflection Test, having an intuitive reasoning style shows to influence people to be more likely to perceive fake news as accurate. Once combined with the effect of the cognitive load manipulation treatment, the effect does not remain significant. The results indicate that people differ in their accuracy perception based on cognitive reasoning style, wherefore further research is recommended to dive into other psychological determinants behind the beliefs in fake news experimentally.

Keywords:

Cognitive overload, Cognitive Load Theory, Fake news, Accuracy perception, Cognitive Reflection Test

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When deciding on the topic, I tried to reflect on the current situation in the world – the ongoing COVID-19 pandemic. This pandemic has highlighted the spread of fake news and brought us into a period of an ongoing info-demic. Ideally, society would learn to differentiate between real and fake news. However, for it to happen, (behavioural) tools need to be developed to address the abrupt spread of info-demic. It is undoubtedly a long way to go. However, taking small steps, such as learning why people believe in misinformation, can help researchers and policymakers create tools for combating misinformation spread.

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1 Introduction

The global pandemic, emerging due to the spread of the COVID-19 virus, has been characterised by its continuously changing nature, bringing high **uncertainty** (Laato et al., 2020b) to people's lives worldwide. The novelty of the situation led to the rise of often diversifying information content related to the topic of the pandemic among various media platforms. The circumstances brought confusion about which information should be trusted and which should not—increased time spent on social media to find out more information about the ongoing novel situation led individuals to higher exposure to COVID-19 related information, the increased **cognitive load** they had to face. For some, dealing with this novel situation was accompanied by experiencing feelings of anxiety. In some cases, these feelings might have even led even to a state of **depression** (Fiorenzato et al., 2021). Besides the negative psychological and social consequences resulting from the **high cognitive load** during the pandemic, caused by the excessive amount of COVID-19 related information, I would like to zoom in on another issue – **the misinformation spread.**

What does this thesis intend to study? This thesis research intends to look into misinformation and investigate what influences people's accuracy perception of misinformation/ fake news. It notices that individuals misjudge the accuracy of COVID-19 related information and spread misinformation due to various **psychological determinants** related to their social media use (Talwar et al., 2019). Many people might be mistakenly believing in and sharing misinformation because they falsely believe in the **accuracy** of the shared content (Pennycook and Epstein et al., 2021). Already before COVID-19 occurred, researchers have asked what makes people believe in misinformation and fake news. Do people honestly believe in the accuracy of the presented content of the misinformation, or is there a **cognitive mechanism** explaining why they believe in the accuracy of the fake news and why they potentially share it further? Or could it be their **intuitive rather than analytical cognitive reasoning** influencing them to mistakenly rate fake news as accurate? Pennycook and McPhetres et al. (2020) emphasise one of the reasons people believe in misinformation. They point out that it is the **social media use of individuals,** which distracts them from correctly **perceiving the accuracy of the news**.

During COVID-19, a similar situation occurred. Hence, when reflecting on the COVID-19 context, this thesis investigates the influence of one of the side effects, which the society could increasingly perceive during the pandemic related to social media use - the increased **cognitive load**. The increased **cognitive load** is a state that comes into existence when an individual is processing novel information. This novel information is treated in the **working type of the memory** of the individual. However, this type of a memory has only limited capacity (van Merriënboer and Sweller, 2010) and hence gets overloaded when exposed to high amount of new information. This thesis therefore investigates the accuracy perception of the COVID-19 related misinformation, intending to test the effect of the increased **cognitive load** on **the accuracy judgment** of the COVID-19 related news. To summarise, the main research question is stated in the following way:

What is the effect of cognitive overload on the accuracy perception of misinformation about the COVID-19 pandemic?

Why is it necessary to investigate what influences how people perceive the accuracy of misinformation? Misinformation/ fake news spread is regarded as **troublesome** since it leads towards the formation of inaccurate beliefs, such as during the COVID-19 pandemic. During that time, there has been widespread of misinformation, including conspiracy theories about the virus' origins or the potential remedies against it. This misinformation spread naturally poses a risk since misinformation, primarily related to health, endangers people, possibly leading to either under/ or over-reacting behavioural tendencies (Pennycook and McPhetres et al., 2020). Believing in misinformation in times, such as the COVID-19 crisis, might lead individuals to a disagreement or denial of the basic facts and information that are presented by the mainstream news (Pennycook and Epstein et al., 2021), resulting in an overall reluctance of some the societal members to comply with measures prescribed by the government, such as those related to the public health, leading to a non-desirable, potentially harmful behaviour for the society (Laato et al., 2020a). Since **the COVID-19 crisis** is **ongoing**, it is necessary to understand what influences people in perceiving the **accuracy of the news**, such as related to COVID-19, on social media. Researchers should aim to comprehend what makes people distracted from correctly **perceiving the accuracy** of the shared online content (Pennycook and McPhetres et al., 2020).

Understanding increased **cognitive load's role** and observing how the **cognitive load influences how people perceive the accuracy of the shared content**, can help policymakers understand the role of **social media. Additionally, it will not only help explain how** people's attention to accuracy is influenced but also might help in developing various interventions to improve how the accuracy is perceived. The role of the cognitive load will be understood through the lens of the Cognitive Load Theory. Additionally, comprehending the effect of increased cognitive load for individuals who have higher **analytic reasoning** and for those who have an intuitive reasoning style, which will be an additional element of this research, could allow policymakers to understand that the policy measures differ in their effects on various individuals. The situation (e.g. COVID-19), which increases cognitive load, might influence the different groups to various extents when perceiving the accuracy of the information they are exposed to. Hence correct recognition could allow policymakers to execute better-targeted addressing of **misinformation corrections**. This could prevent the possible consequence of misinformation sharing in the future. There is an increasing amount of research, which relates to the different ways how individuals could be prompted to reflect on the accuracy of misinformation and hence be prevented from believing in it or even consequently sharing it. There are numerous solutions and normative components, varying from elements such as the optimisation of the presentation of the information, accuracy priming, adaptations in the messaging details or repeated exposure to the corrected content (Pennycook and Epstein et al., 2020). The current situation, therefore, seems to require different methods of tackling the misinformation crisis clearly. Nevertheless, this thesis research attempts to point out the relevance of taking **a step back to discern what happens before people decide to share misinformation. Hence, it intends to investigate** why individuals perceive misinformation as **accurate**.

How will this research be executed experimentally? This thesis research intends to draw on findings from the **Cognitive load theory.** This theory applies evolutionary theory to reflect on **human cognitive architecture** by assuming that the knowledge of an individual is split into biologically primary and secondary knowledge, which in case of the latter, requires a large information store. This is due to the reason that new information only gets processed at a limited amount (Sweller, 2011). Hence, **Cognitive load theory** reflects on the **working memory's limits** of an individual - when the individuals' **cognitive load** surpasses the processing capacity; they encounter struggles to successfully achieve the tasks they are executing (De Jong, 2010). **This thesis intends to apply the ideas from the Cognitive load theory and to carefully investigate how an increased cognitive load, which people experience in times of a crisis, such as COVID-19 could influence how an individual perceives the accuracy of COVID-19 related news** (Pennycook and McPhetres et al., 2020). This will be done experimentally through applying **high and low cognitive load** manipulation on the participants, while they rate the accuracy of the presented selection of misinformation headlines. The intention is to examine the different effects of experiencing **high** and **low** cognitive load on how people perceive the accuracy of misinformation. The high cognitive load will be executed through the help of a dot memorisation matrix, whereas participants in the low cognitive load group will be asked to memorise and later select among other matrices an easy 3x3 dot matrix pattern. On the other hand, participants undergoing the high cognitive load treatment will be asked to memorize a rather difficult 4x3 dot matrix pattern. The increased cognitive load mimics the COVID-19 related context, reminding of the increased cognitive load that individuals experienced due to the novelty of the situation. Additionally, based on cognitive mechanisms, which influence how people perceive accuracy; this thesis research observes the classical reasoning account, which explains that the belief in fake news might be driven by the **unsuccessful engagement in the analytic reasoning thinking** (Pennycook and Rand, 2018). Here, the role of intuitive reasoning, as the opposite of analytical reasoning is regarded in relation to the main research question. The intuitive reasoning will be measured through execution of a Cognitive Reflection Test

(Shane, 2005). Therefore, the **interaction with the cognitive overload is created to account for how an individual perceives the accuracy of misinformation.**

Regarding the **outline** of this thesis, it consists of various parts. Firstly, the introduction is presented together with the relevance of this research. In the following parts, **an extensive literature review** regarding this topic will be introduced. Firstly, it will be summarised how this thesis positions itself into a similar area of research and then the primary theoretical background information will be presented, leading to a detailed description of the leading research **hypotheses**. Afterwards, the **methodology part** and further **applied experimental treatment** will be described, including the data collection process and the outline of the necessary analysis for testing the main hypotheses. Afterwards, the main findings of this thesis research will be presented and summarised, based on which hypotheses they investigate. This part will be followed by a detailed discussion of limitations and future possible research opportunities. With a selection of finalising remarks, the main findings of this thesis will be summarised, and the main research question will be answered. Additional information on the experimental process, survey outline, data, and the executed analysis will be provided in the **Appendix.**

2 Literature Review

In the subsequent section, firstly, the **contribution to the current research** will be described. The contribution to the research will be positioned within several areas of literature findings. However, it will primarily regard the research on the **accuracy perception of misinformation**. Later, based on these findings, the literature review will reveal different concepts related to the main examined subject to provide relevant **scientific reasoning** behind the research of the effect of **cognitive load on the accuracy perception of misinformation.**

Consequently, the main idea behind the concept of misinformation will be introduced. Concerning the spread of misinformation on social media, the literature review will further reflect upon the **"dark side"** (Talwar et al., 2019) of social media use that might influence how people perceive information and form misinformed beliefs. About this "dark side", various cognitive theories will be summarized shortly to get a better picture of how different psychological theories can explain the harmful elements related to the use of social media. In a consequent flow, investigation of these theories will lead to the introduction of the main topic of this thesis research, which is the **Cognitive load theory**. The main element, the **cognitive load**, will be derived from this theory, whereas its central concept and application will be described.

Additionally, the literature on the cognitive load in the COVID-19 context will be investigated, observing how the **cognitive load during the pandemic influenced the accuracy perception**. Hence, a connection between experiencing increased cognitive load and the news' perceived accuracy will also be formed in the context of the COVID-19 pandemic. Lastly, to examine whether individuals differ in how they perceive the accuracy of misinformation, the effect of **analytic and intuitive reasoning** will be additionally positioned within the area of research related to the cognitive abilities, concretely relating to the execution of the **Cognitive Reflection Test.** Here, a selection of relevant literature sources regarding the influence of analytic/ intuitive reasoning on the perception of (mis)information accuracy. This theoretical part will also lead to the formation of three relevant hypotheses for investigating the main research question.

2.1 Contribution to the existing research

This research touches upon different areas of misinformation research. Firstly, it positions itself within the research on the **psychological determinants of social media use** that influence how people perceive online misinformation content, with **cognitive overload** as the possible determinant. This thesis brings novelty to the literature that has been published on the topic and further intends to contextualize it within the COVID-19 crisis. Secondly, it relates to the research on **the accuracy** of misinformation. It regards what influence the accuracy perception of COVID-19 related misinformation for individuals. Additionally, the experimental design conducted by this thesis positions itself within experiments with a similar design, such as previously applied by researchers, like Bago et al. (2020), yet offers a different research question and different execution of the methodical part. All these elements of contribution to the current research will be further explained in the following paragraphs.

2.1.1 Psychological determinants of social media use

First, there have been various research papers regarding the relationship between **psychological determinants**, influencing how people perceive misinformation, believe in it, and explain why they share it further. This branch of research primarily reflects on a selection of psychological determinants related to or connected to the harmful effects of social media use, such as summarized by Talwar et al. (2019). As described by these researchers, these adverse effects of social media use influence how people perceive information and misinformation. There has not been much research that investigates the effect of these determinants on misinformation spread **during a pandemic**. From the existing literature on the context of the COVID-19 pandemic, the work by **Laato et al. (2020a)** and **Islam et al. (2020)** shall be mentioned. The authors, as stated above, inspect how people **perceive misinformation** and **why they decide to share it**. Among others, they identify relevant determinants resulting from social media use by applying different psychological theories. In this thesis, **I relate to**

their theoretical predictions and findings by concentrating on one of the psychological theories they apply **- Cognitive load theory**, and concretely one determinant**- the increased cognitive load**. However, in the previous research mentioned above, regarding the determinant cognitive overload (Laato et al., 2020a), only self-reporting questions about online trust and overload were posed, possibly offering biased responses. In this thesis, an experimental approach has been chosen. The cognitive overload has been simulated by including a "high cognitive load" manipulation element in the experimental design. The reason for that is to prevent **the potentially biased results** when participants get asked about their experienced cognitive overload from happening. Hence, I opt for a design incorporating a **cognitive load manipulation element**. This design intends to bring novelty into the findings of the existing researchers, Islam et a. (2020) and Laato et al. (2020a), on the psychological determinants behind social media use, which affect the news accuracy perception. A **cognitive manipulation element** in a similar form, as I intend to apply in this thesis research, has been previously used by **Bago and De Neys (2020)**, however, in the context of the dual-process model of moral cognition. In their research, participants respond to various moral dilemma situations under cognitive load. These authors intend to see how the more utilitarian responses to moral dilemma situations can be explained by this model and what different effects can be observed in the reactions of the participants once they have the time to reflect on their responses. In a similar form, but this time applied to the context of misinformation, this design has been applied by Bago et al. (2020). These researchers investigate how the participants fail to deliberate between the news headlines that are true and false. In this research, the participants are asked to give their initial response (under cognitive load) about the accuracy of the headlines and repeatedly after they had the time to rethink their answer. Nevertheless, these researchers aim to detect the difference between **the participants' intuitive judging of misinformation accuracy** and the difference (change) between their intuitive reaction and the circumstance later, once the participants get an opportunity to **rethink** their answer about how accurate they perceived the presented content. This experimental design has been accompanied with a time pressure element and an execution of a similar working memory task, as applied in the methodology of this thesis. However, even though these researchers applied a similar method of cognitive load manipulation while asking about the news headlines accuracy, the complete execution of the manipulation task has varied from the intended methodology in its quantity, form, and importance for the conducted research question. Lastly, their research does not position itself **within the research of COVID-19.**

2.1.2 Perception of misinformation accuracy

Further, regarding the **perceived accuracy** of the shared content, this thesis builds on the findings from Pennycook and McPhetres et al. (2020). In their research, they ask people about the accuracy of the news and consequently about their willingness to share them. In their design, by applying actual misinformation, participants have to rate the accuracy of the presented news headlines. Pennycook and

Epstein (2021) also further look into **the role of accuracy** on the decision to share misinformation. In the context of COVID-19, they show that social media use distracts people from **considering the accuracy of the news.** However, in both research papers, the investigation of the determinants, causing individuals to falsely judge the accuracy of misinformation, such as **cognitive overload**, as applied in this thesis research and as introduced in the paragraph above, is missing. However, cognitive overload is introduced in the context of perceiving accuracy of the misinformation by Bago et al. (2020), as described in the part above. Yet, as it was summarized, these authors concentrate on a different research topic, which is the role of deliberation in how susceptible the participants are to political misinformation. They regard the role of classical account of reasoning and the difference between the intuitive responding under cognitive load and the changes in the responses, after participants get the opportunity to rethink their answer.

Furthermore, in investigating what influences the accuracy perception of misinformation, researchers within this area relate their studies to studying the effects of the reasoning capabilities of the people, when judging the news veracity. They discover, when deciding, whether the presented news headlines content is true or false, people struggle to induce in a necessary mental **reasoning process**. Hence, their processes get influenced by various other factors, such as their **motivational reasoning**, which could be reflected for example in a form of a partisanship. The above-mentioned has been found in the research of Pennycook and Rand (2018), who look into what makes people susceptible to believe in fake news. They find out, that the beliefs towards misinformation are primarily **not** dependent on the motivated reasoning way of thinking. Here, a suitable example is the partisan bias (such as believing in fake news due to political ideology preferences) but also on the "lazy thinking", which stands for lack of engaging in the classic reasoning account within the analytic reasoning processes. Hence, this master thesis research tries to position itself also within this category of research, in order to picture differences between different ways of cognitive reasoning for individuals. Hence this research tries to examine, which type of cognitive reasoning influences individuals, when perceiving the fake news accuracy. Analytic reasoning has been shown to influence individuals when perceiving the accuracy of misinformation, by previous researchers, such as Pennycook and Rand (2018). Individuals with more analytic, rather than intuitive way of thinking are found to be less prompt to judge misinformation as accurate. Hence, individuals with intuitive reasoning are also in this research expected to be less able to recognize and less likely to correctly judge the accuracy of the presented misinformation. Similarly, as applied by Pennycook and Rand (2018), by building on the results from the analytic thinking, **Cognitive Reflection Test** will be used to investigate the effect of this type of thinking on the perceived accuracy of the shared news. This thesis attempts to position **intuitive/analytic reasoning** to the model as a moderating variable, in order to see how having intuitive reasoning capabilities influences individuals, who are undergoing a cognitive load manipulation, when judging the accuracy of the presented headlines. Findings from this part could help policy makers to understand, what other factors effect, how one **perceives the accuracy**, besides the cognitive overload, and how the people with different types of cognitive reasoning deal with a high cognitive load.

Overall, as already mentioned before, this thesis indents to take **a step-back from the research why people share misinformation. Instead, it seeks to identify**, **what makes people disregard the accuracy of the presented content -** which consequently might result in the act of misinformation sharing. This research intents to see the effect of the increased **cognitive load** on how people perceive the presented misinformation. To summarise, the novelty of this thesis is predominantly in that it observes the effect of high cognitive load on the perception of accuracy of fake news, specifically in the **COVID-19 crisis** context. Even though methods of exposure to various news headlines in order to rate the accuracy have been introduced before, also with the cognitive manipulation task as an additional task, a similar research question with the above-mentioned method has not been conducted yet. Therefore, this thesis intends to experimentally simulate a high cognitive load (cognitive overload) through an online survey, while testing for the context-related COVID-19 news accuracy perception, with possible practical implications for public policy.

2.2 Theoretical Background

2.2.1 Misinformation

Misinformation, or fake news, posing the central component of this thesis research, is regarded as either misleading or false information. It mimics a piece of information, which reminds of real-life news content via its form, but lacks accuracy and credibility (Lazer et al., 2018). Misinformation can relate to various topics, such as politics, health, or science (Luo et al., 2020). In the context of this thesis, the selected theme of misinformation relates primarily to the health and science topic, reflecting the presented information about COVID-19, widely shared on online media platforms. Covid-19 pandemic appeared when people already struggled **with information overload** on social media and **the pervasive spread of misinformation**. On top of that, an increase in the amount of novel information on social media rapidly influences people's behaviour, and consequently, the effectiveness of the measures posed by the governments (Cinelli et al., 2020). COVID-19 related misinformation hence leads to various negative consequences, influencing people's lives and health. It refers to the false information about the virus, its causes, origins, consequences, or treatment (Hameleers et al., 2020), opening the question of why individuals believe in COVID-19 related misinformation and how these incorrect beliefs could be prevented before they even come to existence. In the context of this thesis study, misinformation is seen as information that was previously considered by independent fact-checkers as false or not accurate, as similarly as applied by Pennycook and Rand (2018).

2.2.1.1 Accuracy perception of (mis)information

How do people fall for misinformation? Pennycook and Epstein et al. (2021) describe the inability to differentiate between real and fake content as the leading cause for why people believe and consequently share the misinformation further on various social media platforms. In the literature, there have been different causes analysed, which influence how people perceive and misjudge misinformation content. The inability to recognize how **accurate** content is could relate to the media or digital literacy, yet the beliefs in false information might often relate to the existing knowledge-consistent facts and beliefs of an individual aligned with the personal worldviews (Lewandowsky et al., 2012). As an example, politically motivated beliefs can be mentioned, indicating the partisanship bias that might influence individuals when perceiving information. Hence, **audience subjectivity** and various bias might motivate the ways of interpreting misinformation (Khan and Adris, 2019). Individuals accept the misinformation easier when it aligns with the current prior information (Lewandowsky et al., 2012). The above-mentioned describes situations where individuals explicitly believe in the accuracy of the presented misinformation. In the paragraphs below, situations will be explored in which individuals are mostly **not aware** of whether their accuracy perception of information is being influenced and hence would usually perhaps not agree with the presented information if they were aware that their accuracy perception is being influenced.

The further cases relate to the situations when the individuals might not believe in the misinformation they are being presented with (unlike, for instance, in the case mentioned above of politically congenial false headlines). Often, as Pennycook and Epstein et al. (2021) discovered in their research, individuals appear to perceive misinformation as true (and consequently express their willingness to share it) because they get distracted from perceiving how **accurate** the presented content was. The process of recognizing misinformation requires the individual to spend a certain number of resources from their motivation and cognition (Lewandowsky et al., 2012). Hence, misinformation beliefs and consequent sharing happen because people cannot recognize which information is **accurate** and which is not (Khan and Idris, 2019). Previous research findings on unintentional misinformation sharing showed that people do not **prefer sharing misinformation** yet fail to **differentiate between misinformation** and factual content due to social media and how the information is presented. Hence, how the information is portrayed on social media affects **their accuracy perception** (Pennycook and McPhetres et al. 2020). One of the aspects that they get distracted from is, for instance, all the necessary information that individuals should notice when perceiving content. To name an example, people disregard the sources of the information that they are being presented with. Hence their behaviour can be characterized through an **insensitive approach to various sources**, even when being of a credible nature (Lewandowsky et al., 2012). This further influences that individuals are incapable of differentiating between true and fake news.

Additionally, when there is unintentionally posted misinformation in some media sources, there will usually be a correction posted. Nevertheless, individuals often do not read these corrections (Lewandowsky et al., 2012). Hence, when they are being presented with misinformation online, they do not realize it has been misinformation and, as a result, do not recognize it is inaccurate. Consequently, at a later point in time, the corrections posted by the source might not receive an equal apprehension by the individuals –, individuals exposed to the misinformation previously might not come across the corrected version (Lewandowsky et al., 2012).
Furthermore, even if at a time of seeing the headline, it could be regarded as a false message, later, after the time of initial exposure, it could create an experience of "familiarity-based credibility" once an individual encounters the information repeatedly (Lewandowsky et al., 2012). To summarize, it appears that **social media influences how misinformation is being perceived** and then potentially shared by individuals and how the misinformation might get often be wrongly considered as accurate. To describe the role of social media in more detail and relate it to the existing psychological theories that describe them, the following paragraph will illustrate the different psychological theories behind social media use.

2.2.2 Theories behind the social media use

Even though social media might offer some benefits to its users during a pandemic, its "potential dark side" also gets attention, possibly negatively impacting its users in how they perceive and process the information they are being presented with (Liu et al., 2021). The **"dark side"** characteristics describe social media use as potentially leading to negative consequences for the well-being of an individual and/or for society (Talwar et al., 2019). Social media influences how individuals perceive the shared information **critically**. Different social media platforms are created and organized so that their functional side prompts the users into fast scrolling through very diverse and often irrelevant content. This process makes it difficult for individuals to correctly perceive the accuracy of the shared information when exposed to the content (Pennycook and Epstein et al., 2021). As Khan and Adris (2019) realize, this happens due to the **fast** and **viral** misinformation spread on social media. Users often do not verify or confirm the information on its accuracy and veracity before they post it, and hence end up posting information on their social media networks, whereas some of them might be regarded as false.

Additionally, also the social media algorithms affect how the information gets portrayed on one's social media and may cause that an individual gets exposed to content that is consisting only of information posted in the form of a "filter bubble" (Pariser, 2011 in Khan and Adris, 2019). This means an individual is exposed to various misinformation of a similar nature. The individual gets repeatedly exposed to this misinformation because it gets shared by various similar sources that they are unintentionally exposed to on social media or are even intentionally following. The high amount of various information available in the online space, either true or false, might lead to individuals experiencing feelings of **information overload**, emerging from the fast and intense spread of information online (Khan and Adris, 2019).

