

**THE RELATIONSHIPS BETWEEN ILLUSORY
TRUTH EFFECT, METACOGNITIVE AWARENESS
AND WORKING MEMORY AMONG YOUNG
ADULTS IN PENANG: THE ROLE OF PROCESSING
FLUENCY**

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UNIVERSITI SAINS MALAYSIA

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by

MAK CHAN WAI

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**HUBUNGAN ANTARA KESAN KEBENARAN ILUSI, KESEDARAN
METAKOGNITIF DAN INGATAN BEKERJA DALAM KALANGAN
DEWASA MUDA DI PULAU PINANG: PERANAN KEFASIHAN
PEMROSESAN**

ABSTRAK

Kesan kebenaran boleh menjadi masalah dalam maklumat hari ini jika maklumat palsu dikongsi berulang kali dalam talian. Mengikut teori dwi- proses, kognisi dibahagikan kepada sistem 1 dan 2. Sistem 1 adalah automatik dan dibawah sedar, sebaliknya, sistem 2 adalah bersengaja dan sedar. Kesan kebenaran juga dikaitkan dengan kelancaran pemprosesan, iaitu betapa mudah cara sesuatu item diproses. Item yang secara relatifnya lebih lancar dalam pemprosesan akan melibatkan sistem 1. Item berulang adalah lebih lancar diproses dan seterusnya dianggap benar berbanding dengan item tidak berulang yang agak rendah dalam kelancaran pemprosesan. Kajian telah mencadangkan bahawa apabila kelancaran pemprosesan dikurangkan, sistem 2 akan digunakan untuk mengurangkan bias daripada pemprosesan sistem 1. Matlamat kajian ini adalah untuk mengkaji hubungan antara ingatan kerja, kesedaran metakognitif, dan kesan kebenaran. Ia juga bertujuan untuk memahami jika kelancaran pemprosesan menjadi pengantara setiap pembolehubah dengan kesan kebenaran. Dalam kajian ini, sistem 2 diwakili oleh kesedaran metakognitif dan ingatan kerja. Kesedaran metakognitif ialah kesedaran dan pengawal seliaan proses mental seseorang. Memori kerja ialah keupayaan untuk menyimpan dan memproses maklumat secara serentak dalam aktiviti kognitif peringkat tinggi seperti menavigasi peta, memberikan pembentangan, dan mengira belanjawan tanpa

kalkulator atau kertas dan pensel. Kajian ini pada mulanya direka bentuk untuk dijalankan secara bersemuka, tetapi disebabkan oleh kawalan pergerakan akibat COVID-19 di seluruh negara, kajian ini diubah untuk dijalankan dalam talian. Seramai 135 peserta menyelesaikan kajian ini dalam talian. Kesan kebenaran diukur dalam dua fasa - fasa pendedahan dan fasa penilaian. Fasa pendedahan melibatkan pendedahan peserta kepada kenyataan yang dilabel Betul, Salah atau Neutral. Dalam fasa penilaian, peserta menilai sejauh mana kebenaran setiap kenyataan yang tidak bermakna dibentangkan secara visual dengan menggunakan skala Likert 6-mata (daripada 1 – pasti palsu sehingga 6 – pasti benar). Para peserta kajian juga menilai tahap kelancaran pemprosesan mereka untuk setiap kenyataan dalam fasa ini. Mereka menyelesaikan tugas memori kerja yang termasuk *Digit Span Backwards*, *Operation Span Task* dan *Symmetry Span Task*. Kesedaran metakognitif diukur dengan Inventori Kesedaran Metakognitif dan Skala Kesedaran Kendiri Metakognitif. Penemuan kajian mencadangkan bahawa kesedaran metakognitif dan ingatan kerja tidak mempunyai hubungan yang signifikan dengan kesan kebenaran $F(1,128)=1.25$, $p=0.27$ dan $F(1,128)=0.96$, $p=0.32$. Terdapat hubungan yang signifikan antara kesan kebenaran dan kelancaran pemprosesan ($r=0.28$, $p<0.05$). Ini mencadangkan bahawa sistem 2 tidak diaktifkan manakala sistem 1 diaktifkan secara automatik. Kenyataan yang diulang dinilai sebagai lebih fasih dan lebih benar berbanding dengan kenyataan yang tidak pernah ditemui (baharu). Kajian ini menunjukkan bahawa pengulangan dan kelancaran maklumat sangat mempengaruhi persepsi kebenaran.

**THE RELATIONSHIPS BETWEEN ILLUSORY TRUTH EFFECT,
METACOGNITIVE AWARENESS AND WORKING MEMORY AMONG
YOUNG ADULTS IN PENANG: THE ROLE OF PROCESSING FLUENCY**