There have been various **psychological theories** applied by researchers previously, explaining aspects related to people's social media use. These theories help comprehend how individuals behave, perceive their social media presence and how their performance could be potentially negatively altered. As an example, these theories explain why people believe in misinformation. The main theory for this thesis research is the **Cognitive load theory** (Sweller, 2011), which was applied to the COVID-19 related misinformation context by, for example, Islam et al. (2020). The selection of the further theories related to this thesis research can be seen in the summarized application of selected theories as presented by Talwar et al. (2019), who combined the findings from **Social comparison theory (SCT)**, **Rational choice theory** and **Self-determination theory**, to explain the "dark side" of the social media usage. These theories in their relation to the social media users are briefly presented below:

First, Talwar et al. (2019) point out that in the previous literature, **the Social comparison theory** was applied to explain the behaviour on social media. They summarize that this theory allows for understanding why individuals induce **self-comparing tendencies**. They either compare themselves with people who are worse than them (downward comparison) or with people who are better than them (upward comparison). Comparing themselves to others allows the individuals to gain a higher sense of affirmation and secures an increase in their cognitive understanding. Further theory applied in explaining social media use by Talwar et al. (2019) is the **Rational choice theory**. In this theory, the choices of individuals, made in a specific contextualized way, are explained in more detail. **When** applied to the social media context, Rational Choice Theory explains how individuals make their decisions and choices on social media. It explains why individuals continuously decide to further use social media to get positive outcomes instead of stopping using social media due to various negative consequences, such **as social media fatigue** (Logan et al. 2018 in Talwar 2019). Social media fatigue is related to various negative aspects, such as information overload, which is **connected** to the main research topic of this thesis – increased cognitive load. As the last applied theory, as described by Talwar et al. (2019), is the application of **Self-determination theory** (SDT), which further explains the social media behaviour of individuals. This theory explains how people behave in their social contexts and how these social contexts and even cultural factors stimulate that individuals experience growth in their mental state, which consequently allows them to experience an improvement in their activity performance. When applied to the social media context, this theory can help understand the fear of missing out that is experienced by individuals in the online world. This theory explains why individuals strike for a certain degree of the feeling of belonging somewhere, usually within a social context (Beyens et al., 2016: in Talwar et al., 2019).

Lastly, the **main applied theory** for this research, in the context of social media, is the **Cognitive load Theory**. This theory gets, for instance, applied by Islam et al. (2020) to explore how social media use behaviour could be explored in the COVID-19 related context. Due to the similar positioning of this research within the context of the COVID-19 crisis, this research will apply the **Cognitive load theory (CLT)** to demonstrate certain influences on behaviour during the time of a crisis. This theory discusses the limited processing capacity of the human brain, which gets easily overloaded on social media and **affects the trust** and the **cognitive load** capacity of the social media users (Sweller, 2011 in Laato et al., 2020b). The theory baseline of **Cognitive load theory** connects social media usage with how people perceive (mis)information. In the context of social media use, it gets often connected to social media fatigue, whereas it explains how this specific fatigue in the online world can be developed (Islam et al., 2020). Additionally, it explains how social media usage can lead to the experience of a **cognitive overload**. This negative determinant of social media use is the key element of this thesis research and will now be introduced in more detail, describing how the cognitive overload (aligned to the findings from Cognitive load theory) possibly affects the perceived accuracy of misinformation.

2.2.3 Cognitive load theory – cognitive load – perceived accuracy

2.2.3.1 Cognitive load theory – introduction

In this part, a closer look will be given to one of the theories mentioned earlier, the **Cognitive Load Theory**. Since its introduction in the 1980s by Sweller, **Cognitive load theory** (CLT) attempts to design several instructions and principles, facilitating optimisation of complex cognitive processes (Paas and Merriënboer, 2020). It does so by applying the model of **Human Cognitive Architecture**. It intends to recognise various effects on human cognition when acquiring secondary information from long-term memory (van Merriënboer and Sweller, 2010; Sweller, 2016). There are **limitations** to human cognition, especially **human working memory** (Sweller et al., 1998). This theory explains how individuals deal with these limitations to human cognition and experience the increased cognitive load. The goal is to observe how their perception of information is affected. With the help of this theory, it will be consequently analysed how individuals experience **increased cognitive load during the COVID-19 pandemic**. Concerning that, Cognitive Load Theory will explain how **increased cognitive load influences how people perceive misinformation** about COVID-19 – which aligns with the main research question.

2.2.3.2 Long- term and working memory

According to the knowledge acquired from the cognitive architecture, the CLT describes the co-existence of two different types of cognitive presence. Two different types of cognitive architecture are **long-term memory** and **working memory** (Sweller & Sweller, 2006 in Paas and Merriënboer, 2020). For the novel information to be stored in the long-term memory, it must be firstly processed within the working memory (Sweller, 2016). Nevertheless, the Cognitive load theory describes that an individual is dealing with a **limited working memory capacity** (Sweller, 2011). From the previous research on working memory limitations, it is apparent that individuals might struggle to succeed at complex reasoning, as long as the necessary elements for the cognitive reasoning have not been previously saved in the long-term memory (Sweller et al., 1998). The working memory hence deals with novel information in a **limited way** and faces additional limitations when processing it further (van Merriënboer and Ayres, 2005). As Sweller et al. (2011) regarded, there are differences between our cognitive processes in the long term and working memory. The total cognitive load that the individual is exposed to **must not exceed the working memory resources**, or otherwise the individual faces difficulties in processing the needed information. Hence, cognitive overload comes into existence when the cognitive system is exposed to several **demanding inputs** (Sweller et al., 2019). The cognitive overload in the context of this thesis translates into a high cognitive load.

In the previous research, it has been described that an individual is only capable of processing up to two to four aspects at the same time in the working memory in an active manner. However, this does not apply to the working memory based on remembering aspects from the long-term memory, but to receiving information via the type of memory, that affects the memory sensors of individuals, such as the novel and unorganized information (van Merriënboer and Sweller, 2010). Hence, working memory experiences limitations, which might not be completely relevant in biological knowledge of primary nature and already well-processed and organized memory. The existing problems arise, as Paas and Merriënboer (2020) summarize when the individuals need to process novel information, where m**ore complex cognitive activity is required**. Additionally, Sweller et al. (1998) stress that when exposed to various combinations of **unfamiliar elements**, individuals will likely struggle with executing complex reasoning processes (Sweller et al., 1998).

To summarize, Cognitive load theory states, when human cognitive capacity is overloaded, an individual's behaviour is altered, possibly resulting in an **irrational action** (Sweller, 2011 in Laato et al., 2020b). Hence, once this capacity is exceeded, the state of **cognitive overload emerges** (Laato et al., 2020b), increasing **conducted errors and confusion** (Logan et al., 2018). High cognitive load affects performance and decision-making strategies, leading to more impulsive behaviour and **omitting the available relevant information** while using cognitive shortcuts (Samson and Kostyszyn, 2015). Novel information from emerging situations gets stored in the **working memory** and is negatively affected by various aspects of the cognitive task itself (van Merriënboer and Ayres, 2005).

2.2.3.3 Types of cognitive load

Cognitive load theory explains how the novel information that individual encounters gets stored and consequently operationalized in the individual **working type of the memory**, which can be characterized by its limited nature of capacity. Previous literature has defined three different conceptualizations of the application of Cognitive load theory, which describe how different cognitive load variations influence working memory. These conceptualizations include the **intrinsic load**, **extraneous load** and **the germane load** (van Merriënboer and Sweller, 2010) and will be further discussed in more detail:

The first variation of Cognitive load theory is defined as the **intrinsic cognitive load**. This aspect relates to the **content and information complexity**, which the individual is expected to **understand** and **learn** in a certain situation. The intrinsic cognitive load does not get directly influenced by how the information is presented. Rather, it depends on the individual's **intrinsic characteristics,** which are related to individual **information processes** (Sweller, 2010 and Islam et al., 2020). These connect to an individual's psychological state and knowledge, which help determine which elements shall be processed in the working memory simultaneously (van Merriënboer and Ayres, 2005). In order to **alter the intrinsic cognitive load**, the nature of the learning content or the ways of the learning processes shall be adapted. Whether an intrinsic cognitive load can characterize, a task gets determined by the present **element interactivity** between the various elements within the task. This means that when there is high element interactivity with other elements, individuals will experience a **higher intrinsic load** (Sweller, 2010).

The second conceptualization of the cognitive load is then **extraneous cognitive load** (Sweller, 2010). This is not completely essential for the performed task. However, it relates to the non-optimal instructional procedures, concretely to the various techniques and environmental stimuli that influence an individual's brain reactions. Hence, the extraneous load explains how the different tasks are presented influences how individuals perceive them. Both visual and auditory elements influence the working memory; hence, both could potentially increase **the extraneous load** (van Merriënboer and Ayres, 2005). In the social media context, it could, for instance, relate to thinking about unimportant items from social media content (Byyny, 2016). Additionally, this type of load comes into existence when one of the processors that influences the working memory is overloaded, such as when exposed to various information sources only in a visual form (van Merriënboer and Sweller, 2010). The last conceptualization of the cognitive load is the G**ermane Cognitive Load**, which is concerned, rather than the intrinsic and extraneous cognitive load, with the characteristics of an individual as a learner. The German Cognitive Load can be described as a load that is more of a **subconscious nature**. It relates to the working memory reserves, which the individual spends on **processing** the intrinsic load regarding the presented information, and then consequently applies for the problem solving and in future decision-making processes (Sweller, 2010 and Islam et al., 2020). Germane cognitive load hence does not depend on the presented information itself, but on how well the working memory can **deal with the intrinsic load** and how it gets influenced additionally, in case there is a high extraneous cognitive load. To summarize, when there is a high extraneous cognitive load, the presence of the high germane cognitive load determines that more of the working memory resources will be placed on dealing with the **heavy extraneous cognitive load** instead of on dealing with the **high intrinsic load** (Sweller, 2010), which naturally limits how the individuals process the presented information. Below, it will be further described how this increased load might, for instance, prevent individuals from **correctly judging the accuracy of the presented information**.

These various conceptualizations of cognitive load are regarded **additively** (Paas et al., 2003). Hence, if its the intention that the individual should understand the presented information, it should be created and designed in a way that assures efficient use of the working memory capacity (Paas and Merriënboer, 2020). When an individual is suspect to a **high intrinsic load** (such as during the COVID-19 times), resulting from the **high subconscious load**, and an increased **extraneous cognitive load** (which can be understood through the confusing ways how the information about COVID-19 has been presented on social media and communicated by various relevant individuals) will lead to an **excessive total load** (Sweller et al., 2011). Previous research showed intrinsic load could not be adapted, yet it can be optimized by altering the learning nature. For this, firstly, the extraneous load needs to be altered, especially when intrinsic cognitive load is high (Sweller et al., 2011). When one of the cognitive load types increases, it allows the cognitive capacity for other conceptualizations (Paas et al., 2003: Islam et al., 2020). This thesis research recognizes the effect of intrinsic cognitive load, mostly related to how an individual can process **intrinsic properties** of the presented content of misinformation and how the **extrinsic cognitive load** influences the accuracy perceptions of the shared content (Sweller, 2016). **Extraneous cognitive overload** has been widely researched and tested in an experimental setting, and its application could bring important insights for policymakers about possible solutions for addressing the cognitive overload that individuals are facing. The possible **reduction of extraneous cognitive load** relates to reducing the amount of information the individual is exposed to, which were part of procedural instructions (Sweller, 2016). It has been shown that **lowering the extraneous load might be sufficient** for reducing the total load the individual is experiencing from social media use. Nevertheless, still, when the reduction of the extraneous load is not sufficient for lowering the cognitive overload, then consequently, also the intrinsic load must be altered (van Merriënboer and Sweller, 2010). Hence, it is relevant to understand how cognitive load influences the perceived accuracy to be addressed and possibly altered.

2.2.3.4 Cognitive overload during COVID-19

How the individuals perceive a situation, and the related information gets influenced by the presence of various environment-related factors, such as **uncertainty**, physiological effects (for instance **stress**) or various **emotional** factors (Evans and Stecker in: Sweller et al., 2019). These factors, related to the process of obtaining information, then might contribute to an increase of the cognitive load of an individual. The presence of these factors, such as high level or uncertainty or stress could have been also observed during the COVID-19 pandemic. During the novel situation, there have been various factors leading to **experiencing higher cognitive load**, indicating that **Cognitive Load Theory** could pose a promising tool in explaining how increased cognitive load could influence how people perceive information during a pandemic (Laato et al., 2020a). The factors explaining, what has led to the increased cognitive load during the pandemic, are described below:

First of all, it is the **novelty of the situation**, which has made it necessary for people to have the urge and need to continuously search for additional information about the novel virus. This has not been hard, since the information about COVID-19 has been dominating all the media channels, including social media (Hong and Kim, 2020). In order to adapt to the unknown situation, which is accompanied by the emergence of strong **uncertainty** feelings, people all around the world have started **sharing** knowledge from verified, but also **unverified** sources on social media, in order to inform the others. Part of this information has been sooner or later proven to be misinformation. Much of this information, which has contributed to **the increased extraneous cognitive overload**, results from the conflicting communication and guidance from the government and various authorities, presenting different perspectives (Hong and Kim, 2020). This information has been often **lacking proper structure and optimally** presentable form and hence decreases the **optimal understanding level** of the communicated content (Laato et al., 2020a). Hence, individuals find it difficult to properly process the information (Hong and Kim, 2020). This leads to problematic consequences, such as to online users failing to **understand the messages' complexity** and to sharing the messages with other people without verifying, if it **is true or false**, hence without properly **perceiving the accuracy** of the shared content. Additionally, in relation to that, during the COVID-19 crisis, some individuals also experienced the **Social media fatigue**, which is related to the information overload. **Social media fatigue** has been described as influencing how people perceive the information, which they are exposed to online. Social media fatigue can result in people falling for various errors, because the state of social media fatigue makes it impossible for them to verify **the accuracy of the news content** (Talwar et al., 2019). Hence, dealing with too much information on social media, in a form that increases the cognitive load, might cause that the individual experiences the state of **feeling overwhelmed** (Logan et al., 2018). Consequently, the capacity of how much the individual can perform, assess or process information on social media, will be reduced. This leads to an increase in conducted errors and the creation of various feelings of frustration, experienced by the individual (Hunter, 2004 in Logan et al., 2018), as it has been observable also throughout the COVID-19 crisis.

2.2.3.5 Cognitive overload and perceived accuracy of the news

The **increased cognitive load**, primarily resulting from the **information overload**, has made it impossible for individuals to judge and comprehend the ongoing situation correctly, and hence differentiate which presented information has been **true** or **false** (Laato et al., 2020a). As already mentioned above, Pennycook and Epstein et al. (2021) showed that people often do not share misinformation intentionally. Previous findings have pointed out that individuals tend to consider information truth-based, often judging it more honestly than in reality (Luo et al., 2020). They do so because they do not manage to differentiate correctly if the content they perceive is **accurate or not**. Hence, as already described above, their social media use causes distraction from **judging the accuracy** of the content.

When **under high cognitive load**, people are expected to react more impulsively and have less trust in the availability of their cognitive resources (Samson and Kostyszyn, 2015), affecting how they perceive the content they see. Pennycook and Epstein et al. (2021) mention that the social media context affects people **to focus on other factors than the accuracy** of the content they see. Scrolling through the feed on social media and being repeatedly exposed to a considerable amount of profound and emotionally engaging content causes a cognitive overload. The result is that individuals become **less reflexive** when judging the accuracy of the news. Pennycook and McPhetres et al. (2020) later confirmed this finding also in the context of misinformation sharing about the COVID-19 pandemic and mention, that for instance, the concentration of an individual on the positive social criticism appears to be more critical for the content perception, rather than paying attention to the accuracy. Hence, after reflecting upon those mentioned above and aligning with the intended research question, which monitors the effect of cognitive overload on the accuracy perception of misinformation about the COVID-19 pandemic, the first hypothesis is formulated:

H1: Being under high cognitive load increases the perceived accuracy of fake news

This hypothesis reflects on the findings described above that individual who experiences cognitive overload cannot recognise that the fake news is not accurate, and hence are expected to wrongly perceive the fake news as accurate. The high cognitive load is regarded in this sense as a cognitive overload. It is expected that there is a difference to the individuals who experience a lower cognitive load. In this sense, the low cognitive load is supposed to mimic that it is not realistic, that people would experience no cognitive overload in a situation such as a global pandemic. Hence, the case of no cognitive load is formulated as a low cognitive load. This full be further explained in the Methodology part.

2.2.4 Further elements related to cognitive processing

2.2.4.1 Intuitive/ Analytic Reasoning and cognitive overload

Another aspect explaining, **what influences individuals when perceiving the accuracy** of the presented information, besides the increased cognitive load, is the **analytic or intuitive reasoning** of the individuals. Human cognition can be divided, as Pennycook and Rand (2018) summarise, into two systems**: System 1** (intuitive) and **System 2 (**analytic) process in the ways of thinking. System 2 requires higher and more demanding effort for the working memory. Pennycook and Rand (2018) showed that being able to discern that the presented information is false better correlates with the **stronger analytic thinking – hence individuals, who have stronger analytic thinking shall be more capable of differentiating between fake and real news and those with more intuitive thinking, should be less capable of differentiating between which news is true and which news is fake**.

In the previous research, the **Cognitive Reflection Test (CRT)** has been applied to recognise the differences between the cognitive capabilities of the individuals. This test provides a measure with three different items. A high number of individuals was seen throughout the past to struggle to complete this test successfully. As a result, this test provides multiple types of answers "intuitive incorrect", "correct", and "other incorrect", whereas intuitive responses pose answers that are regarded as plausible, yet they are not correct (Pennycook and Rand, 2018). To draw on an example of one of the questions, the most popular question from the CRT test provides the "bet and the ball problem", asking the participants: "A bat and a ball cost $1.10 in total. The bat costs $1 more than the ball. How much does the ball cost? ___ cents". For instance, in this example, 10 cents poses the intuitive response individuals usually think of, whereas 5 cents are assumed to be the correct option, portraying individuals who have more of a deliberative analytic way of approaching problems rather than intuitive (Stupple et al., 2017). Individuals that perform worse on the Cognitive reflection test must not by default only fail to think analytically. It could also be due to their unwillingness to engage in thinking which requires them to surpass the default thinking option and hence do not want to engage within thinking, which requires them to reflect on the answer in more detail. Additionally, it could be possible that there is a certain degree of blissful cognitive ignorance, whereas individuals might have the capability to solve these questions analytically (Stupple et al., 2017).

All in all, it has been previously shown in the literature that the CRT performance negatively correlates with perceiving fake news as accurate, by measuring the propensity for analytic reasoning engagement (Pennycook and Rand, 2018). Hence, having higher analytic reasoning skills has been regarded as allowing for more accurate recognition of fake news (Pehlivanoglu et al., 2021). Pennycook and Rand (2018) identified that the participants who had a better (worse) result on the CRT test were more (less) capable of differentiating between the truth and fake news and that even independently of their political preferences. Hence, after reflecting on the above-mentioned, the following hypothesis is formulated:

H2: Having an intuitive reasoning style, compared to having an analytic reasoning style increases the perceived accuracy of fake news

The research of this thesis relates to the effect of cognitive overload on perceiving the accuracy of the presented misinformation. It regards how having to execute a task while thinking about the accuracy affects how capable people are of recognising the news is true or false. One of the possible explanations for individuals being able to recognise whether the news is true or false could be the source-heuristic, which **analytic individuals** are likely to apply when deciding whether the news is true or fake (Pennycook and Rand, 2018). However, the question may arise, how the effect of increased cognitive load might differ for people who are more regarded as thinking intuitively and hence are predominantly thinking in the **System I.** thinking and for people who are more likely to think in **System II.** thinking. Since individuals in System I. thinking are more likely to perceive the misinformation as accurate, they might possibly be more influenced by the higher cognitive load manipulation in the experiment because they are already by default exposed to a different thinking system, System 1.

To relate this Cognitive Reflection Test to the first hypothesis, an interaction effect between these two aspects can be regarded. Previously, researchers have investigated the effect of the various thinking systems present in different situations, in which the individuals are exposed to high stress, for instance, in the **different moral dilemma examples**. To name an example, in the trolley experiment, where the participants are asked to make a simulated decision, whether he/she prefers sacrificing the life of one person in order to save the lives of other people, a moral dilemma situation is introduced. In this situation, when exerting a **cognitive load task** in a highly stressful decision, the individual switches between the systems of thinking, from the rational, into the emotional thinking system (Ramsden, 2015). In tasks similar to this, individuals are expected to act according to whether their thinking can be located within the automatic (**emotional**) or more manual (or **reflective**) mode. The reflective mode likely gets **substituted** by the more automatic mode in stressful situations. However, as has been shown in the above describe the social dilemma of the trolley experiment, the participants in this experiment, who were more likely to decide to kill one person and hence save multiple, have shown a higher mental association with **higher cognitive ability** and control and did show to be more connected to a **rational instead of intuitive thinking style** (Bartels, 2008 in Ramsden, 2015). Concerning this, previous research has shown that those individuals who scored higher on the CRT (in a form like conducted within this thesis research), hence were more likely to think analytically than emotionally, showed to be executing more rational, or in this concrete case of trolley example, more utilitarian decisions

(Hardman 2008: in Ramsden, 2015), indicating that a high cognitive load did not influence individuals to switch between the reflective and emotional system.

In this thesis research, exerting a high cognitive task is expected to deplete the cognitive resources, which allow people to judge whether the presented misinformation is true or false correctly. After analysing previous literature, the individuals with higher analytic reasoning are expected to be more able to differentiate whether the presented misinformation is true or false, hence less influenced by the cognitive load manipulation. On the other hand, individuals with an intuitive reasoning style are expected to perform worse in differentiating whether the presented news are true or false than the individuals with an analytical thinking style. Consequently, when combining those mentioned above, hence forming the interaction effect between the experimental treatment and the CRT score, the following hypothesis can be formulated:

H3. The effect of high cognitive load on the perceived accuracy of fake news is stronger for individuals who have an intuitive reasoning style than individuals who have an analytical reasoning style.

Hence to summarise, the individuals with a **higher intuitive reasoning** skill are expected to be influenced by the high cognitive load manipulation treatment when perceiving the accuracy of the shared content to a greater extent than those who are more analytical in their cognitive processes.

3 Methodology

In order to answer the main research question: ***"What is the effect of cognitive overload on accuracy perception of misinformation/ fake news about COVID-19 pandemic?"*** in this section, the main experimental design will be described. Firstly, a close-up look will be provided on the **experimental manipulation** and other elements applied in the **experimental design**. This detailed description will be followed by a reflection on the applied collection process of the data, including all the various elements and techniques used throughout the data collection. Additionally, also the practicalities of enquiring the participants for this study will be discussed. This part will be continued by describing the primary model and the intended analysis for the collected data. Additionally, the intended use of the **ordered logistic regression** will be reflected upon, together with the analysis of necessary assumptions for using this model. Lastly, the concrete models for testing the main three hypotheses will be introduced in more detail and their mathematical form to illustrate the indented research methodology.

3.1 Design of the experiment

In this section, the experimental method of this study is examined. **This research intends to test the causal influence of the increased cognitive load on people's accuracy perception.** The data will be collected by conducting an online experiment in an **online survey** on Qualtrics as a Randomized Control Trial. The survey will be formed as an **experimental, between-subject design**. In order to study the differences between different degrees of cognitive load influence on the accuracy perception, two groups will be formed: **the treatment group**, which will receive a **high** cognitive manipulation treatment and the control group, which receive **low** cognitive load manipulation treatment. The key experimental manipulation is described below. Participants will be **randomly assigned** to these groups through Qualtrics (www.qualtrics.com). To ensure that participants finish the survey until the end, **a small incentive** was provided, a 3x 10 Euros gift card for Amazon. The winner will be selected through **random lottery incentive**.

3.1.1 Key experimental manipulation

The key **experimental manipulation** relates to the **treatment group** being exposed to the sixteen **high cognitive load manipulation** treatments before executing the task of seeing **each headline** and expressing their opinion on the perceived accuracy. Additionally, the control group receives a **low cognitive load manipulation** treatment before each of the sixteen-headline accuracy perceiving tasks. The high cognitive load manipulation will relate to executing a secondary task, which will require the participants in the treatment group **to engage in a higher additional cognitive activity**, which does not pose the main task of the survey. As the **Cognitive Load Theory** describes, individuals have a limited working memory capacity. Therefore, executing a secondary task while working on a primary (or main task – hence in the context of this thesis, the accuracy perception task) allows simulating an effect of an increased cognitive load (Sweller et al., 2019). Duffy and Smith (2014) explain that in cognitive load experiments like this, participants are asked to memorize a task while executing a task in a different domain.

In the case of highly increased cognitive load, participants' ability to reason is diminished, affecting impulsive decision-making or leading to a failure in comprehending and processing the information they are presented with (Duffy and Smith, 2014). In this experiment, this relates to the **lowered perception of the accuracy of the news**. There are various ways of cognitive load manipulation, like asking participants to memorize numbers or a dot memorization matrix. Afterwards, participants would continue answering the question regarding the first headline. Also, remembering how many times the participants blinked throughout answering survey questions (Duffy and Smith, 2014; Ülkümen et al., 2008) is considered another method of increasing cognitive load. A detailed analysis of the cognitive manipulation options applicable for this thesis was attached in a table in **Appendix A.** As a final treatment, the **dot memorization task**, in the form of consequently **three dots** in **3x3** matrix and **four dots** in **3x3 matrix,** was selected since it has been regarded to burden the resources of the participants (Evans & Stanovich, 2013: in Bago and De Neys, 2019). These matrices are portrayed below:

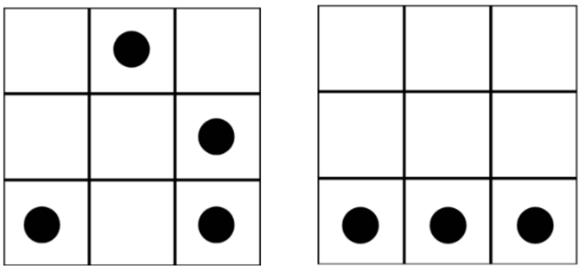

Figure 1: 4 dot memorization matrix (4x3) = high cognitive load, 3 dot memorization matrix 3x3 = low cognitive load

When being portrayed with the patterns, participants only got the opportunity to pay attention to these patterns for 2 seconds. This method, of portraying dot patterns in a matrix form in a time limit, has been previously applied by, for instance, Bago et al. (2020), through a similar form, in the context of misinformation, or by Bonnefon et al. (2013) and Bago and De Neys (2019), who applied this method to misinformation unrelated context. In the task, participants are shown a pattern before executing each main survey question about the accuracy of the shared content. The idea is, when executing an additional task, the cognitive resources of participants will be burdened (Bago and De Neys, 2019). After answering a question about the accuracy, participants are asked to recall one of the patterns they previously saw on the screen. Memorizing a task with a pattern of 3 dots is regarded as "being exposed to a low cognitive load” and executing the memorization task of 4 dots is regarded as undergoing a "high cognitive load" (Bonnefon et al., 2013). Additionally, patterns with three dots are designed simply, whereas patterns with four dots consist of more complicated patterns, making it more difficult for the participants to remember them. The way, how this task has been executed is shown in Figures 2 and 3. Firstly, participants get shown with a dot-matrix element which they must remember. Afterwards, they complete the main task of deciding how accurate they perceive the presented headlines to be. Lastly, they must answer a question related to which dot matrix they have previously seen. Hence, the cognitive load applies to memorizing a pattern while executing the main survey task.

In the experiment of this master thesis, respondents do not receive feedback on how well they performed in the cognitive manipulation task, nor do they receive incentives for completing the task correctly since this could encourage them to cheat. At the end of the survey, participants will be asked about **self-reflection** about the task, such as how hard they found to focus on the task, or how distracting the memorization task has been, to recognize how effective the cognitive manipulation treatment was (Duffy and Smith, 2014).

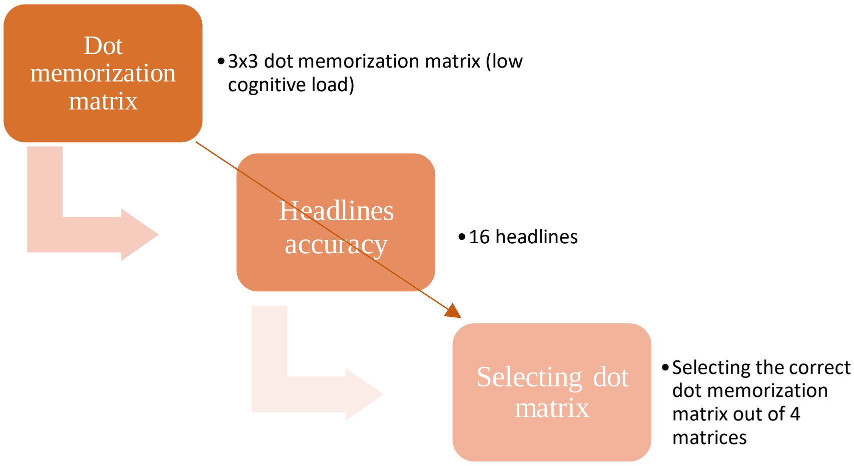

Figure 2: Dot matrix - headlines evaluation low

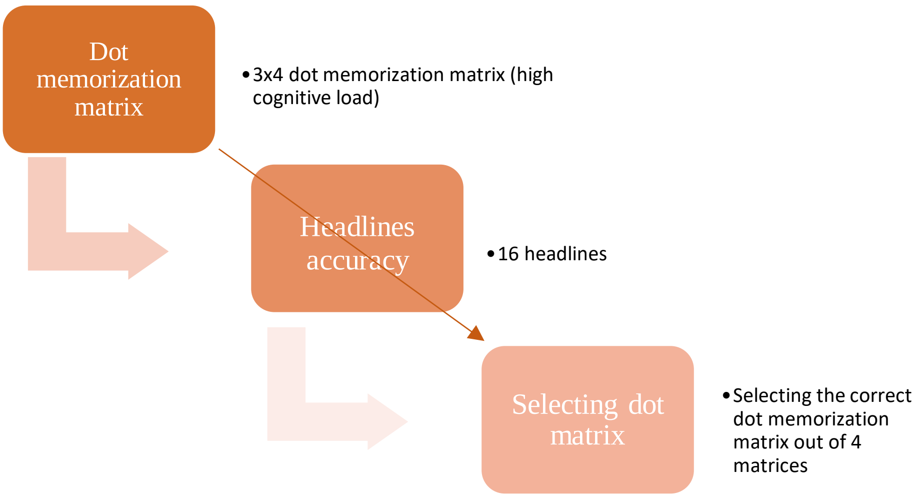

Figure 3: Dot matrix - headlines evaluation high

3.1.2 Main survey task = Headlines evaluation

By following recommendations on conducting experiment testing for misinformation by Pennycook and Binnendyk et al. (2020), **all participants** got presented with a selection of news about COVID-19 in the form of **sixteen headlines**, consisting of half accurate and half false information, presented in random order and asked about the **perceived accuracy** on a scale from (1= "Not at all accurate", 4= "Very Accurate"), as previously applied by Pennycook and Bear et al. (2021). When judging the accuracy of the shared news headlines, news headlines were portrayed as previously in the lab-based interpersonal research paradigm, with an equal number of news headlines portrayed that are regarded as true and false (Bond and DePaulo, 2006 in Luo et al., 2020), in random order. The headlines were presented in a Facebook posts format (Pennycook and McPhetres et al., 2020), created as screenshots. Thematically, the selected news headlines content mainly related to the information on vaccination due to the actuality of the topic at the time of conducting the thesis research. Exposing participants to more types of content aligns with more realistic news content on social media. For generating misinformation, the websites www.snopes.com and www.factcheck.org were applied to verify the falsity of the news. Before the survey conduction, it was intended for most of the misinformation headlines to come from recent news since these could be already familiar to the participants in the case of older news. However, as was established throughout the search process for the debunked misinformation on the fact-checking websites, these offered a lot of misinformation, especially to a US-American political context concerning COVID-19. Since the survey for this thesis research was conducted predominantly for the European participants, this news could not have been used because there could be not be regarded as context-relevant. Hence, also a selection of few more outdated misinformation headlines was used (from the beginning of the COVID-19 crisis in March 2020 until April 2021) since these were available on the fact-checking websites. Participants were shown timely actual content for the authentic content, reminding them of the false content through its form and how the news headlines have been formulated. The factual content should not have been familiar to the participants, preventing them from recognizing whether it is true or false. The factual content was provided through reliable news sources (Pennycook and Binnendyk et al., 2020), which can help participants indicate that the presented news headlines are accurate. Here, by applying the reputation heuristic, participants would be expected to be able to recognize the news from a well-known source, hence even if they are not sure about the veracity of the news, they should be able to identify that it was confirmed through the source recognition (Metzger et al., 2020 in Luo et al., 2020). Before the survey-taking finalization, these headlines were shown to select independent reviewers to classify how easy it would be for participants to recognize the accuracy of the news while executing a high and load cognitive manipulation task. The verbal feedback provided that answering the questions while executing a high cognitive manipulation task was more difficult than rating the accuracy while executing a low cognitive manipulation task.

Figure 4:Example of a misinformation headline

Figure 5: Example of a true headline

3.1.3 Survey outline

The main design for **all participants** consisted of multiple elements. Firstly, participants were briefly informed about the survey's topic and provided with instructions and **an informed consent form**, where they received information related to the participation restrictions (**age limit 18**) and the ways, how the data would be analysed, handled and applied after the data collection, which they agreed upon by confirming. They were also provided with detailed instructions explaining the main task of the survey. The expected time for the participants to complete the survey was about 13-15 minutes. A detailed description of the outline of the survey can be accessed in Appendix B.

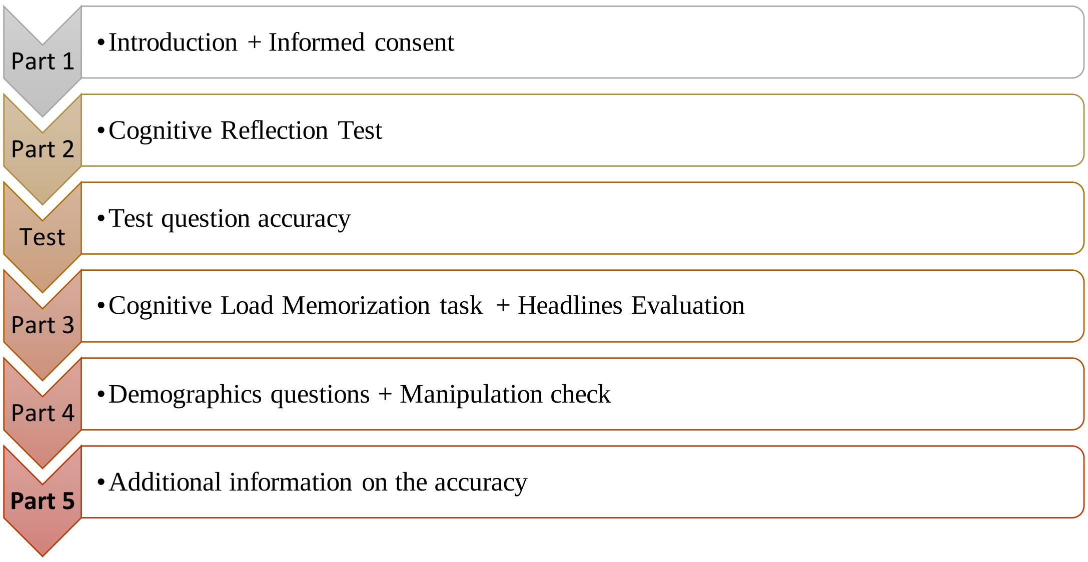

Figure 6: Survey outline

Afterwards, in part 2 of the survey, all participants were presented with three questions from the **Cognitive Reflection Test**, in the usual form, such as applied by Pennycook and Rand (2018). The questions are attached in **Appendix (B).** Before moving on to the main task of the experiment, participants received a chance to try the task out on one **test** question, consisting of one dot memorization question and one headline accuracy question, to get more familiar with the main task of the experiment (see Figure 2 and 3 for concrete realization). Then, in part 3, the accuracy perception is accompanied by the above-described dot memorization task. Hence the main experimental manipulation took part in this section. Here, the participants got by Qualtrics automatically randomly assigned to the **"Treatment"** and **"Control group"** to account for the selection bias in the procedure. Afterwards, the separation between treatment and control group ended, and **all participants** got asked questions related to **demographics**, such as age, gender, place of residence, education, and political preferences. These questions were applied because they help assure that the randomization processes were executed successfully. Also, participants were asked about how difficult they perceived the task of executing the cognitive load task while answering the questions of the main survey part, to find out about the effect of the cognitive load manipulation, on a scale from 1 - "Not at all difficult" to 5 - "Very difficult". Before submitting the survey, participants got a choice between moving further with the information part, where they could find out which of the presented information was false, and links to the related fact-checking websites. Those, who preferred not to read the additional in more detail, had a choice to finish the survey immediately. The full survey can be attached in Appendix (B), together with the summary of the information that participants received before they started filling out the survey and the information participants received as part of the debriefing after filling out the survey.

3.1.3.1 Survey materials

Additionally, it is essential to mention that there has been a mistake in one of the questions regarding the dot memorization task. This problem related to question 14 in the Treatment group, whereas the participants were shown a dot memorization matrix, and this matrix has not been mentioned in the four potential matrices they were supposed to choose from, based on which dot matrix they previously saw. This mistake is related to actual news, and hence, the question will not be deleted from the sample since the main research question relates to the accuracy perception of fake news. Therefore, even if the cognitive overload effect in this question would be higher, the question affected by this mistake is not interested in answering the main research question. Nevertheless, this question will still be removed in one part of the analysis, concretely in the Manipulation check. In this check, this question will be removed for both the Control and the Treatment group in order for the dot memorization task accuracy of the Control and the Treatment group to be compared and potential differences to be drawn. This question must be removed from this part because the answers for this question differed between the participants to a great extent. The difference was caused by mistake in the survey conduction. After this check, question 14 will return to the primary analysis for **the Treatment** and **Control groups.**

3.1.4 Survey procedure

The survey of this study was accessible to the participants for multiple days (29.5.2021- 21.6.20). The participants were contacted through various online social media platforms, such as Facebook, Twitter, Linked In and Instagram. Most participants consisted of people either posing my private acquaintances or their contacts. Additionally, the survey was posted on a Survey swapping WhatsApp page for Erasmus University students. In order to be eligible to participate in the survey, participants had to have sufficient comprehension of **the English language** to understand the misinformation headlines. There have been 358 recorded responses; however, out of these 358 responses, only 215 respondents completed the survey in full. Hence there are 143 respondents who either stopped throughout the survey competition, opened it and answered few questions or did not finish the main mandatory survey questions. As planned, the main applied model to test the hypotheses would be ordered logistic regression. When using G-Power software to calculate the optimal sample size for logistic regression, unfortunately, G-Power does not offer an option for an ordered logistic regression. Running an a-priori logistic regression test and plugging in the most conservative power estimate and statistical power, the optimal sample size should reach a minimum of 347 observations. Yet, this is the most conservative assumption, which has not been fulfilled.

The survey questions were designed so that participants only got the opportunity to move forward to another question, only once they provided an answer. This showed to be rather difficult in part with the Cognitive Reflection Task, where some people expressed their opinion on the question in the verbal form. From the variable Gender, 3 participants were removed from the sample, which responded with “Prefer not to say”. Hence, responses were removed from the data set only to keep filling out responses. Additionally, due to the nature of the cognitive overload task and to assure that the cognitive load manipulation task has worked, the responses that took longer than 40 minutes were removed from the sample. This resulted in the total considered number of participants, 184 (one participant – 1 unique IP address). The survey was rewarded by using a reward, which was awarded to 3 participants with the help of the random selection by using Excel and awarded 10 euros each. The money has been transferred to the selected winners.

3.2 Intended analysis

The data collected through the survey mentioned above will be analysed by selecting various processes of analysing the collected data. With a selection of various tests, it will be regarded how the experimental manipulation influenced the perception of accuracy, as described by the main research question of this thesis and the main formulated hypotheses. First of all, the results section will begin with the **Descriptive statistics analysis,** where the first results will be introduced, and the data will be analysed on its **characteristics**. Here, the main descriptive characteristics will be regarded together and divided into the **Treatment** and the **Control groups**.

Furthermore, the **Randomisation** and **Manipulation checks** will be conducted, and the variables of interest will be tested on their **correlation** and the degree of **multicollinearity**. Lastly, the main model will be introduced, visualising how the three formulated hypotheses will be tested. Consequently, a selection of various applied variables will be introduced in more detail.

3.2.1 Randomization check

The **randomization check** will be conducted to view how the variables that are not part of the main experimental treatment differ for the treatment and the control group. This relates to the demographic variables (Education level, Gender, Age, Political preferences) and the CRT score. The variables will be tested with parametric tests (after reviewing whether the main conditions hold) and non-parametric tests. If the variables are parametric, the student T-Test will be applied to recognize whether the means between the two groups are the same (equal) (Treatment and control group), which also poses the null hypothesis of this test. The alternative hypothesis of this test would mean that the means of the variable between the two groups are not equal. When the variables do not follow the necessary assumptions for conducting a parametric test, the non-parametric tests will be applied. For the categorical and the continuous variables, the Mann-Whitney U test will be applied. This is due to the reason that the conducted experimental treatment is a **between-subject design**. With the Mann-Whitney U Test, the medians of the two groups will be compared. The null hypothesis for this test is that the medians between the two groups, treatment, and control, are the same. The alternative hypothesis would be that the medians between these two groups differ.

Additionally, when the variable is binary, the Chi-Squared test will be applied to identify how the binary variable is distributed between the two groups, the treatment, and the control group. The null hypothesis for this test states that there is no difference in the distribution of the binary variable between the two groups, treatment, and control. The alternative hypothesis, on the contrary states, that there is a difference in the distribution of the binary variable between the two groups. Hence, based on whether the assumptions for the parametric test hold or not, it will be decided whether the parametric or non-parametric tests should be applied.

3.2.2 Correlation, Multicollinearity

Additionally, the **correlation test** is conducted to see how the independent variables in the sample correlate with each other. About that, the variables also shall be tested for the multicollinearity diagnostics test to note the degree of collinearity between the variables of interest.

3.2.3 Manipulation check

Lastly, a **manipulation check** will be conducted in order to study the effect of the high and low cognitive load manipulation on the behaviour of the participants. There are four variables of interest relevant for this test: the Perceived **Difficulty** of the task, the **Duration of the survey,** the **Duration of the dot memorization task**, and **the Accuracy of the dot memorization task**. These variables will allow us to see the differences in the executed cognitive load manipulation treatment between the Control and the Treatment groups.

Firstly, it will be inspected whether the participants in the Treatment group indeed considered the execution of the more difficult memorization task (high cognitive load) as more difficult (through a self-reporting measure) or whether there has been no difference between self-reported difficulty in the low and the high cognitive load manipulation task, which would indicate that the manipulation has not been effective. When considering the **Duration** (of time), which participants are required to fill out the survey since the high cognitive load manipulation task poses a higher cognitive burden, the participants in the Treatment group are expected to need longer time to complete the survey **overall**. Also, the time spent on the **Dot memorization** is expected to be longer for the Treatment group.

Also, when considering the **Accuracy of the dot memorization task**, it will become visible whether the participants in the high cognitive load manipulation task struggled more with the execution of the memorization task or whether there has been no difference between the two groups, in how well they performed in executing this task. The latter would indicate that the difference between the high and the low cognitive load was not high enough to affect the participants when assessing the Accuracy of the presented news headlines. Lastly, the **Duration of the dot memorization task** is monitored. This measure describes the time that is required for answering the out the dot memorization task. Since the patterns in the dot memorization task for the Treatment group have been more difficult, the participants in this group are expected to spend more time answering the dot memorization task questions.

The manipulation check will be conducted with the help of the Mann-Whitney U Test, whereas the null hypothesis for this test states that the **medians** of these variables between the Control and the Treatment group are the same. However, to see whether the manipulation check has been successful, it should be assumed that the medians between the groups, for the variables the Difficulty and the Accuracy of the dot memorization task should not be the same. Hence the null hypothesis should be rejected. Otherwise, it would indicate that there was not a sufficient difference between the high and low cognitive load manipulation task.

3.2.4 Main hypotheses testing

In this part, I will shortly repeat the main intended hypotheses related to investigating the main research question and describe why these hypotheses are formed and how these hypotheses will be tested.

Hypothesis 1:
Being under a high cognitive load increases the perceived accuracy of fake news.

In the first hypothesis, the effect of the experimental manipulation is regarded, whereas it is examined how high cognitive load influences how people perceive the accuracy of the fake news. This hypothesis assumes that when being under high cognitive load manipulation, the fake news should be rated as more accurate than when assessing the accuracy of the presented fake news while being under a low cognitive load manipulation treatment.

Hypothesis 2:
Having an intuitive reasoning style, compared to having an analytic reasoning style, increases the perceived accuracy of fake news.

The second hypothesis studies how individuals who have intuitive reasoning perceive the accuracy of fake news. The intuitive reasoning relates to low Cognitive Reflection Test scores (0 and 1), whereas the analytical reasoning assumes higher scores on the Cognitive Reflection Test. Hence, the interaction term between the variable Fake news and intuitive thinking is added to the model. This hypothesis assumes that individuals who score worse on the Cognitive Reflection Test and hence are assumed to have an intuitive reasoning style should perceive the fake news as more accurate than the individuals who score better on the Cognitive Reflection Test and hence are assumed to have a more analytical reasoning style.

Hypothesis 3:
The effect of high cognitive load on the perceived accuracy of fake news is stronger for individuals who have an intuitive reasoning style than individuals who have an analytical reasoning style.

Lastly, the final hypothesis, H3, pays attention to the interacting effect between the high cognitive load and the intuitive reasoning on the accurate perception of fake news. This hypothesis assumes that the effect of the high cognitive load on the accuracy of fake news should be stronger for the individuals who score worse on the Cognitive Reflection Test and hence are assumed to have an intuitive reasoning style when compared to the individuals who score better on the Cognitive Reflection Test, and hence are assumed to have a more analytical reasoning style and who are not undergoing a high cognitive load manipulation treatment.

3.2.5 Main variables

This section will further delve into the variables created through the primary data collection, as described above. The overview of the used variables in the analysis is provided in Appendix C. I will introduce the main variables relevant for testing the formed hypotheses and the relevant control variables, and further additional variables, which are necessary for the manipulation check

Dependent variable

Perceived accuracy of the misinformation

In the survey related to this master thesis, participants are asked about the 16 presented news headlines' perceived accuracy on a 4-point Likert scale. The perceived accuracy was for a more precise measure not rescaled into a binary variable of accurate/ not accurate but kept as a 4-point Likert scale, posing an ordered variable. The perceived accuracy does not reflect the factual accuracy of the shared content. It means participants are supposed to judge how accurate they report the presented headlines to be. The variable perceived accuracy is rated on a 4-point Likert scale from (1= "Not at all accurate", 4= "Very Accurate"). The data for the 16 news headlines have been recorded in a long format.

Explanatory variable

Condition

Condition is a binary variable, and it expresses whether the participant has been in control or the treatment group, respectively. Participants undergoing the **high cognitive load manipulation treatment (the treatment group)** are given the value one, and they get 0 if they were randomly assigned to the control group. Hence, if they are in the treatment group, they get the value one, and when they are in the control group, they get the value 0. The treatment group is exposed to the high cognitive load treatment, and the control group is suspect to the low cognitive load treatment.