ABSTRACT

The truth effect can be problematic in the information age if false information is shared repeatedly online. According to the dual process theory, cognition is divided into system 1 and 2. System 1 is automatic and unconscious, conversely, system 2 is deliberate and conscious. The truth effect is also known to be associated with processing fluency, which is the ease of how an item is processed. An item which is relatively more fluent in processing would engage system 1. Repeated items are more fluently processed, which in turn are perceived as true compared to non-repeated items that are relatively low in processing fluency. The aim of the current study was to investigate the relationship between working memory, metacognitive awareness, and the truth effect. It also aims to understand if processing fluency mediated each variable with the truth effect. In the current study, system 2 was represented by metacognitive awareness and working memory. Metacognitive awareness is the awareness and regulation of one's mental process. Working memory is the ability to simultaneously store and process information in higher-order cognitive activities such as navigating a map, giving a presentation, and calculating a budget without a calculator or paper and pencil. The study was initially designed to be completed in a face-to-face, physical administration, but due to the Covid-19 nationwide lockdown, it was converted into an online administration. 135 participants completed the online administration of the study. The truth effect was measured in two phases – the exposure phase and the rating phase. The exposure phase involved exposing participants to True, False, and Neutral

statements. In the rating phase, participants rated how true visually presented nonsensical statements on a 6-point Likert scale (with 1-definitely false to 6-definitely true). They also rated how fluent they perceived each statement in this phase. They completed working memory tasks namely the Digit Span Backwards, Operation Span Task and the Symmetry Span Task. Metacognitive awareness measures were the Metacognitive Awareness Inventory and the Metacognitive Self-Awareness Scale. Study findings suggested that metacognitive awareness and working memory had no significant relationship with the truth effect with $F(1,128)=1.25$, $p=0.27$ and $F(1,128)=0.96$, $p=0.32$ respectively. There was a significant relationship between the truth effect and process fluency ($r=0.28$, $p<0.05$). This suggested that system 2 was not activated while system 1 was automatically engaged. Repeated statements were rated to be significantly more fluent and true compared to new statements. Findings from the current study suggest that information repetition and fluency strongly influence the perception of truth.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Sugar causes hyperactivity in a child; the only known human-built structure to be visible from space is the Great Wall of China; bats are blind; and self-harm is just an attention-seeking behaviour. Those are all false statements which were held to be true. Through repetition, misconceptions held by the general population would be regarded as true. Using repetition as a tactic to propagate misinformation is not new. Nazi leaders in 1933 Germany were found to use such tactics to spread false information. For instance, Adolf Hitler once claimed that repetition is a useful method to implant ideas into the populace's memories (Maillat, 2013). Repeating propaganda increases the chances of the message being perceived as true regardless of whether it is true (see Fazio, Rand & Pennycook, 2018).

The phenomenon was empirically observed in the late 70s by Hasher, Lynn and Toppino (1977). The phenomenon was later known as the truth effect (Schwartz, 1982). The illusory truth effect (I. M. Begg et al., 1992) or truth effect (Unkelbach et al., 2019) refers to the tendency to identify repeatedly exposed information as true. It accounts for how claims which were exposed frequently were more likely to be identified as true (Dechêne et al., 2010; Fazio et al., 2015; Law et al., 1998; Nadarevic & Aßfalg, 2017; Pennycook et al., 2018). One might find an article to be true not because of its content but merely because one has seen the article somewhere before. Hasher and colleagues (1977) indicated that the phenomenon implies a fundamental problem of how knowledge is accumulated.

The truth effect was thought of to be an automatic process which was mediated by the ease of processing or processing fluency (Dechêne et al., 2010; Frankish, 2010; W.-C. Wang et al., 2016). An opposing process which was deliberate was found to be effective in driving

down the automatic process (Alter et al., 2007). Thus, a high enough deliberate process such as metacognitive awareness, the awareness and self-regulation of one's mental process (Schraw, 2001) and working memory, the short-term storage and information processing system (A. D. Baddeley & Hitch, 1994), could control the automatic process. The current study aimed to study these opposing forces, and at the same time, to study the truth effect and its relationship with metacognitive awareness and working memory as well as the role processing fluency play.

The truth effect was also conducted mostly in a population which were Western, Educated, Industrialized, Rich and Democratic (WEIRD) (see De keersmaecker, Roets, et al., 2019; Dechêne et al., 2010). The truth effect could thus be a form of bias exclusively as a product of WEIRD culture. Hence, the current study intends to explore whether the truth effect is a universal phenomenon and investigate this in a non-WEIRD context.

1.2 Background of Study

The truth effect was widely studied and its effects was demonstrated across many experiments (Arkes et al., 1991; De keersmaecker, Dunning, et al., 2019; Dechêne et al., 2010; Fazio et al., 2019; Law et al., 1998; Sherry & Fazio, 2020). The method frequently used to measure the truth effect was by asking participants the degree of truth of a statement. They then rated the truth of the statement on a Likert scale for instance, 1-definitely not true to 7-definitely true (Gigerenzer, 1984; Hawkins & Hoch, 1992; Ozubko & Fugelsang, 2010), or using binary choices of true or false (Fazio et al., 2015; Unkelbach, 2007).

Statements used in a truth effect experiment usually varied from trivia to consumer opinions to participants existing knowledge (Dechêne et al., 2010; Fazio et al., 2015; Johar & Roggeveen, 2007). The truth effect was observed under varying interval lengths between the exposure to the initial statements and re-exposure of the same, or repeated, statements.

Repeated statements were rated truer even when it was presented seconds apart (Gigerenzer, 1984) from the initial statements. This is also observed when the repetition was seen several days (I. M. Begg et al., 1992), to even weeks later (Bacon, 1979; Henkel & Mattson, 2011). The effect appears even when participants were explicitly warned (Nadarevic & Abfal, 2017).