The measure of cognitive ability – CRT

The cognitive ability of the participants is measured through the Cognitive Reflection Test measure. This test consists of three questions, which are portrayed in Appendix (B). When processing the data from the CRT, the correct answers get converted into responses that are binary. Firstly, in the analysis, the "correct" (more analytic answers) were given the score of 1 and the "wrong" (intuitive) answers, which are awarded 0. Afterwards, the score of the participants is calculated, posing a CRT score. The result, as mentioned above, is the new variable, which is created and called CRTRes, ranging from 0-3. The participants who score more on the CRT score get regarded as having a more analytical cognitive ability style. It is necessary to mention that the "wrong" answers consist of two types of answers. One answer type is the intuitive answers (System 1 thinking answers), which have been regarded as such by previous literature findings. Another type of incorrect answer are statements that are wrong by default. For the scope of this thesis, I assume the distinction between the intuitive and wrong answers is not necessary. Additionally, the variable Cognitive Reflection Test is recoded into a binary variable Analytical and Intuitive. For the variable Analytical, which expresses whether an individual can be characterized based on the Cognitive Reflection Test result as having a more analytical way of thinking, score two and three have been recoded into one, and the score zero and one have been recoded into the 0. For the variable Intuitive, the score two and three have been recoded into the 0, and the score zero and one have been recoded into the 1. Intuitive means that if it takes the value 1, the individual has an intuitive reasoning style. If it takes the value 0, the individual has an analytical reasoning style. Later it will be explained, why as a measure of Cognitive Reflection ability, only the variable Intuitive will be considered for further analysis (when coded differently, as Analytical, there is too high a degree on collinearity). Hence, the variable will be included in the model as a binary variable **Intuitive**.

Fake

An additional explanatory variable in the model is the **Fake**, which is 1 for when the presented news headline has been fake and 0 for when the presented news headline has been true. Additionally, the analysis will also include interaction terms between the variables mentioned above, which will be an interaction between Condition x Fake, the CRT score (Intuitive/ x Fake and a triple interaction between the variables Condition x Fake and the CRT score (Intuitive).

Additional variables

Other variables in the model include the control variables related to the demographical information of the participants. These include **Gender, Age, Political preferences (Political), Education (Degree)** and **Residence.** These variables are further depicted in Appendix C.

Variables for manipulation check

In order to execute the manipulation check, different variables are required: the **Difficulty**, **Duration of the survey**, **Duration of the dot memorization task** and the **Dot memorization task accuracy**. In order to find out whether the cognitive load manipulation treatment worked, there is a variable, Difficulty, which measures whether participants rated the main task of the survey as difficult or not. This variable consists of answers on a 5-point Likert scale, whereas the 1 represents "Not at all difficult" and the five is "Extremely difficult ". The variable **Duration and Duration of the dot memorization task** measure how much time participants needed for completing the survey and the dot memorization task. The variable **Dot memorization task accuracy** is portrayed on a scale of 0-15, whereas 15 is the maximum points participants could score when choosing the correct dot matrix in the dot memorization task. Only 15 questions have been regarded for the manipulation check in the Dot memorization task accuracy due to the mistake in the conduction of the survey.

3.2.6 Main model

The main regression analysis for this thesis research will be analysed with the **ordered logistic regression**. Because all three main hypotheses have a dependent variable depicted in an ordinal scale (perceived Accuracy), they will be tested with the Ordered Logistic Regression. The key assumption in the ordered logistic regression is that the coefficients describing the relationship between the different categories are the same for the lowest and highest category (hence the relationship which is to be found between the different outcome groups pairs shall be the same for all categories in the Ordered Logistic Regression) (UCLA, n.d.).

Overall, the logistic type of regression differs from the linear regressions in the main key assumptions. The main difference is that it does not require a linear relationship between the two variables types, dependent and independent variables. Additionally, the error terms from the sample do not need to be distributed normally. Hence running a logistic regression does not require using variables that are normally distributed. Also, the assumption of homoscedasticity shall not be needed. Lastly, the main dependent variable shall not be measured in a scale, interval or ratio. Using this model will be possible to test for the relationship between the **ordered variable** of perceived Accuracy and the other explanatory variables (Schreiber-Gregory and Bader, 2018).

However, there is still a selection of assumptions that should hold for an **(ordered) logistic regression**. These are the appropriate outcome structure, assumption of observation independence, the independent variables should be either categorical, ordinal or continuous; there should be no multicollinearity between independent variables; the assumption of the large sample size; the assumption of the linearity of independent variables and log odds and finally the proportional odds assumption should all hold (CEED, n.d.). These assumptions will be addressed in a detail in Appendix (D).

Now, I will portray the main models representing the three hypotheses through a mathematical representation:

Hypothesis 1:

$$\boldsymbol{H1: Perceived\ Accuracy = \beta_0 + \beta_1 Condition + \beta_2 Fake + \beta_3 Condition * Fake + \beta_i ControlVariables}$$

$$P(Perceived\ Accuracy = 1 | ConditionFake, Condition * Fake, ControlVariables) = \frac{\exp(\tau_1 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition * Fake - \beta_4\ ControlVariables)}{1 + \exp(\tau_1 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition * Fake - \beta_4\ ControlVariables)}$$

$$P(Perceived\ Accuracy = 2 | ConditionFake, Condition\#\#Fake, ControlVariables)$$
$$= \frac{\exp\,(\tau_2 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition * Fake - \beta_4\ ControlVariables)}{1 + \exp\,(\tau_2 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition * Fake - \beta_4\ ControlVariables)} - \frac{\exp\,(\tau_1 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition * Fake - \beta_4\ ControlVariables)}{1 + \exp\,(\tau_1 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition * Fake - \beta_4\ ControlVariables)}$$

$$P(Perceived\ Accuracy = 3 | ConditionFake, Condition\#\#Fake, ControlVariables)$$
$$= \frac{\exp\,(\tau_3 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition * Fake - \beta_4\ ControlVariables)}{1 + \exp\,(\tau_3 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition * Fake - \beta_4\ ControlVariables)} - \frac{\exp\,(\tau_2 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition * Fake - \beta_4\ ControlVariables)}{1 + \exp\,(\tau_2 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition * Fake - \beta_4\ ControlVariables)}$$

$$P(Perceived\ Accuracy = 4 | ConditionFake, Condition * Fake, ControlVariables)$$
$$= 1 - \frac{\exp\,(\tau_3 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition * Fake - \beta_4\ ControlVariables)}{1 + \exp\,(\tau_3 - \beta_1 Condition - \beta_2 Fake - \beta_3 Condition\#\#Fake - \beta_4\ ControlVariables)}$$

Hypothesis 2:

$$\boldsymbol{H2: Perceived\ Accuracy = \beta_0 + \beta_1 Intuitive + \beta_2 Fake + \beta_3 Intuitive * Fake + \beta_i ControlVariables}$$

$$P(Perceived\ Accuracy = 1 | Intuitive, Fake, Intuitive * Fake, ControlVariables)$$
$$= \frac{\exp\,(\tau_1 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 CIntuitive * Fake - \beta_4\ ControlVariables)}{1 + \exp\,(\tau_1 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive * Fake - \beta_4\ ControlVariables)}$$

$$P(Perceived\ Accuracy = 2 | Intuitive, Fake, Intuitive * Fake, ControlVariables)$$
$$= \frac{\exp\,(\tau_2 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 CIntuitive * Fake - \beta_4\ ControlVariables)}{1 + \exp\,(\tau_2 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive * Fake - \beta_4\ ControlVariables)} - \frac{\exp\,(\tau_1 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 CIntuitive * Fake - \beta_4\ ControlVariables)}{1 + \exp\,(\tau_1 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive * Fake - \beta_4\ ControlVariables)}$$

$$P(Perceived\ Accuracy = 3 | Intuitive, Fake, Intuitive\#\#Fake, ControlVariables)$$
$$= \frac{\exp\,(\tau_3 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive * Fake - \beta_4\ ControlVariables)}{1 + \exp\,(\tau_3 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive * Fake - \beta_4\ ControlVariables)} - \frac{\exp\,(\tau_2 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 CIntuitive * Fake - \beta_4\ ControlVariables)}{1 + \exp\,(\tau_2 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive * Fake - \beta_4\ ControlVariables)}$$

$$P(Perceived\ Accuracy = 4 | Intuitive, Fake, Intuitive\#\#Fake, ControlVariables)$$
$$= 1 - \frac{\exp\,(\tau_3 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 CIntuitive * Fake - \beta_4\ ControlVariables)}{1 + \exp\,(\tau_3 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive * Fake - \beta_4\ ControlVariables)}$$

Hypothesis 3:

$$\boldsymbol{H3: Perceived\ Accuracy = \beta_0 + \beta_1 Intuitive + \beta_2 Fake + \beta_3 Condition + \beta_4\ Intuitive * Fake + \beta_5 Intuitive * Condition + \beta_6 Fake * Condition + \beta_7\ Intuitive * Fake * Condition + \beta_i ControlVariable}$$

$$P\left(Perceived\ Accuracy = 1 \middle| \begin{matrix} Intuitive, Fake, Intuitive * Fake, Intuitive * Condition, Condition * Fake, Intuitive * Condition * Fake, \\ ControlVariables \end{matrix}\right)$$
$$= \frac{\exp(\tau_1 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 CIntuitive * Fake - \beta_4\ ControlVariables)}{1 + \exp(\tau_1 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive * Fake - \beta_4\ ControlVariables)}$$

$$PP\left(Perceived\ Accuracy = 2 \middle| \begin{matrix} Intuitive, Fake, Intuitive * Fake, Intuitive * Condition, Condition * Fake, Intuitive * Condition * Fake, \\ ControlVariables \end{matrix}\right)$$

$$= \frac{\exp(\tau_2 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 CIntuitive * Fake - \beta_4 ControlVariables)}{1 + \exp(\tau_2 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive\#\#Fake - \beta_4 ControlVariables)} - \frac{\exp(\tau_1 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 CIntuitive * Fake - \beta_4 ControlVariables)}{1 + \exp(\tau_1 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive\#\#Fake - \beta_4 ControlVariables)}$$

$$PP\left(Perceived\ Accuracy = 3 \middle| \begin{matrix} Intuitive, Fake, Intuitive * Fake, Intuitive * Condition, Condition * Fake, Intuitive * Condition * Fake, \\ ControlVariables \end{matrix}\right)$$

$$= \frac{\exp(\tau_3 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 CIntuitive * Fake - \beta_4 ControlVariables)}{1 + \exp(\tau_3 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive\#\#Fake - \beta_4 ControlVariables)} - \frac{\exp(\tau_2 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 CIntuitive * Fake - \beta_4 ControlVariables)}{1 + \exp(\tau_2 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive\#\#Fake - \beta_4 ControlVariables)}$$

$$P\left(Perceived\ Accuracy = 4 \middle| \begin{matrix} Intuitive, Fake, Intuitive * Fake, Intuitive * Condition, Condition * Fake, Intuitive * Condition * Fake, \\ ControlVariables \end{matrix}\right)$$

$$= 1 - \frac{\exp(\tau_3 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 CIntuitive * Fake - \beta_4 ControlVariables)}{1 + \exp(\tau_3 - \beta_1 Intuitive - \beta_2 Fake - \beta_3 Intuitive * Fake - \beta_4 ControlVariables)}$$

To summarize, main model can be portrayed such as:

$$(Y = j | x_1, x_2) = \frac{\exp(\tau_j - \beta_1 x_1 - \beta_2 x_2)}{1 + \exp(\tau_j - \beta_1 x_1 - \beta_2 x_2)} - \frac{\exp(\tau_{j-1} - \beta_1 x_1 - \beta_2 x_2)}{1 + \exp(\tau_{j-1} - \beta_1 x_1 - \beta_2 x_2)}$$

In this model, the variables Fake, Condition and Intuitive are categorical variables regarded as binary. The dependent variable (Perceived Accuracy = Y, which is ordinal) (Williams, 2021), is hence not regarded as continuous. Perceived accuracy is regarded as a categorical variable, due to the reason, that there is a clear indication of an order of categories “Not at all accurate”, “Not very accurate”, “Somewhat accurate” and “Very accurate”. Hence, “Perceived accuracy” can be seen as a collapsed version of an unobserved variable Z, which cannot be measured. Hence, the dependent variable **Perceived Accuracy** is regarded as an **ordered categorical variable** created from this continuous unobserved and unmeasured variable Z (Williams, 2021). Therefore, the correct model to use is the ordered logistic regression. The variable Z is a continuous variable, and the created categorical variable Perceived Accuracy can be regarded as the continuous variable but split into the various cuts, separating the different categories. τj then consequently portrays the different cuts from one into another category.

(Z = latent variable, Y = ordered variable Perceived Accuracy)

Y = 1 if Z* < τ1

Y = 2 if τ1< y* < τ2

Y = 3 if τ2 < y* < τ3

Y = 4 if Z* > τ

4 Results

In this part, the main results of this thesis research will be presented. Firstly, the results of the descriptive statistics will be described and portrayed in the form of tables. Secondly, the results from the **randomization check**, **manipulation check** and correlation and **collinearity** test will follow. Afterwards, the analysis of the **main regressions** will be presented. These results will be accompanied by a selection of tables and figures to better comprehend the presented results. Further tables and results will be shown in the Appendix E.

4.1 Descriptive statistics

4.1.1 Data

The main sample consists of 184 answers. 94 participants from the sample were randomly by Qualtrics assigned to the **treatment group**, which poses 51.09% of the participants. 90 participants were randomly assigned to the **control group**, which poses 48.91% of the whole sample, indicating an almost equal distribution between the treatment and the control group. From this sample, there are 81 male participants and 103 female participants. The average age of the participants from the investigated sample is 27.97 years, with SD age = 8.73 years and the age(min) = 18 years and age(max) = 66 years. The area of residence for the participants in this sample size differs. Most participants reside in the Netherlands, with 53 participants occupying 28.80% of the sample. The participants' second most prevalent country of residence was Slovakia, with 45 participants, which poses 24.46% from the survey. The participants' third most prevalent country of residence was Austria, with 20 participants, posing 10.87 % of the sample size. These three countries pose 64.13% of the whole sample.

In **Table 1**, the descriptive statistics for the categorical variables (Panel A) in the dataset are portrayed, which are the variables, as listed: **Gender**, **Education**, **Political preference**, **Perceived Difficulty**, **CRT score** and **Memorization accuracy**. **Age** and **Duration** are portrayed in the same table under Panel B: Continuous variables. These are divided into two groups**,** according to if they belong to the **treatment** or the **control group**. Additionally, they are portrayed in the number of participants according to category and the related percentage about the full sample. Also, these variables are portrayed in a combined way. As is visible from this table, in terms of finished educational level, most participants from the sample reached **Bachelor's degree** education, with 80 participants, which poses 43.48 % from the sample. The second most prevalent education level was the **master's degree,** with 63 participants posing 34.24% of the sample in this category. The third most prevalent category was High School education, posing with 39 participants 21.20% of the sample. The least prevalent groups were "Less than high school" and "PHD", with only 1 participant each, posing 0.54% of the sample accordingly. Hence, it shall be mentioned that more than half of the sample participants reached at least a Bachelor's degree education, making the participants in the sample in general well educated. Due to the uneven spread of the participants in some of the groups in the sample, a new variable Degree will be created, which will take a value 1 for when participant finished a bachelor's degree and a higher kind of education (master's degree and PhD) and 0 if the participant finished lower category of education (High school and Less than high school). This is because participants who completed at least Bachelor's degree will be regarded as overall more educated. Recoding the variable education into binary variables results in 78.26% of participants out of the sample who completed at least a bachelor's degree and 21.74% of participants who completed only less than a bachelor's degree.

Regarding **political preferences** of the participants in the sample, on a scale from 1 (extremely liberal) to 7 (extremely conservative), it is visible that most participants can be attributed to the middle **(3)** category of the political preferences scale, with 27.17% of the whole sample. The second most prevalent group is **group (2)**, with 25.00% of the whole sample. The third most prevalent group is the **group (4)**, with 20.65% of the whole sample. The groups "Extremely conservative" (7) and "Extremely liberal" (1) only account for 7.07% and 2.72% accordingly. The average political preference is 3.31, with a standard deviation of 1.41. As visible from the variable political preferences, only a few people are in the categories on the right side of the political spectrum. Hence, a new variable Political, will be created, which will consist of category Left (Liberal), which stands for the categories 1, 2, 3 from the variable Political preference and 5,6,7, which will pose the category Right (Conservative). This variable consists of the Middle category (4), where participants are not divided between Left or Right oriented. Overall, 59.24% of the participants belong to the category "Left", 20.65% of the participants belonged to the category "Middle", and 20.11% of the participants belonged to the category "Right".

Furthermore, **Table 1** portrays another categorical variable, the perceived **Difficulty**, which has been regarded as 1 ("Not at all difficult") to 5 ("Extremely difficult"). This variable has been added to the dataset in order to observe how the participants rated the perceived accuracy while executing the dot memorization task, which is the main cognitive load manipulation element) and if there were differences between the Control and the Treatment group. It is visible from the table that the most participants in the Control group, posing 43.33% from the survey, rated the Difficulty of executing a secondary task with the grade "2". From the **Treatment group**, the most participants, 38.30 % (who were undertaking a high cognitive load manipulation treatment), rated the Difficulty with grade "3". Hence, the participants in **the Treatment group** regarded the execution of the cognitive load manipulation task as more difficult; the difference has not been so high. Concretely, the average Difficulty for the Control group has been 2.36 with the SD= 0.93 and for the Treatment Group with the average Difficulty 2.71 and SD= 0.91.

Another categorical variable in *Table 1* is the **Cognitive Reflection Test.** As shown in this table (2) in Appendix, the questions got a different number of correct (analytic) responses. It is visible, the question related to the "Lily pad" (CRT3) had the correct responses, 131. This is followed by the question about "Widget" (CRT2), with 121 correct responses. The most difficult question for the participants appeared to be the "Bat and the ball problem"; however, 114 participants had correctly answered this question. Overall, it can be said that participants scored well on the CRT test, as visible in Table 3; more than 50.54 % correctly answered all three questions. The average score for both groups, treatment and Control combined, has been 1.99 of the score, with an SD of 1.20 of the score. In the Treatment group, the average CRT score was 1.93 with the SD 1.13 points, and in the Control group, the average CRT score has been 2.06 with SD 1.14 points. When the variable CRT score is adapted to a binary variable 1 (intuitive thinking) and 0 (analytical thinking), the number of participants whose thinking can be regarded as analytical is 126, posing 68.48% of the whole sample and the number of participants who get assigned to the intuitive way of thinking is 58, posing 31.52% of the sample. The variable CRT score will be in the further analysis used as a binary variable. As visible from Figure 5, the participants in the Intuitive group perceived the Fake news as slightly more accurate, whereas they perceived the real news as less accurate. Based on *Figure 4*, people with analytical (not intuitive) reasoning styles perceive fake news as less accurate, however real news as more accurate. The differences can be considered small.

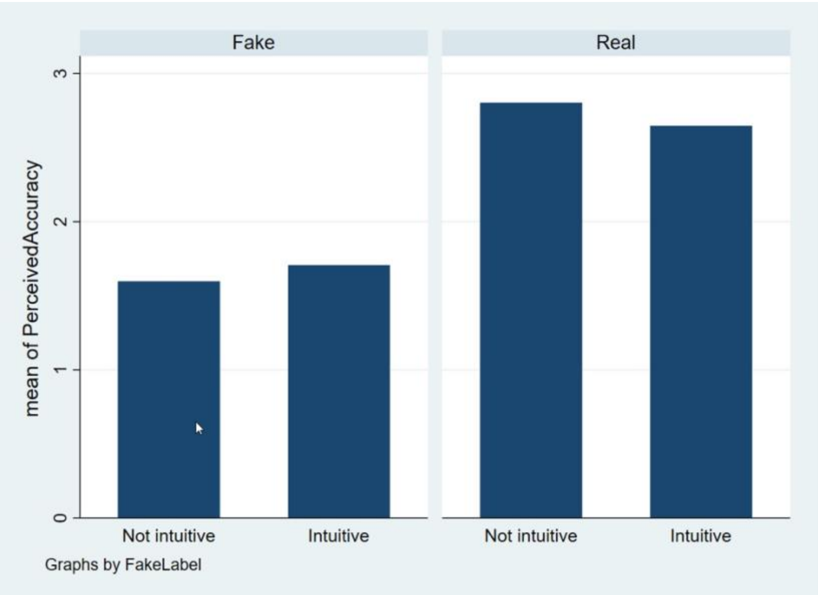

Figure 7 : Mean perceived accuracy of the fake and real news

Panel A: Categorical variables		Treatment No.	Treatment %	Treatment Mean	Treatment SD	Control No.	Control %	Control Mean	Control SD	Total No.	Total %	Total Mean	Total SD
Gender	Male	46	48.94	-	-	35	38.89	-	-	81	44.02	-	-
	Female	48	51.06	-	-	55	61.11	-	-	103	55.98	-	-
Education	Less than high school	1	1.06	-	-	0	0	-	-	1	0.54	-	-
	High school	19	20.21	-	-	20	22.22	-	-	39	21.20	-	-
	Bachelor degree	42	44.68	-	-	38	42.22	-	-	80	43.48	-	-
	Master degree	31	32.98	-	-	32	35.56	-	-	63	34.24	-	-
	PHD or higher	1	1.06	-	-	0	0	-	-	1	0.54	-	-
Political preference	1 (Extremely liberal)	8	8.51	3.35	1.50	5	5.56	3.27	1.31	13	7.07	3.31	1.41
	2	24	25.53			22	24.44			46	25.00		
	3	21	22.34			29	32.22			50	27.17		
	4	20	21.28			18	20.00			38	20.65		
	5	13	13.83			12	13.33			25	13.59		
	6	5	5.32			2	2.22			7	3.80		
	7 (Extremely conservative)	3	3.19			2	2.22			5	2.72		
Difficulty	1 (Not at all difficult)	7	7.45	2.71	0.91	15	16.67	2.36	0.93	22	11.96	2.54	0.93
	2	33	35.11			39	43.33			72	39.13		
	3	36	38.30			27	30.00			63	34.24		
	4	16	17.02			7	7.78			23	12.50		
	5 (Extremely Difficult)	2	2.13			2	2.22			4	2.17		
CRT score	0 (score)	22	23.40	1.93	1.13	15	16.67	2.06	1.14	37	20.11	1.99	1.20
	1 (score)	11	11.70			10	11.11			21	11.41		
	2 (score)	13	13.83			20	22.22			33	17.93		
	3 (score)	48	51.06			45	50.00			93	50.54		
Memorization accuracy	0-16 (score)	94	-	13.38	1.92	94	-	14.79	1.41	184	-	14.07	1.83

<table>
<tr><th></th><th colspan="4">Treatment</th><th colspan="4">Control</th><th colspan="4">Total</th></tr>
<tr><th>Panel B: Continuous variables</th><th>Mean</th><th>SD</th><th>Median</th><th>Min | Max</th><th>Mean</th><th>SD</th><th>Median</th><th>Min | Max</th><th>Mean</th><th>SD</th><th>Median</th><th>Min | Max</th></tr>
<tr><td>Age</td><td>28.35</td><td>9.06</td><td>25</td><td>19 | 59</td><td>27.57</td><td>8.40</td><td>25</td><td>18 | 66</td><td>27.97</td><td>8.73</td><td>25</td><td>18 | 66</td></tr>
<tr><td>Duration of the survey per participant</td><td>16.83</td><td>7.14</td><td>14.37</td><td>6.73 | 39.95</td><td>15.32</td><td>6.02</td><td>14.99</td><td>6.77 | 33.78</td><td>16.09</td><td>6.64</td><td>14.68</td><td>6.73 | 39.95</td></tr>
<tr><td>Duration of the Dot memorization task per participant</td><td>5.85</td><td>2.66</td><td>5.41</td><td>2 .30 | 2.01</td><td>3.25</td><td>1.69</td><td>2.70</td><td>2.30 | 9.70</td><td>4.58</td><td>2.58</td><td>4.18</td><td>1.30 | 22.01</td></tr>
</table>

Table 1: Descriptive statistics for selected categorical and continuous variables

The last categorical variable to be described is the variable memorization accuracy, where participants could score 16 points (one point for each dot memorization task in the 16 questions). As visible from *Table 1,* when reporting for the whole sample, participants in both groups scored on average 14.07 points from the dot memorization task, with an SD 1.83. There can be regarded a little difference between the treatment and the control group when regarded separately. In the treatment group, participants scored on average 13.38 points, and in the control group, participants scored on average 14.79 points, with an SD of 1.41, meaning that participants in the control group were more successful in executing the dot memorization task.

Furthermore, a closer look can be put at the continuous variables in the sample. The first analysed continuous variable in the sample is the **Age** of the participants. The average Age of the participants in the sample is 27.97 years, with standard deviation 8.73 years and a median 25 years. In the Treatment group, the average Age of the participants is 28.35 years, with a standard deviation of 9.06 years. In the Control group, the average Age is 27.57 years, with a standard deviation 8.37.

The expected completion time for the survey was between 13-20 minutes. However, by strictly following the results provided by Qualtrics, it has been shown that the average **duration of the survey** was 60.90 minutes for the treatment group and 71.38 minutes for the control group. The average duration of the survey of the whole sample has been 50.51 minutes, with a standard deviation of 278.64 minutes. The maximum duration for both groups (treatment and control) combined has been 2864.45 minutes, and the minimum duration has been 6.73 minutes. The longer time spent answering the survey questions could have been due to the possible outliers caused by participants pausing the while completing the survey or researching the answers online. In few cases, the survey completing took participants longer than a day. After removing the outliers, which were longer than forty minutes, the average time required for completing the survey was 16.09 minutes, with SD 6.64 minutes and the median 14.68 minutes. In the Treatment group, the average completion of the survey resulted in 16.83 minutes with SD 7.14 minutes and a median of 14.37 minutes. In the Control group, the average completion of the survey was 15.32 minutes, with an SD 6.02 minutes and median 14.99 minutes. By observing the average, it can be regarded that participants in the Treatment group required more time for the survey completion by 1.51minutes. However, as the median shows, the survey competition was longer for the Control group, with a difference of 0.62 minutes. Overall, it can be said that participants in both, treatment and the control group spend approximately a similar amount of time on completing the survey, which contradicts the expectation that the Treatment group would require more time for completing the survey due to a more complex and difficult dot memorization task.

Lastly, the perceived accuracy of the headlines can be regarded graphically. In *Figure (5),* it can be regarded how the mean accuracy perception has differed for different groups (Treatment and Control).

It appears that both groups, Treatment and Control performed similarly in judging the accuracy of both fake and real news. Overall, participants in the Treatment group have rated all the news on average as 2.198, with a standard deviation of 1.095. Participants in the Control group rated the news on average as 2.186, with a standard deviation 1.121.

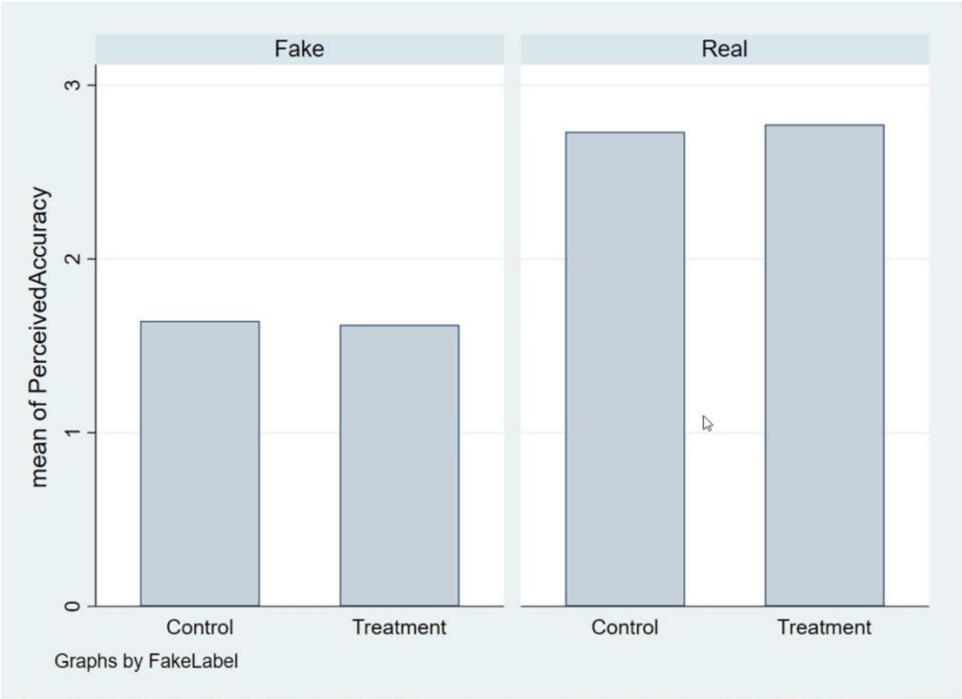

Figure 8: Mean perceived accuracy of the fake and real news

4.1.2 Randomization check

In this part, the conducted randomization checks will be described in order to find out whether the potentially confounding variables are evenly distributed between the two groups, the treatment and control groups. The experimental design of this study is related to a between-subject design. Qualtrics survey allows for executing randomization, yet another additional randomization check should be conducted, in order to observe, whether the collected sample has been sufficiently randomized between the two groups – control and treatment. In this check, variables are regarded that were not influenced by the primary treatment of the executed task. Hence, only variables gender, age, education, political preference and CRT score will be regarded. This will be done through the use of parametric tests. However, in order to be applied, parametric tests require various assumptions to hold. Here, the parametric tests require that the variables are independent, which is assured through the Randomized Control Trial.

Furthermore, the variables used in these tests should be at least either in an interval or in a ratio scale. In the sample of this thesis research, this condition only applies to the variables age. Hence the other variables will be tested for whether they are randomized correctly with the help of non-parametric tests.

Additionally, the data should be distributed through normal distribution, checked through the Shapiro-Wilk test. With the Shapiro-Wilk test, the null hypothesis is formulated that the population of the variable of interest is normally distributed. As visible in Table 3, the p-value (0.00) is lower than the significance level 0.01 (1%); hence the zero hypothesis that the data is distributed with a normal distribution is rejected. As a consequence, the parametric test will also be applied to the continuous variable age.

Variable	Obs	W	V	z	Prob>z
Age	184	0.7377	36.400	8.236	0.00000

Table 2: Shapiro-Wilk Normality test

Variable	z-value	p-value
Age	0.245	0.81
Education	0.053	0.97
CRT score	0.449	0.66
Pol. Pref.	-0.248	0.81
Political	-0.385	0.399

Table 3: Mann-Whitney U Test

As displayed above, the parametric test cannot be applied. Hence, in order to further test for the randomisation, the non-parametric tests will be applied to analyse the variable mentioned above, age of the participants, concretely the **Mann-Whitney U test**, which can be applied minimally to data on the ordinal level, which consists of two samples (treatment and control group). Hence, the Mann-Whitney test will be applied to account for randomisation characteristics. In *Table 3*, it is visible that the differences in the median for the variables age are not significant. Hence the zero hypothesis that the medians are the same is not rejected (0.81>p = 0.1) at 5% significance level and shows that the medians for the age between the group treatment and the group control are the same. Additionally, further variables from the sample will be analysed on their distribution between the two groups and are also depicted in *Table 6*.

The variable **Education** is also not significant 0.97>p=0.1; therefore, the zero hypothesis will not be rejected at 5% significance level. The p value for the variable **Political preference** is also not significant at 10% significance level (0.81); hence the zero hypothesis that the medians between the control and the treatment group are the same is not rejected. This is also the case for the variable **Political**, which combines the variable Political preference into three categories, Left, Middle and Right. The zero hypothesis is that the medians between the control and the treatment group is not rejected (p= 0.399>0.10)

Concerning the distribution of the **Cognitive Reflection Test Score** results, the p value is higher than 10% significance level (0.66), hence the zero hypothesis is not rejected, and the medians do not differ for the two different groups, treatment and control. Hence, it can be said that the results of the above-mentioned tests do not indicate a significant difference between the control and the treatment group for the median values of the variables Education, Age, Political and Cognitive Reflection Test.

Furthermore, the randomisation test will be conducted for the binary variables, Gender, Intuitive and for variable Degree, which was created after recoding variable for Education into a binary variable. The aim is to test whether these variables are evenly distributed between the two groups, Control and Treatment. For this randomisation test, the **Chi-square test** will be performed. The results for **Gender** indicate that there is not a significant difference in the distribution of the variable of interest between the groups mentioned above, since the p-value of the Gender is p = 0.17> 0.1). Another binary variable is the Intuitive, which is created when the variable Cognitive reflection score is changed into a binary variable (analytical = 0, intuitive = 1). The p-value of Intuitive is higher than 10 % significance level (0.29), indicating that there is no significant difference in the distribution of the variable of interest between the Treatment and the control group. For the variable Degree, the p-value (0.876) is higher than 10% significance level, indicating there is no difference between the Treatment and the Control group in the distribution of the variable of interest, having at least a bachelor's degree/ or having less than a bachelor's Degree.

Variable	Degrees of Freedom	χ2	p value
Gender	1	1.8835	0.17
Intuitive	1	1.1440	0.29
Degree	1	0.0242	0.876

Table 4: Pearson's Chi-squaed test

4.1.3 Correlation and Multicollinearity test

Additionally, a test to test for the **correlation** between the dependent and the independent variables is conducted, with the help of the **Spearman Correlation** test, as depicted in *Table 5* below. This test is conducted because it does not require the assumption of normality to hold, and hence it can be regarded as a nonparametric statistic. The variables taken into consideration for the Spearman Correlation Test are regarded as relevant later in the hypotheses testing. As visible from the table, the variables of interest for the analysis overall did not portray a strong correlation. However, there can be still a stronger positive significant correlation recognized for the variable Fake and Perceived accuracy and for the variable Intuitive and Condition in *Table 5.*

As the last test, the sample will be tested on **multicollinearity**, which would occur between the variables if there was a linear relationship between the independent variables. Here, the interaction terms are also added to the model since these will also be added as independent variables. The higher degree of multicollinearity indicates that the model becomes unstable. The commonly regarded rule-of-thumb for the VIF (variance of inflation facto) acceptable for the analysis is ten (O'brien, 2007). The results for the multicollinearity matrix are depicted in *Table 6*. When added to the model as a binary variable Analytical (0,1) and interacting with variables Fake and Condition, then the VIF measure for the degree of multicollinearity is above 10 (10.39), which could be regarded as critical (portrayed in Appendix E). All other variables in this variant have their degree of collinearity (VIF) below 10. The problem with the multicollinearity above ten could be because the reference category (0), which represents intuitive thinking, is smaller for the reference category. As a solution, to avoid larger VIF, the reference category with a higher fraction of the cases will be chosen, and the variable is recoded into 1 – intuitive thinking and 0 – analytical thinking. When recoded, the multicollinearity matrix gives results as attached in *Table 6,* whereas as it can be visible, the VIF degree of collinearity for all variables of interest is below 10. Hence adding ***Intuitive*** to the model appears to be the best solution in terms of the degree of multicollinearity.

Variable	Perceived Accuracy (1)	Condition (2)	Fake (3)	CRTRes (4)
Perceived Accuracy (1)	1			
Condition (2)	0.0068	1		
Fake (3)	-0.5122 ***	0.0000	1	
Intuitive (5)	-0.0070	0.00789***	0.000	1

Table 5: Spearman's rank correlation test (with CRT as binary variable Intuitive)

*Correlation is significant at the 0.1 level (2-tailed) p<0.1

**Correlation is significant at the 0.05 level (2-tailed) p<0.05

***Correlation is significant at the 0.01 level (2-tailed) p<0.01

Variable	VIF	SQRT VIF	Tolerance	R-Squared
Condition	2.92	1.71	0.34	0.66
Analytical	4.40	2.10	0.23	0.77
Fake	2.83	1.68	0.35	0.65
Condition x Fake	4.45	2.11	0.23	0.78
Condition x Intuitive	5.53	2.35	0.18	0.82
Intuitive x Fake	5.41	2.33	0.19	0.82
Cond. x Intuit.. x Fake	6.13	2.48	0.16	0.84
Mean VIF	4.52			

Table 6: Collinearity when CRT as binary variable Intuitive (1) and Analytical (0)

4.1.4 Manipulation Check

In this part, a manipulation check is conducted to determine whether the manipulation applied in the experiment has been effective and if the participants react to the Treatment, as was expected when forming the main hypotheses based on the literature review (Hoewe, 2017). For the parts Duration of the survey, Duration of the dot memorization task and the Accuracy of the task, question 14 has been removed from the data set, for both the Treatment and Control group, due to the mistake as described above in the Survey materials and procedure part.

First of all, the self-reported perceived **Difficulty** of the conducted survey is observed. In the Treatment group, participants get exposed to a dot memorization matrix consisting of 4 dots, hence exposed to a **high cognitive load**. In the **Control group**, participants were exposed to the dot memorization matrix consisting of 3 dots, hence a low cognitive load. The high cognitive load manipulation task was more difficult than the low cognitive load manipulation task. Hence, to regard the differences in the Perceived Difficulty of the survey execution, a Mann-Whitney U-Test is conducted to find out whether the Perceived **Difficulty** of the main executed task differed between the Treatment and the Control group. The goal is to determine whether the participants, who were randomly assigned to the Treatment group, rated execution of the memorization task as more difficult than participants in the Control group. Before the Mann-Whitney U Test, descriptive statistics of the variable Difficulty shall be regarded. From the descriptive statistics for the variable Difficulty, when split into the Treatment and the Control group, it is visible that the average Difficulty for the Control group has been 2.356, with the SD 0.928, and for the Treatment group, the average regarded Difficulty has been 2.713, with the SD 0.911. Hence, there is only a small difference between the Treatment and the Control group in how the participants in these groups regarded the Difficulty in the execution of the dot memorization task. As visible from the Mann-Whitney U test result, the medians for the variable Difficulty are significantly different. Hence the zero hypothesis that the medians are the same between the Treatment and the Control group is rejected at a 1% significance level (0.007). This is aligned with the intended analysis; hence the high cognitive load manipulation task and the low cognitive manipulation task should differ in their difficulty level. However, the self-reported perceived difference is very low.

Secondly, a Mann-Whitney U-Test will be conducted to find out whether the needed time for taking the survey, hence the survey **Duration,** differed between the Treatment and the Control group. The goal is to determine whether the participants, who are randomly assigned to the Treatment group, need more time for the survey completion than participants in the Control group. Before the Mann-Whitney U Test, descriptive statistics of the variable **Duration** shall be regarded. This can be additionally also graphically regarded from *Appendix E.* From the descriptive statistics for the variable Duration, when split into the Treatment and the Control group, it is visible that the average Duration for completing the survey for the Control group has been 15.316 minutes, with the SD and for the Treatment group, the average regarded Duration has been 16.38, with the SD 7.10. The median of Duration for the Treatment group has been 14.99 minutes, and the median for the Duration of completing the survey has been 14.37 in the Control group. Hence, there is a difference between the Treatment and the Control group in how long participants needed to complete the survey. As visible from the Mann-Whitney U test result, the zero hypothesis, that the medians are the same between the Treatment and the Control group is not rejected at a 5% significance level (p=0.248). This is not aligned with the expectation about this cognitive load manipulation task, whereas participants in the Treatment group are expected to require more time for completing the more difficult survey.

Thirdly, the **Duration of the memorization task** can be regarded. After observing the descriptive statistics for the average Duration of the Dot memorization task, it can be recognized that the participants in the Control group required on average less time (15.316 seconds) for choosing the dot matrix out of the selection of 4 matrixes, that the participants in the Treatment group. The average time for choosing the dot memorization task per question has for the Treatment group been 16.833 seconds. After observing the medians, it can be regarded that the median for the answering of the dot memorization task for the Control group has been 2.675 seconds, and for the Treatment group, it has been 5.412 seconds. Hence, from the descriptive statistics, it is visible that participants in the Treatment group required more time to choose the dot matrix among the four dot matrixes.
Additionally, this difference will be regarded with the help of a Mann-Whitney U Test. The null hypothesis states that there is no difference in the medians of the **Duration of the memorization task.** It is visible that the p-value is 0.000; hence this result is significant at a 1% significance level. It can be said that the null hypothesis that the medians between the Treatment and the Control group are the same is rejected at 1% significance level. This result aligns with the expectation that there should be a difference in the Duration of the dot memorization task.

Lastly, to inspect whether the manipulation of the experiment has been effective, the results related to the **Accuracy of the dot memorization task** will be regarded. The nature of the executed task determines that the dot memorization task with 4 dots should be more difficult. Hence, it is assumed that this task would be more difficult for the participants. In the paragraph above, the subjective perception of the difficulty of the conducted task as rated by the participants themselves was described. However, also the results of the executed task can be regarded. Hence, in this paragraph, the correct execution of the dot memorization task will be compared between the two groups, control and Treatment. If there are too many wrong answers in one of the groups (or in both groups), it could be assumed that the manipulation treatment has not been executed correctly. After removing question 14 (so the total amount of questions is for this manipulation check 15), it can be regarded in the descriptive statistics of this variable that the average memorization score was higher for the Control group, with a score of 14 points, with the SD 1.31, incorrectly answering the dot memorization task (out of 15 questions). For the treatment group, the average score in the dot memorization task was lower, and it posed an average of 12.72 points (out of 15 points), with an SD of 1.87 points. Hence, it can be recognized that the average dot memorization score was higher for the Control group.

Furthermore, it is tested with the Mann-Whitney U-Test to find out whether there is a difference in the median for the variable Dot memorization task. From the results of the Mann-Whitney U-Test, it can be visible that the zero hypothesis that the medians between the Treatment and the control group are the same is rejected at 1% significance level (0.00). Hence, it can be regarded that there is a difference between how well the Treatment and the Control group executed the Dot memorization task. The difference could be driven by the difficulty of the task, indicating that there was a significant difference between how difficult the high and low cognitive manipulation tasks have been actually (not as rated by participants but how participants performed). However, it could also indicate that the cognitive manipulation task has not been effective enough since not all people answered the dot memorization question correctly and guessed the necessary answers. Therefore, it might not have overloaded them enough when executing the main accuracy rating task. Overall, it can be observed that the manipulation check, apart from the variable Duration, aligned with the expectations. The variable Duration could have been influenced by various other elements, which could have influenced why the participants in the Treatment group required a similar amount of time as the Control group, and hence it will not be regarded as problematic for the scope of this research.

Variable	z-value	p-value
Difficulty	-2.694	0.007
Dot memo	4.647	0.000
Duration	-1.155	0.248
Duration memo	-8.180	0.000

Table 7: Mann-Whitney U Test

4.1.5 Regression analysis

4.1.5.1 Ordered logistic regressions for H1, H2, H3

In this part, the main three regressions will be run. The results of the three ordered logistic regressions are depicted in *Table 8.* As visible from *Table 8*, there are in total 9 models conducted. Each of the three hypotheses relates to three different groups of models. Firstly, models 1-3 relate to Hypothesis 1, models 4-6 are related to the testing of Hypothesis 2, and lastly, models 7-9 are related to the testing of Hypothesis 3. *Model 1* has been conducted to inspect the result from the ordered logistic regression without an interaction term. The intention is to detect the effect of being in the Treatment group on the perceived Accuracy of the news after controlling for the variable Fake. Here, as it was reflected upon in the H1, it is expected that the participants in the Treatment group should be perceiving the news headlines as more accurate. *Model 2* represents the main Hypothesis 1, whereas it includes interaction terms between the treatment and the variable Fake; however, without controlling for any additional variables. In this model, the hypothesis is predicting that the being in the treatment group (hence having high cognitive load) will increase participants' perceived accuracy of fake news. In *Model 3*, the Control variables, such as demographical information, are added to the model to control for extraneous or confounding effects.

In *Model 4*, the intention is to examine the effect of the variable Intuitive (hence when someone is engaging in an intuitive reasoning style) on the Perceived Accuracy. This model is only controlled for the variable Fake, and there is no interaction with the variable Fake added yet. It is expected from the hypothesis that having intuitive reasoning style will increase the perceived accuracy of the news. Consequently, in *Model 5*, the interaction term with the variable Fake is added. However, this model remains without Control variables. Hence, based on the H2, it is expected that individuals with intuitive cognitive reasoning will be perceiving the fake news as more accurate than the people with analytical reasoning style. Lastly, in *Model 6*, the Control variables are added to the model.

In *Model 7*, the interaction effect between the variable Condition and Fake is noted, and the effect is based on the hypothesis as described above. However, it is only controlled for the variable Intuitive. In the consequent *Model 8*, the variable Intuitive is added as a triple interaction term with the variables Condition and Fake, however, without controlling for any additional variables. This model is reflecting on the H3, whereas based on this hypothesis it is expected that participants with intuitive reasoning style would be more influenced by the high cognitive load treatment when perceiving the accuracy of fake news, than the participants with analytical reasoning style. Lastly, in *Model 9*, the Control variables are added to the model. The intention behind the formation of these various models is to identify any differences in the variations of these models, which could have any relevance for the testing of the main hypotheses and potentially lead to diversifying results. All models in this table have the "Perceived Accuracy" as a dependent variable. This variable is an ordered variable, on a scale from 1 ("Not accurate at all") to 4 ("Extremely accurate"). Other variables in the model are explanatory variables *Treatment, Fake, Condition, Intuitive, Treatment* x *Fake*, *Treatment* x *Intuitive*, *Treatment* x *Fake* x *Intuitive,* and the Control variables *Gender*, *Age*, *Education*, *Political preference,* and the *Residence in the Netherlands*. In total, there are 2944 observations. This is because the data was portrayed in the long format, meaning each of the 16 questions over the 184 participants from the sample was recoded into a long format.

In *Table 8*, firstly, the models for the H1 can be regarded. ***Model 1*** has only been controlled for the variable Fake, without interaction with the variable Condition. It can be marked that the effect of the

variable Condition is not statistically significant, yet the effect of the variable Fake is significant. Hence, for one unit increase in Fake (hence going from 0 = True to 1=Fake), there is an expected 2.091 decrease in the log odds of being in a higher level of Perceived Accuracy, given all of the other variables are held constant. This effect is statistically significant at a 1% significance level (p=0.000). Furthermore, when observing ***Model 2***, after the interaction term between the variable Condition (when being in the treatment group) and the variable Fake has been added, however, as visible from *Table 8*, it can be regarded that the effect of the interaction term is not statistically significant (with p-value = 0.649 > 0.1). Afterwards, in ***Model 3***, the Control variables have been added to the model, concretely the Gender, Age, Education, Degree, Political and the residence Netherlands. Also, the interaction term between the variable Condition and the variable Fake remained in the model. This effect of this interaction term remained not statistically significant (with p-value = 0.635 > 0.1). Furthermore, the control variables in the model can be observed that have a significant effect on the dependent variable, such as concretely Political preference and Gender. It can be regarded that for the variable Political preferences, the difference in effect increase in the variable Political preferences (going from the category Left to the category Middle, there is expected an increase 0.18 in the log odds of being in a higher level of Perceived Accuracy when all of the other variables in the model are held constant. This effect is significant at a 5% significance level. Additionally, it can be regarded that an increase in the variable Political preferences (going from the category Left to the category Right, there is expected an increase 0.20 in the log odds of being in a higher level of Perceived Accuracy when all of the other variables in the model are held constant. This effect is significant at a 5% significance level. Also, for the variable Gender, when keeping all other variables fixed, for one unit increase in Gender (hence going from 0 = Male to 1=Female), there is an expected 0.145 decrease in the log odds of being in a higher category of Perceived Accuracy (hence perceiving the news as more accurate) and this effect is significant at 5% significance level (p = 0.047).
To summarise, from models 1-3, it can be concluded that there is **not enough support** for the H1, that being under high cognitive load increases the probability of perceiving the fake news as more accurate.