Introduced by Stanovich and West, the dual process theory categorized thinking processes into system 1 and system 2 (Evans, 2003; Stanovich & West, 2000). System 1 and system 2 were often argued to be in opposition with one another, with system 1 generally described to be a less evolved cognitive system (Evans, 2003). It was proposed to be shared between animal and humans, and thus functions implicitly. On the other hand, system 2 was more capable of abstract thinking and thought to have been derived from a later evolutionary development (Evans, 2003). Examples of system 2 processes are metacognitive awareness and working memory.

Metacognitive awareness is the ability to understand one's thinking process (Flavell, 1979; Fleming & Lau, 2014). A high metacognitive awareness indicates the capacity to reflect cognitively, able to understand one's own limitation and even formulate strategies to address said limitation (Flavell, 1979; Schraw & Dennison, 1994). In other words, metacognitive awareness allowed for a more conscious engagement with the process of completing a given task. In terms of academic achievements, metacognitive awareness was correlated with better academic performance (Rashid et al., 2006; Rickey & Stacy, 2012; Ward & Butler, 2019; Young & Fry, 2008).

Working memory is a mental system which functions as a short-term storage and concurrent information processing (Alan Baddeley, 1992). The term was coined by George Miller, Eugene Galanter and Karl H Pribram in their 1960 book titled 'Plans and the structure of behaviour' (see Cowan, 2014). It is an important component of the human mind, as it facilitates planning, comprehension, reasoning, problem-solving (Cowan, 2014; Lee & Kang,

2002; Nyberg & Eriksson, 2016; Süß et al., 2002). The everyday example of working memory is seen in our ability to do simple arithmetic in the mind without using a calculator, remembering the next steps in making a dish while focusing on the current cooking step, and holding a conversation with someone new while repeating her new name in mind. Working memory was regarded as a cognitive process belonging to system 2 due to it being a deliberate process (see Oppenheimer, 2008).

The predominant explanation for the truth effect is that it was mediated by processing fluency (see Dechêne et al., 2010). Processing fluency is the subjective feeling of ease when a stimulus is processed (Unkelbach & Greifeneder, 2013). In other words, when an information was seen again, it will be subjectively experienced with ease. This ease in processing possibly influences the judgement of truth (Leboe & Whittlesea, 2002; Whittlesea & Williams, 1998). Processing fluency affects not just perception of truth, it also influences many aspects of decision-making. The experiences of fluency were demonstrated in various studies to have affected our perception of familiarity (Whittlesea & Williams, 2000), fame (Jacoby et al., 1989), a person's ability (Greifeneder et al., 2010), the economic value of stocks (Alter & Oppenheimer, 2006), and even the value of companies (Hertwig et al., 2008).

Processing fluency was recognized as a cognitive process belonging to an automatic system (Alter et al., 2007; Böckenholt, 2012; Kahneman, 2011; Morewedge & Kahneman, 2010). The reliance on repetition as a cue for truth could be a default strategy of thinking. Also, the automatic system is an unconscious process which meant that the perceiver might not be aware of its influence (I. M. Begg et al., 1992; Kahneman, 2011). In a study by Alter and colleagues (2007), the researchers observed that when system 1 was disrupted, system 2 was more engaged in driving a more rational decision. This suggested that a strong or highly active system 2 could override system 1. Thus, a higher level of metacognitive awareness and working memory might reduce the truth effect.

The current study, to date, was the first to be conducted in a non-WEIRD setting (see Dechêne et al., 2010). WEIRD is a term coined by Henrich, Heine, and Norenzayan (2010), and they reported that an overwhelming amount of psychological research was mainly conducted in specific regions in the world. Moreover, the participants recruited belonged to a predominantly Western, Educated, Industrialized, Rich and Democratic (WEIRD) nations; hence, the term WEIRD (Henrich et al., 2010). Prior to 2010, this sample was derisively known as “college sophomores from the University of Michigan” (see Kanazawa, 2020).

Furthermore, many theories in psychological science were tested in samples mainly consisted of American undergraduates (Kanazawa, 2020). This is problematic as these psychological theories wouldn't generalize to the rest of the human population (Cheon et al., 2020; Henrich et al., 2010). For example, The Big Five personality traits (Openness, Conscientiousness, Extraversion, Agreeableness and Emotional Stability) that appeared to have a large body of evidence was discovered to be non-representative in non-WEIRD population (Laajaj et al., 2019). Evidence supporting Big Five such as correlations between a person's earnings and conscientiousness were mostly conducted in the West and richer countries. Conscientiousness seemed to be a weak predictor when the correlations were tested in non-WEIRD populations (Laajaj et al., 2019).

It is becoming more apparent that one's cultural background has a significant impact on one's behaviour and mental processes. East Asians, for instance, focus on perceiving the whole picture while Americans focus on specific details (Chua et al., 2005). In another example, studies of the proclivity to explain another person's behaviour in terms of their personality, or the fundamental attribution bias error, suggested that individuals often falsely attribute an aggressive behaviour (cutting a person in traffic) to the person's personality (e.g., rude, selfish, or terrible driver), instead of situational factors (e.g., an emergency, wife giving birth or late for a job interview). The fundamental attribution bias was less pronounced among

non-WEIRD populations, as individuals in these populations tend to focus on the context of the behaviour displayed (Morling et al., 2002).