Secondly, the analysis will concentrate on models 4-6, which relate to the testing of the H2. In ***Model 4***, the result for the variable Fake has remained identical to the result in model M1. The effect of variable Intuitive (whether someone has an intuitive reasoning style or not) has not been statistically significant. In ***Model 5,*** after the interaction term between the variable Intuitive reasoning (when having intuitive reasoning based on the results of the Cognitive Reflection Test) and the variable Fake has been added, it can be examined that for the interaction term between the Fake news and the Intuitive, keeping all other variables fixed, for one unit increase in Intuitive (hence going from 0 = Analytical to 1=Intuitive), when perceiving Fake news rather than true news, there is an expected 0.532 increase in the log odds of being in a higher category of Perceived Accuracy (hence perceiving the news as more accurate). This effect is significant at 1% significance level (p = 0.000). Additionally, in ***Model 6***, the Control variables have been added to the model. However, these variables remained, affecting the perceived Accuracy similarly, as in ***Model 3.*** Overall, from **Models 5** and **6**, it can be concluded that the **H2** is supported that having an intuitive reasoning style of reasoning increases the perceived Accuracy of fake news.

Thirdly, the analysis will concentrate on models 7-9, which relate to testing of the **H3**. For these models, an interaction between the variable Condition x Fake has been created. In ***Model 7***, the relationship between this interaction and the dependent variable perceived accuracy has been tested. However, it has only been controlled for the variable Intuitive, without interaction with the variable Intuitive reasoning. Here, the interaction term between the variable Fake and Condition has, similarly, as portrayed in the analysis of ***Model 2***, not have a significant effect on the perceived Accuracy. In ***Model 8,*** the triple interaction term between the variable **Condition x Fake** and the variable **Intuitive reasoning** (when having intuitive reasoning based on the results of the Cognitive Reflection Test) has been created. There has been no significant effect found of the **triple interaction term** on the Perceived Accuracy. Afterwards, in **Model 9**, the control variables have been added to the model, concretely the Gender, Age, Education, Political preference and Dutch residence. Also, the triple interaction term between the variable **Condition x Fake x Intuitive reasoning** remained in the model. Also, here, it can be seen that the triple interaction term does not have a significant effect on the Perceived Accuracy. The selected Control variables, Political Preference, Education and Gender in Model 9, have a similarly significant effect on the perceived Accuracy, as in ***Model 3*** and ***Model 6***, and hence will not be analysed again.

Table 8:): Ordered logistic regression, predicting the relationship between the dependent variable perceived accuracy

	M1	M2	M3	M4	M5	M6	M7	M8	M9
Condition	0.0190	0.0475	0.031				0.0499	-0.0807	-0.1104
	(0.0698)	(0.0938)	(0.094)				(0.0939)	(0.114)	(0.1145)
Fake	-2.091***	-2.058***	-2.063***	-2.091***	-2.265***	-2.273***	-2.058***	-2.292***	-2.2995***
	(0.0766)	(0.105)	(0.106)	(0.0766)	(0.0917)	(0.0918)	(0.105)	(0.125)	(0.125)
1.Intuitive				-0.0424	-0.281***	-0.2045*	-0.0436	-0.532***	-0.4671***
				(0.0751)	(0.101)	(0.105)	(0.0753)	(0.149)	(0.1525)
Condition x Fake		-0.0638	-0.067				-0.0629	0.0474	0.0461
		(0.140)	(0.140)				(0.140)	(0.171)	(0.171)
Intuitive x Fake					0.532***	0.536***		0.790***	0.801***
					(0.150)	(0.150)		(0.223)	(0.223)
Intuitive x Condition								0.455**	0.483**
								(0.202)	(0.206)
Intuitive x Fake x Condition								-0.462	-0.472
								(0.302)	(0.3019)
Gender (Female = 1)			-0.145**			-0.151**			-0.153**
			(0.073)			(0.739)			(0.0743)
Political preference (Middle)			0.185**			0.1843**			0.1615*
			(0.091)			(0.0909)			(0.0955)
Political preference (Right)			0.200**			0.2048**			0.2102**
			(0.095)			(0.0952)			(0.0955)
/cut1	-1.630***	-1.616***	-1758***	-1.654***	-1.735***	-1.854***	-1.628***	-1.778***	-1.859***
	(0.0709)	(0.0779)	(0.159)	(0.0656)	(0.0698)	(0.1524)	(0.0810)	(0.0905)	(0.1621)
/cut2	-0.611***	-0.596***	-0.734	-0.634***	-0.712***	-0.8269	-0.609***	-0.754***	-0.868***
	(0.0637)	(0.0715)	(0.156)	(0.0576)	(0.0619)	(0.1486)	(0.0749)	(0.0846)	(0.1587)
/cut3	1.059***	1.074***	0.943**	1.036***	0.964***	0.8856**	1.061***	0.926***	0.8189**
	(0.0673)	(0.0750)	(0.157)	(0.0612)	(0.0643)	(0.1493)	(0.0779)	(0.0856)	(0.1589)
Observations	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944

Standard errors in parentheses ,*** p<0.01, ** p<0.005, * p <0.1

*** p<0.01, ** p<0.05, * p<0.1

Table (8): Ordered logistic regression, predicting the relationship between the dependent variable perceived accuracy (1 = Not at all Accurate, 4 = Very accurate), Condition = 1 for Treatment and 0 for the Control group, 1= Intuitive thinking and 0 = Analytical thinking and a selection of significant control variable

4.1.5.2 *Marginal effects and odds ratio*

In order to gain further insights into the effects of the coefficients from the analysed hypotheses, the marginal effects and the odds ratio shall be calculated. However, only the significant results will be presented and interpreted in more detail, hence primarily related to Hypothesis 2.

Odds ratio

In *Table 9*, the proportional odds ratios are displayed only for the Models related to Hypothesis 2 since this hypothesis appeared to be supported in the previous paragraphs. **In Model 4**, for the variable Fake, for one unit increase in Fake (hence going from 0 to 1), the odds of being in the category "Very Accurate" of Perceived Accuracy versus the other categories combined "Not at all accurate", "Not very accurate" and "Somewhat accurate" are 1.236 times greater, given that all of the other variables in the model are kept constant. Additionally, the odds of the combined "Very accurate", "Somewhat accurate", and "Not very accurate" compared to "Not at all accurate" is 1.236 times greater, given that all other variables in the model are held constant. Hence, this can be transferred into the odds of perceiving accuracy as "Not very accurate or better" versus "Not at all accurate", being about 87.639% lower for the variable Fake than True. The odds of perceiving the accuracy as "Somewhat accurate" or "Very accurate" vs "Not at all accurate" or "Not very accurate" are about 87.639% lower for Fake news rather than for true news. Similar results for the Variable Fake are gained in Model 2 and Model 3.

For **Model 5**, for the variable Intuitive, one unit increase in Intuitive (hence going from 0 to 1) increases the odds of being in the category "Very Accurate" of Perceived Accuracy versus the other categories combined "Not at all accurate", "Not very accurate" and "Somewhat accurate" by about 7.02% (1.702 times), when the news is fake, compared to being true. Additionally, the odds of the combined "Very accurate", "Somewhat accurate", and "Not very accurate" compared to "Not at all accurate" is (7.2%) 1.702 times greater for participants who have an intuitive reasoning style and deal with fake news. Similar results for the interaction between variable Fake and Intuitive are gained in *Model 6* after adding the Control variables. The Odds Ratios for the Control variables in ***Model 6*** can be analysed followingly. For the variable Gender, one unit increase in Gender (hence going from 0 to 1) increases the odds of being in the category "Very Accurate" of Perceived Accuracy versus the other categories combined "Not at all accurate", "Not very accurate" and "Somewhat accurate" about 0.86 times. Additionally, for the variable Political, one unit increase in Political (hence going from category 1 Left to 2 Middle) increases the odds of being in the category "Very Accurate" of Perceived Accuracy versus the other categories combined "Not at all accurate", "Not very accurate" and "Somewhat accurate" about 1.20 times. Lastly, one unit increase in Political (hence going from category 1 Left to 3 Middle) increases the odds of being in the category "Very Accurate" of Perceived Accuracy versus the other categories combined "Not at all accurate", "Not very accurate" and "Somewhat accurate" about 1.23 times.

Table 9: Odds ratio for the Models 4-6

	M4	M5	M6
Condition			
Fake	0.1236***	0.104***	0.103***
	(0.00946)	(0.00952)	(0.00946)
Intuitive	0.959	0.755***	0.815**
	(0.0720)	(0.0760)	(0.0852)
Condition x Fake			
Intuitive x Fake		1.702***	1.710***
		(0.255)	(0.257)
Intuitive x Condition			
Intuitive x Fake x Condition			
1.Gender_			0.8597**
			(0.0635)
6.Political_Preference			1.2023**
(Middle)			(0.109)
(Right)			1.2273**
			(0.1168)
Observations	2,944	2,944	2,944

Average Marginal effects

As visible from *Table 10*, the marginal effects for Model 6 will be portrayed. These results are also portrayed graphically in *Figure E7 in Appendix E* and hence will be interpreted together. Model 6 represents *Hypothesis 2*, after controlling for the control variables, which showed to be partially supported in the ordered logistic regression, hence it is of the highest relevance to run the average marginal effects for this model. As visible in the top part of the table, the analysis will concentrate on interpreting the four categories of the dependent variable ("Not at all accurate" to "Very accurate"), representing the numbers 1 to 4 in the consequent variables of interest. Secondly, the variables that will be analysed include number 2, representing the variable Fake news. Hence, the analysed variables of interest will be 2- 1, 2- 2, 3-2 and 4- 2.

As visible from Model 6 (*Table 10*), after adding an interaction effect with the variable Fake, the marginal effects show that on average, for an individual who is thinking intuitively and is exposed to fake news, the probability of judging the news as "Not at all accurate" decreases by 7.94 percentage points (on Figure 5 portrayed as Outcome 1) compared to the person who is exposed to fake news but is not an intuitive thinking person. Furthermore, on average, for an individual who is thinking intuitively and is exposed to fake news, the probability of judging the news as "Not very accurate" increases by 2.72 percentage points (on Figure 5 portrayed as Outcome 2), compared to the person who is exposed to fake news but is not an intuitive thinking person. Additionally, on average, for an individual who is thinking intuitively and is exposed to fake news, the probability of judging the news as "Somewhat accurate" increases by 3.8 percentage points (on Figure 5 portrayed as Outcome 3), compared to a person who is exposed to fake news but is not an intuitive thinking person. For the last category, on average, for an individual, who is thinking intuitively and is exposed to fake news, the probability of judging the news as "Very accurate" increases by 1.39 percentage points (on Figure 5 portrayed as Outcome 4), compared to the person who is exposed to fake news but is not an intuitive thinking person.

1._predict : Pr(PerceivedAccuracy==1), predict(pr outcome(1))

2._predict : Pr(PerceivedAccuracy==2), predict(pr outcome(2))

3._predict : Pr(PerceivedAccuracy==3), predict(pr outcome(3))

4._predict : Pr(PerceivedAccuracy==4), predict(pr outcome(4))

1._at: Fake = 0

2._at: Fake = 1

	(1)	(2)
VARIABLES	special	special
0. Intuitive	(base outcome)	
1 1		0.0283**
		(0.0150)
1 2		-0.07940***
		(0.0277)
2 1		0.01837**
		(0.00933)
2 2		0.0272***
		(0.00910)
3 1		-0.00836
		(0.0051)
3 2		0.0383***
		(0.0137)
4 1		-0.0384**
		(0.0193)
4 2		0.0139***
		(0.00516)
Observations	2,944	2,944

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Marginal effects the interaction term for the Model 6

As visible from the graph in Appendix E, the marginal effects of the variable Intuitive, with an interaction term Fake on the variable Perceived Accuracy, the probability of rating the fake news as "Not at all accurate" decreases when the participants are having intuitive reasoning stye, compared to having an analytical reasoning style. Additionally, the probability of the participants rating the Perceived Accuracy of the fake news as "Not very accurate", "Somewhat accurate", and "Very accurate" increases if the participant has an Intuitive reasoning style, compared to having an analytical reasoning style. The magnitude of these effects has been described in the paragraph above, whereas for the category "Not very accurate", the magnitude has been lower. These results support Hypothesis 2 that having an intuitive reasoning style increases the perceived Accuracy of misinformation.

5 Discussion

5.1 Results implications

In this research, the main research question is related to observing ***the effect of cognitive overload on accuracy perception of misinformation/ fake news about the COVID-19 pandemic.*** To test the main research question, an experiment has been conducted where participants have been exposed to a version of a cognitive load manipulation treatment. The effect of this Treatment on the accuracy perception of the participants when exposed to fake news/ misinformation has been regarded. There have been three main hypotheses formulated to investigate the intended research question.

Before the conducted regression analysis, **randomization** and **manipulation** checks were conducted. It can be summarized that the randomization in the survey procedure has been conducted successfully, and there have been **no significant differences** between these variables between the Treatment and the Control group. In the **manipulation check**, there has not been found a significant difference in the Duration that the participants in both groups required for filling out the Survey. However, there has been found a significant difference in the Duration that participants required for executing the **Dot memorization task**. As another manipulation check, the **Accuracy of the dot memorization task** was recognized. Here, even though the difference has been only a small one, the medians between the two groups Control and Treatment concerning the Accuracy of the dot memorization task were significantly different. Additionally, it could be summarized that the manipulation has been effective in terms of how difficult participants self-reported the executed task. Even though there has been a difference in how accurate the participants have been in the dot memorization task, the difference has only been low, and participants overall still performed well in the execution of the high cognitive load manipulation dot memorization task. Hence, additional checks would have to be performed to detect whether the participants in the Treatment group got affected by the cognitive load manipulation treatment or whether they just perceived it as more difficult, but their cognitive perception did not get affected, as also the results for the Hypothesis 1 portray.

When observing the results from the regression analysis, for the first hypothesis, **Hypothesis 1**, there has not been enough evidence to support the claim ***that "being under high cognitive load increases the perceived accuracy of fake news more".*** Hence, the results from testing this hypothesis indicate that the finding identified from the previous literature review, that experiencing cognitive load influences how individuals perceive the Accuracy of the presented misinformation and that the Cognitive Load theory could explain the reasoning behind it, is not supported by the results conducted for the scope of this master thesis. This differs from the finding by Bago et al. (2020), who identified that increased cognitive load and pressure increased the perceived Accuracy of fake news. Hence, the findings from this thesis do not support the theoretical prediction, which was summarized by Islam et al. (2020), that increased cognitive load could be regarded as one of the contributors, which makes individuals disregard the Accuracy of the content in an experimental simulated way. There are various explanations for this result. First of all, the possible reason could relate to the conducted cognitive load manipulation element, which, when applied previously by Bago et al. (2020), might not have been effective enough to simulate in the case of this master thesis perceived increased cognitive load. Secondly, the choice of the fake and real news included in the Survey could have also played a role. The participants might have been previously exposed to the news since some of them were almost one year old, and hence participants could have been already aware that this news is fake. In real life, the information portrayed to the participants could be more subtle, and it could be way harder to recognize whether the presented information is true or false.

Additionally, as Pennycook and Rand (2018) mention, when individuals are explicitly asked to decide whether the news is true or false, they become more analytical. When they get reminded that not all news might be correct (such as in this Survey by seeing that some of the news could be "Not at all accurate" and "Not very accurate" could have influenced them to think that the presented news are false and hence might have expressed that they mention them as "false" even though before this Survey, they could have assumed they were true. In my Survey, individuals were also asked to fill out the Cognitive Reflection Test at the beginning. This might have prompted them to assess the Accuracy of news more analytically and improve their accuracy perception capabilities.

The further limitations related to the more details related to the experimental manipulation and data collection, which could have possibly contributed to the not significant effect of the cognitive load manipulation treatment, and hence will be mentioned in the *Limitations* part below in more detail.

From all regression analyses conducted, only the variables of interest in the results from Hypothesis 2 have been shown to have a significant effect on the dependent variable. Hypothesis 2 states that "***Having an intuitive reasoning style, compared to having analytic reasoning style increases the perceived accuracy of fake news".*** Hence, the results from testing this hypothesis align with the assumed theoretical prediction and align with the results of the previously conducted research by Pennycook and Rand (2018), which predict a correlation between the CRT performance and the perceived Accuracy of fake news. Hence, people who have more intuitive reasoning should be less likely to perceive fake news as accurate. These researchers describe the way of thinking as "lazy thinking" as aligned with the expectation based on the results from Pennycook and Rand (2018), who noted a general tendency of more analytically thinking individuals to be better in recognizing the true news from the fake news, even when scoring the CRT basing on the number of intuitive answers. However, this result could be influenced through the form of the analysis, whereas the hypothesis stated Intuitive, which also included answers of people who might not have felt like answering the Cognitive Reflection Test questions and only guessed a selection of answers randomly. Pennycook and Rand (2018) explain their finding based on the fact that analytically thinking individuals are better at recognizing the true news among the fake news, which helps them differentiate between the true and fake. To further test the significant effects of Hypothesis 2, the odds ratio test and the average marginal effects have been observed. Here, the findings further strengthened the perceived hypothesis that having an intuitive reasoning style, compared to having an analytic reasoning style, increases the perceived Accuracy of fake news, which has been particularly the case for rating the news as "Not at all accurate".

The third main hypothesis constructed in this thesis research, Hypothesis 3 expects, that the ***effect of high cognitive load on the perceived Accuracy of fake news is stronger for individuals who have an intuitive reasoning style than individuals who have an analytical reasoning style.*** The theoretical prediction behind this hypothesis related mostly to the research on the cognitive overload and moral dilemma questions, whereas it has been expected that people with higher cognitive ability and hence more analytical thinking style were expected to be less influenced in stressful situations (such as in a moral dilemma situation) by their intuitive thinking style and were expected to be decided more by their utilitarian decisions (Hardman 2008: in Ramsden: 2015). However, this has not shown to be the case in my conducted research. Yet, after running the ordered logistic regression and controlling for a selection of control variables, there has not been enough support for this hypothesis. Hence, for the expected result, which was previously regarded in the setting of a Moral Dilemma experiment, there has not been found enough support. The most likely explanation for the insignificant effect of the interaction between the Fake news x Condition x Intuitive relates to the unsuccessful cognitive load manipulation, which has not been shown to bring any effect on either Control or the treatment group, as has been already described concerning the Hypothesis 1, for which there has equally not been enough support found enough. Hence, the conclusion cannot be made about whether having an intuitive reasoning style strengthens the effect of cognitive overload more than the individual having an analytical reasoning style because there has not been found enough support for the effect of the cognitive load manipulation to work. I see possible explanations for the insignificant results in the limitations of the conducted experiment, which are mentioned in part below.

Lastly, when observing the results for the control variables, such as related to the demographical information of the participants, it can be regarded that there have been found significant influences of the variable Political and the Gender on the perceived Accuracy of the news. After observing additional literature, it can be concluded that it is interesting to observe the finding for the variable political. This is because the finding from this thesis indicates that participants on the more "right" side of the political spectrum, hence those that can be regarded as more conservative, are more likely to believe in the Accuracy of the presented news. This finding has been supported after controlling for variable Political in the results of all the conducted models. This finding aligns with the widely studied perception that more conservative individuals are worse at differentiating between true and false news and are more susceptible to (political) misperceptions (Garett and Bond, 2021).

5.2 Limitations

In the master thesis research, various limitations can be identified, which might have contributed to the overall prevalence of less significant results, not supporting the claims formulated based on the literature review. The main limitations relate to the sample, experimental design and the conducted analysis.

5.2.1 Sample

Regarding the **sample** utilised for the data analysis, it has been fairly small and only consisted of 184 participants. Papers conducted similar research, one such that relates to this master thesis research by similarities in its form and design has consisted of several participants above 1000 (such as 1635 MTurkers in the case of Bago et al. (2020)). The smaller sample size can be explained by the difficulties in acquiring participants and also since only full and timely acceptable (below 40 minutes) answers have been applied in the analysis part. Some of the answers have been removed from the sample for analysis purposes, as described in the Data collection part. Even though, as mentioned above, the sample has been successfully randomised between the Treatment and the Control group, there have still been few imbalanced elements observable when it comes to the overall sample, highlighting a possibility of **selection bias, which have consequences for the external validity of this thesis research.** This is because most of the participants were approached by me to take part in the survey. They mostly consisted of people from my surroundings, mostly related to my acquaintances related to my university degree studies. This could have possibly influenced that choice of the participants has unfortunately not been representative of the overall sample from the society. This finding has been further observable on to the demographic's characteristics. More than 50% of the participants in the survey have finished at least a bachelor's degree education, and the majority of the sample shall be regarded as rather young (below 30). This might have also influenced the results, even though the variable *Age* has not seemed to have significantly influenced the perceived accuracy of the news. Yet, the older generation and uneducated individuals were underrepresented in the overall sample and hence the sample utilised for this research is not fully representative of the whole society.

Hence, overall, there is a selection of limitations related to the geographical, cultural and contextual specificity (Islam et al., 2020), which could influence how people perceive the various misinformation content. However, as Bago et al. (2020) mention, it is an overall problem within the research of misinformation that the participants in the experiments (conducted in this area of research) are mostly not the individuals who are most susceptible to misinformation. It is mostly educated and young people, which influences the results.

5.2.2 Limitations in the experimental design

The limitations in the experimental design relate to the

- **Cognitive load manipulation**,
- **Selected news headlines content**,
- **Cognitive Reflection Test,** measuring the cognitive ability of the participants, and
- **The execution time of the dot memorisation task**.

Cognitive load manipulation treatment is related to utilising the dot memorisation matrix (4x4), in which either 3 or 4 dots have been placed. Researchers have previously applied this to increase the cognitive load while executing additional tasks, such as by Bago and De Neys (2019) and Bago et al. (2020). In this thesis, unlike by Bago and De Neys (2019), there has not been feedback provided on whether the participant has successfully conducted the memorisation task, and hence the participants might have become less concentrated and just guess the correct answer; hence the cognitive manipulation might not have been successful. From conversations with some of the participants, after they took the survey, I understood that some of the participants would have felt more motivated to perform better if they knew how well they performed. However, as depicted in the descriptive statistics for the Dot memorisation accuracy, the average accuracy of the participants in the dot memorisation task has still been sufficiently high. Hence, I assume that the feedback would not have made too much difference to the results. However, regarding the feedback, it could be mentioned that there have been no attention checks made, such as suggested by Pennycook and Binnendyk et al. (2020). However, I consider the nature of the main survey task to pose an attention check because of the engaging design in which the survey has been conducted. This has required the participants to continuously stay concentrated on executing the main task. Even though feedback could have been provided at some part of the survey on how well the participants performed in the dot memorisation ask, the successful score on the dot memorisation task questions strengthens the belief that for the scope of this master thesis, it has not been necessary to include.

Selected news headlines content

A further limitation relates to the task of perceiving the accuracy of fake news. As Pennycook and Binnendyk et al. (2020) recommended, the news headlines should be presented to the participants in a format, as they would be potentially presented in the form of Facebook posts to gain a relatable, real-life effect. Participants were shown a selection of news headlines without any break in between aside from the dot memorisation check. Hence the execution of the accuracy perception task might not have reminded them of a real-life situation, which they could be exposed to on social media. Additionally, participants could have been asked whether they use social media (specifically Facebook) to overcome this limitation. Those that do not use this social media platform could have been affected differently by seeing the news on Facebook. This could be prevented by asking participants whether they utilise the social media network or not.

A further limitation relates to the presented content of misinformation. In this thesis research, some of the utilised "true news" were more shocking, which participants regarded as "Fake", and it might have strengthened their beliefs that all of the news headlines in the survey are fake. Concerning that, there has been no difference between the different types of misinformation because most of them were related to health-related misinformation. Some of the presented headlines were not consisting of health-related information, which could be additionally looked at in future research to identify, whether the effect of experiencing a cognitive overload and or having an intuitive or analytical reasoning style influences how people perceive the accuracy of the different types of misinformation (such a related to partisanship news headlines, hence different political claims or even more emotional statements rather than less emotional news headlines). Additionally, only 16 (+ one test) = 17 headlines were utilised in the survey. Adding more headlines and randomly choosing a selection of 16 of them to show to the participants could have improved the ability of this research to overgeneralise the results of the conducted experiment (Pennycook and Binnendyk et al., 2020), which has not been the case in my experiment. However, this research has regarded fake news in general and has not concentrated on the concrete type of misinformation, such as of a partisanship nature. Hence I believe this limitation can be overlooked.