1.3 Problem Statement

In today's age of digital information when many are prone to information overload, the rise of fake news is especially alarming. Factually dubious contents are widely circulated through social media rendering the public more vulnerable to misinformation (Clayton et al., 2019). In 2016, the Oxford dictionary named *post-truth* word of the year, it was given the definition of "relating to or denoting circumstances in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief (Oxford Dictionary, 2016). The following year, the Collins Dictionary and American Dialect Society (ADS) named "fake news" as the 2017 word of the year (American Dialect Society, 2018; Hunt, 2017). Collins dictionary defined "fake news" as "false, often sensational, information disseminated under the guise of news reporting". The ADS carries two definitions, namely "false or disinformation presented as actual news" and "actual news that is declared to be false or untrue" (American Dialect Society, 2018; Hunt, 2017).

A study investigating news stories distributed on the social media Twitter, with a dataset of approximately 3 million people ranging from 2006 to 2017, observed that false news were 70% more likely to be reposted (Vosoughi et al., 2018). When false information is widely read, seen, and heard, the influence of the truth effect would be problematic, especially if this effect stretches across various fields including politics, news media outlets, and advertisement.

Being exposed to the headline of a fake news just once was enough to increase its believability (Pennycook et al., 2018). To not notice one's tendency to be affected by the truth effect is to render one vulnerable to being swayed by information merely by relying on the fluency of repetition rather than by careful examination. The consequence is a society that is

easily manipulated, for example, Russiagate, the conspiracy in which US president Donald Trump was allegedly a Russian agent, and that he was involved in a collusion with the Russian government to manipulate the 2016 presidential election (Majin, 2019). There was a widespread media coverage on the issue from 2016 to 2019 even though the allegations were unsubstantiated (Majin, 2019). Nearly half of Americans still believed in the conspiracy even after a special council found no evidence of any collusion (Kahn, 2019). In another example, the Pizzagate conspiracy was an incident in which the spread of false information had gone too far. It was a conspiracy in which a child sex trafficking ring was linked to several high-ranking officials of the US Democratic party and restaurants i.e. the Comet Ping Pong Pizzeria (Kang, 2016). The conspiracy was spread across various platforms on the internet, for example, YouTube, Twitter, Reddit, 4chan. This has led restaurateurs and staffs of restaurants that were allegedly linked to the conspiracy to receive multiple death threats and resulted in a North Carolina man shooting a Comet Ping Pong Pizzeria (C Eugene, 2016; Kang, 2016; Kang & Goldman, 2016).

According to a 2018 survey by Ipsos, 74% of Malaysians purported that they could detect fake news. However only 50% of Malaysians reported that they have believed a news to be real in the past which they later discover to be untrue. Furthermore, 58% of Malaysians believed that the average citizen is indifferent about facts, where they “just believed what they wanted” and 68% believed that their understanding of the world, for example, immigration and crime rate are more accurate than the average person (Ipsos, 2018).

The survey revealed an example of an overconfident bias, which is an overestimation of one’s own ability and underestimation of the ability of others (Moore & Healy, 2008). Overconfidence will not reduce one’s risk, only one’s perception of risk. An example would be smokers, who tend to downplay their own risk of cancer compared to the risk of other smokers (Slavic, 2001, as cited in Moore & Healy 2008). Accordingly, downplaying one’s risk

to cognitive bias would not make one less susceptible to the bias. Conversely, it might make one more susceptible to biases (Kahneman, 2011; Strahilevitz et al., 2015).

Additionally, with the internet presenting an explosion of information, it has given rise to a new problem, i.e., the google effect, where the ability to make memory is being compromised by the quick click of internet search. Internet users tend to forget details of information which they consider to be readily available online (Sparrow et al., 2011). This meant that with more and more information being accessible online, less and less information would be stored in memory. Added by the fact that false rumours on social media possessed the likelihood to be disseminated faster as well as further (Vosoughi et al., 2018), this could be problematic.

If people do not remember the credibility of the source of information, then they have a higher tendency of relying on process fluency as a cue for truth judgement, which could render them vulnerable to the truth effect. Working memory, a limited mental capacity for information to be maintained and manipulated in a short period of time (Au et al., 2015; Chooi, 2012; Fukuda et al., 2010) could reduce the likelihood of the truth effect occurring. Information which were maintained in working memory could eventually be integrated into the long-term memory (Nyberg & Eriksson, 2016). This would suggest that working memory might encourage accurate memory of information sources.

The awareness of one's personal thinking process, or metacognitive awareness, might also be important in tackling the truth effect. If being unaware and lacking active processing of encountered information were the root causes of this biased way of believing, then putting a halt in the automaticity could alter the course to this default of way of thinking. In the current age of populist winning the hearts of people as more practical than winning minds, it is important to understand the possible mechanism behind this method of persuasion.

It bears merit to understand the truth and the relationship between working memory and metacognitive awareness. In addition to that, it is also important to understand how the process might be mediated by processing fluency. Biased decision seems largely influenced by processing fluency. Stimulus which were positively processed might appear more true, more familiar, beautiful and even more likeable (Alter et al., 2007; Alter & Oppenheimer, 2009; Wänke & Hansen, 2015; Whittlesea & Williams, 1998). In other words, it is important to also study the mediating effect of processing fluency as it represents the mechanism by which biases arisen.