An additional limitation is that some of the misinformation has been outdated and was firstly posted on the internet at the beginning of the COVID-19 crisis at the beginning of the year 2020. Hence, some of the misinformation has been debunked, and participants might have heard about the reasoning behind it and might not have regarded it the same way, as if they were seeing the news headline for the first time. Also, the participants might have felt like all the news has been incorrect once they saw that some of the presented news were false and hence might have been biased towards answering that all news is incorrect, which could have decreased their perceived accuracy, meaning how they would perceive the content if they saw the news headlines independently of each other. This has been not taken into account, since by following Pennycook and Binnendyk et al. (2020), it has been assumed that the fake news content is not influenced by the time element of the reality, and hence shall not become outdated, as it can be with the true news. In my design, I regard choosing outdated fake news as a limitation because some of the chosen news has been already presented on social media as false, and hence participants could have easily accessed the information before. There can also be seen a limitation regarding the chosen true news. Some of the true news chosen for the survey can be regarded as more "confusing" and not completely clear, whether true or false. As Pennycook and Binnendyk et al. (2020)

advise, the true news should not come from fact-checking websites or be more questionable because these true headlines are not representative of the general category of “true news” if their truthful background requires to be checked. Lastly, to account for part of this limitation mentioned in this paragraph, a question could have been included in the survey, which would indicate whether the participants have seen the news previously, such as applied by Pennycook and Rand et al. (2018). This could assure that only participants would be considered, seeing the news for the first time and hence cannot know whether they are true or false.

The Cognitive Reflection Test

Another limiting element of the survey design consists of the application and analysis of the Cognitive Reflection Test. The CRT score has been regarded to perceive whether an individual has an analytical or intuitive thinking style. However, this measure can earn a certain amount of criticism. The CRT score is usually applied for measuring the cognitive ability of the participants. However, as (Pennycook and Rand, 2018) criticise, in their research, as well as applied in my research, the Cognitive Reflection Test score results have been used to differentiate whether an individual **applies** an analytical or intuitive thinking style and that perceived with executing another task – perceiving the accuracy of the fake news. This is not entirely correct because the CRT score measures the **cognitive ability** (or numeracy) of the participants, rather than the fact whether they manage to think analytically or intuitively in a concrete situation, such as perceiving the news accuracy. As Pennycook and Rand (2018) mention, it has not been widely tested yet, whether the results of the Cognitive Reflection Test, meaning whether someone who is according to this measure considered to be thinking analytically or intuitively, can also be applied to testing for the beliefs in fake or true news.

The execution time of the dot memorisation task

As a last element regarding the limitations in the experimental design, the time element can be regarded. Bago and De Neys (2019), who previously similarly applied the cognitive load manipulation element in their experimental research, mention that utilitarian responses should take longer than the time for the more intuitive responses. Therefore, how much time participants spend on executing a particular task influences the responses and hence matters for the analysis. This means, when participants are given more time to reflect on the specific answer to a question, they will typically not engage in the intuitive reasoning style. Part of the limitations in my applied experimental design is that there has been no time limit for participants in the dot memorisation task and the headline accuracy perception task. In the dot memorisation task, they had to answer which dot memorisation task they previously saw. However, they were not given any time limit to perform this task. Together with a time limitation, this task has been previously applied by Bago et al. (2020) as a part of cognitive overload manipulation. The use of a time deadline could have strengthened the initial response process, which would have made them respond more intuitively and hence do not elaborate on the results longer. The same applies to the question about the perceived accuracy. In addition to time pressure, the increased cognitive load could have increased their first intuitive reasoning and help simulate the situation of a cognitive overload, when one does not have time to spend more time deliberating about which answer should be correct.

5.2.3 Limitations in the analysis

There have been several main limitations identified in the conducted analysis of the collected data. The main limitation is the **parallel odds assumption** for the ordered logistic regression, which has not been fulfilled for some of the explanatory variables (only the variable Fake). Alternatively, in future research, this sample could be analysed with a partial proportional odds model (generalised ordered logit (Gologit2)), which has not been conducted in the scope of this master thesis. Additionally, due to the high collinearity, the variable "Analytical", which has been the binary variable for whether the individual has analytical or intuitive reasoning style, at first the variable has been coded as "Analytical" = 1 and "Intuitive" = 0. However, as previously shown, it has been found that this variable is suspect to a high degree of collinearity when included in the interaction term with Fake and Condition (above 10). Therefore, the variable Intuitive has been created, which expresses the same as Analytical but recoded into 1= Intuitive and 0= Analytical. This measure might be regarded as problematic because it does incorporate not only the intuitive answers (as explained in the theoretical part about Cognitive Reflection Test) but also the "wrong" answers, which other reasons could also cause, then only having an intuitive reasoning style. These answers could be, for instance, posed by individuals, who normally engage in an analytical thinking style, but for example, did want to spend effort on filling out the Cognitive Reflection Test results.

5.3 Future research

The results from the analysis of the tested hypotheses do not sufficiently support the predictions, which were identified in the theoretical part of this thesis. Hence, based on the analysed results, it has not become clear whether and how the Cognitive Load Theory could explain how the increased cognitive load influences people in their accuracy perception of fake news. Yet, that does not mean that the Cognitive Load Theory cannot be utilised to explain the perception of misinformation in society. It just means that this particular experimental treatment used for this sample did not significantly affect the accuracy perception of the fake news. It could be possibly reasoned that the Cognitive Load Theory could be instead applied, as Islam et al. (2020) suggest, in understanding how individuals understand and gain knowledge through various news articles. However, as Islam et al. (2020) summarise, Cognitive Load Theory has been previously not sufficiently applied in the literature to be confidently used to explain why people believe in and share misinformation. These researchers admit that there might be other, more fitting theories to explain this behaviour and hence be more suitable to explain the reasons behind the effects of the increased cognitive load and its relation to other related factors, especially **social media fatigue.**

This thesis research results emphasised the role of the intuitive reasoning style in perceiving misinformation as accurate. This aligns with what researchers such as Bago et al. (2020) previously marked, that intuitive processing plays a relevant role in the beliefs in fake news. They regard it as "thinking fast"; hence, users tend to induce a fast scrolling through their social media platforms while being exposed to a high amount of diverse content. This also contributes to social media fatigue. Hence, I believe future research should incorporate the role of social media fatigue within the explanation of what influences people in perceiving fake news as accurate. The role of social media fatigue should be investigated further in the context of various other psychological determinants, such as previously identified by Talwar et al. (2019) and Islam et al. (2020), which were mostly summarised on a theoretical basis level. However, researchers should aim to test these findings experimentally, also in the COVID-19 setting. As Islam et al. (2020) mention, other factors can influence people in their accuracy perception of online content, such as fear of missing out, privacy concerns, anxiety, or depression. Future research can be advised to investigate the effect of these other elements while including a more representative sample of society to inspect the effect of the increased cognitive load on the perceived accuracy of misinformation. It could dive deeper into the underlying psychological influences, which contribute to believing and consequently spreading misinformation concerning the beliefs about misinformation about COVID-19 and fake news in general.

Regarding possible improvements related to the **experimental design**, future research could apply the cognitive load manipulation rather in a laboratory setting, where the participants would be more stimulated to pro-actively engage in the execution of the main survey task. If conducted in a lab setting, further various, even combined, forms of the cognitive load manipulation treatment could be executed, such as summarised in Appendix A. One of the more common conducted methods, which has been previously successfully applied in the research related to a Numbers method, where participants have to remember a selection of numbers (low = 2 digits and high = seven digits) before each treatment and are required to remember these (Duffy and Smith, 2014). This method has not been applied in this thesis research due to the worry that participants could cheat. However, if conducted in a lab, this method could pose a more effective solution for increasing the cognitive load of participants.

6 Conclusion

This thesis research intended to examine the effect of the cognitive load on the accuracy perception of COVID-19 related misinformation. Additionally, the goal was to monitor how other elements, such as the cognitive reasoning style, could influence how individuals get affected when perceiving the accuracy of fake news about COVID-19. Up to this date, over a year has passed since the global pandemic, and COVID-19 has continuously contributed to the high spread of misinformation on social media. The spread of misinformation is dangerous because it can result in serious implications on the behaviour of the members of society and influence their attitudes and various beliefs, potentially posing a danger to the democratic way of living (Khan et al., 2021), wherefore many researchers have been attempting to identify the tools to fight the misinformation spread. However, I intended in thesis research to take a step back and emphasize that it is important to understand the various psychological determinants that influence individuals when perceiving online news information. Also, it is relevant to realize that the situation related to COVID-19 might contribute to their cognitive overload and, overall, negatively influence their mental state.

In this thesis, a randomized control trial experiment has been conducted to regard the effect of one of the determinants, cognitive overload, on the accuracy perception of misinformation. The goal of the experimental manipulation was to simulate a situation of a high cognitive overload, which has been used as a metaphor for "cognitive overload". On the other hand, the low cognitive load has been applied to simulate the situation, where individuals are not exposed to a cognitive load, yet reflecting on the real-life situation, that there is always a (small) cognitive load that people get exposed to in their everyday tasks. The high cognitive load has been expected to make people respond with their first possible answer that comes to their mind, and hence was expected to evoke their intuitive (System I. thinking) rather than thought through, analytical (System II. thinking) responses (Bago and De Neys, 2019). This high cognitive load element was expected to make them more prompt to make cognitive mistakes, such as perceiving the fake news as accurate. However, there has not been enough support for the H1, that being under high cognitive load increases how people perceive the accuracy of the misinformation.

In addition, this thesis research intended to inspect how having an intuitive (analytical) reasoning style influences how an individual perceives the accuracy of misinformation, hence the H2. It has been shown that individuals with an intuitive reasoning style in this research indeed seemed to perceive the fake news as more accurate than individuals with analytical thinking styles. However, contrary to the theoretical prediction, there has not been enough evidence found for the H3, which would support the claim, that individuals with intuitive reasoning style, compared to individuals with an analytical reasoning style, would be more affected by the high cognitive load when perceiving the accuracy of misinformation. Even though the main research question of this thesis has not been supported with the analyzed results, that does not necessarily mean that psychological determinants should not be taken into account when observing how and why individuals perceive fake news as accurate. The policymakers should understand the various underlying psychological processes, which contribute to individuals' beliefs in fake news. This thesis research has listed various limitations regarding the external validity and choice of sample size. Additionally, there have been identified several possible limitations regarding the experimental manipulation and the applied analysis. I believe that especially the experimental design and the choice of the misinformation headlines might have contributed to not finding enough support for the created hypotheses and hence pose why the results only partially align with the predicted theoretical expectations.

Regarding future research in the field, it could be recommended to further look into various psychological determinants behind fake news perception and experimentally test their effects. It is recommended that the policymakers reflect on the underlying psychological processes and differences between the individuals, such as implementing the differences in terms of the cognitive reflection style. They should attempt to craft solutions to combat fake news beliefs that reflect the differences and create better-targeted solutions. To summarize, understanding what influences people to believe in the accuracy of fake news is the first necessary step in stopping fake news spread worldwide.

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8 Appendix

Appendix A: Evaluation of considered cognitive load manipulation methods

Cognitive Load Manipulation	Description	+	-
1. Numbers	Participants are showed a selection of numbers (low=2 digit/ high= 7-digit number) cognitive load treatment) before each treatment and asked to remember them. When applied to this thesis, participants get directed to memorize the numbers and have to answer a question related to this memorization task, once their completed the main tasks (in this case once they responded on their accuracy perception of the presented headlines (Duffy and Smith (2014).	This manipulation has been **extensively applied** especially in a lab setting. It allows to see how the participants performed in remembering numbers task, since they need to note them down after they completed the task. Potential cheating could be prevented by disabling the CTLR-C and CTLR-V function on Qualtrics.	However, the effectivity of this manipulation might be **limited** in an online setting, potentially leading to cheating of the participants. Here, they might write down information regarding their 7 numbers on piece of paper. Additionally, people might remember the presented 7 numbers in chunks, and hence memorize them easier.
2. Combination numbers and letters	Participants are showed **combination of numbers and letters** before each treatment and asked to remember them and recall them, once their completed their main survey task. The letters have been included into the design due to the fact, that people seemed to be capable to memorize sets of only numbers better	Solves how participants remember the numbers – by including a letter, making it harder to remember the numbers in chunks.	Effectivity might be limited in an online setting, potentially leading to cheating of the participants. People might still cheat (write down information on a piece of paper).

3. Dot Matrix Task	In this task, the application method, as used by Bonnefon et al. (2013), where the high cognitive load relates to the use of 4 dot pattern matrix, the low one to the three dots. When adapted to the idea of this research, participants in the cognitive load treatment will be shown a dot pattern in 4x4 matrix, whereas they are required to do this task and remember the dots throughout the main tasks of the survey. In the end, they need to indicate, which matrix they saw.	This method could solve for the potential risk of the participants in online cheating, as described in the two variants above, since it might be more difficult to quickly redraw a matrix. It also allows for a higher control, since it will be possible to recognize how well the participant was doing in the task.	This task could be maybe potentially influenced by the way how the participant forms his memory – high photographic memory, which could potentially pose bias to the method, influencing how people recall an image only after seeing it shortly.
4. Blinking	As applied previously by for example Ülkümen et al. (2008), participants in the high cognitive load manipulation are asked to count the number of how many times they blink with their eyes, throughout the whole process of the survey. After completing each task of the survey (in this case all the headlines regarding true/ fake news and the accuracy perception, they are expected to count their blinks and report the number of how many times they blinked. In the low cognitive load manipulation group (control group) participants are only asked to count blinking and work in short filler task and report how many times they blinked in the beginning of the survey and not throughout the main part of the survey.	This method is regarded positively for online survey (such as in the case of this thesis on Qualtrics). It relates to task, that it cannot be cheated.	Yet, if the task is too hard, participants could decide to stop counting throughout the whole process and just make up a number. Hence, there is only a limited induced control possible. Further, limitation is the lack of research where this method is applied, especially in the context when the experiment already relates to a heavy cognitive task, such as reading 20 different headlines. Hence, it is unclear how this method would apply in the context of assessing true content from misinformation.

Appendix B:

B.1 Survey outline

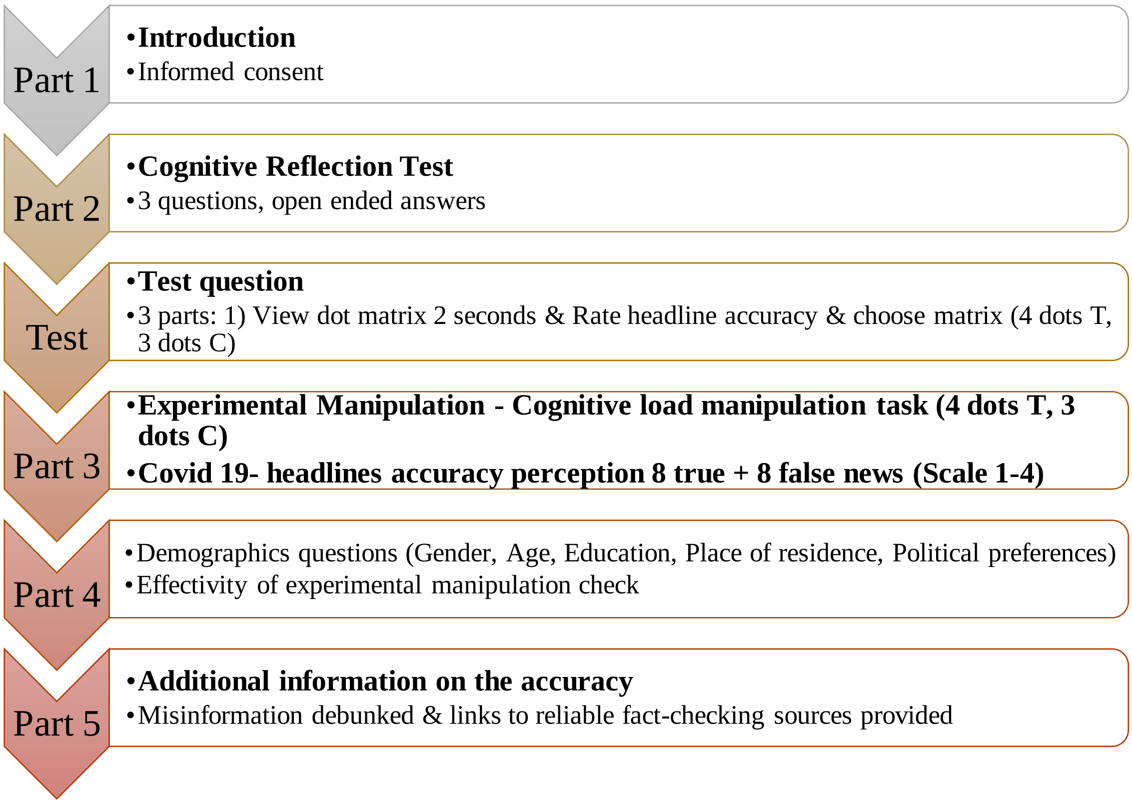


Figure B1: Survey outline (detailed)

B2. Survey execution

PART 1 = Introduction

Dear participant, before starting the survey, please read the following: The following survey is conducted for a Master Thesis at the Erasmus University Rotterdam. Some more information about the survey is provided at the end. Please note that you can stop taking part in the survey without consequences. The results of the survey will only be interpreted at a group level and will not be traced back to the individual answers. The data will be handled with care and the results will only be used for the purpose of this Master Thesis and you will remain anonymous. The collected data will be stored anonymously, by using password protection for a period up to 5 years after publication. If you have any questions about the survey, you can contact me any time by email: 575592md@eur.nl.

Please click all following statements to agree:

I am 18 years old or older. I am aware that I can stop the survey any time without any consequences. I am aware that the results will be only interpreted at a group level and can not be traced back to an individual. I am aware that the data will be stored anonymously, by using password protection for a period up to 5 years after publication

Please read these instructions carefully! This experiment is composed of 16 questions related to COVID-19 news headlines and a couple of additional questions. It will take you about 14 minutes to complete and it demands your full attention. You can only do this experiment once. In the main task, you will be presented with a set of news headlines from 2020/2021, related to the COVID-19 pandemic. You will be asked to indicate; how accurate you think the presented headlines are. That is, do you think the headline is accurately describing something that actually happened? Additionally, throughout this experiment, you will be asked to remember a pattern. You will be shown a different pattern before seeing each headline. You will be asked to remember this pattern and recall it, after you answer how accurate the headline was. You will only see the pattern for 2 seconds. Therefore, try to remember it in that time as precisely as you can. In this experiment, if you finish the survey completely, you can win a price. 3 people who finished the survey completely will be randomly selected and awarded with a 10 Euros Amazon voucher. You will be asked to fill in your email if you want to participate in the lottery. Only if you finish the survey completely, and fill in your email, you will be included in the lottery. I will contact you within two weeks after the survey completion, in case you won the price. In the main task of this experiment, you will get repeatedly asked about the accuracy of different presented headlines about COVID-19. Additionally, you will be asked to remember and recall different dot matrix patterns, consisting of 3 dots. Now you will get the possibility to try out this task one time, before answering the questions of the main task. This test question will help you to get more familiar with the nature of the task.

PART 2 = Cognitive Reflection Test

Cognitive Reflection Test: (Shane, 2005)	
i.	“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? _____ cents”
ii.	“If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? _____ minutes”
iii.	“In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? _____ days”

PART 3 = A) News headlines accuracy task

Fake news: 8 news headlines:

WEB.ARCHIVE.ORG
Unvaccinated Women Report Miscarriages After Interactions with Vaccinated People - Montana Daily Gazette

NATIONALFILE.COM
REPORT: Pfizer Vaccine Confirmed To Cause Neurodegenerative Diseases - Study - National File

TRUTHUNMUTED.ORG
Stop COVID Testing Immediately: PCR And Quick Test Swabs May Be Cancer-Causing – Truth Unmuted

KENYA-TODAY.CO.KE
59 people die as Pastor gives them dettol to drink in church to prevent Coronavirus

CITYSCROLLZ.COM
Chinese Doctors Confirmed African Blood Genetic Composition Resist Coronavirus After Student Cured

LIFESITENEWS.COM
Asymptomatic transmission of COVID-19 didn't occur at all, study of 10 million finds

THEGATEWAYPUNDIT.COM

Study Results: Facemasks are Ineffective to Block Transmission of COVID-19 and Actually Can Cause Health Deterioration and Premature Death

WEB.ARCHIVE.ORG

Unvaccinated Women Report Miscarriages After Interactions with Vaccinated People - Montana Daily Gazette

True news: (+ one extra test headline) for the trial:

NPR.ORG

Vatican OKs Receiving COVID-19 Vaccines, Even If Research Involved Fetal Tissue

NPR.ORG

Adults With COVID-19 Twice As Likely To Have Eaten At Restaurants, CDC Study Finds

NEWSWEEK.COM

400 people quarantined at Fiji hospital after COVID patient dies

WASHINGTONPOST.COM

Bar owner charged with selling fake coronavirus vaccine cards in one of the first cases of its kind

WIONEWS.COM

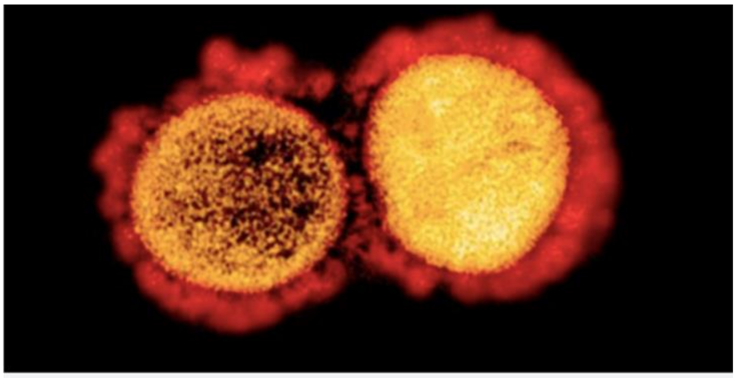
Indonesia: Reused COVID-19 nasal swabs scam busted at airport

ABC.NET.AU

Vlad the vaccinator: Dracula's castle lures visitors with COVID-19 jabs

BBC.COM

Stephen Karanja: Kenyan anti-vaccine doctor dies from Covid-19



CTVNEWS.CA

Florida 'church' leader accused of selling toxic bleach marketed as COVID-19 'miracle cure'

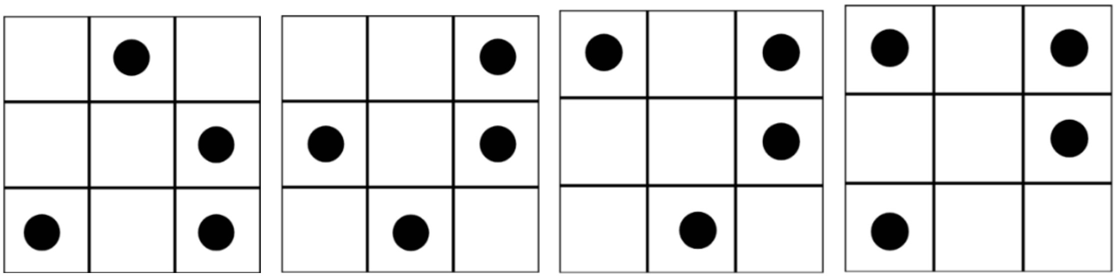
CTVNEWS.CA

Private Florida school won't employ vaccinated teachers

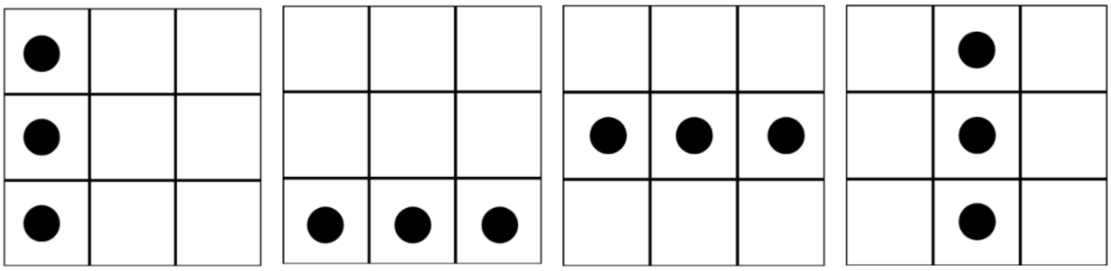
PART 3B) Dot memorization task execution

- Dot memorization task example (survey consisted of 17 unique combinations of dot memorization matrix squares

Treatment group: 4 dots memorization matrix



Control group: 43 dots memorization matrix



PART 4 = Demographics + other questions

- In which country do you currently reside?
- What is your gender?
- What is your highest completed level of education?
- Here is a 7-point Likert scale on which the political views that people might hold are arranged from extremely liberal (left) to extremely conservative (right). Where would you place yourself on this scale?
- If you like to be included in the lottery to win Amazon coupon, write your email below: 3 participants will be randomly selected to win the price.
- How difficult did you find answering the questions about the accuracy of the headlines while remembering the dot pattern?

PART 5 = Additional information – Misinformation debunked

- First, participants get a choice what they would prefer to do:

You are finished with the main task.
What would you like to do?

○ A. I would like to learn more about the survey and find out, which headlines were false and finish the survey afterwards

○ B. I would like to move to the end of the survey without seeing additional information

- Afterwards they receive more information:

The main topic of this survey is misinformation/ fake news. In the survey, you were shown 16 headlines related to COVID-19 related news, that were posted on online media news platforms since March 2020. Out of these 16 headlines, 8 headlines were true, and 8 headlines were false. The 8 false headlines consisted of either false or misleading information. They mimicked true information, reminding of a real-life news content via its form, but lacking accuracy or credibility. These false headlines were actually posted on different news platforms, however, were proven to be false by various independent fact-checking websites.

Now, you will be shown, which headlines were false. Additionally, next to each headline, you can see a link to a fact-checking website, where the news was investigated upon their accuracy and explain why they were marked as false. If you marked the headline as accurate, and it was actually false, it might be beneficial to read about the reasoning, why these headlines were not accurate.

If you prefer to receive more information about the survey, do not hesitate to contact me on my e-mail adress 575592md@eur.nl.

1. https://www.snopes.com/fact-check/pfizer-neurological-damage/
2.https://www.snopes.com/fact-check/covid-vaccine-microsoft-chip/
3. https://www.politifact.com/factchecks/2021/apr/21/blog-posting/paper-about-mask-wearing-was-not-stanford-and-make/
4. https://www.politifact.com/factchecks/2021/apr/21/facebook-posts/no-womens-cycles-and-fertility-are-not-affected-be/
5. https://www.politifact.com/factchecks/2020/apr/08/viral-image/no-evidence-59-people-died-drinking-disinfectant-p/
6.https://www.snopes.com/fact-check/asymptomatic-covid-patients/
7. https://www.snopes.com/fact-check/coronavirus-cameroonian-student/
8. https://www.snopes.com/fact-check/covid-19-tests-chemical-cancer/End of the survey.

Appendix C: Variables description

Variable name	Description
Perceived Accuracy	Categorical variable for the perceived accuracy (1) = Not at all accurate (4) = Very accurate
Condition	A Binary variable, indicates whether a person is undergoing a cognitive load treatment or not (1 = Treatment group, 0 = Control group)
Fake	A binary variable, indicates whether the presented news is Fake or Real (1 = Fake news, 0 = Real news)
CRTRes	Cognitive Reflection Test score (0-3)
Intuitive	Binary variable created from the Cognitive Reflection Test Score (1) = Intuitive thinking, (0) = Analytical thinking
Age	Continuous variable for the age of the participants
Gender	A dummy variable (1= female, 0 = male)
Education Degree	A categorical variable for highest reached education level 1 = Less than Highschool, 2 = High school, 3 = Bachelor, 4= Master, 5 = PHD A binary variable created from the educatioal level 1 = Bachelor Degree and higher = Less than a Bachelor degree
Netherlands	Having a Dutch residence
Political preference Political	Categorical variable indicating political preferences from Extremely liberal (1) to Extremely conservative (7) Categorical variable created from Pol. Preference (1) = Left (2) = Middle (3) = Right
Difficulty	Categorical variable indicating how difficult participants perceived the survey from (1) = Not at all difficult to (5) = Extremely difficult
Dot memorization	A categorical variable measuring the score in the dot memorization task (Lowest score = 0, Maximum Score = 15 score)
Duration	A continuous variable expressing how much time participants needed to successfully finish the survey (in minutes)
Memotimefinal	A continuous variable expressing an average duration of the dot memorization task per question and participants (in seconds)

Appendix D: Ordered logistic regression assumptions

- ***Appropriate outcome structure***

First, the assumption of the **appropriate outcome structure** must hold, hence in an ordered logistic regression, the main dependent variable should be on the ordinal scale (Schreiber-Gregory and Bader, 2018). Hence, the response variable needs to be in an ordinal scale, which is indeed the case, since in all three hypotheses, the response variable is the **Accuracy perception**, which is regarded on an ordinal scale from 1-4, from "Not at all accurate" to "Very accurate".

- ***Assumption of observation independence***

In the (ordered) logistic regression, the observations should be independent and do not come from the same data. Data has been either created repeatedly (by repeated measurement or by matching the user data) (Schreiber-Gregory and Bader, 2018). This assumption might not be assured to hold. It cannot be said that the observations in the sample are independent, due to the reason, that the data has been portrayed in the long format and everyone in the sample got 16 observations in total. Hence, these observations should not come from repeated measurements or data that has been matched.

- ***The independent variables shall be either categorical, ordinal or continuous. (CEED, n.d.)***

Furthermore, the independent, hence the explanatory variables, need to be continuous, categorical or ordinal. This is indeed the case for the variables applied in the main hypotheses testing, as pictured above, in the description of the main variables.

- ***There shall be no multicollinearity between the independent variables (CEED, n.d.)***

(Ordered) logistic regression should consist of independent variables, which do not pose a problem with multicollinearity (Schreiber-Gregory and Bader, 2018). The independent variables and their interactions have been successfully tested for multicollinearity, and no multicollinearity was found. However, this has only been the case for the model, where the Cognitive Reflection Test score was included as a variable "Intuitive". The results of the multicollinearity matrix are attached in Tables 6A and the Appendix. The lowest and most suitable variable for the analysis has been kept in the model. Henceforth the final model will include only the variable Intuitive (1 = intuitive cognitive reflection style, 0 = analytical cognitive reflection style).

- ***Assumption of large sample size*** (Schreiber-Gregory and Bader, 2018).

(Ordered) logistic regression should require a sufficiently large sample size, which is in the literature regarded as a minimum of 10 cases for each independent variable used in the mail model. Since there are 184 observations in the sample, this condition is fulfilled. Additionally, the variable Perceived

Accuracy is depicted in a long-form, which increases the total number of observations to 2944, which is sufficiently high.

- ***Assumption of linearity of independent variables and log-odds***

There should be an assumption fulfilled in the logistic regression that the independent variables and log odds are linear. Hence, the independent variables should be related to the log odds in a linear way (Schreiber-Gregory and Bader, 2018). This assumption is assumed to hold.

- **The proportional odds should be present in the sample, meaning that the independent variables should have identical effects on how the ordinal dependent variables are split cumulatively**. ***(CEED, n.d.)***

This assumption indicates that the relationship between the different parts of the ordinal variable Perceived Accuracy outcomes should be the same. This is the last assumption for ordered logistic regression. This assumption can be tested with the help omodel and the Brant test. The zero hypothesis for the **o model** is no difference in the coefficients between the models. Additionally, this model does not recognise factor variables; hence the "i." has been removed from the factor variables for this test. The o model does not apply for models that include interaction terms; hence, this test has only been run for M1, M4 and M7. The results align with the results of the Brant test, and since the Brant test can be run for all of the models, only the results of this testing will be presented. Results of the Brant test (attached in Appendix E) indicate that this assumption of proportional odds does not hold for all the explanatory variables since the results for these tests are significant (UCLA, n.d.) when adding the interaction, the variable "Fake" in the model. This indeed makes sense because true and fake news have been regarded differently in terms of accuracy perception. As have been previously regarded in the literature, the proportional odds assumption which does not hold is a common case when the sample size is large, which is indeed the case in my thesis research, due to recoding the 16 news headlines into a long format which resulted in the total amount of observation of 2944 observations (Brant, 1990). However, previous literature findings offer a solution for when the proportional odds assumption is violated, which is the partial proportional odds model (Generalized ordered logistic model) (gologit2) (UCLA, n.d.). This model has been not regarded in the scope of this master thesis, and the proportional odds assumption will be regarded in the Limitations part in more detail. This is because the only problematic variable for this assumption has been the variable Fake; therefore, the analysis will continue with applying the Ordered Logistic Regression.

Appendix E: Additional tables from the analysis

(Descriptive statistics, correlation, collinearity, randomisation and manipulation checks)

Table E1 Descriptive statistics CRT

Descriptive statistics for the three cognitive reflection test answer

	Correct	Wrong
Bat and Ball problem (CRT1)	114	70
Widget question (CRT2)	121	63
Lily pad question (CRT3)	131	53

Table E2 Spearman's rank correlation

Spearmen correlation for when CRT as categorical variable (0-3) | (in the main text, CRT score as binary variable 1,0 (intuitive, analytical)

Variable	Perceived Accuracy (1)	Condition (2)	Fake (3)	CRTRes (4)
Perceived Accuracy (1)	1			
Condition (2)	0.0068	1		
Fake (3)	-0.5122 ***	0.0000	1	
CRTRes (4)	0.0145	-0.0332*	0.0000	1

Table E3 Collinearity (when CRT score as binary variable Intuitive (0), Analytical (1) to compare)

Variable	VIF	SQRT VIF	Tolerance	R-Squared
Condition	6.46	2.54	0.16	0.85
Analytical	4.40	2.10	0.23	0.77
Fake	7.36	2.71	0.14	0.86
Condition x Fake	9.84	3.14	0.10	0.90
Condition x Analytical	8.33	2.89	0.12	0.88
Analytical x Fake	9.18	3.03	0.11	0.89
Cond. x Analyt. x Fake	10.39	3.22	0.10	0.90
Mean VIF	7.99			

Collinearity when CRT as analytical (in the main text, as Intuitive)

Figure E4: Survey duration in minutes (Manipulation check)

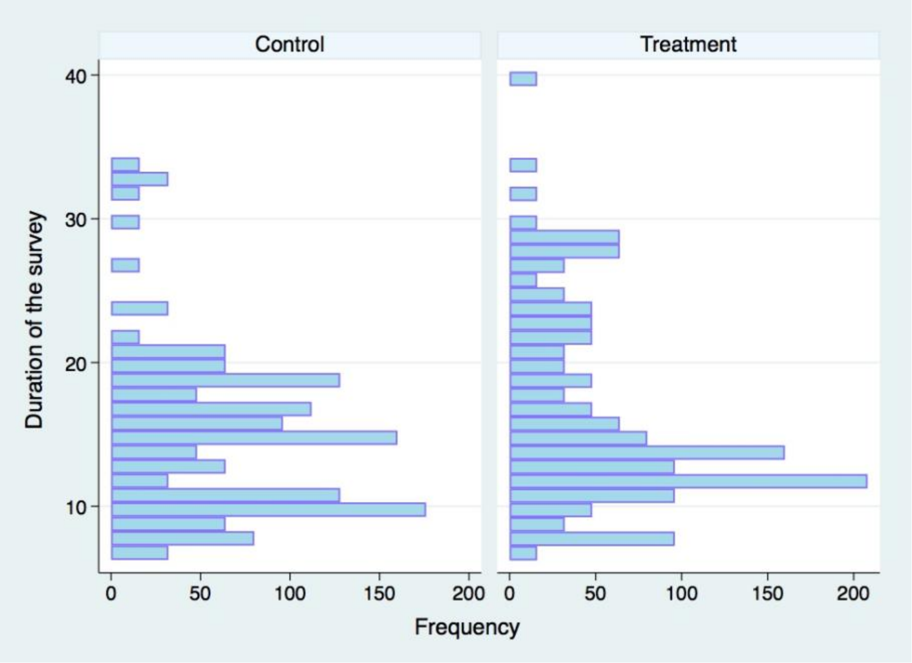


Figure E4: Histogram expressing the duration of the survey in minutes, divided into the Treatment and the Control group

Table E5 (a,b) Ordered Logistic Regression

In this Appendix, two tables are introduced, *Table E5a* and *Table E5b.* These tables portray different versions of the base categories for the variable Political preference. From the *Table 3*, it is visible, that the category "Right" was applied as a base category. From the *Table 4*, it is visible that category *Middle* was applied as a base category, in order to observe the different effects in the categories of the variable Political.

From the *Table E5a*, it is visible, that the category "Right" was applied as a base category. The analysis for this variable change in a following way: It can be regarded that for the variable Political preferences, that there is an increase in the variable Political preferences (going from the category Right to the category Left, there is expected an decrease 0.2001 in the log odds of being in a higher level of Perceived Accuracy, when all of the other variables in the model are held constant. This effect is significant at 5% significance level (Model 3).

The analysis from the *Table E5b*, for the variable Political (Model 3), changes in a following way: It can be regarded that for the variable Political, that there is an increase in the variable Political preferences (going from the category Left to the category Middle, there is expected an decrease 0.185 in the log odds of being in a higher level of Perceived Accuracy, when all of the other variables in the model are held constant. This effect is significant at 5% significance level. For the other models (M6 and M9), the results remain similar.

	M1	M2	M3	M4	M5	M6	M7	M8	M9
Condition	0.0190	0.0475	0.031				0.0499	-0.0807	-0.110
	(0.0698)	(0.0938)	(0.0944)				(0.0939)	(0.114)	(0.1147)
Fake	-2.091***	-2.058***	-2.0639***	-2.091***	-2.265***	-2.273***	-2.058***	-2.292***	-2.300***
	(0.0766)	(0.105)	(0.106)	(0.0766)	(0.0917)	(0.0920)	(0.105)	(0.125)	(0.125)
1.Intuitive				-0.0424	-0.281***	-0.205*	-0.0436	-0.532***	-0.467***
				(0.0751)	(0.101)	(0.092)	(0.0753)	(0.149)	(0.153)
Condition x Fake		-0.0638	-0.0678				-0.0629	0.0474	0.046
		(0.140)	(0.141)				(0.140)	(0.171)	(0.171)
Intuitive x Fake					0.532***	0.536***		0.790***	0.801***
					(0.150)	(0.150)		(0.223)	(0.223)
Intuitive x Condition								0.455**	0.483**
								(0.202)	(0.206)
Intuitive x Fake x Condition								-0.462	-0.472
								(0.302)	(0.302)
Gender (Female = 1)			-0.1451**			-0.151**			-0.153**
			(0.073)			(0.0739)			(0.074)
Political preference (Left)			-0.2001**			-0.2048*			-0.2102***
			(0.0948)			(0.0952)			(0.0955)
Political preference (Middle)			-0.0159			-0.0205			-0.0487
			(01113)			(0.112)			0.1131
Observations	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table E5a: Ordered logistic regression

Political preference Right (base)

	M1	M2	M3	M4	M5	M6	M7	M8	M9
Condition	0.0190	0.0475	0.031				0.0499	-0.0807	-0.1104
	(0.0698)	(0.0938)	(0.094)				(0.0939)	(0.114)	(0.1150)
Fake	-2.091***	-2.058***	-2.063***	-2.091***	-2.265***	-2.273***	-2.058***	-2.292***	-2.2995***
	(0.0766)	(0.105)	(0.106)	(0.0766)	(0.0917)	(0.0918)	(0.105)	(0.125)	(0.125)
1.Intuitive				-0.0424	-0.281***	-0.2045*	-0.0436	-0.532***	-0.467***
				(0.0751)	(0.101)	(0.1046)	(0.0753)	(0.149)	(0.154)
Condition x Fake		-0.0638	-0.067				-0.0629	0.0474	0.0461
		(0.140)	(0.141)				(0.140)	(0.171)	(0.1712)
Intuitive x Fake					0.532***	0.5365***		0.790***	0.801***
					(0.150)	(0.1501)		(0.223)	(0.223)
Intuitive x Condition								0.455**	0.4829**
								(0.202)	(0.2059)
Intuitive x Fake x Condition								-0.462	-0.4718
								(0.302)	(0.302)
Gender (Female = 1)			-0.145**			-0.1512**			-0.1527**
			(0.073)			(0.0738)			(0.0045)
Political preference (Left)			-0.185**			-0.1834**			-0.1615*
			(0.091)			0.0909			(0.0919)
Political preference (Right)			0.0159			0.2049			0.0487
			(0.1112)			0.1112			(0.1132)
Observations	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944	2,944

Standard errors in parentheses ,*** p<0.01, ** p<0.005, * p <0.1

*** p<0.01, ** p<0.05, * p<0.1

Table E5b: Ordered logistic regression

Table E6: Brant test

Results from the Brant Test show the Chi^2 of the whole model is significant at 1% significance level in models (p < 0.01 for M1, M2, M3, M4, M7, M8), hence, the **parallel odds assumption** does not hold. M5, M8 is significant at 5% significance level (here, if regarded as not significant at 1% significance level, parallel odds assumption does hold).

The problematic variable in the test only appears to be the variable "Fake".

M1

Brant test of parallel regression assumption

	chi2	p>chi2	df
All	16.980	0.002	4
1.Condition_	3.590	0.166	2
1.Fake	13.400	0.001	2

A significant test statistic provides evidence that the parallel regression assumption has been violated.

M2:

Brant test of parallel regression assumption

	chi2	p>chi2	df
All	21.560	0.001	6
1.Condition_	5.250	0.072	2
1.Fake	3.570	0.167	2
1.Condition_#1.Fake	1.500	0.473	2

A significant test statistic provides evidence that the parallel regression assumption has been violated.

M3

Brant test of parallel regression assumption

	chi2	p>chi2	df
All	46.20	0.000	16
1.Condition_	6.37	0.041	2
1.Fake	3.56	0.169	2
1.Condition_#1.Fake	1.53	0.466	2
Gender_	8.77	0.012	2
Age	1.91	0.384	2
Political_Preference	2.44 | 0.41	0.296 |0.815	2
Degree	2.05	0.385	2

Netherlands_	4.07	0.131	2

A significant test statistic provides evidence that the parallel regression assumption has been violated.

M4:

Brant test of parallel regression assumption

	chi2	p>chi2	df
All	18.320	0.001	4
1.Intuitive	4.820	0.090	2
1.Fake	13.260	0.001	2

A significant test statistic provides evidence that the parallel regression assumption has been violated.

M5

Brant test of parallel regression assumption

	chi2	p>chi2	df
All	15.330	0.018	6
1.Intuitive	0.230	0.892	2
1.Fake	10.970	0.004	2
1.Intuitive#1.Fake	0.880	0.643	2

A significant test statistic provides evidence that the parallel regression assumption has been violated.

M.6

Brant test of parallel regression assumption

	chi2	p>chi2	df
All	37.48	**0.005**	16
1.Intuitive	0.100	0.950	2
1.Fake	11.310	0.003	2
1.Intuitive#1.Fake	1.010	0.603	2
1.Gender_	5.93	0.052	2
Age	2.8	0.247	2
Political_Preference	2.511 | 0.5	0.285 |0.778	2
Degree	2.12	0.346	2
1.Netherlands_	4.520	0.104	2

A significant test statistic provides evidence that the parallel regression assumption has been violated.

M7

Brant test of parallel regression assumption

	chi2	p>chi2	df
All	15.780	0.003	4
1.Con_Fake	10.020	0.007	2
1.Intuitive	5.420	0.067	2

A significant test statistic provides evidence that the parallel regression assumption has been violated.

M8: Estimated coefficients from binary logits

Legend: b/t

Brant test of parallel regression assumption

	chi2	p>chi2	df
All	18.750	0.016	8
Age	3.700	0.158	2
1.Intuitive	6.050	0.049	2
1.Con_Fake	9.230	0.010	2
1.Intuitive#1.Con_Fake	0.980	0.611	2

A significant test statistic provides evidence that the parallel regression assumption has been violated.

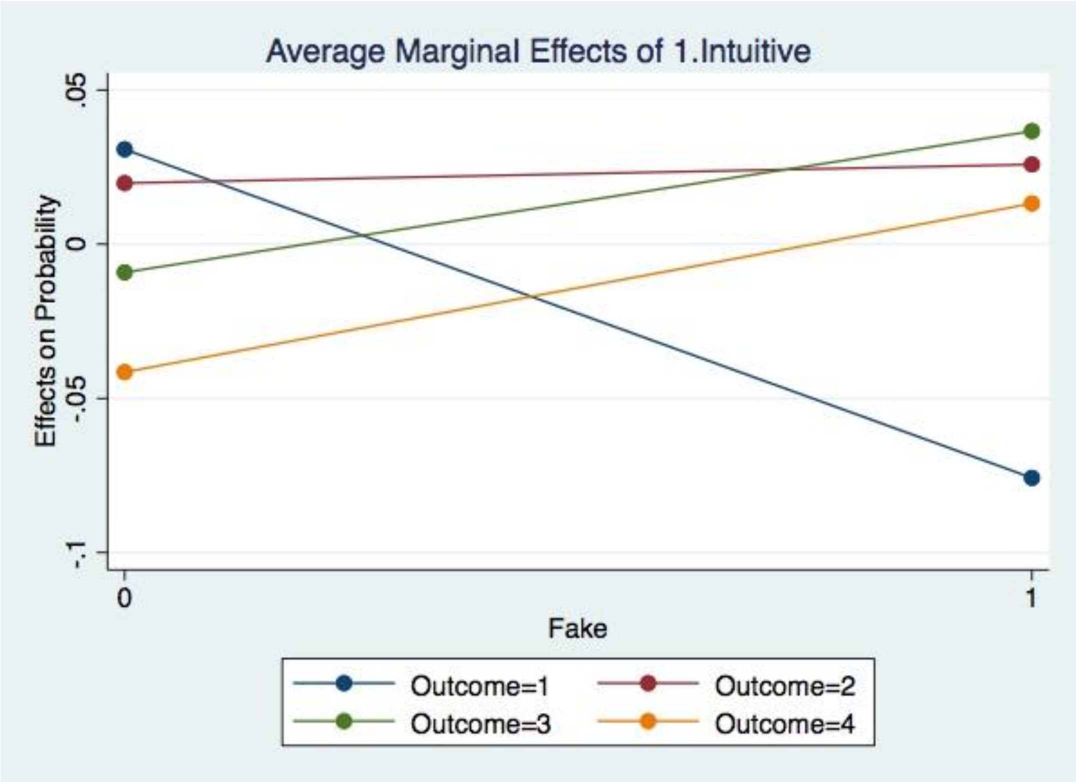
M9:

Brant test of parallel regression assumption

	chi2	p>chi2	df
All	52.94	0.001	26
Age	3.93	0.140	2
1.Intuitive	3.64	0.162	2
1. Condition	10.47	0.005	2
1.Intuitive#1.Con_Fake	1.47	0.480	2
1.Gender_	7.14	0.028	2
Political_Preference	3.36 | 0.5	0.187 | 0.780	2
Degree	1.24	0.537	2
1.Netherlands_	4.08	0.130	2

A significant test statistic provides evidence that the parallel regression assumption has been violated.

Figure E7: Average marginal effects



Average Marginal Effects for the variable Intuitive x Fake, when Intuitive = 1