Processing fluency mediated the truth effect by how repetition was processed. When information encountered was easy to process, it increased the tendency to perceive it as more truthful compared to information which were comparatively more difficult to process. The ease of processing was associated with familiarity. When an information seems familiar, there is an increase likelihood of perceiving it as true. When the information was difficult to process, it felt unfamiliar and therefore its veracity was more likely to be met with scepticism (Alter et al., 2007; Alter & Oppenheimer, 2008; Oppenheimer, 2006). In summary, repeated exposure enhanced processing fluency and in turn, the enhanced fluency informed truth judgement.

The accumulating studies on the truth effect to date were conducted predominantly in WEIRD populations (see Dechêne et al., 2010). There is no empirical evidence supporting the truth effect among individuals in non-WEIRD populations. Culturally, it is observed that Asians were more sceptical of positive emotion compared to Westerners (Joshanloo & Weijers, 2014; Koo & Francisco, 2014). As more fluent stimuli was related to positive valences (e.g., feeling good, liking, true, confidence) (see Alter & Oppenheimer, 2009), it might be possible that the positivity which relates to repetition might be met with more opposition in a non-WEIRD population. Furthermore, the study was in Penang, Malaysia. Malaysia has a diverse

blend of ethnicity which could add nuance to the findings. It is important to verify if the truth effect could be replicated in a culture outside of the western context.

1.4 Research Questions

- 1a . What is the relationship between metacognitive awareness and the truth effect?
- 1b. Is there a significant difference in the relationship between high, medium, and low metacognitive awareness and the truth effect?
- 2a. What is the relationship between working memory and the truth effect?
- 2b. Is there a significant difference in the relationship between high, medium and low working memory and the truth effect?
- 3a. What is the relationship between metacognitive awareness and processing fluency?
- 3b. Is there a significant difference in the relationship between high, medium and low metacognitive awareness and processing fluency?
- 4a. Is there a significant difference between working memory and processing fluency?
- 4b. Is there a significant difference in the relationship between high, medium and low working memory and processing fluency?
5. What is the relationship between processing fluency and the truth effect?
6. Does processing fluency have a mediating relationship between working memory, metacognitive awareness, and the truth effect?

1.5 Research Objectives

The main objective of this study was to investigate factors that influenced the truth effect. The following objectives collectively sought to identify the factors that influence the truth effect.

- 1a. To investigate the relationship between metacognitive awareness and the truth effect.

- 1b. To determine if there is a significant difference in high, medium, and low metacognitive awareness and the truth effect.
- 2a. To investigate the relationship between working memory and the truth effect.
- 2b. To determine if there is a significant difference between high, medium, and low working memory in their relationship with the truth effect.
- 3a. To investigate the relationship between metacognitive awareness and processing fluency.
- 3b. To determine if there is a significant difference in relationship between high, medium, and low metacognitive awareness and processing fluency.
- 4a. To investigate the relationship between working memory and processing fluency.
- 4b. To determine if there is a significant difference between high, medium and low working memory in their relationship with processing fluency.
5. To investigate the relationship between processing fluency and the truth effect.
6. To determine if processing fluency mediates the relationship between metacognitive awareness, working memory and the truth effect.

1.6 Significance of Study

This study aimed to investigate the relationship between the deliberate system and the truth effect. Past studies have suggested many ways in which the truth effect could operate as well as how robust it is (Dechêne et al., 2010). Moreover, the rise of populists in the world has been alarming, posing a threat to human rights globally (Galston, 2018; Roth, 2017). This rise in populists would follow the rise of populist rhetoric, persuading the masses to an unreasonable position by illogical means, for example, the appeal to tribalistic tendencies of ‘us vs them’ (Lewis et al., 2019; Suddaby et al., 2017) and the use of repetition (Maillat, 2013; Montgomery, 2017).

Though the truth effect is not the only bias which allows misinformation to propagate, it will nonetheless significantly change the way information is being consumed and accepted. Moreover, the subject of truth effect has not been conducted in Malaysia to date. Thus, the current research might provide insight into how a multicultural population might manifest the truth effect.

The thinking process, under the dual process theory, comprises of system 1 and system 2. The fast but unreflective nature of system 1 creates a condition for cognitive biases to persist as most unknowingly forgo careful consideration for snap judgements (Kahneman, 2011). Biases can be reduced if they come under the attention of system 2, as it utilizes a more analytical and deliberate approach. Therefore, understanding how system 2 might interact with a phenomenon like the illusory truth effect would provide insights into the next step moving forward regarding cognitive biases. Studies have rarely sought the relationship between cognitive bias and the component of rational thinking, specifically metacognitive awareness and working memory (De keersmaecker, Dunning, et al., 2019; Dechêne et al., 2010).

Typically, studies on truth effect focused on exploration of the bias; for instance, the duration that enables this effect (Dechêne et al., 2010), the topics in which the effects might be induced (Reber & Schwarz, 1999), and how change in accent and rhythm of a sentence influence perceived truth (Lev-Ari & Keysar, 2010; Mcglone & Tofighbakhsh, 2000). Only recently are there studies focused on factors which might reduce the bias, for example, Fazio and colleagues (2015) studied the amount of knowledge and De keersmaecker and colleagues (2019) studied individual differences against the illusory truth effect.

Thus, this study aims to study the connection between this cognitive bias and other cognitive processes, specifically working memory and metacognitive awareness. If knowledge and analytical thinking have shown to have little effect on this bias, then maybe it is not about

analytical thinking but the depth of awareness or introspection one has. Nevertheless, this might shed light for future study into the robustness of the illusory truth effect.

This study could also be an addition to the vast literature of cognitive psychology on the truth effect as well as the dual processing theory. By mapping out the connection between the variables involved, this would allow future researchers to draw a clearer connection between interplaying biases and cognitive process involved in system 1 and 2. If certain components of system 2 would invariably influence system 1 in ways which could reduce biases, then future research could focus on the mechanisms behind the influence. At the same time, it might also reveal how far system 1 could operate unaffected by the deliberate system 2.

Another significance of this study is that it can inform how best to approach teaching the public on combating this bias. If strong working memory might be a predictor of how susceptible one is to the illusory truth effect, then it might behove future policy makers to create an education system which promotes a high working memory geared towards remembering credible sources and identifying markers of a good information. As for metacognitive awareness, promoting introspection and the reduction of rote learning would be important. Individuals can be taught to be aware of the process of learning and how one attains the knowledge.

Furthermore, this is possibly the first study of the truth effect being tested on a non-WEIRD population. A WEIRD or Western, Educated, Industrialised, Rich and Democratic population might have a different culture and thinking pattern than a non-WEIRD population. This would allow the study to examine if there were any cultural factors involved. As most conclusions of psychological studies were drawn from the West, there might be an issue of representability and generalizability (Cheon et al., 2020). It is imperative and valuable to

provide support to what seems to be a robust feature of the cognition with empirical findings from a non-Western context.

Ideally, if a sufficient working memory could allow for a better focus and longer retention of information and a sufficient metacognitive awareness to be more cognizant of the process of learning, individuals may not be easily succumb to the truth effect. Being more conscious or having the ability to remember that information encountered were true or false might be a pathway to circumvent the robust phenomenon of the truth effect. Consciously reflection on the information consumed could perhaps allow the individual to distinguish if the information encountered was learned or its merely familiarity because it was encountered before.

In other words, one should be more aware of the information attained or retrieved through appropriate strategies and not based purely on instinct and feeling. This might not be all the factors necessary to understand the bias and how the dual process theory functions, but they are vital first steps in unravelling mechanisms driving cognitive biases. Findings of this study could provide information of how our mind works in evaluating information and how we can avoid succumbing to biases.

1.7 Research Scope

The scope of this study involved the investigation of the truth effect and its relationship with working memory and metacognitive awareness. Additionally, it also investigated the role of processing fluency in the relationship amongst the study variables. The study explored how the degree of metacognitive awareness and working memory performance influenced the degree of the truth effect, and if processing fluency had a mediating effect between the truth effect and the other variables. This study was conducted in Malaysia with a proposed sample size of approximately 107.

1.8 Conceptual and Operational Definitions

All variables of interest in the current study are conceptualized and operationalized as follows.

1.8.1 Truth Effect

The truth effect was defined as an increase in perceived truth after repetition (Unkelbach et al., 2019). Truth effect was operationally defined as significantly higher truth ratings of repeated statements compared to truth ratings new statements (Dechêne et al., 2010). Truth values or judgments were rated on a 6-point Likert scale. The difference in truth ratings between New and Repeated statements was labelled as MeanDiff Truth.

1.8.2 Metacognitive Awareness

Metacognitive awareness is defined as the ability to be aware of and regulate one's cognition (Flavell, 1979; Fleming & Lau, 2014). Metacognitive awareness was operationally defined by the total scores on the Metacognitive Awareness Inventory (MAI) (Schraw & Dennison, 1994) and the Metacognitive Self-Assessment Scale (MSAS) (Faustino et al., 2019). Items in the MAI and MSAS were rated on a 5-point Likert scale. Following Martirosov & Moser (2021), metacognitive awareness scores were divided into high, medium and low groups of equal sizes for fine-grained analyses. Based on Moreau and Wiebels (2021), a composite score was also created for Metacognitive Awareness by aggregating the MAI and MSAS for further analysis of the variable.

1.8.3 Working Memory

Working memory is a multicomponent system which operates as a short-term storage and concurrent processing information (A. Baddeley, 1992). In the current study, Working Memory was operationally defined as the scores attained from the Digit Span Backward (DSB), Operation Span Task (OSpan) and Symmetry Span Task (SymSpan). In the final analyses,

working memory scores were divided into high (HWM), medium (MWM) and low (LWM), following the methods of Petten, Weckerly, McIsaac and Kutas (1997). Scores were divided by sorting the data from an ascending order. The upper limit, which represents the highest values in the dataset, is determined by identifying the maximum value(s) from the sorted dataset. These maximum values serve as the upper boundary or extent of the data distribution under consideration. Conversely, the lower limit, representing the lowest values in the dataset, is determined by identifying the minimum value(s) from the sorted dataset. These minimum values indicate the lower boundary or extent of the data distribution. The middle limit, also referred to as the central tendency, encompasses the majority of the data, excluding the extreme values represented by the upper and lower limits. High working memory is operationalized as the upper limit in scores. Mid working memory is operationalized as the second upper or middle limit in scores and low working memory would be the lowest limit in scores. A composite score of WM (Moreau and Wiebels, 2021) was created by aggregating raw working memory scores from all three measures (DSB, OSpan, and the SymSpan).

1.8.4 Processing Fluency

Processing fluency is the subjective sense of ease when an information was processed (Graf et al., 2018; Herzog & Hertwig, 2013). Processing fluency was operationally defined according to Graf and colleagues (2018), as the average rating of how Effortful, Difficulty, Clear, Fluent and Comprehensive a statement is. Fluency was rated on a 6-point Likert scale. The difference in fluency ratings for New and Repeated statements was labelled as MeanDiff Fluency or mean difference in fluency rating.

1.9 Conclusion

This research focused on the truth effect and examined how working memory and metacognitive awareness influenced this bias. Additionally, it also explored if and how processing fluency mediated the relationship between the truth effect, metacognitive awareness and working memory. The ease of which information could be accessed online also contributes to how easily false information may be consumed. Repeated exposure to information albeit false increases the likelihood of the information being believed more readily.

The objectives of the study were to explore the relationship between the interplaying factors mentioned above, with its significance deriving from the problem statements of combating bad information and how studying this phenomenon would be important in this post-truth world to create an informed society that relies on rational thinking instead of allowing ourselves to be easily swayed by bias intuition.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, each variable pertaining to the truth effect and system 2 of the dual process theory will be reviewed in terms of its definition. This chapter also discusses how the truth effect operates and its related attribute and mechanism. The chapter investigates how the dual process theory might be involved. Specifically, the study explored the possible effects of system 2, which consists of metacognitive awareness and working memory, on the truth effect. Lastly, the chapter discusses the role of processing fluency in the occurrence of the truth effect.

2.2 The Illusory Truth Effect

Although the truth effect was long being utilized since time of antiquity (Hertwig et al., 1997), it was first properly studied and identified in 1977 by (Goldstein et al., 1977). The researchers set out to investigate the basis for how judgement of truth was being made. Using frequency as the main variable, the results revealed that statements which were shown more often were judged to be truer. This confirmed the conjecture put forth in which people used frequency of statements being heard as a reference for believability.

Also, the statements used were plausible but its accuracy ambiguous. For instance, the statement “Greenland contains a population of 500,000”. It is plausible that the population is 500,000 but at the same time truth remains relatively uncertain. The truth effect was observed across a wide array of topics, ranging from sports, history, current affairs, and politics to arts, geography, social customs, and science.

Studies of the truth effect typically involve two stages. The first stage consists of displaying statements and the second stage displays some of the same earlier statements mixed in with new ones. During the second stage, the participants are required to judge how true each

statement is. Although there are differences in methodology across studies, most studies revolve around these two stages. Below are some of the experiments on the illusory truth effect.

2.2.1 (Gigerenzer, 1984) - Looking for The Truth Effect in A Non-laboratory Environment

Arguing that laboratory setting of past studies might lack the validity of a natural setting. The researcher decided to conduct the experiment in the homes of participants. Participants were randomly sampled from telephone listing, all of which were adults living in Schwabing, Munich, Germany. They were instructed to listen to 60 recorded statements. Like Hasher, Goldstein and Toppino (1977), the statements were made to be plausible but ambiguous ranging from a wide array of topics, from sports and arts to science and religion. An example of one of the topics is religion and the statements were "In the world, there are more Roman Catholics than there are Moslems" and "Shintoism is the native religion of Korea."

The statements were in audio, one group heard each statement being read in a male voice and another heard each statement recorded in a female voice. The repeated statements were presented either 1 or 2 weeks later, followed by a truth rating session consisted of a 7-point Likert scale. Despite the experiment's setting, gender of the speaker and the time interval for thinking (5 seconds to think before assigning a truth rating and 10 seconds for assigning a truth rating), repeated statements were being rated as being truer.

2.2.2 (Schwartz, 1982) – Investigate Shortened Period of Repetition and The Effect of Familiarity as a Substitute for Truth Value

Previous experiments spaced the reading of initial statements and the repeated statements weeks apart (Bacon, 1979; Gigerenzer, 1984; Hasher et al., 1977). Schwartz (1982) decided to only space them minutes apart because the short interval might facilitate better recognition, possibly reducing the tendency to misremember statements as true.

Using 64 statements, participants were instructed to read them instead of listening like Hasher, Goldstein and Toppino (1977) and Gigerenzer (1984). There were two groups. One group was instructed to rate how true the statements were, while another group was instructed to rate how likely have they encountered the statements before. This is to test the hypothesis of whether pre-experimental familiarity was used as a substitute for perceived truth. Results in the experiment have shown that the repeated or old statements were on average rated higher for truth rating and familiarity rating.

However, the mean of the truth rating was higher compared to the mean of the familiarity rating. The researchers concluded that the association between perceived truth and pre-experiment familiarity was not significant. Familiarity and the truth effect might be operating independent of one another, despite both being biased to prior exposure.

2.2.3 (Arkes et al., 1989) – Studying Opinion Statement on The Illusory Truth Effect

The study introduced opinion statements as opposed to trivia. Opinion statements were more interesting and personal to the participants compared to trivia statements, there might be more commitment to the statement and hence less susceptible to repetition. Opinion and trivia statements were mixed into the list. Each participant was to read the list of statements on the

first week before returning to rate the statements on the second week. Results suggested that regardless of the statement being trivia or opinion, repetition induced higher perceived truth.

The researchers also attempted to investigate if knowledge on a subject matter held influence on the truth effect. Participants who reported to have lower knowledge on a subject matter seem to be less susceptible to the truth effect, albeit exposed to just a single repetition. One reason the researchers posited was that low knowledge reduced familiarity and confidence, therefore reducing the perceived validity of a given subject.

2.2.4 (Hawkins & Hoch, 1992) – Level of Involvement in Responding to Advertising on The Truth Effect

Looking into the effects of advertising, the researcher used product-related claims as statements. The claim might involve health such as Vitamin C attained from Rose hip were better health wise compared to synthetic Vitamin C or as general as the largest full-service dinner restaurant in the U.S is Red Lobster. Participants rated the claims to be truer when being repeated compared to claims that were only shown once.

In the study, the researchers also added level of involvement as a variable i.e., the ability and motivation one has when responding to a marketing advert in a thoughtful way. High level of involvement conditions involved asking participants to evaluate the truthfulness of each statement on both initial and the repeated-statement stage. Low level of involvement conditions on the other hand involved asking participants to rate how comprehensible the statements were on the initial stage followed by rating the level of truth when the statements were shown the second time. The results showed that though the truth effect was significant for all conditions, a high level of involvement condition had a lower association to the truth effect compared to low level of involvement.

2.2.5 (Johar & Roggeveen, 2007) – Examining Ways to Change False Belief From Repeated Advertising

The study investigated two types of claims, direct and indirect. An example of a direct claim was “Avis offers collision insurance.” and an indirect claim was “All car rental companies offer collision damage insurance. Avis is a car rental company”. Refutations were direct in nature i.e., “Avis does not offer collision insurance”. Repeated direct statements which were confronted with refutations or aligned condition were rated lower on a 7-point scale (from 1 = definitely false to 7 = definitely true), compared to repeated indirect statements which were met with refutation or non-aligned condition, with the mean truth rating of aligned condition 4.95 and the non-aligned condition 5.23 respectively. In other words, if a counter claim and the initial direct claim was similar, then belief of the initial claim could be reduced.

In another experiment of the study, a logo was added to the claims. When direct claims with logo were followed by refutation with logo, the truth rating of the claims taken after that was higher with mean truth rating of 5.72 compared to when direct claims with logo were followed by refutation without logo 4.85. The mean score of indirect claims with logo and refutation without logo is 4.87. The researchers concluded that for a change in belief to be effective, claims and refutation should be aligned but not overly aligned. When alignment was too high, for example, the refutation with added logo condition, there will be a resistance in processing of the refutation to update the original claim.

2.2.6 (Fazio et al., 2015) – Investigating if Knowledge Held an Immunity Against the Illusory Truth Effect

The assumption of this study was if one were to have knowledge on a given fact; for example, “The Pacific Ocean is the biggest ocean on Earth”, then repeating a falsehood like “The Atlantic Ocean is the biggest ocean on Earth” will not alter the original knowledge. Participants were first tested on their knowledge. They then were given a list of statements to rate how interesting each of them was. Some of the statements were true and some were false. Immediately after, the participants were given another set of statements to judge how true each statement was.

The results revealed that although participants possessed the correct knowledge initially for example giving the correct answer “kilt” to the question “What is the name of the short-pleated skirt worn by Scots?”, they still rated the statement “A sari is the name of the short-pleated skirt worn by Scots” as being truer after repetition. The researcher reasoned that when faced with repetition participants did not rely on stored information but instead rely on the ease of processing as a cue for validity. Hence, the researcher concluded that knowledge might not protect one from the truth effect.

2.3 Truth effect and its Related Biases

The truth effect can be grouped under the rubric of related biases for example the mere exposure effect, the false fame effect and the revelation effect (Dechêne et al., 2010; Unkelbach, 2007). One of the commonalities among these effects or cognitive biases is the sense of having seen or heard before or being familiar. However, they do differ to a certain degree as described below.

2.3.1 The Mere Exposure Effect

The mere exposure effect is the tendency to align preference with familiarity (Robert B. Zajonc, 1968). In studies of the mere exposure effect, participants were usually shown neutral stimuli for example lines, nonsense words, public figures or a series of faces multiple times (between 0 to 25 times), followed by a 7-point Likert scale of how positive they felt about the stimuli (Bornstein, 1989). In one study by (Robert B. Zajonc, 1968), participants were shown foreign words printed on a card, and they were asked to pronounce each word before proceeding to the next card. Each word had varying frequency of presentation; for instance, some group will have the word “Jandara” appeared 10 times and the word “Iktita” appeared only twice and vice versa for the other group. Results suggested that words that appeared more often were judged to be more positive or of higher goodness in meaning. Subsequent experiments found similar findings showing a positive relationship between frequency of exposure to a given stimuli and high ratings of likability (Bornstein, 1989). The parallel between the mere exposure and the truth effect is that both required repetitions to elicit their inherent affective states. The mere truth effect affects likability upon repetition and the truth effect affect perceived truth upon repetition.

There was an explanation that used a different theoretical framework for the mere exposure effect (R. B. Zajonc, 2001), namely the classical conditioning paradigm, in which a conditioned response (CR) was elicited after an unconditioned stimulus (US) was repeatedly paired with a neutral stimulus (NS). For instance, food (US) cause salivation (UR) in dogs. So, if a bell (NS) was being rung repeatedly with food (US) presented, the dog would come to associate the bell with food. In this instance, the bell has become a conditioned stimulus (CS) which would elicit a conditioned response (CR), salivation from the dog. Figure 2.1 depicts the process of classical conditioning: