Towards a More Honest World: An Integrated Empirical Study to Elucidate the Effects of Environmental Factors on Dishonest Behaviors

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Towards a More Honest World: An Integrated Empirical Study to Elucidate the Effects of Environmental Factors on Dishonest Behaviors

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Chapter 1 *Introduction*

In all situations with human presence, dishonesty seems inevitable. As defined in authoritative dictionaries, “dishonesty” signifies “the reverse of honesty; lack of probity or integrity; disposition to deceive, defraud, or steal; thievishness; theft, fraud. Also, a dishonest or fraudulent act” (Oxford English Dictionary, n.d.). This concept has been intertwined with the development of human society, manifesting in various forms from massive financial fraud to minor childhood mischief. Few people can claim they have never engaged in any form of dishonesty throughout their lives. Dishonesty has dual facets; on one hand, it can lead to adverse consequences. On the other hand, it offers the ability to circumvent challenges, aiding us in certain situations. This dichotomy provokes mixed feelings: people appreciate its utility yet resent its potential for harm. People have always shown a keen interest in this complex and intriguing phenomenon.

1.1 Dishonesty in philosophy and ethics: unethical and immoral

Dishonesty is commonly linked to “unethical” and “immoral” behavior. In philosophy and ethics, morality and ethics have long been central themes. Morality and ethics serve as fundamental and central guides for individuals, particularly in community life. While “moral” and “ethical” are closely related, subtle distinctions exist in their definitions.

According to the explanation provided by the Oxford English Dictionary (n.d.), “ethics” is defined as “Moral principles, or a system of these.” It is further explained as “The codes of conduct or moral principles recognized in a particular profession, sphere of activity, relationship, or other context or aspect of human life.” The definitions also suggest the inherent connection between ethics and morality. However, ethics primarily emphasizes a framework proposed by one or several individuals or philosophical schools, namely, considering good and bad from an objective perspective. For instance, the “right” connected to motives emphasized by the deontological theories; the “good” of outcomes generated by actions emphasized by the consequentialist theories (Meyers, 2018); or the Confucian ethics, centering on “how to become good (i.e., benevolence, righteousness, manners, wisdom, honest),” in contrast to Western ethics which concentrate on defining what good is (Zhu, 2020).

On the other hand, in the Oxford English Dictionary (n.d.), “morality” is defined as “The quality or fact of being morally right or wrong; the goodness or badness of an action.” It places greater emphasis on a subjective assessment of whether an individual’s behavior aligns with established

criteria (i.e., ethics). An individual's sense of morality is collectively shaped by numerous psychological factors, such as personality, social cognition, emotional intelligence, metaphysical convictions, and value orientations (Gray et al., 2012; Li, 2023; Varghese, 2014; Walker & Frimer, 2007). Morality preference facilitates the exhibition of prosocial behavior in individuals (Capraro & Rand, 2018). Thus, cultivating and upholding robust morality is important when pursuing societal progress.

As mentioned above, there exists a nuanced distinction between ethics and morality. However, in fields other than philosophy and ethics, such as sociology and psychology, the distinction between ethical behavior and moral behavior seems not as clearly defined as it is in philosophy or ethics studies, given that these two forms of behavior are indistinguishable while being observed. Thus, the terms are commonly used interchangeably. For instance, "moral behavior" (e.g., Hertz & Krettenauer, 2016) and "ethical behavior" (e.g., Deshpande et al., 2006; Mesmer-Magnus et al., 2010) are both commonly understood as actions that align with societal norms. In general, individuals predominantly exhibit such moral and ethical behavior (Zak, 2006). However, deviations from ethics and morality typically occur when individual gains supersede ethical conduct. Dishonesty is a prominent example.

Without ethics and philosophy, there would be no concept of immorality or unethical behavior such as dishonesty. Philosophy and ethics establish a foundation for understanding dishonesty, prompting initial thoughts and interest in it.

1.2 Dishonesty in economics and criminology: fraud

Beyond philosophy and ethics, the fields related to dishonest behavior include economics and criminology. Unlike philosophy and ethics, which provide the foundational understanding of dishonesty, economics and criminology focus on its practical manifestations in real life, fraud. Fraud is defined by the Oxford Dictionary as "the using of false representations to obtain an unjust advantage or to injure the rights or interests of another", typically appears in economic-related crimes (i.e., financial fraud).

Financial fraud is a global phenomenon. In terms of range, financial fraud spans from individual financial fraud (e.g., Hagen & Malisa, 2022) to accounting fraud, occupational fraud (Association of Certified Fraud Examiners, 2022; Lisic et al., 2015; Tutino & Merlo, 2019) within corporations. In terms of form, financial fraud spans various types, including consumer products fraud, prize and lottery fraud, charity fraud, relationship fraud, investment fraud, food fraud, and more (DeLiema, Deevy, et al., 2020; Deliema, Shadel, et al., 2020; Griffiths, 2010; Hagen & Malisa, 2022; Gwenzi et al., 2023; Spink & Moyer, 2011; Xiao et al., 2022). Financial fraud leads to substantial financial damages to nations and governments, as well as psychological and physical harm to individuals. For instance, occupational fraud, which is broadly divided into corruption, asset misappropriation, and financial statement fraud, has been reported to cause considerable financial damage. A comprehensive analysis of 2,110 cases across 133 countries, spanning from January 2020 to September 2021, revealed an average loss of $1.78 million per incident, cumulating in a total

reported loss exceeding $3.6 billion (Association of Certified Fraud Examiners, 2022). The same report showed that the average organization loses 5% of its annual revenue to fraud; accordingly, global losses are estimated to surpass $4.7 trillion annually. Individual financial fraud has equally concerning consequences. According to a report by the Federal Trade Commission (2024), consumers reported losses exceeding $10 billion to various forms of fraud in 2023, with investment scams alone accounting for more than $4.6 billion—making it the category with the highest reported losses that year. On the other hand, food fraud, which involves illegal profit-making through adulteration, dilution, misrepresentation, and label substitution, presents health risks to consumers and has led to widespread public outrage (Gwenzi et al., 2023; Spink et al., 2017). Notable cases include the scandal of melamine-contaminated powdered formula in China (Guan et al., 2009; Tyan et al., 2009; Wen et al., 2016), the horse meat scandal in Europe (Agnoli et al., 2016; O'mahony, 2013), and the red yeast rice pills event of Kobayashi Pharma in Japan (Kajimoto, 2024; Katsumura, 2024). Although these discussions merely touch the surface of financial fraud, they sufficiently demonstrate the severity and pervasiveness of this issue.

Due to the substantial negative impact of fraud, economists and criminologists have invested considerable effort in its detection. They have developed numerous detection techniques, from data mining methods (Ngai et al., 2011), analysis of vocal, linguistic, and financial cues (Throckmorton et al., 2015) to applying fraud triangle risk factors (Huang et al., 2017; Sánchez-Aguayo et al., 2021), social media crowdsourcing (Matti et al., 2014), and convolutional neural networks (Fu et al., 2016).

Despite some of these studies reporting positive results, fraud remains a prevalent issue. The latest report by the Association of Certified Fraud Examiners (2024) indicates that between January 2022 and September 2023, organizations continued to lose 5% of their annual revenue to fraud, the same as reported previously (Association of Certified Fraud Examiners, 2022). Despite the development of numerous detection techniques, the severity of fraud remains unchanged. This raises questions about whether these effective methods are not being adequately implemented, or if these methods are not effective as expected. Regardless, the exploration of fraud within economics and criminology continues to be an enduring journey.

Moreover, it seems that the primary focus in economics and criminology has been on the detection and mitigating of losses after the occurrence of fraud. In contrast, psychology focuses on understanding the foundation of fraud, namely dishonesty, and reducing its occurrence.

1.3 Dishonesty in psychology: cheating, lies, and deception

Dishonesty has long been a key focus in psychology, with contributions from various fields aimed at better understanding and reducing such behaviors (Liu et al., 2020). While some of these studies describe such behaviors by using words such as “lie”, “cheating”, or “deception,” the essence is dishonesty (e.g., Niiya et al., 2008; Rigdon & D’Esterre, 2015; Rotman et al., 2018; van ’t Veer et al., 2014).

1.3.1 Self-serving dishonesty

Dishonesty means deceiving others. Thus, it is widely studied in the field of social psychology. The most broadly studied theme is probably the effect of individuals (the deceiver, the deceived, the observer, etc.) on the occurrence of dishonesty. Köbis et al. (2019) found that the presence of observers reduces dishonest behavior. Kocher et al. (2018) presented experimental evidence indicating that dishonesty shifts in group settings compared to individual settings. Previously, Pascual-Ezama et al. (2015) reported a similar concept named “Peer effects,” which means that the presence of varied identities (e.g., in-group or out-group identity) differentially influences (increases or decreases) the occurrence of dishonest behavior. This phenomenon may be caused by changes in the perceived risk of detection, the saliency of ethicality, and social norms (for further details, see Gino et al. (2009)). Additionally, other research explored the connection between dishonest behaviors and other social behaviors, such as charitable behavior (Cojoc & Stoian, 2014), and trust (Bocian et

al., 2016).

In contrast, personality psychology primarily focuses on the personality traits linked to dishonesty. Gino and Ariely (2012) found that more creative individuals tend to be more dishonest, highlighting a link between creativity and dishonesty. It was also found that the "honesty-humility" trait within the HEXACO Model of personality (Ashton & Lee, 2007) explained individual variations in dishonest behavior (Hilbig & Zettler, 2015; Heck et al., 2018; Kleinlogel et al., 2018; Schild et al., 2020). Likewise, Masood and Mazahir (2015) reported that extraversion, conscientiousness, openness to experience, and lower levels of self-control were significant predictors of dishonest behavior. Additionally, numerous studies focused on exploring the relationship between personality traits and dishonest behavior (e.g., Avelino et al., 2017; Brunell et al., 2011; Day et al., 2011; Giluk & Postlethwaite, 2015; Karim et al., 2009; Markowitz & Levine, 2021; Nathanson et al., 2006; Peled et al., 2019; Roeser et al., 2016; Williams et al., 2010). More recently, a multilevel meta-analysis of 50 studies conducted by Plessen et al. (2020) showed that dishonesty positively correlates with dark traits, while it shows negative correlations with openness, conscientiousness, agreeableness, and the previously mentioned honesty-humility. Accordingly, personality psychology aims at predicting, detecting, and preventing dishonest behaviors through an understanding of personality.

Research in physiological psychology has primarily focused on studying the physiological responses related to dishonest behavior. Some of these studies focused on external responses that were conveniently measurable, including galvanic skin response and skin potential response

(Thackray & Orne, 1968), facial perspiration (Dcosta et al., 2015), periorbital region's thermal variations (Rajoub & Zwiggelaar, 2014; Tsiamyrtzis et al., 2007), nodding, foot, leg, hand movements (Sporer & Schwandt, 2007), and facial expressions (Granhag & Strömwall, 2002). Other studies explored deeper physiological indicators, such as brain activity (e.g., Kozel et al., 2004; Langleben et al., 2002; Phan et al., 2005; Spence et al., 2001; Spence et al., 2004; Priori et al., 2008; Zheltyakova et al., 2022) and hormones (Lee et al., 2015). These studies have either advanced polygraph technology and fostered interdisciplinary partnerships with fields like criminology and justice, or they have laid the groundwork for the physiological and neuroscientific understanding of dishonest behavior. In addition to the immediate physiological responses associated with dishonest behavior, physiological psychology also explored the delayed physiological impacts of dishonest behavior. For instance, Brinke et al. (2015) suggested that dishonest behavior could have detrimental health effects over time. Moreover, physiological psychology also investigated how physiological factors affected the occurrence of dishonest behavior. Wibral et al. (2012) found that administering testosterone significantly reduced lying in men. Physiological psychology integrates psychology, physiology, and neuroscience. This interdisciplinary approach has enhanced the objectivity and comprehensiveness of psychology's insights into dishonest behavior.

While the majority of the studies mentioned above concentrated on dishonesty for financial gain, educational psychology devoted more attention to a different form of dishonesty, academic dishonesty. Academic dishonesty is a pervasive phenomenon observed globally, spanning all

educational levels from primary schools to graduate schools, and was perceived to be on the rise (Chapman & Lupton, 2004; Gynnild & Gotschalk, 2008; Johnson, 2013; Wajda-Johnston et al., 2001; Wideman, 2008). Although academic dishonesty may not cause immediate financial damages, it still leads to considerable issues of injustice and losses (e.g., damage to the school's reputation) and is associated with potential dishonesty in other settings (Carpenter et al., 2004; Lovett-Hooper et al., 2007; Nonis & Swift, 2001; Sims, 1993). Educational psychology primarily investigated factors influencing academic dishonesty, including gender (e.g., Athanasou & Olasehinde, 2002; Lin & Wen, 2007; Niiya et al., 2008; Whitley et al., 1999), educational stage (Kirkland, 2009), and academic discipline (e.g., Chapman et al., 2004; Iyer & Eastman, 2006; Krueger, 2014; Lambert & Hogan, 2004; McCabe et al., 2006; Morris & Kilian, 2007). Perceptions of academic dishonesty among students and faculty were also considered an interesting and meaningful investigation (e.g., Gilbert et al., 2011; Koljatic & Silva, 2002; Nazir & Aslam, 2010; Pe Symaco & Marcelo, 2003; Smyth & Davis, 2004). Other research explored strategies that enable teachers to detect and reduce academic dishonesty (Broeckelman-Post, 2008; Faucher & Caves, 2009). This theme sometimes extends across other psychological fields; for example, some personality psychology studies aimed to identify personality factors that affect academic dishonesty (de Bruin & Rudnick, 2007; Giluk & Postlethwaite, 2015). Educational psychology focuses on understanding and reducing dishonest behavior within academic environments. Minimizing academic dishonesty is essential, as it not only shapes students' attitudes and practices regarding dishonest behavior but also continues to influence their behavior

upon entering society after graduation.

All the dishonest behaviors mentioned above, as a form of antisocial behavior, undeniably have negative impacts. However, this kind of behavior represents just one aspect of dishonesty. In psychology, dishonesty is more complex and multifaceted.

1.3.2 Altruistic dishonesty

The definition of dishonesty introduced at the beginning of this dissertation was characterized by an exclusively negative connotation. However, within the field of psychology, dishonest behavior not only results in victimizing others but also encompasses aspects that can be perceived positively. There exists a kind of dishonesty that potentially benefits others and may even sometimes require the liar to sacrifice their own interests, known as altruistic dishonesty.

Altruistic dishonesty represents the intersection between altruistic behavior and dishonesty. Individuals frequently encounter moral dilemmas when faced with decisions of dishonest behavior, weighing the benefits derived from dishonesty against preserving their positive self-image through honesty (Gino, Ayal et al., 2013; Mead et al., 2009). When the interests of others are incorporated into this consideration, they disrupt the original balance, creating a new moral dilemma. Altruistic dishonesty can be classified into three types, depending on the gains of the liar. The first type is the altruistic dishonesty benefiting both the liar and others. The second type results in personal loss for the liar but gains for others. The third type is dishonesty solely increasing benefits for others, without

affecting the gains or losses of the liar. Gino, Ayal et al. (2013) found that, compared to situations that only increase benefits for others (i.e., the third type), individuals tended to be more dishonest when the lies benefited both themselves and others (i.e., the first type). Gino and Pierce (2009) reported the examples of individuals sacrificing their own interests to benefit others (i.e., the second type). Altruistic dishonesty, particularly when the liar benefits concurrently with others, occurs more frequently than self-serving dishonesty. As this form of dishonesty is often perceived as more ethically acceptable, despite the inherent immorality of dishonesty (Gino, Ayal et al., 2013).

Beyond the laboratory settings, altruistic dishonesty also frequently occurs in daily life, commonly referred to as the "white lie" (Argo & Shiv, 2012). Unlike altruistic dishonesty observed in laboratory settings, the motivation behind altruistic dishonesty in real life is more frequently linked to emotional objectives than to financial gain. For instance, healthcare professionals who lie to patients and parents who lie to their disabled children serve as prominent examples (Ryan et al., 1995).

Altruistic dishonesty, as an interesting theme in psychology, broadens our understanding of dishonest behavior through various perspectives. However, self-serving dishonesty, theoretically, is more typical, and causes a more substantial negative impact in daily life. Consequently, the majority of research, including this study, focuses on self-serving dishonesty.

1.3.3 Various theories related to dishonesty

The widespread prevalence of dishonesty in daily life is undeniable. To effectively prevent dishonesty,

it is essential to have a deep understanding of its internal mechanisms (Mazar et al., 2008a). Through years of studies, psychologists have begun to investigate the mechanisms of dishonesty and develop various theories. Although these theories were detailed in publications such as Jacobsen et al. (2018), this section will present a summary to enhance understanding of dishonesty and establish a theoretical foundation for this study.

Expected Utility Theory (EU), a foundational and widely accepted framework within economics, was considered a rational approach in decision-making under risk (Bell, 1995). Becker (1968) suggested that this theory could explain criminal and dishonest behaviors, introducing one of the most influential theories on norm-violating actions, which posited that the decision to engage in dishonest behavior was the result of weighing potential benefits against associated risks (Jacobsen et al., 2018; Thielmann & Hilbig, 2018). Drawing from this theory, diminishing the benefits of dishonest behavior, increasing the probability of its detection, or strengthening the penalties for such behavior should be effective strategies to reduce dishonesty (Mazar et al., 2008b).

Self-Concept Maintenance Theory (SCM) is derived from the concept of self-concept (Mercer, 2012), which means how individuals perceive themselves (Mazar et al., 2008b). Mazar et al. propose that individuals establish internal benchmarks based on social norms and other criteria, and use these benchmarks to evaluate their behavior. The self-concept is updated based on these evaluations: positive updates, resulting from behavior that meets the benchmarks, are gratifying, while negative updates, resulting from behavior that contravenes the benchmarks, are distressing. The SCM Theory

also suggests that there exists an acceptable threshold for dishonesty. Slight dishonest behaviors can circumvent the updating, thereby people can maintain a consistently positive self-concept. The SCM Theory helps explain findings from some studies showing that participants do not maximize their deceitful gains, even when their dishonesty cannot be detected (e.g., Guo et al., 2020; Liu & Yamada, 2024). The possible explanation is serious dishonesty exceeds the acceptable threshold for most individuals, potentially disrupting their ability to maintain a positive self-concept. The SCM Theory, highlighting a gap in the EU Theory, suggests that when facing the ethical dilemma of dishonest decision-making, individuals also consider internal rewards, not just external ones such as financial benefits.

Such internal rewards may also relate to Festinger's (1957) Cognitive Dissonance Theory (CD), which suggested that conflicting cognitions can cause psychological stress and anxiety. CD Theory has led to widespread discussions within psychology and has developed considerably over time (Harmon-Jones & Mills, 2019). This dissertation will not provide an in-depth review of the theory's evolution or associated research; instead, it will focus on applying the framework to explain the mechanisms underlying dishonest behavior. CD Theory suggested that individuals, after experiencing dissonance between their cognitions, tended to take action to reduce or eliminate this dissonance. For instance, a habitual smoker may experience discomfort when acknowledging the health risks associated with smoking. This discomfort stems from the contradiction between the habit of smoking and the cognition of its detrimental health effects. To reduce this discomfort, the

individual might change their behavior to resolve the contradiction, such as by quitting smoking or denying the serious health risks associated with smoking. Similarly, when individuals reject dishonest behavior, they possibly aim to avoid the dissonance caused by the contradiction between dishonest actions and maintaining a positive self-concept. This discussion seems to extend CD Theory by including proactive strategies for avoiding potential dissonance, while the original CD Theory focuses on how dissonance forms and how individuals respond to it after it occurs. This extension aligns with EU Theory mentioned above, suggesting that the possibility of dissonance could be considered a kind of risk, and individuals may make decisions to avoid this risk.

Beyond simply abandoning dishonest behavior, several strategies enable individuals to engage in dishonest behavior while reducing the likelihood of facing negative consequences, such as dissonance. Moral Disengagement Theory (MD) suggests that individuals employ a variety of mechanisms to rationalize dishonest behavior, thereby reducing psychological stress and anxiety (Bandura, 1991, 2002; Bandura et al., 1996; Boardley & Kavussanu, 2011). These mechanisms include moral justification, which allows individuals to convince themselves that dishonest behavior serves a righteous cause. Euphemistic labeling means naming dishonesty with less objectionable terms to soften the negative perception of dishonesty. Advantageous comparison contrasts dishonesty with more egregious ones to make it seem acceptable. Furthermore, this theory highlights the roles of displacement and diffusion of responsibility. Displacement of responsibility means individuals can attribute their actions to the influence of authority figures or external pressures, and diffusion of

responsibility occurs when the responsibility of dishonesty is shared among multiple people. Dehumanization, which means divesting victims of their human qualities, is particularly noted in situations involving severe moral transgressions more than dishonesty. Deceiving a stray cat by falsely promising food is perceived as a lesser moral violation than deceiving people. This may also explain why, in a fraud known as the "pig-butchering scam," the perpetrator names the victim as a "pig" (Wang, 2024). The final mechanism is attribution of blame, which imputes the blame to antagonists or environmental circumstances. These mechanisms could promote dishonest behavior by allowing individuals to avoid the dissonance that potentially arises from dishonesty.

Cognitive psychology offers a distinct perspective on dishonesty. In numerous cognitive psychological studies, dishonesty has been considered to be related to cognitive resources (CR). For example, it is reported that self-control resource depletion leads to lying (Mead et al., 2009; Gino et al., 2011). Similarly, Wu et al. (2019) reported that ego depletion increased material-based lies. These findings support the "Will hypothesis," which states that people are selfish and dishonest by default, and cognitive control is required to resist the temptation of lies (Greene & Paxton, 2009; Speer et al., 2020). By contrast, the "Grace hypothesis" suggests that people, by default, are honest and require cognitive control to allow themselves to lie (Speer et al., 2020). The Grace hypothesis is also supported by various studies, which suggest that lies require more cognitive resources. Van't Veer et al. (2014) reported that participants with low cognitive load lied more to receive more rewards. Similarly, a meta-analysis of 21 studies found that the response times (RTs) for lies were consistently

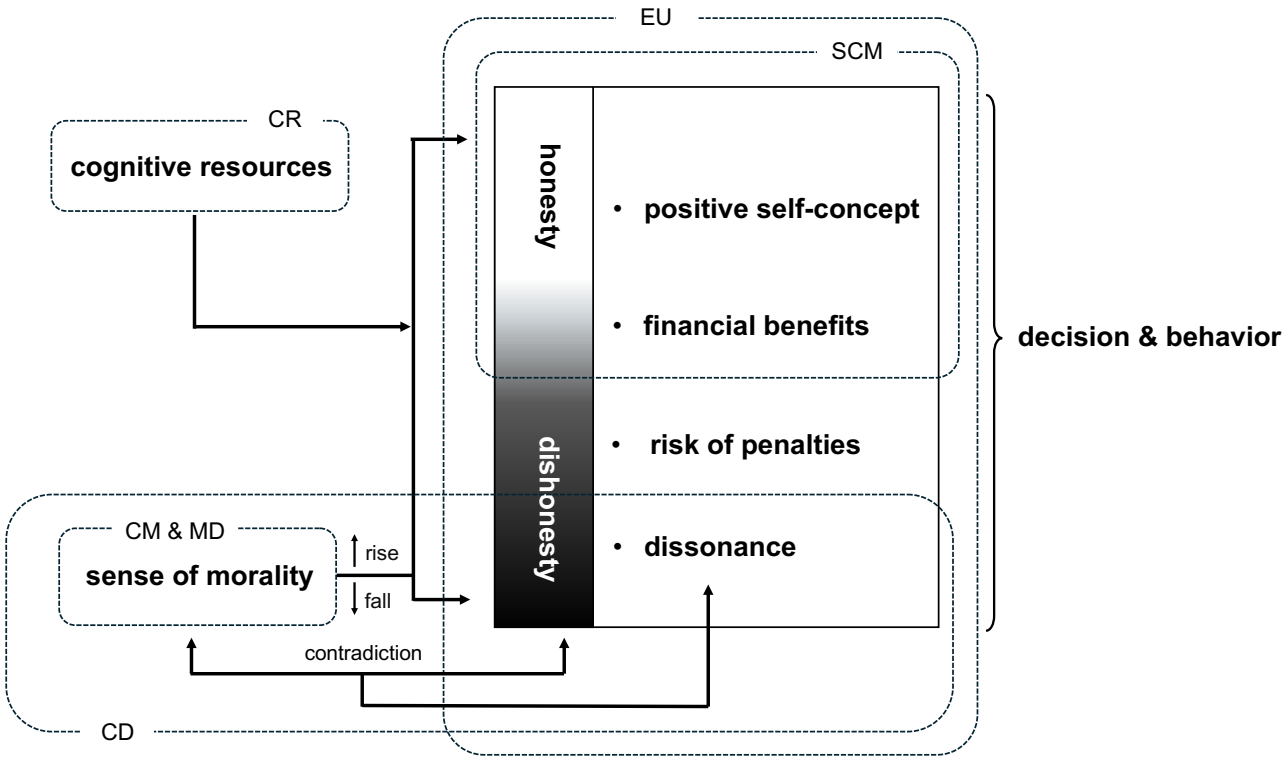
longer than those for telling the truth, showing that lies typically require more cognitive effort than honesty (Verschuere et al., 2018). Thus, the discussion on cognitive resources and dishonesty consistently revolves around two contrasting hypotheses: the "Grace hypothesis" and the "Will hypothesis." Recently, Speer et al. (2020) proposed an explanation aimed at reconciling the two conflicting perspectives. They suggested that cognitive control was not needed to be honest or lie but to help people overcome moral default. In other words, cognitive control could help ethical people lie, and it could also help unethical people become honest (Speer et al., 2022).

Another perspective on dishonesty in cognitive psychology was provided by the Conceptual Metaphor Theory (CM; Lakoff & Johnson, 1980). CM Theory defines a conceptual metaphor as "understanding one domain of experience that is typically abstract in terms of another that is typically concrete" (Kövecses, 2017). Beyond assisting in comprehending and expressing emotions, previous research findings suggested that metaphors could influence human behavior and decisions. Specifically, it was found that there is an inherent cognitive link between the black–white metaphor and morality (e.g., Sherman & Clore, 2009). However, further study is needed to explore whether metaphorical factors influence dishonest behavior.

As discussed above, these theories may be interconnected (e.g., EU and SCM) or opposite (e.g., the Grace hypothesis and the Will hypothesis). Figure 1.1 shows the decision-making process regarding dishonest behavior and the involvement of these theories. On the left side, internal personal factors essential for dishonest behavior are presented, including CR and the sense of morality. Both

CM and MD are considered to be related to shifts in the sense of morality. Previous studies have reported that CM influences one's self-perception of morality (e.g., Uebayashi et al., 2016), while the mechanisms in MD lead to moral disengagement. A reduction in moral self-perceptions (or moral disengagement) suggests an increased likelihood of dishonest behaviors occurring. The right side of the figure shows individuals evaluating the advantages and disadvantages of dishonest behavior, a process proposed by EU Theory. The gradient-colored rectangle symbolizes the transition from honesty (represented in white) to dishonesty (represented in black). The right-hand side of the rectangle represents the potential consequences associated with honesty and dishonesty. Honest behavior allows the individual to maintain a positive self-concept, aligning with the SCM Theory. The grey area between dishonesty and honesty shows SCM's acceptable band for dishonesty, where individuals can maintain a positive self-concept while also obtaining financial benefits through dishonesty. In addition to financial benefits, dishonest behavior is also related to risks of penalties and cognitive dissonance. This cognitive dissonance is caused by the contradiction between unethical behavior (dishonesty) and the individual's inherent sense of morality, as described by the CD Theory. Collectively, these theories constitute the framework for the current understanding of dishonest behavior.

Figure 1.1 Involvement of different theories in the process of dishonest behavior



Note. In this figure, dashed boxes indicate the specific portions of the dishonest behavior process that correspond to each theory.

1.3.4 Paradigms for dishonesty-detection

The above theories provide a robust foundation for studying dishonest behavior. However, empirical research in psychology still faces considerable challenges. Conducting such experimental studies often requires inducing participants to commit dishonest behavior, which can cause psychological burden and mental strain. For instance, if studies on academic dishonesty were to be conducted in secondary schools, they could cause substantial distress among students. This may raise serious potential ethical issues. Moreover, the financial costs of these studies often exceed those of other

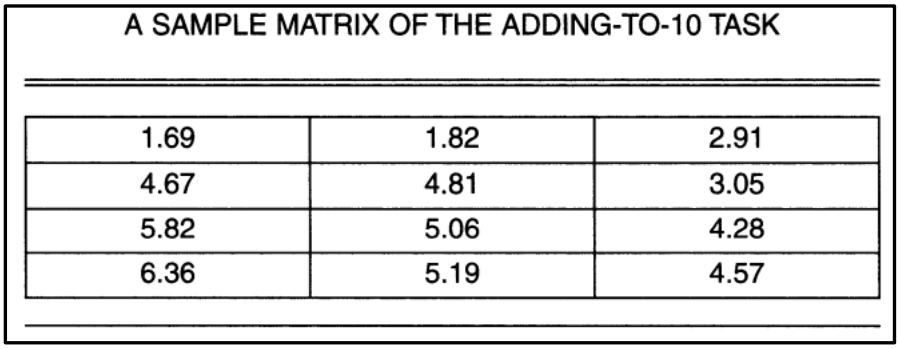
types of psychological research, because a sufficiently strong incentive is required to motivate participants to commit dishonest behavior. Accordingly, experimental psychological research on dishonest behavior frequently faces additional ethical and financial challenges. Psychological researchers have pursued strategies to effectively address these issues. Currently, “dishonesty to obtain money” is often highlighted as a prominent example of dishonest behavior and selected as the subject of study. Since this kind of dishonest behavior is less harmful, its negative consequences can be controlled by experimenters. Furthermore, monetary costs can also be controlled by experimenters. Experienced experimenters can evoke a sufficiently strong motivation for dishonesty while keeping costs within an acceptable range. Until now, several experimental paradigms have been developed for studying “dishonesty to obtain money,” each with distinct strengths and limitations.

Liu et al. (2020) have summarized and categorized various paradigms by how they detect dishonest behavior, such as confederate reports and probability analyses. Similarly, Jacobsen et al. (2018) have summarized the paradigms based on the nature of the dishonesty being investigated, including paradigms that detect dishonesty at the individual level and those that compare levels of dishonesty across different conditions. These studies effectively summarized the characteristics of each paradigm and categorized the paradigms appropriately. However, it was not considered in these studies that minor adjustments to the paradigm could produce a series of tasks with distinct characteristics. For instance, subtle modifications to the same paradigm can enable it to achieve two purposes: detecting dishonesty at the individual level and comparing dishonest behaviors between the

conditions (e.g., Guo et al. (2020) vs. Liu et al. (2020)). It seems that separate paradigms for detection tasks exist, yet they share the same foundational paradigm. Hence, the categorization, while useful, may also present certain limitations. This dissertation, therefore, does not reiterate existing classifications but aims to provide a concrete understanding of the current tasks in experimental psychology by detailing several mainstream paradigms.

One of the most prevalent paradigms for dishonesty detection is the Matrix task, introduced by Mazar et al. (2008b) (e.g., Gino et al., 2009; Gino, Krupka et al., 2013; Grolleau et al., 2016; Mead et al., 2009; Rotman et al., 2018; Shu & Gino, 2012; Verschuere et al., 2018). Figure 1.2 shows a sample matrix of this task. In the task, participants are presented with a 3*4 matrix including a unique pair of three-digit numbers that sum to ten. The participants are asked to identify this pair to solve the matrix, and to solve as many matrices as possible within a set time limit. The number of matrices solved represents the participant's score, with a higher count resulting in increased rewards. In Mazar et al. (2008b), participants were randomly allocated to the control group or the cheating-possible group. In the control group, the experimenters checked the number of successfully solved matrices, precluding any opportunity for cheating. In contrast, participants in the cheating-possible group self-reported their scores, presenting the potential for dishonestly reporting to receive additional rewards. The scores from the control group provide a baseline for comparing the scores of the cheating-possible group. If the analysis results show significantly higher scores in the cheating-possible group than those in the control group, it suggests the occurrence of dishonest behavior.

Figure 1.2 A sample matrix of Matrix task



A SAMPLE MATRIX OF THE ADDING-TO-10 TASK

1.69	1.82	2.91
4.67	4.81	3.05
5.82	5.06	4.28
6.36	5.19	4.57

Note. Participants are asked to identify a pair of these twelve numbers that collectively sum to ten. In this figure, the correct answer consisted of the number 4.81 located in the second column of the second row, coupled with the number 5.19 found in the second column of the fourth row. From "The dishonesty of honest people: A theory of self-concept maintenance," by N. Mazar, O. Amir, and D. Ariely, 2008, *Journal of Marketing Research, 45*(6), p. 635 (https://doi.org/10.1509/jmkr.45.6.633). Copyright 2008 by the American Marketing Association.

This also lays the groundwork for developing a kind of dishonesty-detection paradigm, which creates an artificial baseline representing honesty. When indicators significantly exceed this baseline, it is considered that dishonest behavior occurs. This paradigm has also been extended to other dishonesty-detection tasks. For instance, Vohs and Schooler (2008) provided participants with a series of challenging yet solvable problems (Schmeichel et al., 2003). In the control group, participants were asked to answer the problems and were subsequently checked by the experimenter. Conversely, participants in the cheating-possible group were asked to self-assess and obtain the rewards by

themselves after the experimenter left. Additionally, the experimenter claimed that she did not have permission to keep the answer sheets, and instructed the participants to shred them after receiving the rewards. This ensured that participants could cheat without risk of detection. The amount of rewards was analyzed as an indicator of dishonesty. This task is similar to the Matrix task, differing primarily in the type of questions presented to participants. However, both tasks exhibit inherent limitations: the Matrix task is susceptible to computational errors, while the task by Vohs and Schooler (2008) cannot control the potential disparities in participants' prior knowledge of the questions.

Subsequent research has refined the Matrix task by incorporating unsolvable matrices; these do not contain any pairs of numbers that sum to ten (Kouchaki & Smith, 2014; Nicholls et al., 2020; Roeser et al., 2016; Wiltermuth, 2011). For instance, out of twenty provided matrices, only thirteen are solvable, while seven are not. Participants were asked to answer whether they solved each matrix. A participant is deemed dishonest when reporting that unsolvable matrices are solved. This adjustment appears logical, yet it has a critical oversight. Specifically, even if participants report they solve a solvable matrix, they might not be honest. Consequently, some participants may misreport in solvable matrices and this task lacks the capability to detect dishonesty within the solvable matrices, resulting in skewed indicators of dishonest behavior. However, this task can be used in neuroscientific research without any limitation, because these studies focus on variations in physiological indicators when dishonest behavior occurs, rather than on alterations in behavioral indicators (Speer et al., 2020).

The Matrix task has been further refined to detect dishonest behavior at the individual level

(Gino et al., 2011; Gino & Mogilner, 2014; Kanat-Maymon et al., 2015; Pettit et al., 2016; Rigdon & D'Esterre, 2015; Shu & Gino, 2012; Wu et al., 2017; Zhong et al., 2010). In the modified task, participants are placed in an anonymous setting. Participants believe that their true scores cannot be matched with their reported scores because the question sheets are submitted separately from the answer sheets. However, experimenters could match the two sheets using methods imperceptible to the participants, such as code words written with invisible ink or special markings invisible to participants. Dishonesty is identified when the reported score exceeds the true score. However, this approach also has a considerable drawback: its effectiveness depends on the participants' trust in the anonymity of the environment. In other words, since both the question and answer sheets are collected ultimately, participants may stop dishonest behavior to avoid the risk of exposure.

Another widely used paradigm utilizes probabilities as a moral baseline; for instance, the probability of each face of a die appearing is 1/6, and the likelihood of a coin showing heads or tails is 1/2. This type of task was first presented by Fischbacher and Föllmi-Heusi in 2007 and was further developed by Fischbacher and Föllmi-Heusi (2013) into a paradigm. Since then, it has been widely used and referenced in numerous subsequent studies; the two most prevalent forms utilize either a die roll (e.g., Arbel et al., 2014; Banerjee et al., 2018; Bašić & Quercia, 2022; Clot et al., 2014; Shalvi et al., 2012) or a coin toss (e.g., Abeler et al., 2014; Amir et al., 2016; Aydogan et al., 2017; Bryan et al., 2013; Bucciol & Piovesan, 2011; Cohn et al., 2014; Guo et al., 2020). Additional examples are comprehensively summarized in the meta study conducted by Abeler et al. (2019). In contrast to the

Matrix task, this paradigm employs a large dataset to ensure that, without dishonesty, behavioral indicators converge toward the expected probabilities. For instance, when a coin is flipped a sufficiently large number of times, the expected probability of reporting heads or tails should be equal, at 50 percent each. However, if participants are informed that they will receive rewards only when they report heads and are provided with the opportunity to misreport, the frequency of reported heads is likely to significantly increase. Similarly, in dice-based tasks, rewards can be linked to specific outcomes (e.g., only rolling a "six" earns a reward). Additionally, the amount of reward from dice rolls could correspond to the number rolled (e.g., one dollar for each pip). Researchers can customize the details of these tasks to align with their specific goals. In these tasks, if the indicators significantly exceed the expected probabilities, it can be concluded that dishonest behavior has occurred. This paradigm is also used to evaluate differences in dishonest behavior across different conditions. The advantage of this paradigm is its simplicity, utilizing commonplace items such as dice and coins. Schild et al. (2021) also reported the external validity of the coin toss task. However, a drawback is that aligning reported outcomes with expected probabilities often necessitates an extensive dataset, requiring a large sample size. When the dataset is limited, due to the insufficient number of coin tosses, extreme values are more likely to occur, which may be erroneously perceived as signs of dishonest behavior. This paradigm has also been further developed into tasks that can detect dishonest behavior at the individual level (Kocher et al., 2018; Köbis et al., 2019). In this revised task, participants do not roll an actual die; instead, they roll a virtual die or view a video of a randomly

selected die roll. Participants report their scores via computer, which records the actual outcome. This allows for later verification of discrepancies between reported and recorded outcomes to determine dishonest behavior.

Furthermore, Liu et al. (2020) refined this paradigm to enable the detection of dishonest behavior at the individual level without the use of computers. Liu et al. chose remotely readable dice (Mental Dice, Marc-Antoine, Figure 1.3) instead of normal dice. These dice allow experimenters to know the dice-roll outcomes even while being in a different room. To the participants, these dice appear indistinguishable from ordinary dice, thereby not influencing their perception of exposure risk.

Figure 1.3 Mental Dice, numbers on the dice correspond to numbers on the remote controller

In addition to these two commonly employed paradigms, there are others that are utilized less

frequently, such as Mind games (Kajackaite & Gneezy, 2017), Sender–receiver games (Gneezy, 2005; Jacobsen et al., 2018; Rosenbaum et al., 2014), Visual perception task (Gino & Ariely, 2012; Gino et al., 2010), and Cheating task with a confederate (Niiya et al., 2008). These tasks are designed with particular purposes, each with its own strengths, making them suited to specific situations. They have been summarized in several review papers (e.g., Jacobsen et al., 2018; Rosenbaum et al., 2014). Table 1.1 provides details about these tasks, including the name of each task, methods for detecting dishonest behavior, definitions of dishonest behavior within the tasks, characteristics and shortcomings of the tasks, representative studies using these tasks, and whether dishonest behavior was detected in these studies. All of the paradigms above provide methods for investigating and exploring dishonest behavior, and constitute the main approach in current experimental psychological research on dishonest behavior.

This study primarily employed the coin toss task and its newly developed derivatives for several reasons. First, previous research has adapted this task for both online and offline Japanese and Chinese environments and demonstrated its effectiveness in inducing the dishonest behavior of participants (e.g., Guo et al. (2020)). Additionally, coins are ubiquitous in Japan, making experiments easier to conduct. Furthermore, as mentioned above and shown in Table 1.1, the shortcoming of the coin toss task is relatively minor and easier to address compared to other tasks.

In the coin toss task, dishonest behavior is manifested through increases in dishonest indicators (i.e., the scores reported by participants). Regardless of the motivation, intention, or

specific actions taken, any increase in participants' dishonest indicators from when they are honest is considered dishonesty. Consequently, the definition of dishonest behavior in this research is consistent with this. The definition of dishonesty in each experiment may vary slightly depending on the specific settings, which are detailed in the introduction section of each experiment.

Table 1.1 Detailed information on each task

Task	Detection of dishonesty	Definition of dishonesty	Shortcomings (Characteristics)	Representative studies	Whether "dishonesty" was detected
Matrix task I	Comparison with the cheating-impossible condition	Reporting significantly higher performance	Potential calculation errors	Mazar et al. (2008b)	Yes
Matrix task II	Comparison of performance between question and answer sheets	Reported higher performance	A substantial number of participants are required to ensure they believe they are anonymous	Zhong et al. (2010)	Yes
Matrix task III (Spot-the-difference task)	Reporting solving an unsolvable trial	Lies about solving an unsolvable trial	Applicable only in neuroscientific research	Speer et al. (2020)	Yes
Problem-solving task	Comparison with the cheating-impossible condition	Walking away with significantly more money compared to the impossible-cheating condition	Cannot control the potential disparities in participants' prior knowledge of the questions	Vohs and Schooler (2008)	Yes
Coin toss task	Comparison with chance level	Reporting significantly higher scores compared to chance level	Aligning outcomes with expected probabilities often requires a large sample size	Bryan et al. (2013)	Yes
Die under cup task	Comparing the observed distribution with the expected distribution of a fair roll	Overreporting the die roll performance	Aligning outcomes with expected probabilities often requires a large sample size	Shalvi et al. (2012)	Yes
Mental dice task	Comparison with recorded outcomes	Overreporting the die roll performance	Data collection and organization require considerable time	Liu et al. (2020)	Yes
Mind games	Comparing the observed distribution with the expected distribution	Overreporting the performance	Part of the task is not reflected in observable behavior	Kajackaite and Gneezy (2017)	Yes
Visual perception task	Recording participants' responses	More options that increase the earnings	Unintentional errors may be mistaken for dishonesty	Gino et al. (2010)	Yes
Sender-Receiver games	Participants choose to convey either correct or incorrect information to another participant.	To create in another a belief that the communicator considers to be untrue	Dishonesty is somewhat permitted by the experimenters	Gneezy (2005)	Yes
Cheating task with a confederate	The confederate and participants report the participants' behavior	Cheating on the exam	Requires skilled confederates	Niiya et al. (2008)	Yes

1.4 Study purposes and summaries of each chapter

The first three sections of this chapter each discussed different aspects of dishonesty. The first section explored the theoretical roots of dishonest behavior, focusing on ethics and philosophy. The second section presented examples of dishonesty in real life, based on studies in economics and criminology. The third section reviewed the psychological research on dishonesty, summarized the theoretical knowledge from these studies and outlined the methodologies used. Collectively, these discussions highlighted the extensive efforts of each field to understand the mechanisms of dishonest behavior and to reduce its prevalence in everyday life. Despite these efforts, our theoretical and practical knowledge about dishonest behavior remains substantially limited. The mechanism of dishonest behavior is not fully understood, and the replicability of research findings is not promising (e.g., Foerster et al., 2013; Van der Cruyssen et al., 2020). Moreover, effective strategies to reduce dishonest behavior in the real world are still lacking. In recent years, prominent researchers specializing in the study of dishonest behavior have been accused of academic misconduct, undoubtedly adding insult to injury (Lee, 2023).

The primary purpose of this study is to provide novel insights and perspectives that enhance both the theoretical understanding and practical reduction of dishonest behavior. Specifically, this study aims to explore the factors that influence dishonesty and verify the effect of these factors through the framework of environmental psychology. This study focuses on environmental factors for the following reasons. Compared to the complexity of personality and social factors, which have

primarily been the focus of earlier research, environmental factors offer the advantages of being both measurable and controllable systematically and rigorously, and they are omnipresent in daily life. If it can be demonstrated that environmental factors effectively influence dishonest behavior, this method would undoubtedly be the quickest and most effective approach for real-world applications. On the other hand, it was shown that environmental factors have the potential to affect dishonesty. Zhong et al. (2010) reported that a dark environment tends to increase dishonest behavior. Additionally, other environmental factors, such as temperature and time pressure, which affect cognitive resources, may influence the occurrence of dishonesty. Another study further reported that environmental factors like temperature and sound could be used to predict individual emotion (Komuro et al., 2021), indicating that environmental factors might be used to predict human behavior. However, despite the potential influence of numerous environmental factors on dishonest behavior, limited research has been conducted in this area, resulting in a significant gap in the literature (Liu et al., 2020). Thus, this study aims to enhance the understanding of dishonest behavior by identifying environmental factors that affect dishonest behavior, verifying their effects with experiments, and discussing the internal mechanisms. Furthermore, this study also attempts to discuss the potential of applying its findings to reduce dishonest behavior in real life. The summary of each chapter is as follows.

Chapter 2 focused on cognitive modeling to comprehensively explore the factors that affect dishonest behavior in everyday life. A Bayesian Belief Network (BNN) was employed to explore the

connections between selected variables and dishonest behaviors. Specifically, the effect of environmental factors was evaluated by calculating the mutual information between the selected variables and dishonest behavior within the BBN. A total of 36 environmental variables were selected and modeled with an indicator representing dishonest behavior. The results indicated that, although the calculated mutual information values between environmental factors and dishonest behavior appeared to be relatively small, it cannot be conclusively stated that environmental factors have no effect. Notably, factors related to environmental comfort and personal perception seemed to show a stronger influence compared to other factors. In addition, another exploratory analysis using a Psychological Network revealed that the structure and characteristics of the environmental factors differed when honesty and dishonesty occurred, suggesting that environmental factors play a role in the occurrence of dishonest behavior. The findings presented in Chapter 2 indicate that it is challenging to completely prevent dishonest behavior using environmental factors; however, the influence of certain environmental factors on dishonesty cannot be overlooked.

Beginning with Chapter 3, the focus shifted to evaluating the effects of specific factors and discussing the underlying mechanisms. In Chapter 3, the focus was on environmental darkness, a factor that theoretically has a substantial influence on dishonest behavior, as evidenced by Zhong et al. (2010). However, due to some unignorable limitations in the original study, a replication (Experiment 2) was conducted to verify this phenomenon more thoroughly. The replication results showed that dark environments indeed promoted dishonest behaviors; however, the unchanged

perceived anonymity among participants challenged the mechanism proposed in the original study. Subsequently, an alternative mechanism suggesting that ambiguity in task outcomes promotes dishonest behavior was proposed and investigated through four experiments (Experiment 3, 4, 5, and 6). Findings from Experiment 3 showed that the effect of darkness on dishonest behavior diminished when ambiguity was eradicated. In the latter three experiments, the effect of task outcome ambiguity on dishonest behavior was assessed through various methodologies, including visual masking (Experiment 4), manipulation of stimulus appearance (Experiment 5) and weight (Experiment 6). Considering the results of these experiments, the findings did not contradict the hypothesis that perceptual ambiguity affects dishonest behavior. Specifically, Experiment 6 provided empirical evidence that positively supported this hypothesis. However, one cannot assert that ambiguity invariably produces a significant effect on dishonest behavior in every context. The findings of Chapter 3 urged a reconsideration of the link between darkness and dishonesty. It suggested that ambiguity might be critical in the decision-making process of dishonesty.

Chapter 4 supplemented the discussion of how black-white metaphors influence dishonest behavior, which was discussed in Liu (2021). Liu (2021) reported null results suggesting that black-white metaphors have no effect on dishonest behavior. However, the results have not been thoroughly discussed. Chapter 4 reviewed the experiments and results from Liu (2021) and subsequently discussed and summarized the experimental details that may have contributed to these findings. The discussion indicated that the effect of metaphorical factors on dishonest behavior still requires further

validation. The effect might be related to factors such as the vehicle of the metaphor, the duration of participants' exposure to the stimulus, and reward systems.

Chapter 5 investigated the effect of two factors—time pressure and rewards—on dishonest behavior. First, Chapter 5 extended the discussion about the effect of time pressure on dishonest behavior reported in Liu (2021). Liu (2021) found that time pressure could increase dishonest behavior, with a correlation between perceived time pressure and dishonest behavior. These results contradicted studies suggesting that time pressure fosters honesty. In Chapter 5, a hypothesis was proposed to reconcile the contradiction, suggesting that the varying results may arise from subtle differences in rewards. An experiment (Experiment 7) was conducted to test this hypothesis. The results of Experiment 7 showed no evidence that the inconsistent conclusions from the previous studies were caused by rewards. However, due to certain limitations in Experiment 7, it could not be conclusively stated that this explanation was entirely impossible. Moreover, Experiment 7 did not replicate the results reported by Liu (2021); that is to say, the effect of time pressure on dishonesty was not significant. It was shown that the effect of time pressure on dishonest behavior was not stable and might be influenced by various kinds of factors. Chapter 5 further discussed the potential factors contributing to the results and provided directions for future research.

Chapter 6 provided a summary of each experiment's results, evaluating the effects of environmental factors on dishonest behavior and discussing their underlying mechanisms. It also discussed and extended existing theories based on the results of this study. Additionally, Chapter 6

pointed out the limitations that need to be addressed and outlined valuable directions for further research. Finally, it included an integrative discussion on dishonest behavior.

Chapter 2 *The effect of multiple environmental factors on dishonest behavior*

2.1 Experiment 1: exploratory research identifying factors influencing dishonest behavior using Bayesian belief networks and psychological networks

Introduction

As mentioned above, there is still a lack of effective methods to reduce dishonesty in real life situations. This could be due to the difficulty of replicating the results obtained in the laboratory within real-world settings. When dishonest behavior occurs in real life situations, the environment is considerably more complex and variable. These environmental factors might exert complex and interrelated influences, thereby affecting the process of individuals' decision-making. Therefore, to develop an effective strategy for reducing dishonest behavior, it is crucial to understand the impact of environmental factors on such behavior. However, the influence of most environmental factors on dishonest behavior remains unknown. Additionally, as mentioned in Chapter 1, using the environment to reduce dishonest behavior is also considered a valuable attempt. Thus, Experiment 1 aims to extensively explore the factors that may influence dishonest behavior and to discuss whether dishonesty can be affected by environmental factors. Since it was considered important to investigate as many factors as possible, any factor showing even the slightest possibility of influencing dishonest behavior was included in this study. The factors included in this study are as follows.

First, some factors related to time units were taken into consideration. The first factor was the day of the week. Ruffle and Tobol (2014) reported that participants who took part on the first workday of the week were significantly more honest than those who participated later in the week. In their

experiment, the time of payment was Thursday afternoon, while the time of participation varied from Sunday through Thursday of the same week. They suggested that since the temporal separation between decision-making and receiving the reward was too long, Sunday participants were unable to imagine the benefits of the reward clearly and thus acted more honestly. However, this phenomenon may have other plausible explanations, such as changes in behavior caused by shifts in emotion between weekdays and weekends (Esposito et al., 2022; Helliwell & Wang, 2014; Sigmundová et al., 2016). Either way, this suggests that the day of the week might be a factor influencing dishonest behavior. Thus, despite the use of a different reward system from Ruffle and Tobol (2014), the day of the week was still included as a factor in this experiment. Similarly, in cultures such as China and Japan, there exists a concept similar to a week called “Xun (旬)”, which divides a month into three parts. This unique unit of time was also included in the exploration. Moreover, given that an earlier study reported that the time of day can influence unethical behavior, the time of day was also considered as a factor (Kouchaki & Smith, 2014).

Next, several physical environmental factors were included in the exploration. To conduct experiments in a real life setting rather than in a controlled laboratory environment, a crowdsourcing service was utilized in this experiment (see more details in the “Method” section). This approach allowed participants to choose their own experimental sites, which could influence their behavior in various ways, especially in momentary mood (Sandstrom et al., 2017) and evaluating the exposure risk. The experimental site, its characteristics, whether it was indoor or outdoor, participants’

subjective perception of the site size, familiarity with the site, and the presence of any partitions were incorporated into this experiment. At the experimental site, the presence of other people and their characteristics (such as their relationship with the participant) could also affect the participant's dishonest behavior; hence, these factors were included in this experiment (Gino et al., 2009). Other physical environmental factors, such as temperature and lighting factors like brightness and color temperature, may also influence dishonest behavior. Earlier research has shown that dishonest behavior increases under dim environments, highlighting the effect of brightness (Zhong et al., 2010). Temperature may influence dishonest behavior by consuming cognitive resources (Gaoua, 2010; Liu et al., 2020; Pilcher et al., 2002). Some factors related to moral metaphor may influence participants' moral self-perceptions, thereby affecting dishonest behavior, similar to the effect of temperature and color temperature on prosocial behavior (Baron et al., 1992; Ijzerman & Semin, 2009; Williams & Bargh, 2008). There are other factors incorporated into the exploratory analysis, given their potential relevance and possible interaction with the aforementioned factors (e.g., weather may be related to temperature; Aigang, 2011).

Furthermore, the experiment includes some physical characteristics at the individual level. Clothing has been found to potentially influence behaviors primarily through its symbolic meaning, which is systematically reported by Adam and Galinsky (2012) and referred to as "enclothed cognition." In this experiment, the effects of clothing were explored through clothing colors that have potential metaphorical effects and the degree of clothing exposure that may be related to the sense of

being observed. Additionally, a related factor, the effects of accessories, was also investigated.

Finally, to further investigate the effect of environmental factors on dishonest behavior (if any), this experiment also incorporated various factors including individual habits and subjective indicators. These habits and subjective perceptions may serve as individual differences that contribute to the influence of environmental factors on dishonest behavior, making it worthwhile to explore them in this experiment. These factors include health status (Shattuck & Muehlenbein, 2016), the use of medicine and health supplements (Dickinson & MacKay, 2014), drinking (Wechsler et al., 1994), sleep habits (Pilcher et al., 2015), and the timing of meals (changes in blood glucose; Orquin & Kurzban, 2016). The subjective indicators related to these factors are amenity, stress level, chronic stress level, urge to urinate, intensity of thirst, sensation of satiety, and degree of sleepiness. Additionally, two factors that influence the motivation for dishonest behavior were also investigated: satisfaction with reward and Socioeconomic status (Sweeting et al., 2011).

The aim of Experiment 1 is to comprehensively explore the influence of various factors on dishonest behavior. Using the Bayesian Belief Network can be a highly appropriate and suitable choice for this purpose. Generally, a Bayesian Belief Network, also known as a Bayesian network or graphical model, is a powerful probabilistic model that represents and quantifies the relationships between variables (Aguilera et al., 2011). It is based on Bayesian probability theory and graphical representation. In a Bayesian Belief Network, variables are represented as nodes, and the connections between the nodes are represented as directed edges. The connections indicate the dependencies and

causal relationships between the variables. Each node in the network is associated with a conditional probability table (CPT), which specifies the probability distribution of the node given its parent nodes (Landuyt et al., 2013). BBNs provide a flexible framework for modeling complex systems and reasoning under uncertainty in psychology, such as psychological symptom inference (García-Herrero et al., 2012), estimation of individual psychological characteristics (Litvinenko et al., 2017), and public health concerns (Glückstad et al., 2021). In this experiment, the BBN can provide an intuitive understanding of the relationships between the input variables (i.e., environmental factors) and quantify their specific effect on the output variable (i.e., dishonest behavior) (see the Methods section for details). This approach allows for the evaluation of whether environmental factors influence dishonest behavior and determines the strength of their effect.

On the other hand, Psychological Network (PN) offers another approach to understanding the influence of environmental factors on dishonest behavior. The psychological network model consists of nodes representing observable variables, such as environmental factors, and edges that represent the statistical relationships, thereby enabling the representation of relationships among variables as a network (Epskamp et al., 2018; Kunisato et al., 2023). The use of psychological networks can be divided into four steps: (1) estimating the edges between nodes using statistical methods, (2) visualizing the network based on the estimated statistical relationships, (3) discussing centrality indices that represent network characteristics, and (4) assessing the accuracy of the edges and the stability of the centrality indices (Kunisato et al., 2023). Using the Psychological Network, it is

possible to analyze the characteristics of environmental factors associated with (dis)honest behaviors. By comparing the visual differences between the models and the centrality indices, it is possible to explore the environmental differences when honest and dishonest behaviors occur. In other words, substantial differences between the models indicate the potential effect of environmental factors on dishonest behavior. The centrality indices allow further discussion of the factors that may influence dishonest behavior. Kunisato et al. (2023) provided a thorough and comprehensible introduction to centrality indices. Centrality indices are divided into three types: Strength, Closeness, and Betweenness. Strength is defined as the sum of the strengths of all edges connected to a node. Closeness is calculated as the reciprocal of the sum of the shortest path lengths from a node to all other nodes. Betweenness measures how often a node appears on the shortest path between two other nodes. Strength quantifies the direct influence of a factor on another. Closeness indicates how connected a node is to other nodes, including indirect influences. Betweenness represents the importance of a variable as a mediator, which might not be crucial for this study; this measure is often beneficial for understanding psychological symptoms and interventions. On the other hand, strength and closeness are useful for identifying the most important environmental factors when dishonest behavior occurs.

In summary, Experiment 1 selected environmental factors that potentially influence dishonest behavior through a review of previous research. Both Bayesian Belief Network (BBN) and Psychological Network (PN) were employed to comprehensively and extensively explore their effects

on dishonest behavior. Although there are various forms of dishonest behavior, Experiment 1 focuses on one representative type: reporting scores that are greater than actual scores, whether intentional or not, is defined as dishonesty.

Methods

Ethics information

This study strictly followed the guidelines set forth in the Declaration of Helsinki (2013) in its execution. This study protocol was approved by the Ethics Committee of the Department of Human Sciences (Psychology), Graduate School of Human-Environment Studies, Kyushu University (Approval number: 2022-004). Due to the online, anonymous nature of the experiment, no access to information that could potentially identify individual participants was available either during or after the data collection process. Participants provided informed consent via a participation agreement with the crowdsourcing service.

Participants

Participants for this study were recruited randomly from all the users of Yahoo! Crowdsourcing Service. Since BBN requires a large sample size, data were collected from as many participants as possible within the constraints of research funding and experimental time. After data exclusion, the dataset for analysis included 1,384 participants (men = 1006, women = 367, no response = 11, M_{age} = 48.51 years, SD = 11.20).

Materials

Participants accessed the experimental program via an embedded link in the Yahoo! Crowdsourcing Service survey form. After clicking this link, participants were redirected to the webpage where the experiment was conducted. The experimental webpage was made by a JavaScript program developed using jsPsych (de Leeuw, 2015; Kuroki, 2021). The data were recorded using the program and collected using phpMyAdmin.

Procedure

Data collection began on July 25, 2023, and ended on August 21, 2023. One round of data collection (from 50 participants) was conducted each day during this period. The crowdsourcing service provided six possible start times for experiments each day. To ensure variability in the time variables, the experiments were started at various times of the day, on different days of the week, and during each Xun. The detailed schedule is outlined in Figure 2.1. Participants were informed that this was an experiment exploring supernatural phenomena. They completed the task designed to detect dishonest behavior and a questionnaire surveying environmental factors.

Figure 2.1 Schedule for data collection in Experiment 1

Sun.		Mon.		Tue.		Wed.		Thu.		Fri.		Sat.	
2023				7/25	8	7/26	8	7/27	8	7/28	8	7/29	8
					11		11		11		11		11
					14		14		14		14		14
					17		17		17		17		17
					20		20		20		20		20
					23		23		23		23		23
7/30	8	7/31	8	8/1	8	8/2	8	8/3	8	8/4	8	8/5	8
	11		11		11		11		11		11		11
	14		14		14		14		14		14		14
	17		17		17		17		17		17		17
	20		20		20		20		20		20		20
	23		23		23		23		23		23		23
8/6	8	8/7	8	8/8	8	8/9	8	8/10	8	8/11	8	8/12	8
	11		11		11		11		11		11		11
	14		14		14		14		14		14		14
	17		17		17		17		17		17		17
	20		20		20		20		20		20		20
	23		23		23		23		23		23		23
8/13	8	8/14	8	8/15	8	8/16	8	8/17	8	8/18	8	8/19	8
	11		11		11		11		11		11		11
	14		14		14		14		14		14		14
	17		17		17		17		17		17		17
	20		20		20		20		20		20		20
	23		23		23		23		23		23		23
8/20	8	8/21	8										
	11		11										
	14		14										
	17		17										
	20		20										
	23		23										

Note. Cells in the first row that represent the days of the week, correspond to two columns below each: the date in the left column and the point in time in the right column. Each cell with a yellow background indicates one round of data collection.

Experiment 1 utilized a modified version of the coin toss task (Kocher et al., 2018; Lohse et al., 2018) to evaluate participants' dishonest behavior[1]. In this task, participants were presented with a virtual coin on the screen and were asked to "toss" it by clicking a button. This virtual coin had an

equal probability (50%) of landing on heads or tails. After completing 20 trials of this task, the participants were asked to report the number of coins that landed on heads as a score. The participants were informed in advance that the score would serve as the basis for an additional reward (calculated as 5P (≈ 5 yen) * the number of "heads"). Participants could receive more rewards by reporting a higher score. The experimental program recorded the actual results of the coin tosses. The cheating indicator for each participant was calculated as the difference between the participant's reported score and the actual score. A potential drawback of this approach is that participants may realize that their actual score can be recorded, thereby abandoning dishonest behavior. However, previous studies indicated that this did not significantly influence the results (Kocher et al., 2018; Lohse et al., 2018). The rationale was that a significant degree of dishonest behavior continued to manifest itself, even when participants might suspect their actions were observable (Lohse et al., 2018). Moreover, to conceal the true purpose of detecting dishonest behavior, this task did not include any instructions about prohibited behavior.

Additionally, a questionnaire was used to collect data on the environmental factors surrounding participants during the experiment. A total of 36 selected variables were detailed in Table 2.1, each variable was assigned a straightforward name, along with its corresponding number and a detailed description of what was specifically investigated. The original Japanese text utilized in Experiment 1 is available in the Supplementary material 1. Several factors were divided into distinct variables; for example, drinking was divided into "drinking habit" and "drunkenness". Given the

inability to measure some variables, such as actual temperature and brightness, their measurement relied on participants' subjective perceptions.

Table. 2.1 The variables included in Experiment 1 and their explanations.

No.	Variables name	Specific contents of the variables investigated
Q1	Weekday	the day of the week (Sun., Mon., etc.)
Q2	Xun	Xun which the experiment was conducted in
Q3	Time_zone	the time of the day (e.g., 0 AM to 3 AM)
Q4	Site	the experimental site
Q5	Indoor_outdoor	indoor or outdoor
Q6	Site_nature	the type of experimental site
Q7	Site_size	subjective perception of the site size
Q8	Shelter	the presence of partitions within the site
Q9	Site_familiarity	participants' familiarity with the experimental site
Q10	Others_presence	the presence of others
Q11	Others_influence	the effect of other people
Q12	Subjective_temperature	participants' subjective temperature
Q13	Brightness	participants' subjective brightness
Q14	Color_Temperature	the overall color temperature of the experimental site
Q15	Amenity	participants' subjective amenity
Q16	Weather	the weather during the experiment
Q17	Clothing_type	the type of clothing colors worn by participants
Q18	Clothing_color	the clothing colors worn by participants
Q19	Exposure_degree	the level of exposure of the participants' clothes
Q20	Accessory	whether participants wore accessories (jewelry or hats)
Q21	Health_Status	the health status of the participants
Q22	Medicine	the medication usage of the participants
Q23	Supplement	the use of dietary supplements by the participants
Q24	Drinking_habits	the drinking habits of the participants
Q25	Drunkenness	the effects of alcohol in the experiment
Q26	Average_sleeping_time	the sleep habits of the participants in the recent month
Q27	Sleeping_time	the participants' pre-experiment sleep duration
Q28	Sleepiness	the level of sleepiness
Q29	Dinner	the time since the participants' last meal

Q30	Thirst_degree	the level of thirst
Q31	Urge_to_urinate	the urge to urinate
Q32	Full_stomach	the level of satiety
Q33	Stress	the participants' perceived momentary stress
Q34	Chronic_stress	the participants' perceived chronic stress
Q35	Satisfaction_with_reward	the satisfaction with the reward
Q36	Socioeconomic_status	the participants' self-assessed socioeconomic status

The order of the task and the questionnaire were randomized to reduce any potential bias. At the end of the experiment, participants were shown a four-digit code for receiving the reward. All participants received the highest level of reward. They were unaware of this information beforehand and believed that cheating would result in higher rewards for themselves.

Analysis

Bayesian Belief Network

This experiment evaluated the effects of environmental factors on dishonest behavior by constructing a BBN model. A BBN is composed of several key components that facilitate the modeling and analysis of complex relationships between variables. These components include nodes, directed edges, conditional probability tables (CPTs), prior and posterior probabilities, and inference evidence. As aforementioned, 36 variables that potentially affect dishonest behaviors were selected for the BNN construction. According to convention (e.g., Li et al., 2022), the BBN model in this study was determined based on the experimenter's knowledge and experience. However, modeling 36 variables in BBN posed significant challenges. To address this complexity and minimize subjective bias, the

EGAnet package (version 2.0.6) in R (Golino & Christensen, 2024) was utilized for data preprocessing. Exploratory Graph Analysis (EGA) is employed to identify dimensions within multivariate data using psychometric networks (Christensen & Golino, 2019). As shown in the R code in Supplementary material 2, the analysis was conducted using EGAnet (version 2.0.6) with the default settings, which means the automatic correlation estimation (corr = "auto") to compute inter-variable relationships, the graphical lasso model (model = "glasso") was employed for network analysis, alongside the Walktrap algorithm (algorithm = "walktrap") used to detect community structures within the network.

EGA merged 36 factors into several dimensions, with each dimension containing several clusters. The clusters represented different values. This meant the values of the dimensions could be derived from the values of the factors within them through data analysis. In this process, K-means (Ahmed et al., 2020), a popular and effective clustering method, was used to automatically group similar data points together. The implementation of K-means was based on Python's Scikit-learn (Pedregosa et al., 2011).

The BBN model was constructed based on the dimensions and the target variable. Existing data analysis tools were adopted to automatically build the BBN model. In this process, a BBN model was first defined in Python using Pgmpy (Ankan & Panda, 2015), a popular library for BBN implementation and analysis. In constructing the BBN model, the Dirichlet distribution (Wong, 1998) was employed as the prior distribution. Specifically, prior probabilities were smoothed by setting the

"equivalent_sample_size". Then, the data was loaded from storage and used to construct the BBN models. In the default model, all the dimensions were connected to the target variable of dishonest behaviors. For a specified model with customized connections between dimensions, the corresponding settings were manually added in the Python program. Subsequently, the "BayesianEstimator" function was used to compute the BBN model parameters for conditional probability tables (CPTs). Finally, a BBN model with inner probabilities to the target variable was obtained, which can be used for further analysis.

The primary objective of this study is to explore; thus, two BBN models were developed. The first model assumed that input variables are independent (the default model). The second posited connections between the input variables. After constructing these models, the influence of each input variable (i.e., dimensions) on the output variable (i.e., dishonest behavior) was assessed utilizing mutual information. Mutual information is a concept from information theory that measures the amount of information obtained about one random variable through another random variable. It quantifies the mutual dependence between the two variables. Mutual information was computed using Python's Scikit-learn tools (Pedregosa et al., 2011).

Psychological Network

Utilizing Psychological Network (Epskamp et al., 2018; Kunisato et al., 2023), the characteristics of environmental factors associated with (dis)honesty were analyzed. Data were separately extracted from participants with a cheating indicator equal to 0 and those with indicators greater than 0, creating

datasets of environmental factors when (dis)honesty occurs, respectively. Guided by the recommendations of Kunisato et al. (2023), the two models were constructed by selecting the network edges through regularization (Blanken et al., 2022). The edges were estimated using the estimateNetwork function from the bootnet package in R. The modeling results were visualized using the plot function. The code for regularization and visualization is as follows:

```
result <- estimateNetwork(data, default = "EBICglasso", corMethod = "spearman")
plot(result, theme = "gray", layout = "spring", labels = TRUE)
```

Following the model construction, the accuracy of the edges in these models was assessed according to Kunisato et al. (2023) using the code detailed below.

```
accuracy_edge <- bootnet(result, nBoots=1000, nCores=4, statistics=c("edge", "strength", "closeness", "betweenness"))
```

To further compare the differences in the environments when honesty and dishonesty occur, the centralityPlot function in R was utilized to visualize centrality indices for two models. Moreover, the Correlation Stability Coefficient (CSC) for each centrality indices was calculated using the corStability function.

```
centralityPlot(result, include = c("Strength", "Closeness", "Betweenness"))
stability_centrality <- bootnet(result, nBoots = 1000, type = "case", nCores = 4, statistics = c("strength", "closeness", "betweenness"))
```

```
corStability(stability_centrality)
```

Results

Participants who were unable to provide correct answers to Q1 Weekday (12 participants) or Q3 Time Zone (seven participants) were excluded from the analysis since they were regarded as not having participated in the experiment seriously. Additionally, participants who declined to answer their health status in Q21 (nine participants) were also excluded. One participant was excluded from the analysis for his request for data deletion, due to his inability to receive the reward after forgetting the code. Consequently, data from a total of 26 participants were excluded from the analysis (several participants met multiple criteria). Following the data exclusion, the dataset used for analysis comprised 1,384 participants.

Exploratory Graph Analysis

Based on the results of EGA, the 36 variables were categorized into 8 dimensions, the nodes represent the variables, and the dimensions are colored (Figure 2.2). Table 2.2 presents the names of these dimensions along with their sub-variables. The eight dimensions identified are as follows: Time and Environmental Factors (TE), Personal Habits and Environment Interaction Factors (PHEI), Environmental Comfort and Personal Perception Factors (ECPP), Social Interaction Factors (SI), Personal Dressing Factors (PD), Health Status Factors (HS), Sleeping Pattern Factors (SP), and Dietary and Satiety Factors (DS). The stability of the model structure was also assessed using

dimensionStability function (Figure 2.3). It is observed that items replicated between 68% and 100% of the time within their respective dimensions, suggesting that the current model structure is relatively stable (According to Christensen and Golino (2019), a value of ≥ 0.70 should be considered stable). These eight dimensions were used as input variables into the BBN.

Figure 2.2 The EGA results of Selected variables

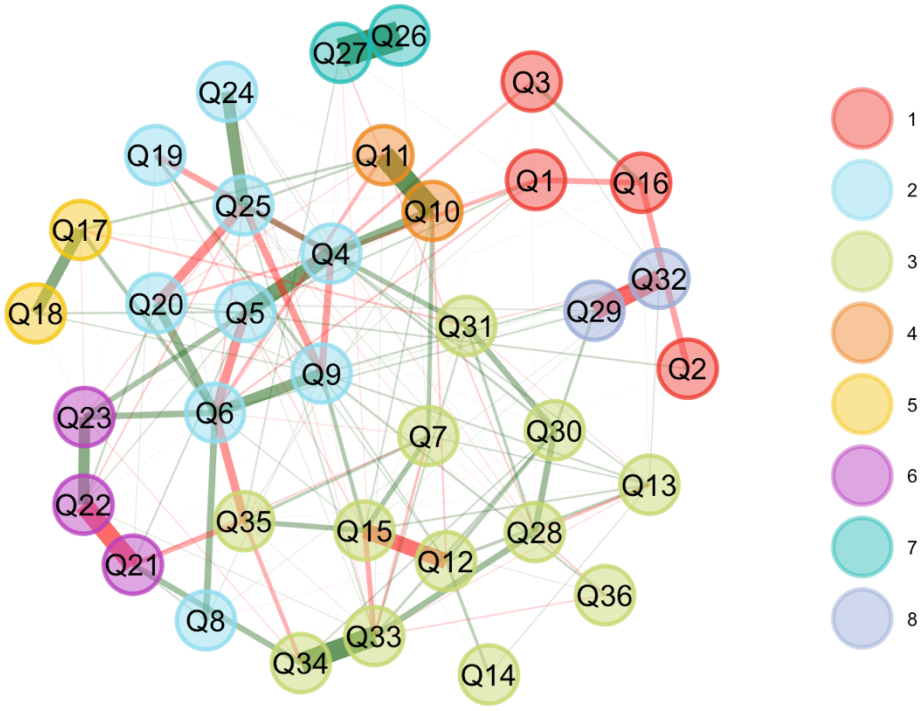
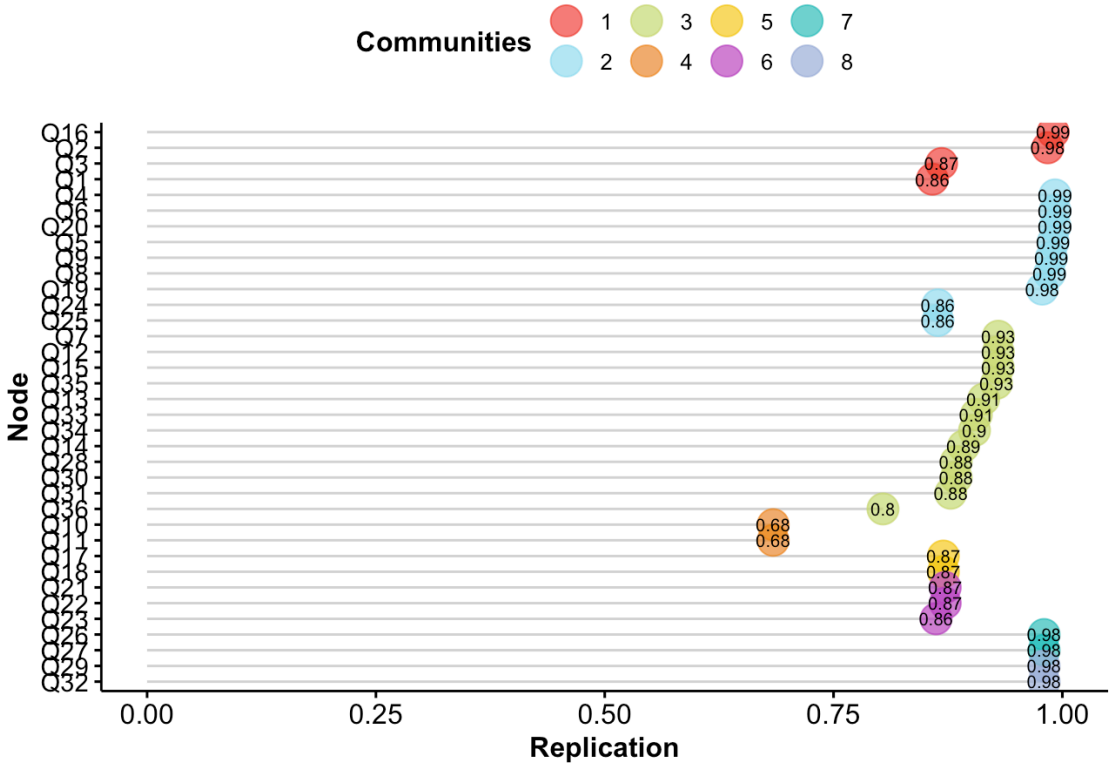


Table 2.2 The EGA results of Selected variables

Dimensions	**Sub-variables**
1. Time and Environmental (TE)	Weekday, Xun, Time_zone, Weather
2. Personal Habits and Environment Interaction (PHEI)	Site, Indoor_outdoor, Site_nature, Shelter, Site_familiarity, Exposure_degree, Accessory, Drinking_habits, Drunkenness

3. Environmental Comfort and Personal Perception (ECPP)	Site_size, Subjective_temperature, Brightness, Color_Temperature, Amenity, Sleepiness, Thirst_degree, Urge_to_urinate, Stress, Chronic_stress, Socioeconomic_status, Satisfaction_with_reward
4. Social Interaction (SI)	Others_presence, Others_influence
5. Personal Dressing (PD)	Clothing_type, Clothing_color
6. Health Status (HS)	Health_Status, Medicine, Supplement
7. Sleeping Pattern (SP)	Average_sleeping_time, Sleeping_time
8. Dietary and Satiety (DS)	Dinner, Full_stomach

Figure 2.3 Item stability of the selected variables in EGA



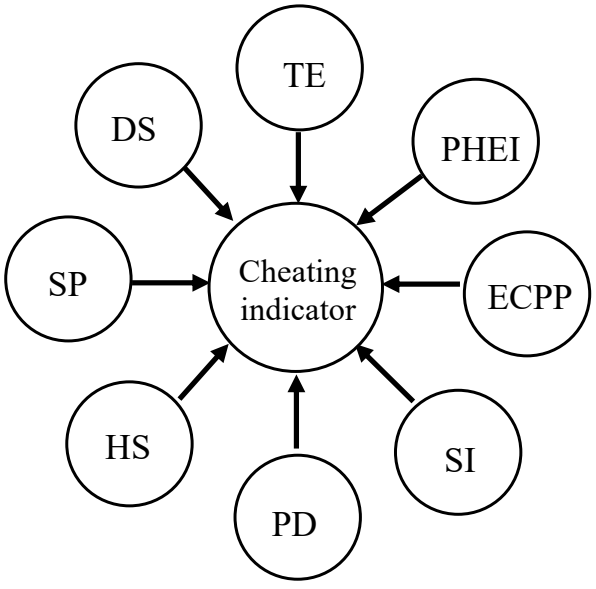
BBN models

As mentioned above, this experiment explored two kinds of BBN models with distinct structures: one that assumed interactions among input variables, and another that assumed independence among these variables. In the former, the relationship between variables was determined by the researcher's

knowledge and expertise, following the conventions of Bayesian modeling (Li et al., 2022). Figure 2.4 shows the models along with their corresponding mutual information data. The results revealed that, under the assumption of input variable independence, HS had the most substantial effect on the cheating indicator, exhibiting mutual information of 0.0201. Upon assuming interactions among the input variables, ECPP had the most substantial effect, with mutual information of 0.0714. Subsequently, repeated random sampling cross-validation was employed to validate the accuracy of the two models. Specifically, 70% of the data was randomly sampled to build the BBN models, and 30% of the data was used to test their accuracy. This process was repeated multiple times to obtain reliable and convincing testing results. The Independence BBN exhibited an average accuracy of 0.2476, while the Interactions BBN demonstrated an average accuracy of 0.7308.

Figure 2.4 The BBN Models and Corresponding Mutual Information

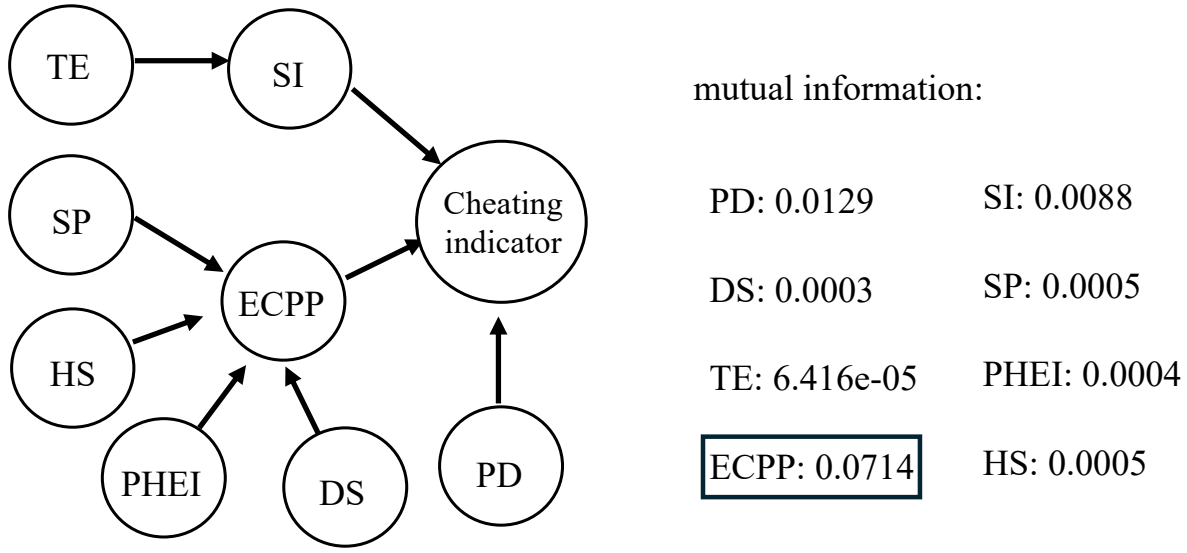
(a) Independence BBN



mutual information:

PD: 0.0001	SI: 0.0090
DS: 0.0014	SP: 0.0096
TE: 0.0031	PHEI: 0.0103
ECPP: 0.0065	HS: 0.0201

(b) Interactions BBN



Note. The variables enclosed in the box are the most influential factors.

Furthermore, an unexpected number (132/1,384) of participants exhibited a negative cheating indicator, indicating that they reported fewer scores than actual scores, resulting in fewer rewards than they deserved. This likely suggested that these participants did not understand the task instructions. Thus, the modeling and calculations were reconducted after excluding these data to ensure more accurate results. In the revised model, HS (with Mutual information = 0.0049) was the most influential variable under the assumption of independent input variables, whereas ECPP (with Mutual information = 0.0628) was the most influential when interactions among the input variables were considered (Table 2.3).

Table 2.3 Mutual information of variables in the two reconstructed BBN.

	Without negative indicators		**Only dishonesty**	
	independence	interactions	independence	interactions
HS	0.0049	0.0004	0.0002	0.0061
PHEI	0.0041	0.0007	0.0004	0.0052
ECPP	0.0030	0.0628	0.0006	0.2932
SP	0.0024	0.0004	0.0002	0.0049
DS	0.0023	0.0005	0.0003	0.0045
SI	0.0019	0.0115	8.858e-05	0.0647
TE	0.0018	2.951e-05	0.0003	0.0002
PD	0.0007	0.0220	0.0002	0.0698

For exploratory purposes, data were extracted from participants whose cheating indicators were greater than zero, meaning those who committed dishonest behavior, and a new BBN was constructed using these data. The results showed that ECPP was the most influential variable, regardless of whether the input variables were considered independent or correlated, with mutual information values of 0.0006 and 0.2932, respectively (Table 2.3).

PN models

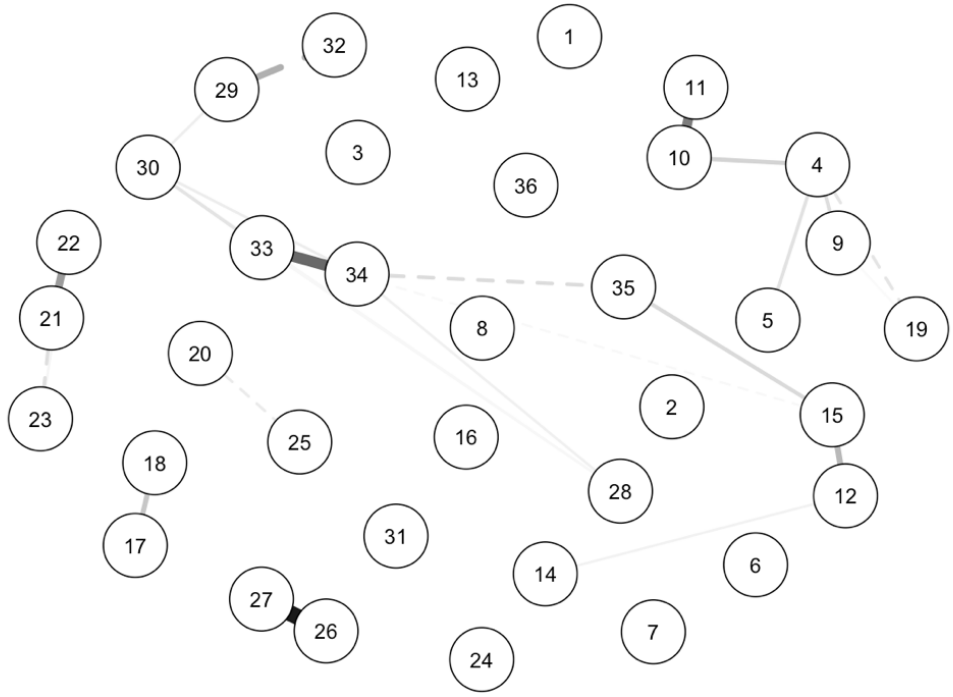
Figures 2.5, 2.6, and 2.7 illustrate the PN results. Figure 2.5 presented two models representing the environmental characteristics when honesty and dishonesty occurred. Figure 2.6 shows the accuracy of the edges in these models, indicating that the 95% confidence intervals are quite narrow, suggesting that there is no need to worry about the accuracy of the edges (Kunisato et al., 2023). Figure 2.7 shows the centrality indices for both models.

The results of the Correlation Stability Coefficient of each centrality indices showed that the Strength demonstrated a CSC of 0.75 in the honest model and a CSC of 0.59 in the dishonest model (Figure 2.8). In two models, both the CSC for closeness and betweenness were lower than 0.25, which were considered appropriate thresholds in Kunisato et al. (2023) [2].

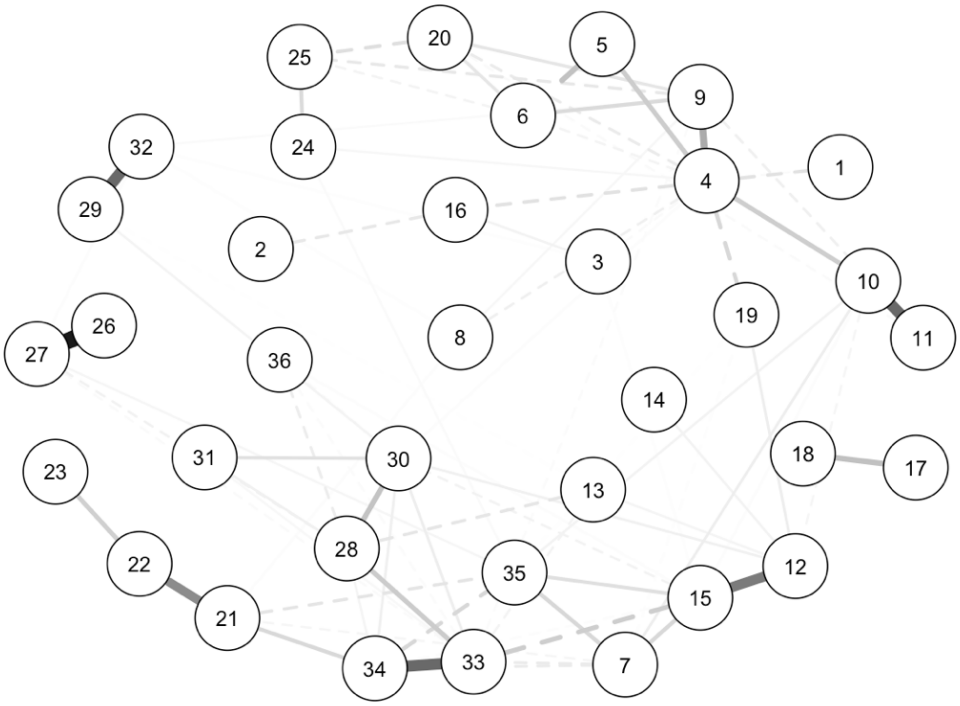
The Strength indices showed differences between the two models. For instance, in the honest model, the top three variables by Strength were Q33 Stress, Q4 Site, and Q15 Amenity, while in the dishonest model, they were Q26 Average sleeping time, Q27 Sleeping time, and Q34 Chronic stress. Additionally, several variables in the dishonest model had a Strength of zero, while no such variables were observed in the honest model.

Figure 2.5 The results of Psychological Network

(a) Psychological Network of environmental factors during occurrences of dishonest behavior



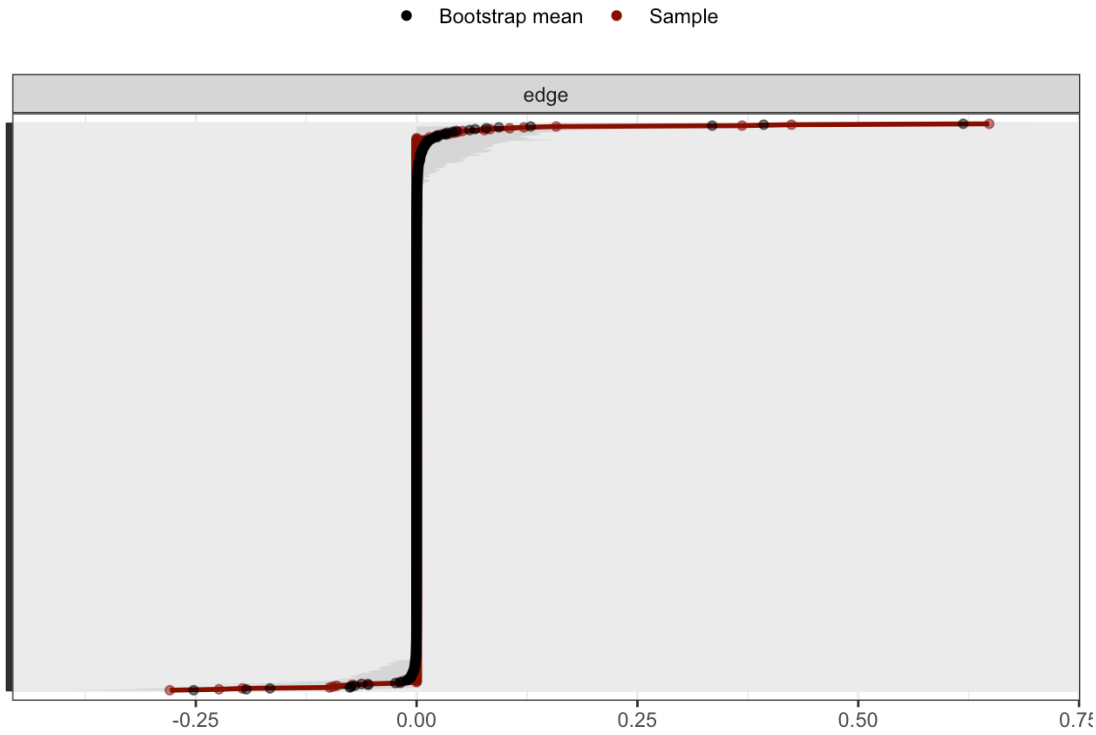
(b) Psychological Network of environmental factors during occurrences of honest behavior



Note. Solid lines represent positive relationships, while dashed lines indicate negative relationships.

Figure 2.6 The accuracy of the edges

(a) dishonesty model



(b) honesty model

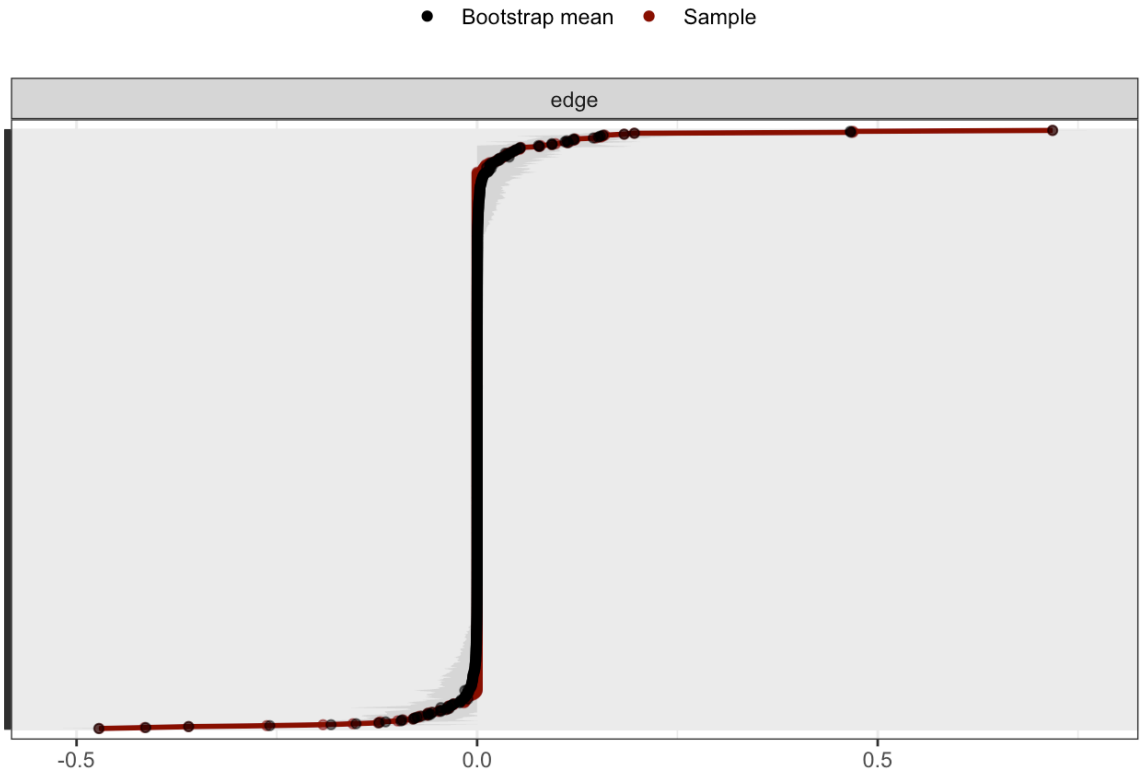
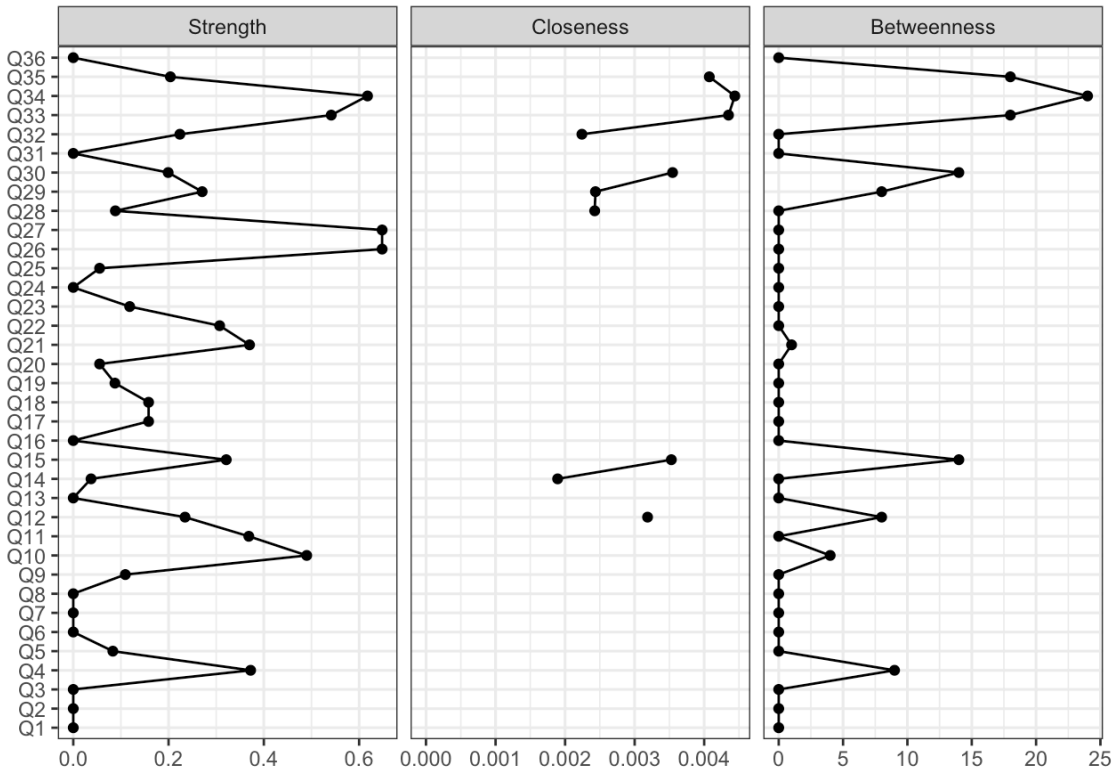


Figure 2.7 The centrality indices of two models

(a) dishonest models



(b) honest models

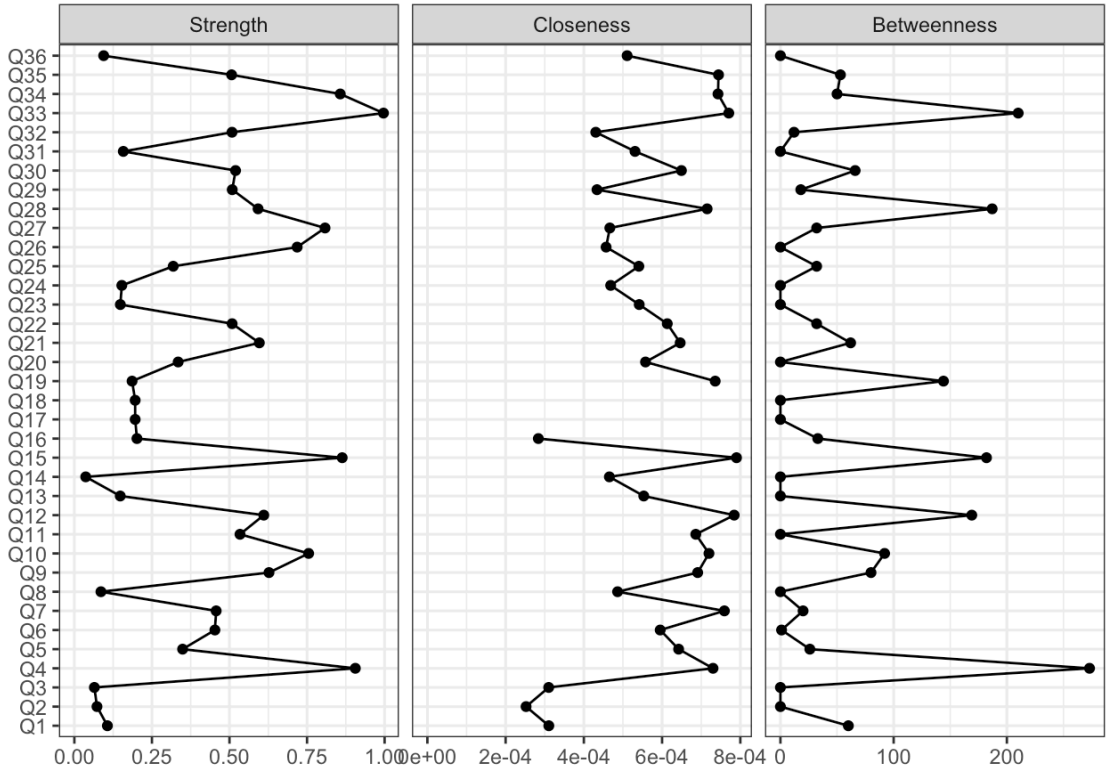
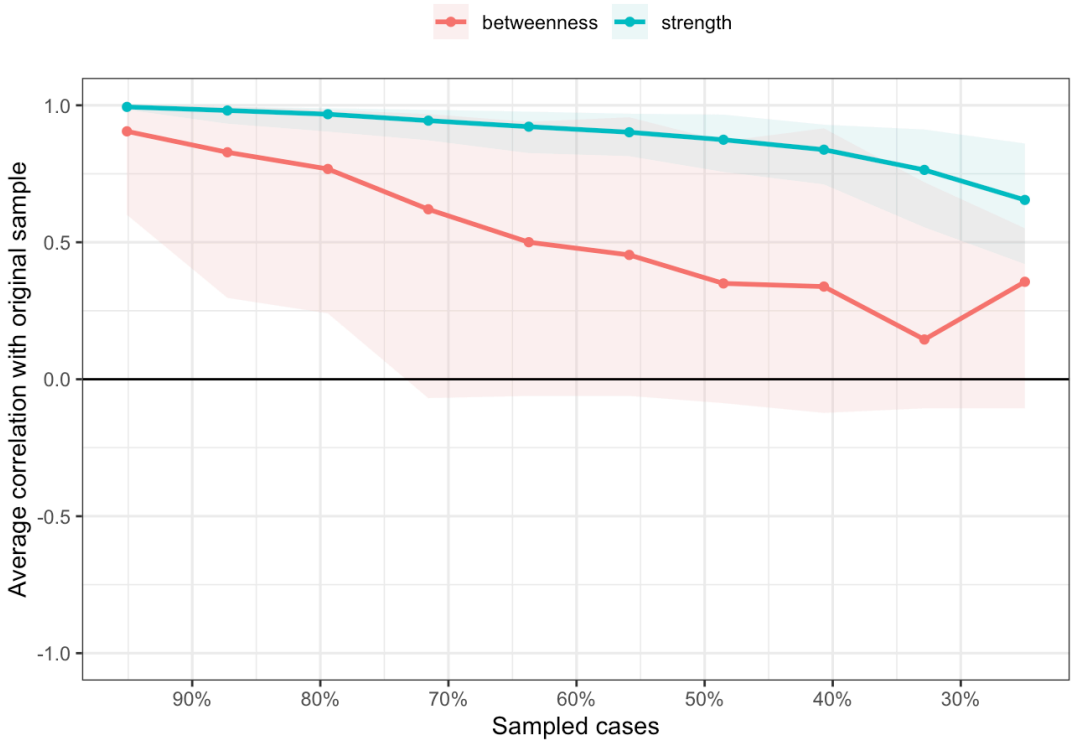
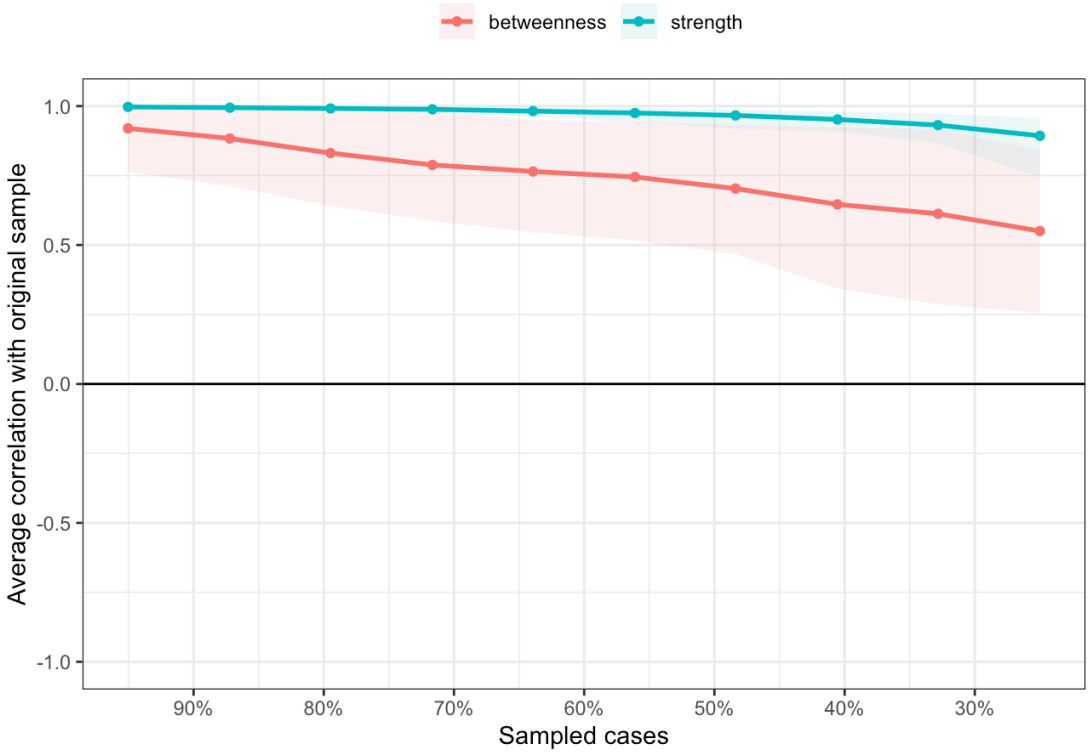


Figure 2.8 Stability of centrality indices

(a) dishonest model



(b) honest model



Note. Statistic closeness does not contain any variance and is therefore not shown.

Discussion

Whether environmental factors influence dishonest behavior

Since mutual information in this experiment only quantified the relative impact of the factors on dishonest behavior without providing an objective statistical standard, the results from BBN cannot conclude whether environmental factors influence dishonest behavior. Specifically, the mutual information values were relatively small, making it difficult to assert a significant effect of environmental factors. However, according to the definition of mutual information, since it was not zero, it also cannot be asserted that environmental factors have no effect. The primary reason for these results is likely due to the majority of participants maintaining honesty during the experiment, which means too many participants (1048/1384) have a cheating indicator of zero. This led to insufficient variability in the output variables, diminished the utility of the BBN. This also indirectly demonstrates the difficulty of eliminating all dishonest behavior solely by controlling the environment.

On the other hand, the results of the PN provided more valuable insights. The two models (Figure 2.5) provided a visual representation of the structural characteristics of environmental factors during honesty and dishonesty. During occurrences of honest behavior, environmental factors exhibited noticeably more correlations (i.e., more edges). A detailed comparison of the two models revealed several differences. In the honesty model, a connection between 7 (Site size) and 15 (Amenity) was shown, which was absent in the dishonesty model, possibly suggesting a tendency for individuals to maintain honesty in large and comfortable spaces. The link between 12 (Subjective

temperature) and 19 (Exposure degree), which was shown in the honest model, did not appear in the dishonest model, implying that dishonest individuals might prefer to conceal themselves even in hot environments. In other words, wearing clothes with a low degree of exposure may influence tendencies toward dishonesty. The negative correlation between 13 (Brightness) and 28 (Sleepiness) indicated that honest individuals may feel sleepy in low light conditions, unlike dishonest individuals. The relationship between 13 (Brightness) and 12 (Subjective Temperature) suggested that honest individuals perceived hotter temperatures with increased brightness, the connection was not observed in dishonest individuals. This may be due to the effect of antisocial behavior on temperature perception (Ijzerman & Semin, 2009). All of these hypothesized discussions suggest that certain environmental factors may influence dishonest behavior. The same environmental factors showing different centrality indices in the two PN models further supported this claim.

Which environmental factors have a greater influence on dishonest behavior

BBN allows for an intuitive discussion on which environmental factors have a greater impact on dishonest behavior. A total of six BBN models were constructed, utilizing environmental factors as input variables. The mutual information of these factors was calculated to evaluate their effects on dishonest behavior. Given the higher average accuracy and the fact that environmental factors are rarely independent in real life, greater emphasis was placed on results from models that consider interactions among input variables. The results suggest that ECPP, including Site Size, Subjective Temperature, Brightness, Color Temperature, Amenity, Sleepiness, Thirst Degree, Urge to Urinate,

Stress, Chronic Stress, Socioeconomic Status, and Satisfaction with Reward, may be the most influential environmental factor on dishonest behavior (Figure 2.4 (b)). This finding remained consistent after excluding data from participants not seriously participating in the experiment (Table 2.3). Moreover, when focusing solely on dishonesty data, the results showed that ECPP consistently has a relatively substantial effect on dishonesty in both the "independence" and "interactions" models. This suggests that the factors within ECPP may influence not only the occurrence but also the severity of dishonest behavior. On the other hand, the strength indices in PN indicated that stress and amenity were important for honest behavior, while chronic stress was important for the occurrence of dishonest behavior. This finding is consistent with the results from the BBN, which enhances the credibility of these findings. However, it is important to emphasize that the purpose of this experiment is to explore possibilities rather than to draw firm conclusions. In other words, the above conclusions are speculative and not definitive.

Limitations and Conclusion

A potential critique is the influence of the researcher's subjective factors on the results. For example, in BBN, the variables placed closer to the output variables and those with more parent nodes may exhibit a greater influence. This limitation is recognized. However, the current modeling is considered justifiable due to the clear directional relationships between variables. For example, there are potential causal relationships between the factors, such as "Sleeping time" in SP having an influence on "Sleepiness" in ECPP, and "Dinner" in DS potentially affecting "Thirst degree" and

“Urge to urinate” in ECPP. Therefore, despite the limitation, the current results remain valuable for discussion.

Additionally, some participants in this experiment reported negative dishonest indicators. The most likely explanation is that they either did not understand the instructions or did not participate earnestly. Such situations could also occur among participants with positive dishonest indicators, raising concerns about the validity of the dishonest indicators in this experiment. To address this, I compared the absolute values of negative and positive indicators. The results showed that the absolute values of the positive indicators were significantly greater than those of the negative indicators ($p < .0001$). This suggests that the primary driving force behind the positive indicators remains dishonest behavior, as participants reported scores significantly higher than their actual scores, exceeding the typical increase expected from misunderstanding the instructions or lack of earnest participation. Therefore, the dishonest behavior indicators in this experiment remain valid.

Moreover, in Experiment 1, EGA was used for data preprocessing, and nominal scales were directly used for analysis. Since EGA is a relatively novel method that has not been widely adopted, there are concerns regarding the capability of the EGAnet package in R to handle nominal scales perfectly. This may lead to potential statistical issues, resulting in decreased accuracy of the analysis results related to nominal scales. In future research, it may be advantageous to convert these nominal scales into dummy variables or consider alternative methods explicitly designed to handle nominal scales effectively.

This chapter employed two novel approaches, Bayesian Belief Networks (BBN) and Psychological Networks (PN), to explore the potential influence of environmental factors on dishonest behavior. BBN showed no conclusions regarding whether environmental factors influence dishonest behavior, indicating the difficulty of eliminating dishonest behavior solely by controlling the environment. However, the effects of several environmental factors should not be overlooked. Specifically, factors categorized under ECPP (Environmental Comfort and Personal Perception), including Site Size, Subjective Temperature, Brightness, Color Temperature, Amenity, Sleepiness, Thirst Degree, Urge to Urinate, Stress, Chronic Stress, Socioeconomic Status, and Satisfaction with Reward, are considered more likely to influence dishonest behavior compared to other factors. On the other hand, results from the Psychological Network indicated that the structure of environmental factors differed between situations of honesty and dishonesty, as shown by the models' visual differences and centrality indices. This also indicated the potential influence of the environment on dishonest behavior. Additionally, the centrality indices suggested that stress and amenity are important for (dis)honest behavior.

Although the employment of these two approaches may have some minor flaws and limitations, it is reiterated that the purpose of this chapter was not to derive definitive conclusions but to explore possibilities. The findings of this chapter indicate the possibility that environmental factors may influence dishonest behavior and identify several factors worth further investigation. Further experiments are needed to verify the effects of these factors. Thus, the subsequent chapters will focus

on verifying the effect of environmental factors on dishonest behavior and further elucidate the underlying mechanisms through experiments.

Footnotes

[1] In addition to the task used, the original coin toss task (Fischbacher & Föllmi-Heusi, 2013; Guo et al., 2020) for dishonesty-detection was also employed in Experiment 1. In this task, participants were required to find a physical coin, toss it 20 times, and subsequently report their score for the additional reward. However, after data collection, it was realized that this task was often used to evaluate the average level of dishonesty within a group (e.g., Guo et al., 2020; Liu & Yamada, 2024), which did not align with this experiment's focus, individual-level dishonest behavior. Therefore, the results of this indicator were not discussed or reported and were not used in the analysis.

[2] In discussing centrality indices, a CSC below 0.25 is considered inappropriate, and ideally, the CSC should exceed 0.50 (Epskamp et al., 2018; Kunisato et al., 2023). Both the CSC for closeness and betweenness were lower than 0.25; thus, discussions were conducted without relying on these measures.

Chapter 3 *Anonymity or ambiguity? Why does darkness influence dishonest behavior*

3.1 Background

The findings in Chapter 2 indicate that factors within the ECPP (such as brightness, temperature, and color temperature) are more likely to influence dishonest behaviors. Indeed, as early as 2010, Chen-Bo Zhong and the colleagues reported the effect of brightness on dishonesty. However, the study had considerable flaws that cannot be overlooked (See more details in Experiment 2). Moreover, in recent years, one of the original authors, Francesca Gino, became embroiled in a scandal involving academic misconduct, which has caused an uproar in the psychological community (Lee, 2023). Later, several papers involving Zhong, have been retracted, and the first author of these retracted papers, Ping Dong has been stripped of the academic degree and position due to making up data (Youmshajekian, 2024). This naturally raises concerns about the reliability of the phenomena reported by Zhong et al. (2010). In response, in Chapter 3, a series of experiments were conducted to investigate the effect of brightness on dishonesty, beginning with a conceptual replication, followed by four experiments that uncover a new mechanism. In summary, the purpose of Chapter 3 is to verify the effect of brightness on dishonest behavior and to elucidate the underlying mechanisms behind this phenomenon.

3.2 Experiment 2: Darkness promotes dishonesty in a coin toss task

Introduction

Zhong et al. (2010) found that the darkness engendered an increase in dishonest behavior and attributed this influence to alterations in perceived anonymity. Perceived anonymity is closely tied to the environment's actual anonymity but also may be swayed by cognitive bias. Zhong et al. (2010) emphasized that while the actual anonymity in their experiment does not vary with the darkness of the room, participants' cognitive biases (caused by the phenomenological experience of impaired vision in the dark) led them to believe they were less observable in the dark. This amplified their perceived anonymity, thereby escalating dishonesty—a phenomenon they termed "illusory anonymity." This explanation is supported by the "Three Principles to REVISE People's Unethical Behavior" proposed by Ayal et al. (2015), which point out that increased visibility potentially reduces anonymity, enabling better surveillance and thereby deterring dishonesty. Furthermore, anonymity has been linked to concepts like decision observability, with studies reporting that increased decision observability (i.e., reduced anonymity) may stimulate pro-environmental and pro-social behaviors (e.g., Vesely et al., 2022). Consequently, it seems reasonable that Zhong et al. (2010) explained the observed increase in dishonest behavior in dark conditions was due to a heightened sense of anonymity.

However, several reasons led us to conduct a replication of Experiment 1 of Zhong et al. (2010). First, Zhong et al. (2010) considered that the actual anonymity was not altered. They said that

“although the room in the experimental condition was darker than the one in the control condition, participants had no trouble seeing and identifying each other” (Zhong et al., 2010, p. 314). Thus, it is considered that the visibility was altered at least to some degree by their method, for similar sized rooms of 15 ft x 14 ft, there were 12 fluorescent lights in light conditions and 4 fluorescent lights in dark conditions. Although the dishonesty in the task (the Matrix Task from Mazar et al. (2008b)) of their experiment could not be detected simply by observation, the experimenters could detect dishonesty attempts by observing the participants’ expressions. In this instance, the observation by other parties, such as the experimenter, could compromise the participants’ temporary anonymity (i.e., the state when the participants performed the task without the observation), indicating that the actual anonymity within the experimental context is potentially subject to change. Another reason is that participants’ perceived anonymity was important in their arguments, however, it was not found that any relevant results were reported in the experiment of dishonesty (Experiment 1 of Zhong et al. (2010)). Zhong et al. (2010) did not examine any measures related to perceived anonymity, thus it is unclear whether the mechanism in which room darkness leads to cheating really involves perceived anonymity. That is, the effect of anonymity has insufficient plausible grounds to support the conclusions of the original study. Further empirical evidence is required to substantiate this claim. The third reason is that the Matrix Task was considered ill-suited for studying dishonesty (Heyman et al., 2020). Hence, despite the widespread use of the Matrix Task, it is needed that validating the effect of darkness on dishonesty by employing an alternative task. For these reasons, it is necessary

to conduct further experiments to explore the relationships between anonymity, darkness, and dishonesty. Compared to the original experiment, the individual experiment approach was adopted, creating an environment where actual anonymity is consistently zero. Participants' illusory anonymity was then elicited by dimming the room's brightness, followed by an investigation into perceived anonymity and the use of another widely recognized task to assess dishonest behaviors. In summation, the refinements provide several key advantages: first, they can control the variability of actual anonymity. Second, they can provide evidence for the first time on perceived anonymity in the observed phenomenon. Third, they facilitate a discussion regarding the potential generalizability of the phenomenon, especially under tasks more suitable for detecting dishonest behavior.

An experiment was planned with a between-subjects design which has one factor (brightness) with two levels (light and dark). Based on the results of the original experiment, a significantly higher frequency of dishonest behavior was anticipated in the dark condition compared to the light condition. This led to the formulation of the following hypothesis:

H1: Darkness will promote dishonest behavior.

Experiment 2, similar to Experiment 1, defines reporting scores that are greater than actual scores as dishonesty. However, it differs in that dishonesty is only considered to have occurred if the dishonest indicators are statistically significantly above the chance level (See more details in "Methods").

Methods

Ethical information

The experiment was conducted in accordance with guidelines from the Declaration of Helsinki (2013). The ethics committee of the First Hospital of China Medical University approved the protocol (approval number: 2021-388-2). Before the experiment, each participant provided written informed consent, indicating voluntary participation with an understanding that they retained the right to withdraw from the experiment at any given time.

Power analysis and participants

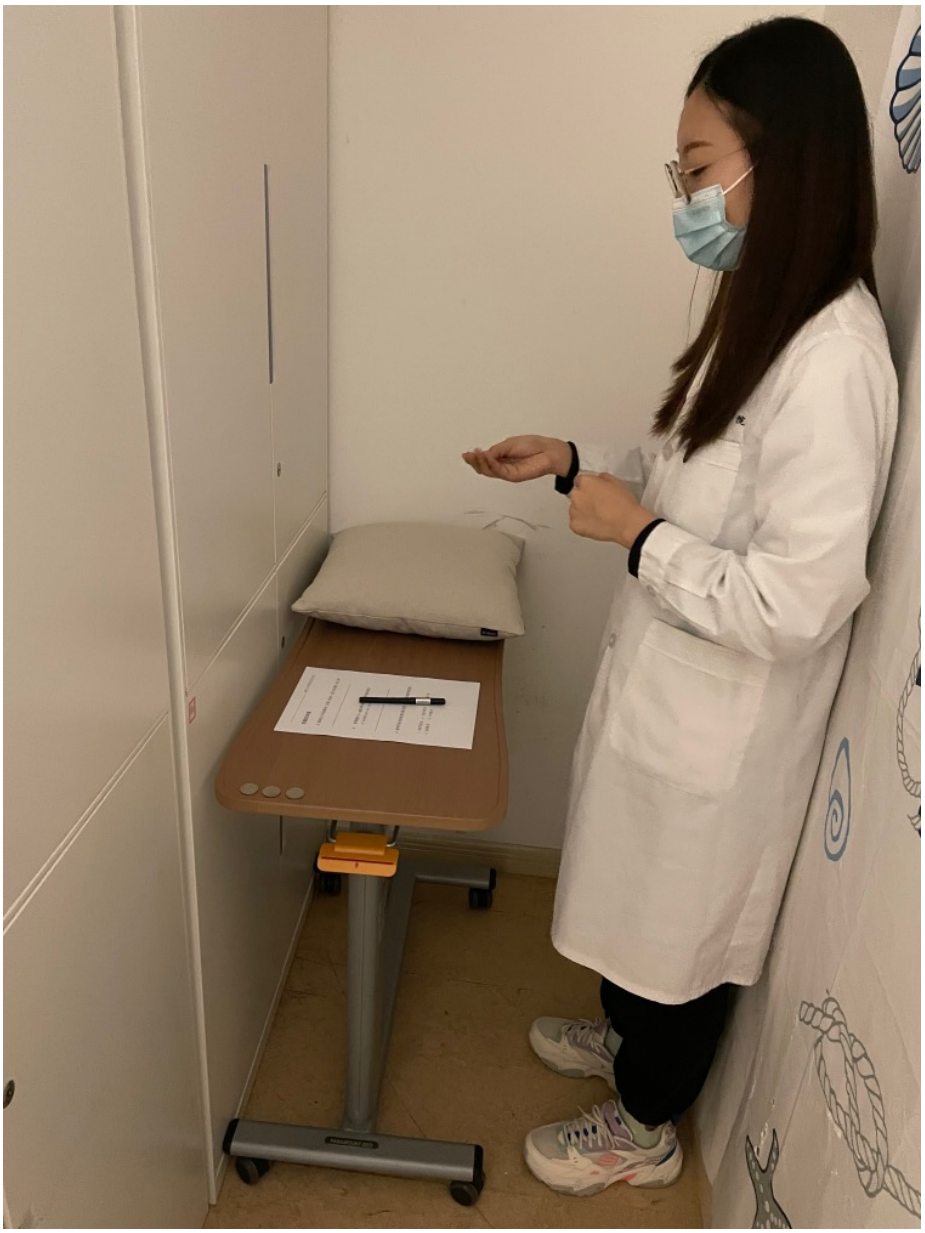
The required sample size was calculated in G*power 3.1.9.3 (Faul et al, 2009). In G*Power, it was set that the significance level $\alpha = 0.05$, power level $1-\beta = 0.8$, allocation ratio N2/N1 = 1, and the effect size $d = 0.5$ (medium effect; Cohen, 1988) for the *t*-test. The required total sample size is 102, with 51 participants in each group. Participants were undergraduate and graduate students at China Medical University and staff at the First Hospital of China Medical University. the participants were recruited while excluding those who violated the exclusion criteria (See “Data exclusion”). Data collection was halted once 102 valid responses were received.

Procedure

The experiment was conducted in a small room within the First Hospital of China Medical University (Figure 3.1). Firstly, participants provided written informed consent. Then, participants were randomly assigned to one of the two brightness conditions. To observe the effect of brightness more

precisely, the brightness was differentiated in two conditions to the greatest extent feasible within a reasonable range. The light condition was calibrated to over 1000 lux, while the dark condition was set to less than 10 lux, as measured by a lux meter (Deli DL333205). Brightness was manipulated using a lamp with adjustable brightness (MKD MT-L200).

Figure 3.1 The coin toss task.



The participants were initially informed that they were assisting with research on paranormal phenomena, and they were asked to provide informed consent. Consistent with Experiment 1, to conceal the true purpose of detecting dishonest behavior, Experiment 2 also did not include any instructions regarding prohibited behavior. After introducing the experiment, the experimenter sat with his/her back to the participants in another corner of the room, separated by a row of lockers. Then, the participants started the "coin toss task". This task is an adjusted version of the paradigm presented by Fischbacher and Föllmi-Heusi (2013) for dishonest detection. In the present study, several coins were provided on a table (Figure 3.1), and participants were free to select any one coin. Then, participants were asked to flip the coin 10 times and report the number of "tails" outcomes as their score. For every "tail", participants could receive 3 Yuan (CNY) as a reward. Participants were instructed these rules in advance. Given that the experimenters were unaware of the participants' true scores, this setup provided an opportunity for the participants to be dishonest to receive more rewards. The scores reported by participants were utilized as a measure of the degree of dishonesty. See "Data Analyses" for more details.

After participants reported their scores, they were asked to evaluate the room brightness by using a magnitude estimation method (from 0: not light at all to 100: very strongly light) and the perceived anonymity by using a 5-point Likert scale (1: not anonymous to 5: very anonymous). The original question regarding perceived anonymity was phrased as follows: "请评价本次游戏里的匿名感 (即感觉被观察的程度)" which means "Please rate the sense of anonymity in this game (i.e.,

the feeling of being observed).” To align more closely with the introduction of research on paranormal phenomena, the experimenter provided a verbal explanation: “This question is intended to assess the extent to which you feel your behavior is observed or influenced by others.”

Participant recruitment commenced on October 12, 2021, and the experiment was carried out through December 14, 2021.

Data exclusion

Participants were excluded if they were unable to complete the task properly, did not provide adequate data, determined the real purpose during the experiment, or demanded the removal of their data.

Data Analyses

A *t*-test was used to test whether there was a significant difference between the mean number of “tails” in the two brightness conditions. Besides, the *t*-test was also used to test whether there was a significant difference between the mean number of “tails” reported by the participants in the two conditions and chance level (i.e., 5) to confirm if the dishonesty occurred. If there is a significant difference between the reported scores and the chance level, it is considered that the participants were dishonest (Bryan et al., 2013; Guo et al., 2020). According to the protocol, the two one-sided tests (TOST) was also used to test if the effect size was significantly equivalent to 0 when a significant difference between the two conditions was not obtained in the first analysis mentioned above. In this experiment, the smallest effect size of interest (SESOI) was $d = 0.5$, and this was used as the equivalence bounds in the TOST (Cohen, 1988; Lakens et al., 2018).

Pre-registration

The protocols above were registered on Open Science Framework (OSF) on October 11, 2021 (https://osf.io/nkjq5) and April 3, 2022 (https://osf.io/p54tj). The following content was written based on data obtained after the pre-registration.

Results

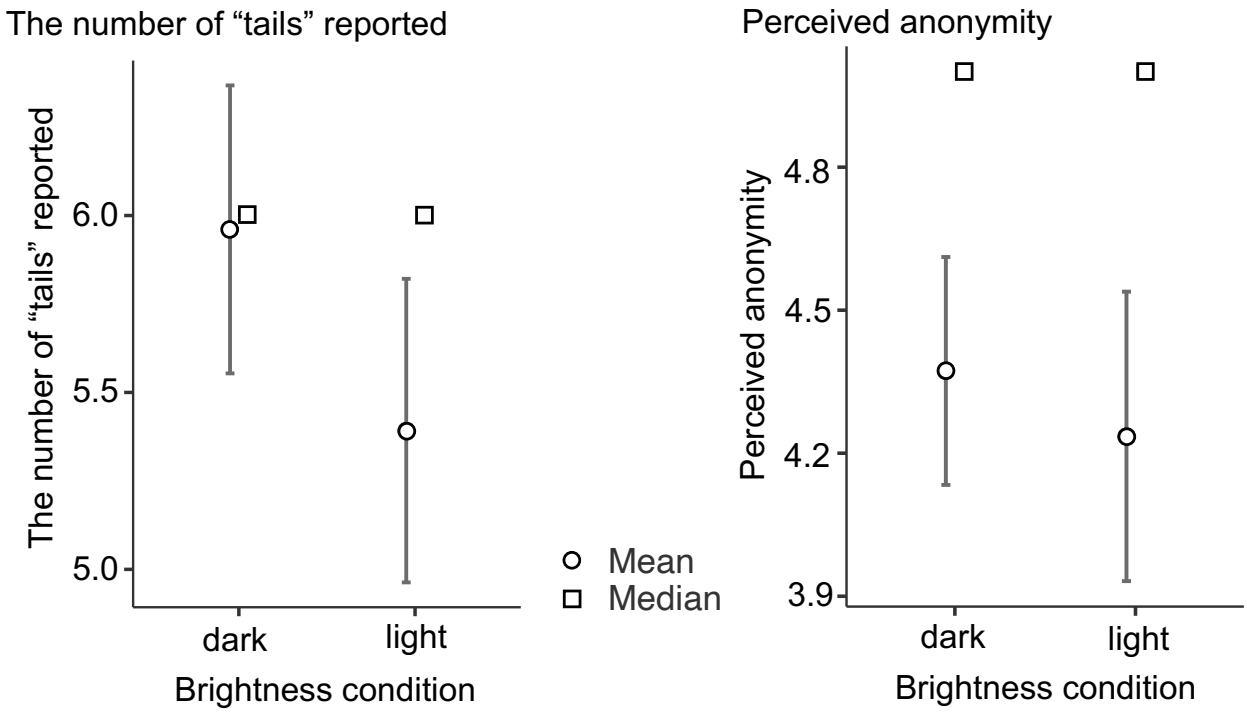
A total of 105 participants were recruited to collect the pre-registered number of 102 participants while excluding those who violated the exclusion criteria. Three participants were excluded from the analyses because they failed to provide adequate data (due to their movement or touching of the desk lamps, the lighting conditions were altered). Data from the remaining 102 participants (female 68.63%, male 29.41%, no response 1.96%, M_{age} = 23.73, SD = 6.65) comprised the final dataset for the analyses. Analyses were conducted by using jamovi software (2023, Version 2.3.21.0; https://www.jamovi.org/).

Firstly, for the manipulation check, the perceived brightness in two conditions were compared. The perceived brightness in the light condition was significantly higher than in the dark condition ($t(100) = -8.86$, $p < .001$, Cohen's $d = -1.75$).

Next, a t-test was performed to compare the number of "tails" that participants reported and perceived anonymity in two conditions (Figure 3.2). The mean score reported in dark condition was 5.96 (SD = 1.48; Mdn = 6); the mean score reported in light condition was 5.39 (SD = 1.56; Mdn =

6). Participants in the dark condition reported a significantly higher score than the light condition ($t(100) = 1.885$, $p = .031$, Cohen's $d = 0.373$). On the other hand, the mean perceived anonymity in dark condition was 4.37 ($SD = 0.87$), while that in light condition was 4.24 ($SD = 1.11$). The difference between the perceived anonymity in the two conditions was not significant ($t(100) = 0.696$, $p = .244$, Cohen's $d = 0.138$). For this reason, a TOST was appended to test if the effect size could be regarded as 0. The results of the TOST were significant (TOST Upper: $t(100) = 3.22$, $p < .001$, TOST Lower $t(100) = -1.83$, $p = .035$, equivalence bounds (raw): Low = -0.498, High = 0.498), which means that the effect of darkness on perceived anonymity was significantly equivalent to 0.

Figure 3.2 Mean and median number of "tails" reported and perceived anonymity in the two conditions.



Note. Error bars denote 95% confidence intervals.

Moreover, the number of "tails" that participants reported in the two conditions was both significantly higher than chance level (dark condition: $t(50) = 4.63$, $p < .001$, Cohen's $d = 0.648$; light condition: $t(50) = 1.79$, $p = .040$, Cohen's $d = 0.251$).

Discussion

By comparing the number of "tails" that participants reported in the two conditions, it was found that the darkness of the room could promote participants' dishonesty. The result lends support to H1. This finding is also in line with the original experiment (Zhong et al., 2010). The results of the original experiment were successfully replicated, even though more precise control over the lighting conditions was implemented and a different task was utilized. It is evident that the significant difference was found in means, but not in the medians. This discrepancy can be attributed to that some participants reported fairly higher scores (> 7) in the dark condition, whereas this was not the case in the light condition, with participants reporting scores that widely dispersed around 6. This indicates that dishonesty was more prevalent in the dark condition.

Besides, dishonesty was observed in both two conditions. It suggests that participants in the experiment have a tendency to be dishonest overall. This is similar to the results of Zhong et al. (2010). Moreover, taken as a whole, dishonest behavior is evident at a moderate level. This also demonstrates that the coin toss task and reward system utilized in Experiment 2 provided participants with an appropriate motivation to lie, while also creating an environment in which participants felt free to be

dishonest.

Moreover, the results of the manipulation check showed that the brightness used in this experiment had significant effects on participants' perceived brightness, which means the experimental manipulation was appropriate.

On the other hand, the more interesting finding pertained to perceived anonymity. Based on the results of TOST, the perceived anonymity of the participants in the two conditions was equal. That is to say, although it was found that the darkness of the room did promote dishonesty, the cause of this phenomenon might not be a difference between participants' perceived anonymity as Zhong et al. (2010) inferred. The difference between the results of this experiment and those of the original experiment could potentially be attributed to differences in experimental environment and design. For instance, in the original experiment, participants were not alone, while in this experiment, there was no presence of a second individual within the participant's field of view. Such difference undoubtedly impacts the participants' perceived anonymity. The influence of the presence of others on the actual anonymity of the experimental environment is also worth noting. Considering that despite the absence of others, participants in a laboratory experiment may still experience a sense of being observed, the issue will become more complex. Additionally, another difference between this experiment and the original experiment is the experimental purpose presented to participants; specifically, participants in Experiment 2 were informed that the study concerned paranormal phenomena, a detail not mentioned in the original experiment. This description might lead participants to interpret the evaluated sense of

anonymity as not only pertaining to observation by the experimenters but also potentially encompassing observation by supernatural entities. This interpretation of anonymity differs from that in the original study, which focused solely on anonymity in relation to the experimenters (though the original study did not investigate). This difference in the understanding of anonymity could also be a potential reason for the differing conclusions about anonymity between this and the original experiment. In sum, under different actual levels of anonymity in experimental settings and differing interpretations of anonymity, the influence of brightness on perceived anonymity could vary and thus require further empirical exploration. Based on the results of the present study, it is considered that the conclusions drawn in the original study attributing the promoting effect of the darkness of the room on dishonesty to perceived anonymity may be presumptive, especially in circumstances where perceived anonymity was not thoroughly investigated.

A further alternative view of the relation between darkness and dishonesty can be offered by the latest findings from social psychology. It has been reported that the effect of brightness on pro-social actions may be moderated by societal factors, such as self-construal (Esteky et al., 2020). Moreover, the influence of brightness on pro-social behavior is believed to be mediated, in part, by satisfaction with illumination and perceived anonymity (Ru et al., 2022). Intriguingly, the findings on perceived anonymity by Ru et al. (2022) differ from those of the present study. They observed that variations in brightness affected participants' perceived anonymity. It is postulated that this discrepancy may arise from the subtle differences in the design of the laboratory environment and the

positioning of the experimenter. However, it is important to note that although pro-social actions and dishonest behavior are often considered in tandem within behavioral ethics, their subtle distinctions (e.g., dishonest behavior frequently entails the possibility of more stringent penalties) make it debatable to what extent findings on pro-social behavior can be reliably applied to dishonest actions. In summary, these suggest the presence of intricate underlying mechanisms and multifaceted phenomena awaiting exploration in subsequent studies.

The original experiment, which found that darkness promotes dishonest behavior, was successfully replicated with more precise control over the lighting conditions and using a different task. However, the results of perceived anonymity did not align with the interpretation of the original study. Consequently, it is posited that the conclusions drawn in the original experiment may have been somewhat presumptive and suggest further empirical validation. Future experiments need to investigate other potential explanations.

3.3 Experiment 3: The effect of darkness on dishonesty in a non-visual task

Introduction

Experiment 2 found that perceived anonymity remained unchanged across various brightness conditions, which suggested that factors other than perceived anonymity could drive dishonest behavior in dark environments. The facilitating effect of darkness on dishonesty can be tied to visibility. Visibility, a critical determinant of dishonesty, was suggested as a principle for revising people's unethical behavior (Ayal et al., 2015). Numerous studies have underscored the importance of visibility in various decisions and behaviors, including checking behavior (Birnholtz et al., 2012), prosociality (Bradley et al., 2018), the subjective magnitude of one's actions (Steinmetz et al., 2016), and pro-environmental actions (Vesely et al., 2022). Regarding dishonesty, low light conditions signified reduced visibility, which implied a decreased likelihood of detection for dishonesty and thereby increased its occurrence. In essence, anonymity emphasized by Zhong et al. (2010) was an aspect of visibility: an increase in room brightness enhanced visibility, which could reduce perceived anonymity. However, it is crucial to distinguish between anonymity and visibility, with the latter being a broader concept that encompasses several examples. In some cases, unethical behavior occurs as the perpetrator's identity is difficult to ascertain, such as nocturnal graffiti defacement. Conversely, some unethical behaviors arise as the actions themselves are difficult to detect, such as if a renowned food manufacturer illicitly incorporated a banned additive. While the former situation is a

manifestation of anonymity, the latter underscores the observational ambiguity of certain actions. Therefore, besides anonymity, ambiguity is also crucial, which is influenced by visibility. Ambiguity provides a reasonable explanation for the promoting effect of darkness on dishonest behavior. A dark condition amplifies visual ambiguity, which discourages observation of events occurring there, particularly the outcomes of actions indeed performed. In this situation, individuals could be more predisposed to dishonesty, even if their perceived anonymity remains unaltered.

Besides the visibility for changing unethical behavior, which Ayal et al. (2015) emphasize, social and moral psychology provides further theoretical frameworks that may enhance our comprehension of this phenomenon. The Self-Concept Maintenance Theory (SCM, Mazar et al., 2008), discussed in Chapter 1, posits that individuals maintain a balance between honesty and certain dishonest behaviors to preserve their self-perception of integrity while receiving benefits. Ambiguity, by blurring the line between honesty and dishonesty, allows such dishonest behavior to fall within the acceptable threshold proposed by SCM Theory, making it easier for individuals to maintain a positive self-image. Additionally, the Moral Disengagement Theory (MD, Bandura et al., 1996) offers an alternative viewpoint. This theory introduces “Moral Justification”, which means providing moral reasons for potential immoral behavior. In situations where ambiguity is present, it facilitates the justification of dishonest behavior as an unintentional error, thereby providing moral grounds for such behavior. Both theories suggest that ambiguity promotes dishonest behavior, offering a robust theoretical basis for this phenomenon. Conversely, if this study can provide empirical evidence of the

impact of ambiguity on dishonest behavior, it would confirm the practicality and validity of these theories or identify their limitations, thereby refining and broadening the theoretical framework.

As mentioned above, these explanations warrant empirical validation. Moreover, if perceptual ambiguity of action outcomes is the key for the underlying mechanism through which darkness promotes dishonest behavior, eliminating that ambiguity should also nullify the effect of darkness. Specifically, when the environment is darkened yet participants are still able to clearly discern the outcomes in a task, the rate of dishonest behavior should be comparable to that observed in light conditions. An experiment was designed using a non-visual task to ensure that participants could clearly ascertain the outcomes even in a darkened environment, to assess the following hypothesis:

H2: Task type (visual vs. non-visual) and illuminance (dark vs. light) would interact with each other for dishonest behavior.

Additionally, to assess the validity of our experimental method—specifically, its effectiveness in eliciting dishonest behavior among participants— an additional hypothesis was made:

H3: Participants would exhibit dishonesty above the chance level in each condition.

Similar to Experiment 2, in Experiment 3, reporting scores that are greater than actual scores is considered dishonest behavior, regardless of the participants' intention. Moreover, dishonest behavior also includes behavior that leads to obtaining higher scores for participants. Dishonesty is considered to have occurred if the dishonest indicators are statistically significantly above the chance

level.

Methods

Ethical information

The study followed the guidelines of the Declaration of Helsinki (2013) and its future amendments. Ethical approval for the research protocol was granted by the Ethics Committee of the Department of Human Sciences (Psychology), Graduate School of Human-Environment Studies, Kyushu University, with the approval number of 2022-004. Prior to the experiment, all participants provided written informed consent. Participants were made aware of their right to discontinue participation at any stage.

Design

This experiment employed a two-factor between-subjects design. The two factors were illuminance (light and dark) and task type (visual and non-visual), respectively. Considering that a portion of the necessary data was provided in Experiment 2, Experiment 3 only collected data for the non-visual task under the two different illuminance levels. Participants were randomly divided into one of two illuminance conditions by the experimenter. They were not informed of the condition to which they were assigned.

Power Analysis and Participants

G*Power 3.1.9.3 was used for power analysis. Given that both factors pertain to between-subject designs, it was selected that the “A priori” option for “ANOVA: Fixed effects, special, main effects

and interactions" in the G*Power calculations. Due to the absence of precedent for the developed non-visual task and the lack of prior research to refer to, effect sizes of $f = 0.25$ were used in the power analysis as the smallest effect of interest. Moreover, the primary emphasis was on the interactions between these two factors, rather than the main effects of a single factor. Consequently, a power analysis was conducted specifically targeting the interaction. Thus, the other input parameters were set as: significance level $\alpha = 0.05$, power level $1 - \beta = 0.8$, Numerator df = 1 ((the levels of illuminance - 1) * (the levels of task type - 1)), Number of groups = 4 (the levels of illuminance * the levels of task type). The analysis indicated that 128 participants were required, and 32 were allocated to each of the four groups. Considering that a portion of the requisite data was already provided by Experiment 2, the to-be newly obtained sample size was adjusted to 64. Ultimately, the valid data were collected from 64 participants with a mean age of 23.02 years ($SD = 3.42$), which included 21 males and 43 females. The male-to-female ratio was controlled to ensure consistency with the dataset from Experiment 2. Data from these 64 participants were combined with data from the 102 participants in the earlier study and constituted the final dataset, which resulted in 166 participants.

Procedure

As previously noted, data collection was solely focused on the non-visual task under the two different illuminance conditions. Consistent with Experiment 2, for illuminance settings, the light and dark conditions were set to 1000 lux and less than 10 lux, respectively. The experiment was conducted in an experimental room at Kyushu University. Initially, participants were asked to provide written

informed consent and complete a demographic questionnaire. After the instructions of the experimental procedure, the experimenter exited the room. A novel non-visual task was designed to detect dishonest behavior. The experimental setup consisted of 20 identical-looking, opaque cups placed on a table, 10 each in the top and bottom rows. In each trial, a vertically aligned pair was used. One cup in the pair contained a table tennis ball, while the other was empty. The cup into which the table tennis ball was placed was determined randomly by the experimenter. Participants were asked to guess which cup contained the table tennis ball without physically touching the cups (which means touching the cup to confirm the correct answer before making a decision might be considered a kind of prohibited behavior). Following their answer, participants were allowed to shake the cups to verify the accuracy of their guesses. Each participant completed 10 trials. Upon completion of all the trials, participants reported the number of correct guesses as their earned score. For each score, they received a reward of 100 yen. This implied that participants were overpaid if they engaged in dishonest reporting.

Data exclusion

Participants were excluded if they failed to complete all the tasks properly or provide adequate data, determined the real purpose of the experiment before disclosure (which included communicating with the experimenter regarding the possibility of dishonesty in the experiment), or demanded the removal of their data.

Stopping Rule

Participants were recruited while excluding those who violated the above-mentioned exclusion criteria (five participants were excluded for determining the real purpose). Once valid data from 64 participants were received, data collection was stopped.

Data Analyses

All analyses were conducted using the software jamovi (Version 2.3). First, a two-way analysis of variance (two-way ANOVA) was used to assess if the interaction was significant (H2). Subsequently, a one-tailed one-sample *t*-test was used to assess whether the mean scores reported in both conditions were significantly above chance level (5) to examine the occurrence of dishonesty. Moreover, to further assess the effect of illuminance via a non-visual task, a *t*-test and an equivalence testing (two one-sided tests, TOST) were used to examine whether the difference in the scores between the two illuminance conditions was significant as an additional analysis. Following Lakens et al. (2018), Experiment 3 utilized the SESOI of $d = 0.5$, which was used as the equivalence bounds in the TOST.

Pre-registration

All data and research materials were made publicly accessible via the Open Science Framework (OSF, https://osf.io/uv6zm/). As our data analysis was conducted using statistical software, jamovi, there is no specific analysis code to disclose. Instead, OMV files (the jamovi file) detailing the analysis process and results have been uploaded to the OSF.

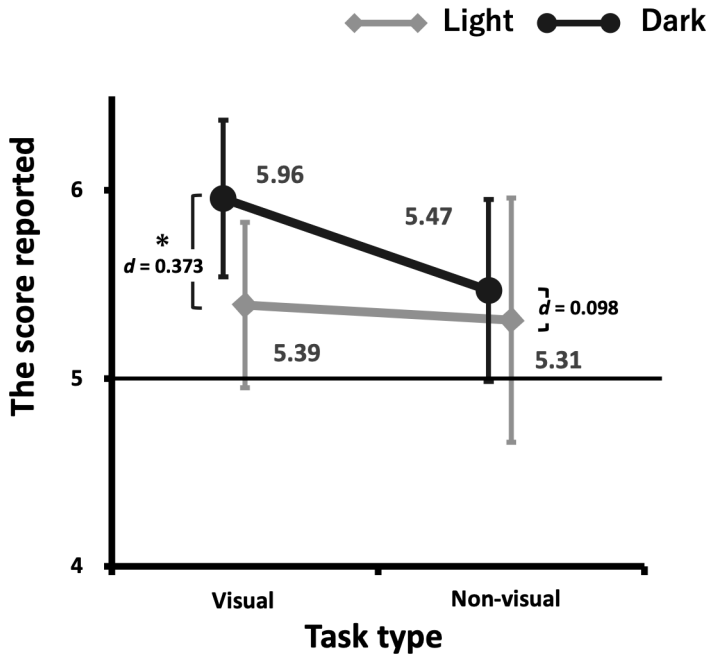
The protocol above (including the experiment and analysis plans) was preregistered on the OSF (https://osf.io/p6j4t) on June 3, 2022. The additional analysis was registered (https://osf.io/xpyct) on August 3, 2022. Data collection commenced following pre-registration and was completed in 2022.

Results

A two-way analysis of variance (ANOVA) on the reported score showed that neither the main effect of task type nor illuminance, as well as their interaction, were significant (Figure 3.3; task type: $F(1,162) = 1.34, p = .25, f = 0.09$; illuminance: $F(1,162) = 2.15, p = .14, f = 0.11$; interaction: $F(1,162) = 0.70$, $p = .41$, $f = 0.06$). In the non-visual task, no significant differences were observed between the reported scores in the two illuminance conditions (Welch's $t(57.3) = 0.39$, $p = .696$, Cohen's $d = 0.10$). Moreover, the results of the TOST were also not significant (TOST Upper: $t(57.3) = 2.39$, $p = .010$; TOST Lower $t(57.3) = -1.61$, $p = .057$, equivalence bounds (raw scores) = ±0.795).

Furthermore, the one-sample *t*-test showed that the score reported in the dark condition was significantly above chance level ($t(31) = 1.97$, $p = .029$, Cohen's $d = 0.35$), while the score reported in the light condition was not ($t(31) = 0.98$, $p = .167$, Cohen's $d = 0.17$).

Figure 3.3 Mean score reported in each condition



Note. *$p < .05$. Error bars represent the 95% CI. The line at 5 indicates the chance level.

Discussion

No significant interaction between the task type and illuminance conditions was observed. It cannot be stated that H2 was supported. Consequently, it could not be concluded that only when visual tasks were employed, dishonest behavior was more prevalent in the dark condition compared to the light condition. However, this result may also stem from a relatively large effect size specified in the power analysis, leading to an inadequate sample size. Moreover, when the visual task was used, significantly higher dishonesty in the dark condition was accompanied by a larger effect size (Cohen's $d = 0.37$; Experiment 2). Conversely, there was no conclusive evidence of a significant difference in dishonesty between the two illuminance conditions when non-visual tasks were used, and it is more important

that the effect size was minimal. Additionally, the results of the equivalence testing showed that the effect size of illuminance could not be considered significantly equivalent to 0. However, the sample size of this experiment fell short for a TOST in which based on calculations made via the "powerTOSTtwo" function in R, 140 participants were required for a reliable equivalence test.

In Experiment 3, data from the dark condition suggested the occurrence of dishonest behavior, while the light condition did not yield evidence for such behavior. Consequently, H3 was not fully supported.

In summary, the results in Experiment 3 were insufficient to substantiate any definitive conclusions. The results of both the *t*-tests and equivalence testing suggested that it cannot be asserted that ambiguity had or did not have an impact on dishonest behavior. To assess the effects of ambiguity more precisely, perceptual ambiguity of the task outcome was directly manipulated in Experiment 4.

3.4 Experiment 4: Does the ambiguity (visual masking) influence dishonesty?

Experiment 4 aimed to assess the effect of perceptual ambiguity on dishonest behavior. In other words, it sought to test the following hypothesis:

H4: Perceptual ambiguity would promote dishonest behavior.

In Experiment 4, visual masking, in particular metacontrast masking, was used to create different conditions characterized by varied levels of visual ambiguity. This was achieved by adding a subsequent visual stimulus to the content shown to participants, making the content harder to check clearly (Enns & Di Lollo, 2000).

In Experiment 4, reporting scores that are greater than the actual scores is considered dishonesty, regardless of the cause. However, similar to Experiment 2, dishonesty is only considered to have occurred if the dishonest indicators are statistically significantly above the chance level.

Methods

Ethical information

The study followed the guidelines of the Declaration of Helsinki (2013) and its future amendments. Ethical approval for the research protocol was granted by the Ethics Committee of the Department of Human Sciences (Psychology), Graduate School of Human-Environment Studies, Kyushu University, with the approval number of 2022-001.

Design

To assess H4, a between-subjects experimental design with a single factor (the ambiguity of task outcomes) was employed. This factor was manipulated at two levels: ambiguous and control conditions. Compared to the control condition, the task outcomes in the ambiguous condition were harder to check. Participants were recruited from the users of Yahoo! Crowdsourcing Service in Japan. Participants' assignment to the two experimental conditions, ambiguous and control groups, was random and executed using a JavaScript function.

Power Analysis and Participants

As in Experiment 1, because of the unavailability of prior information, $d = 0.5$ was considered as the smallest effect were interested in detecting. In G*Power 3.1.9.6, it was set that the significance level $\alpha = 0.05$, power level $1 - \beta = 0.95$, allocation ratio N2/N1 = 1, and $d = 0.5$ for a power analysis. It was selected that "A priori" of "Means: Difference between two independent means (two groups)" in G*Power. The required total sample size for a one-tailed *t*-test was 176 participants, with 88 in each group. The final dataset consisted of data from 176 participants (130 males, 45 females, and one non-response). The participants' mean age was 47.2 years ($SD = 10.9$).

Materials

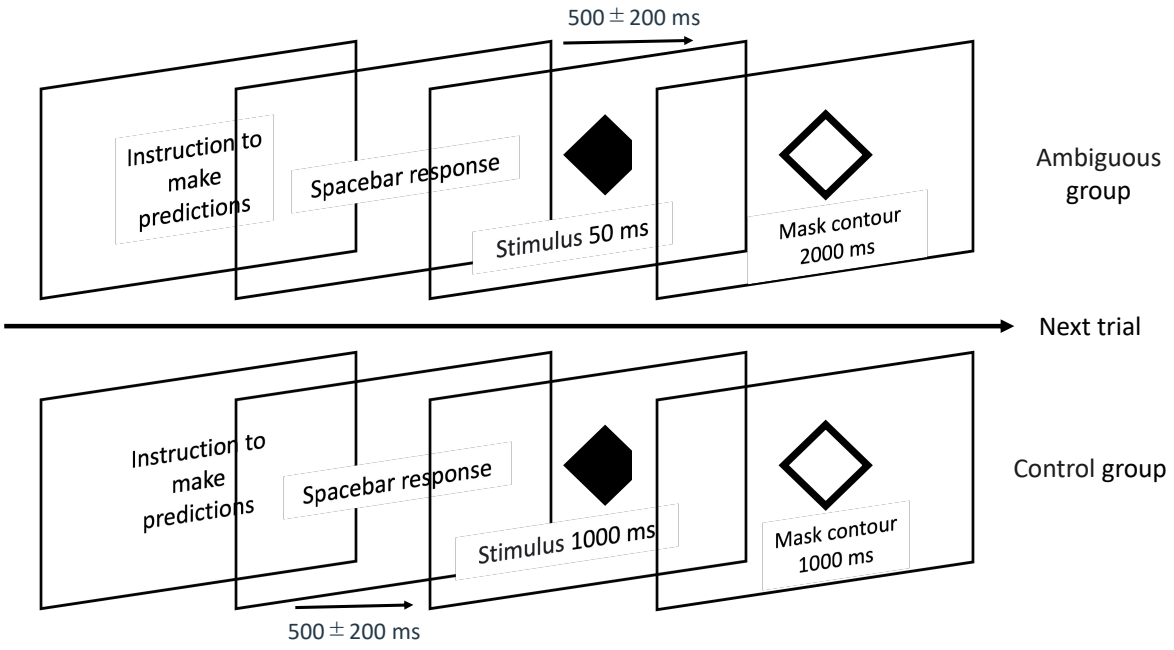
A JavaScript-based experimental program, created using jsPsych (de Leeuw, 2015; Kuroki, 2021), was employed. Participants accessed the experimental page via a link provided by the Yahoo!

Crowdsourcing Service survey form. Data collection was conducted using phpMyAdmin.

Procedure

To avoid any guesses regarding the purpose of the experiment, it was disguised as an extrasensory perception experiment (Guo et al., 2020; Liu et al., 2020). Consistent with Experiments 1 and 2, Experiment 4 also did not include any instructions regarding prohibited behavior. The program randomly divided the participants into two ambiguity conditions. Participants who participated in one condition were excluded from the other. Participants completed a task that was a newly designed dishonesty-detection task based on a paradigm presented by Fischbacher and Föllmi-Heusi (2013). In each trial, a rhombus with one of its four corners disappearing at random was displayed on the screen (Figure 3.4).

Figure 3.4 Predicted task in Experiment 4



Participants were required to predict the disappearing corner's orientation (horizontal or vertical) before the rhombus was shown. For instance, if participants predicted "horizontal" and the right or left corner disappeared, their predictions were correct. The participants' accuracy rate could be 50%, which was considered as the chance level. Participants could verify their predictions by pressing the space key after they made their selections. Outcomes appeared at a random time interval (500 ± 200 ms) after their key was pressed. A random time interval made it so that participants were unable to anticipate the timing of the outcome presentation, which thereby enhanced the effect of the subsequent visual masking. After the presentation of each stimulus (rhombus), a rhombus frame was displayed as a masking contour. These masking contours closely conformed to the shape of the stimuli without overlapping them, as metacontrast (Enns & Di Lollo, 2000). In the ambiguous group, the stimulus was presented for 50 ms, and mask contours were displayed for 2000 ms. In contrast, in the control group, the stimulus was presented for 1000 ms, and mask contours were displayed for 1000 ms. This ensured clear task outcome perception for participants in the control group, while participants in the ambiguous group faced challenges in outcome checking. Each participant completed all 10 trials and reported the number of times they were correct. For every "correctness," participants received 10 points (approximately 10 yen) as a reward. Since the experimenter could not confirm the actual score, participants were paid more if they overreported. Scores reported by participants were analyzed as an indicator of dishonesty. After participants reported their scores, they rated the subjective difficulty they experienced when they confirmed the task outcomes on a 5-point

Likert scale (1 = *simple* to 5 = *difficult*). Additionally, an attention check question ("What month is it?") was used to identify instances of satisficing and enhance the reliability of our dataset.

Data exclusion

Participants were excluded if the program detected that the stimulus could not be accurately presented for the required duration on their equipment. Additionally, participants unable to correctly answer the attention check question "What month is it?" were also excluded.

Stopping Rule

In accordance with the guidelines of crowdsourcing service (change in the number of recruits must be in increments of 50) and considering the exclusion, 200 participants were initially recruited. According to a predetermined plan, if there were not enough participants after exclusion (< 176), an additional recruitment of 50 participants would be conducted, and this process would be repeated until the number of valid data reached the required number (176). Enough participants were successfully recruited in the first recruitment round.

Data Analyses

All analyses were conducted using the software jamovi (Version 2.3). First, a one-tailed *t*-test was employed to assess whether the scores reported by participants in the ambiguous group were significantly higher than those in the control group (H4). Second, a one-tailed *t*-tests was applied to

assess whether the mean scores reported in both conditions were significantly above chance level (5) to examine the occurrence of dishonesty (H3). Furthermore, when the first analysis did not indicate a significant difference, an equivalence testing (TOST) was used to determine if the effect size was significantly equal to 0. Following Lakens et al. (2018), this experiment utilized the SESOI of d = 0.5. This was set as the equivalence bounds in the TOST.

Pre-registration

This protocol was preregistered on the OSF (https://osf.io/ju9ah) on October 3, 2022. Data collection commenced following pre-registration and was completed in 2022.

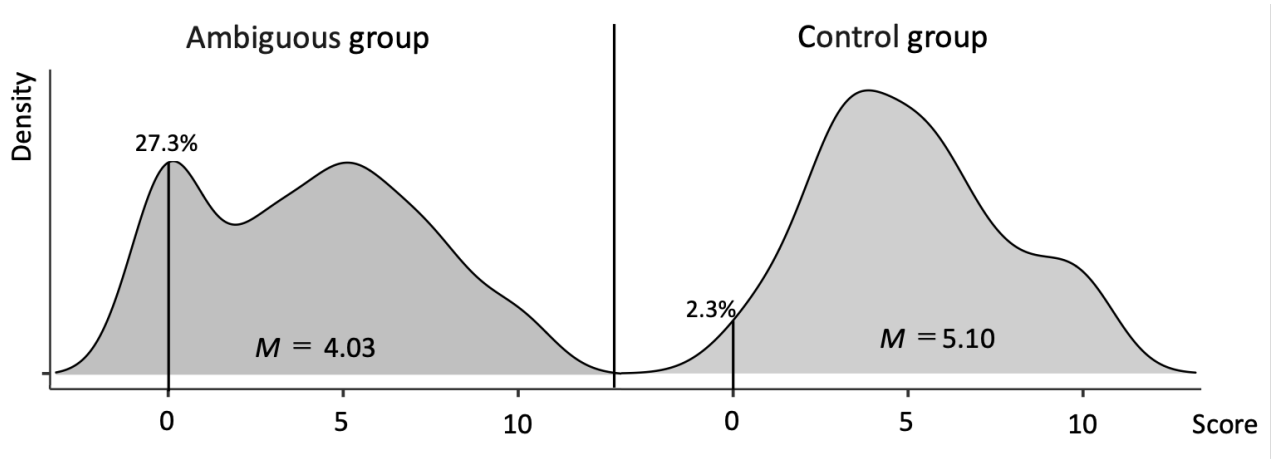
Results

Inconsistent with H4, it was not shown that participants in the ambiguous group reported higher scores compared to those in the control group (Welch's $t(168.22) = -2.42$, $p = .99$, Cohen's $d = -0.36$). The TOST further revealed that the scores between the two groups were not significantly equivalent (Welch's $t(168.22) = -2.42$, $p = .017$, TOST Upper: $t(168.22) = 0.898$, $p = .185$; TOST Lower $t(168.22) = -5.74$, $p < .001$, equivalence bounds (raw scores) = ±1.46). Moreover, participants in the control group reported higher scores on average. As shown in Figure 3.5, this discrepancy was primarily driven by a substantial proportion of participants in the ambiguous group who reported a score of 0. Specifically, 27.3% (24) in the ambiguous group reported a score of 0, compared to a mere

2.3% (2) in the control group. To assess H3, one-sample *t*-tests showed that the scores in both groups did not significantly exceed the chance level (ambiguous group: Student's $t(87) = -2.84$, $p = .997$, $d = -0.30$; control group: Student's $t(87) = 0.363$, $p = .359$, $d = 0.04$).

Additionally, an exploratory analysis was undertaken to assess whether the difficulty in checking the outcomes experienced by participants in the ambiguous group was significantly greater than that of the control group. Participants in the ambiguous group considered that they encountered significantly greater difficulty (Student's $t(174) = 8.18$, $p < .001$, $d = 1.23$).

Figure 3.5 Scores reported in the two conditions in Experiment 4



Discussion

The results of the exploratory analysis showed that Experiment 4 successfully manipulated varied levels of perceptual ambiguity of task outcomes in the two conditions. However, it cannot be stated

that the results support H4. In fact, the results countered the hypothesis: the indicator of dishonesty in the control group was significantly higher than that in the ambiguous group. Specifically, participants in the ambiguous group reported lower scores, largely attributable to a higher proportion of participants who reported a score of 0. This indicated that a minimum of 27.3% maintained honest reporting even when the task outcomes were difficult to ascertain. However, apart from those who reported 0, the remaining participants possibly engaged in varying degrees of dishonest behaviors. Owing to visual masking, it was extremely difficult for participants in the ambiguous condition to check the outcome. When participants reported any scores except 0, they probably reported based on the rewards they wanted (one participant emailed that he reported the same score as the chance level, five, as he could not check the answer, and he did not consider it was dishonest). This constituted a significant methodological shortcoming that should be addressed by setting different levels of perceptual ambiguity, without affecting participants' ability to confirm the outcomes. Moreover, the score reported in the control group was not significantly above the chance level, which suggested that H3 was not supported. It cannot be conclusively asserted that dishonest behaviors occurred. These findings were inconsistent with prior research that utilized similar tasks (Guo et al., 2020; Liu & Yamada, 2024). This might be because the high difficulty of the task used in Experiment 4 could have resulted in participants being so engrossed that they overlooked opportunities for dishonest behaviors.

Overall, Experiment 4 was not effective in assessing the effect of ambiguity on dishonest behavior. Therefore, the experimental methodology was improved in Experiment 5 which employed a design that manipulated perceptual ambiguity without affecting participants' ability to observe the outcomes of the task.

3.5 Experiment 5: Does the ambiguity (stimulus appearance) influence dishonesty?

In Experiment 5, a novel task inspired by a lottery framework was devised, wherein the level of perceptual ambiguity was manipulated by varying the visual distinctiveness of the target stimulus from other stimuli. This approach allowed for the creation of different degrees of ambiguity. Additionally, unlike Experiment 4, this setup provided ample time for participants to confirm the outcomes, regardless of being in the ambiguous or control condition. Despite the differing levels of difficulty in checking due to perceptual ambiguity, participants were able to accurately verify the outcomes if they chose to do so. This modification enabled a more precise evaluation of the impact of ambiguity on dishonest behavior.

In Experiment 5, any behavior that leads to obtaining higher scores for participants (for further details, see the Methods section) and reporting scores that are greater than actual scores are considered dishonest behavior. Dishonesty is considered to have occurred only when the dishonest indicators are statistically significantly above the chance level.

Methods

Ethical information

The study followed the guidelines of the Declaration of Helsinki (2013) and its future amendments. Ethical approval for the research protocol was granted by the ethics committee of the First Hospital

of China Medical University (approval number: 2021-388-2).

Design

The blinding and design employed in Experiment 5 were identical to those implemented in Experiment 4. Participants for Experiment 5 were recruited from the students and staff of China Medical University. They were randomly divided into one of two conditions (ambiguous vs. control groups) by the experimenters.

Power analysis and participants

The statement of power analysis for Experiment 5 closely resembled that of Experiment 4. Specifically, in G*Power 3.1, it was set that the significance level $\alpha = 0.05$, power level $1 - \beta = 0.8$, allocation ratio N2/N1 = 1, and effect size $d = 0.5$. The required total sample size is 102 for a *t*-test (one tailed test), with 51 participants in each group. The final dataset consisted of data from 102 participants (35 males, 63 females, and four non-response). The participants' mean age was 22.5 years ($SD = 1.10$).

Procedure

As in Experiment 4, this experiment was disguised as an extrasensory perception experiment. To evaluate dishonest behaviors, participants completed a ball-based lottery task. In this task, an opaque black plastic box was placed on the table, and housed six table tennis balls. An opening at the top of the box allowed participants to draw the table tennis balls. One of the six balls was designated

as the “special ball,” which differed from the other through either a unique color or pattern (Figure 3.6). In each trials, participants took a ball from the box without watching. If the “special ball” was drawn, the participant would be deemed as a “winner” and would receive a monetary reward of 3 yuan. Conversely, drawing any other ball resulted in a “loss,” with no monetary gain. Participants were asked to complete 30 trials, and to mix the balls thoroughly between trials to maintain a 1/6 probability of drawing the special ball in the new trial (when the participants did not intend to be dishonest). Additionally, participants were instructed not to distinguish the special ball when drawing. After introductions, the experimenter left the laboratory, leaving the participant alone to complete the task. During the experiment, no one could observe the participant. Upon completion, participants exited the laboratory and reported the number of “wins” to the experimenter as their score, then received their rewards.

Figure 3.6 Balls used in the lottery task of Experiment 5

Note. General ball (left), special ball in the ambiguous group (center), and special ball in the control group (right, yellow).

To introduce two levels of ambiguity, different special balls were used across different groups (Figure 3.6). For the ambiguous group, the "special ball" had a single star above its logo in contrast to the three stars on the other balls. This subtle difference made it more challenging for participants to distinguish it. Conversely, in the control group, the "special ball" was distinctly colored yellow, whereas all other balls were white, which facilitated effortless differentiation. Except for the "special ball," other balls used across the two groups were identical.

Data exclusion

Participants were excluded if they did not understand or follow the instructions. The remaining exclusion criteria for Experiment 5 were congruent with those in Experiment 3.

Stopping Rule

The stopping rule for Experiment 5 was congruent with those delineated in Experiment 3 (five participants were excluded, four who determined the real purpose, and one who did not follow the instructions). Once valid data from 102 participants were received, data collection was stopped.

Analysis

The analyses in Experiment 5 were consistent with those in Experiment 4.

Pre-registration

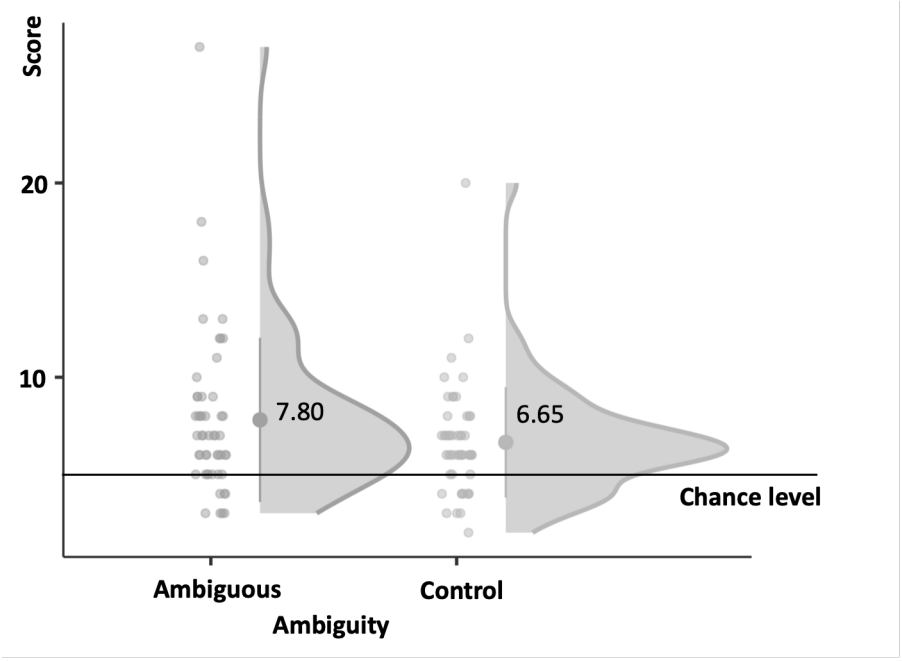
This protocol was preregistered on the OSF (osf.io/27n9j) on March 4, 2023. Data collection commenced following pre-registration and was completed in 2023.

Results

A one-tailed *t*-test was conducted to assess whether the score reported by participants in the ambiguous group was significantly higher than those in the control group. There was no significant difference in dishonest behavior between the two conditions ($t(100) = 1.62$, $p = .054$, $d = 0.321$). Due to a lack of significance, additional tests for equivalence were conducted in accordance with the protocol registered on the OSF. The results of the TOST were not significant (TOST Upper: Welch's $t(87.6) = 4.15$, $p < .001$; TOST Lower: Welch's $t(87.6) = -0.90$, $p = .185$; equivalence bounds (raw scores) = ±1.80).

Furthermore, the scores for both conditions were significantly above the chance level (Figure 3.7, ambiguous group: $t(50) = 4.74$, $p < .001$, $d = 0.664$; control group: $t(50) = 4.14$, $p < .001$, $d = 0.580$).

Figure 3.7 Scores reported in the two conditions in Experiment 5



Note. Each point represents a report.

Discussion

The results cannot be regarded as evidence supporting the H4, which indicated that no evidence showed that the perceptual ambiguity of task outcomes influenced dishonest behavior. However, the result from the TOST was non-significant and did not provide any determinate results. Furthermore, certain effect sizes were observed between conditions. Therefore, it would be premature to conclusively assert a complete absence of the effect of ambiguity. A plausible explanation was that Experiment 5 did not include a manipulation check, which left it unclear to what extent the differences in ambiguity were effectively created between conditions. If the difference in ambiguity was insufficient, it could undermine the observed effect of ambiguity. Moreover, the perceptual ambiguity

was manipulated through the visual features of the balls, which could potentially be influenced by extraneous variables, such as laboratory lighting conditions. To assess the effect of ambiguity more precisely, it was necessary to control these extraneous variables as rigorously as possible. Another possibility, similar to Experiment 3, is that the failure to observe significant results in Experiment 5 is due to the use of a relatively large effect size in the power analysis.

Lastly, the results of the *t*-test that compared the score against chance levels suggested that participants in both conditions seemed to be dishonest, which indicated that H3 was supported. The task in Experiment 5 could effectively induce dishonest behavior. This showed the efficacy of the task in inducing and detecting dishonest behavior.

3.6 Experiment 6: Does the ambiguity (weight) influence dishonesty?

In Experiment 6, the effect of ambiguity on dishonest behavior was further assessed by widening the difference in ambiguity between the conditions. To achieve this, a set of stimuli with varying weights was used, and two experimental conditions were created. In the ambiguous condition, it was hard for participants to distinguish the target stimulus from the other stimuli. Conversely, in the control condition, participants were able to readily and clearly distinguish between the two kinds of stimuli. This task also could circumvent the influence of the extraneous variable (lighting conditions). In Experiment 5, while participants in both conditions displayed dishonest behavior, the magnitude of the dishonesty was relatively medium. This could potentially be attributed to excessive opportunities (trials) for dishonesty. Consequently, the number of trials was reduced in Experiment 6.

Since the design and methodology of Experiment 6 are similar to those of Experiment 5, the definition of dishonesty in Experiment 6 is consistent with that in Experiment 5.

Methods

Ethical information

The study followed the guidelines of the Declaration of Helsinki (2013) and its future amendments. Ethical approval for the research protocol was granted by the ethics committee of the First Hospital of China Medical University (approval number: 2021-388-2).

Design

The designs, blinding, and randomization employed in Experiment 6 were identical to those in Experiment 5.

Power Analysis and Participants

The statement, method, and results of the power analysis were the same as those in Experiment 5. The final dataset consisted of data from 102 participants (41 males, 60 females, and one non-response). The participants' mean age was 22.6 years (*SD* = 1.66).

Procedure

The procedure for Experiment 6 closely followed that of Experiment 5. The ball-based lottery task from Experiment 5 was retained, using the same instructions, with the only modification being an improvement to the stimulus. Specifically, it was used that a new type of hollow plastic ball, which could be filled with steel bead of varied weights. This allowed us to manipulate the weight while keeping the balls' appearance consistent. In the ambiguous group, the "special ball" was filled with an approximately 30 g steel bead, while the other balls contained approximately 15 g. In contrast, the "special ball" in the control group was filled with an approximately 10 g steel bead and other balls devoid of any steel beads. Consequently, participants in the control group could simply discern whether the ball they drew was the special ball or not, while those in the ambiguous group required more careful judgment. Before the main trial, participants completed five practice trials to ensure that they could accurately identify the special ball. Similar to Experiment 5, in Experiment 6, the

experimenter left the laboratory before the main trials began, leaving the participant alone to complete the task. Participants completed 18 trials and reported the number of times they had successfully drawn the "special ball" as a score.

Data exclusion

Participants were excluded if they failed to identify the "special ball" from other balls in practice trials even once. The remaining exclusion criteria for Experiment 6 were congruent with those in Experiment 5.

Stopping Rule

The stopping rule for Experiment 6 was congruent with those in Experiments 3 and 5 (nine participants were excluded, two who determined the real purpose and seven who failed the practice trials).

Analysis

The analyses in the protocol of Experiment 6 were consistent with Experiment 5.

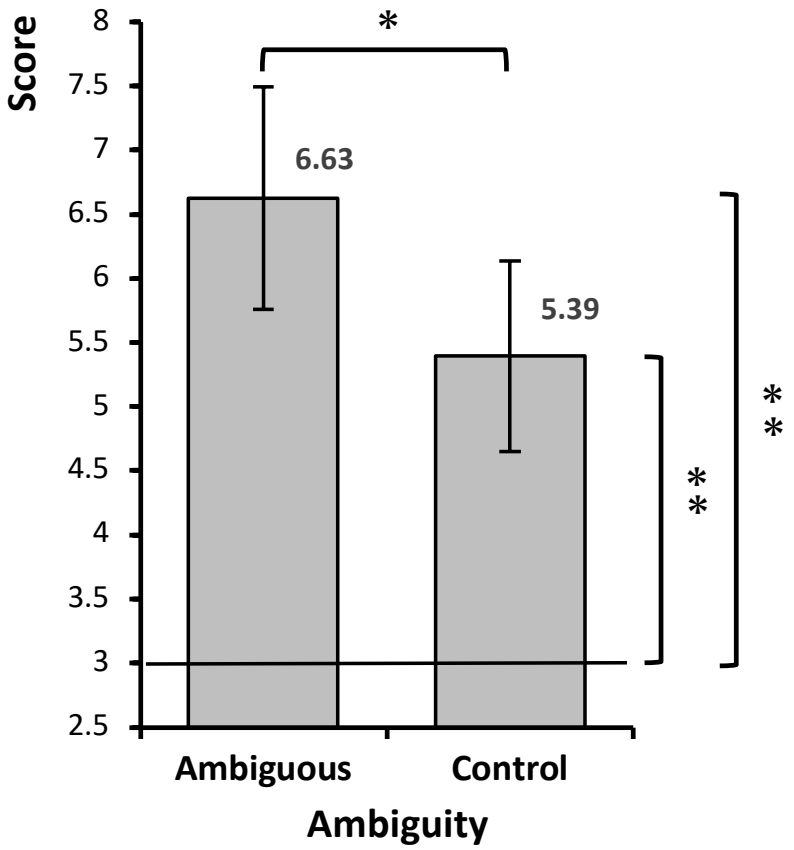
Pre-registration

This protocol was preregistered on the OSF (osf.io/9fjya). Data collection commenced following pre-registration and was completed in 2023.

Results

As shown in Figure 3.8, participants in the ambiguous group reported significantly higher scores ($t(100) = 2.17$, $p = .016$, $d = 0.429$). Furthermore, the scores reported by participants in both groups were significantly above chance level (3), ambiguous group: $t(50) = 8.40$, $p < .001$, $d = 1.176$, control group: $t(50) = 6.44$, $p < .001$, $d = 0.901$.

Figure 3.8 Scores reported in the two conditions in Experiment 6



Note. *$p < .05$, **$p < .01$. Error bars represent the 95% CI. The line at 3 indicates the chance level.

Discussion

The results of the *t*-tests that compared scores reported across the groups indicated that dishonest behavior was more likely to occur when perceptual ambiguity was present than when it was not, which implied that H4 was supported. Additionally, comparisons with chance levels indicated that participants in both conditions may have engaged in dishonest behavior, which implied that H3 was also supported. This demonstrated that the method employed in Experiment 6 was also effective in providing participants with the appropriate incentives and environment for dishonest behavior.

In summary, the findings from Experiment 6 offered compelling evidence showing perceptual ambiguity promoted dishonest behavior. Additionally, these results provided a novel explanation for previous studies that suggested darkness promoted dishonest behavior (Zhong et al., 2010; Liu et al., 2023). Specifically, the results suggested that, in addition to a sense of anonymity, increased perceptual ambiguity in the task outcomes may also contribute to the promotion of dishonest behavior in darkness. Furthermore, the findings that this phenomenon was caused by perceptual ambiguity in stimulus weight suggests the weakness of the vision-dependent explanations (anonymity) used in previous studies.

3.7 General discussion of Chapter 3

The finding of Zhong et al. (2010) was successfully replicated in Experiment 2. However, the results of perceived anonymity did not align with the conclusion of the original study. This shifted the focus to perceptual ambiguity. Although the majority of the four experiments related to ambiguity failed to yield definitive conclusions, the findings did not contradict the hypothesis that perceptual ambiguity affects dishonest behavior (H4). Specifically, Experiment 6 provided empirical evidence that positively supported this hypothesis. Thus, perceptual ambiguity might serve as the underlying mechanism through which darkness promoted dishonest behavior. Certainly, the findings of Experiment 5 imply that the significant effect of ambiguity on dishonest behavior is not observed in all situations. When considered in conjunction with the findings from Experiment 6, the effect of ambiguity in promoting dishonesty might be contingent upon the level of ambiguity. Consequently, should it need to be concluded that darkness promoted dishonest behavior through the mechanism of perceptual ambiguity, a subsequent study should ascertain whether the ambiguity induced by darkness was sufficient to induce dishonest behavior.

On the other hand, the relationship between darkness, anonymity, and dishonesty still requires further investigation. In particular, in Zhong et al. (2010), participants completed the task in a group setting, while Experiment 2 isolated participants. Although Experiment 2 did not observe an effect of darkness on perceived anonymity, the effect of darkness on anonymity and dishonesty in group settings remained an open question for future research. Additionally, the impact of an “imagined

observer" on participants should be considered. Participants in psychological experiments might consider that they were under a perpetual sense of observation. This phenomenon was also named as the "Implicit Bystander Effect," which suggested even without the physical presence of others, behavior could be influenced (Garcia et al., 2009; Garcia et al., 2002). Subtle cues that indicated the presence of an observer (e.g., using a computer displaying eyespots) could more easily trigger this perception (Haley & Fessler, 2005). Considering these cues could further refine our understanding of anonymity, darkness, and dishonest behavior.

Moreover, the underlying mechanisms of perceptual ambiguity influences dishonest behavior remain unclear. This could be a complex process that involved both the participants and any (potential) observers. The results were discussed based on the theories introduced in Chapter 1. First, from the participants' perspective, this could primarily be interpreted regarding self-persuasion and justifications. Individuals generally require a perception of a positive self-image (Greenberg et al., 1986; Pyszczynski & Kesebir, 2013), and engaging in dishonest behavior poses a risk of tarnishing that perception. However, ambiguity diminished the difference between correct and incorrect outcomes, which allowed participants to convince themselves that they had merely committed a trivial mistake, without a negative impact on their self-image. This aligns with Festinger's (1957) CD Theory, which showed that acting dishonestly can cause significant discomfort for individuals striving to preserve a positive self-concept (i.e., dissonance), such discomfort may be mitigated by the presence of ambiguity (Tesser, 2001). A theory of greater pertinence is the SCM Theory by Mazar et

al. (2008), which showed that should the degree of dishonesty remain sufficiently minor so as not to conflict with a positive self-conception, participants may engage in such behavior with little difficulty. Moreover, this diminished difference provided justifications, which made individuals more likely to engage in dishonest behavior (Shalvi et al., 2012). Therefore, when faced with ambiguous outcomes, participants could be inclined to assume that the outcomes were favorable and report without rigorous checks, similar to "self-serving mistakes" (Leib et al., 2019), or "moral justification" of MD Theory (Bandura et al., 1996). In summary, several theories offer explanatory frameworks for the phenomena observed, or conversely, the findings lend empirical evidence to these theoretical perspectives. Nevertheless, more comprehensive experimental verification is necessary, and should incorporate factors such as the participants' self-concept and the extent of cognitive dissonance experienced.

Second, there were also considerations that involved (potential) observers, which could be divided into two aspects: difficulty of surveillance and ease of exculpation. The difficulty of surveillance made it challenging to detect dishonest behaviors. As posited in prior research, low visibility conditions were conducive to being dishonest (Ayal et al., 2010). Another aspect was ease of exculpation, which implied if dishonest behavior was exposed, the ambiguity could allow for the behavior to be explained as an unintentional error, which mitigated the risks of facing punitive consequences owing to dishonesty. Indeed, such motivation was an important point regarding research misconduct. According to the definition in the Code of Federal Regulations (42 CFR 93.103: https://www.ecfr.gov/current/title-42/section-93.103), "honest error" was not considered research

misconduct. Thus, in many allegations of research misconduct, the accused often claimed that it was a simple mistake or error made unintentionally. This intentionality-based justifiability could also be an important criterion for the person being dishonest in conducting their act. Thus, these possibilities would serve as valuable directions for future research on the mechanism of dishonest behavior.

The findings concerning the assessment of H3 were thought-provoking. Since the design of Experiment 3 was quite different from that of the subsequent experiments, and the ambiguous condition in Experiment 4 did not effectively assess participants' dishonest behavior, the results of Experiment 3 and the ambiguous condition in Experiment 4 were excluded from the discussion. It cannot be ascertained whether the dishonest behavior occurred in the control group of Experiment 4. In contrast, such behavior was evident across all conditions in Experiments 5 and 6. In Experiment 5, it was observed that dishonest behavior in the ambiguous and control groups exceeded chance levels (ambiguous group: d = 0.664; vs. control group: d = 0.580). This pattern was even more pronounced in Experiment 6, where rates of dishonest behavior in both groups exceeded chance levels (ambiguous group: d = 1.176 vs. control group: d = 0.901). To discuss the reasons contributing to the observed variations in dishonest behavior, the three experiments were compared. Differences between Experiments 4 and 5 or 6 were summarized in three primary points. First, the experimental environment. Experiment 4 was conducted online, while Experiments 5 and 6 took place in a controlled laboratory environment. An online experiment was always conducted in the place that the participant chose and was often familiar to the participant, such as the participant's home, where they

felt safe and would not be observed. In addition, there was generally a greater sense of anonymity online since participants were represented by their user IDs rather than their real names. It would be logical to observe more dishonest behavior in Experiment 4; however, this was not the case. Therefore, it is considered that this difference in dishonest behavior may not be related to these differences in experimental settings. Second, there are the participants' characteristics. Participants in Experiment 4 were Japanese Yahoo users, with a mean age of 47.2 years, while the participants in Experiments 5 and 6 were Chinese university students, with a mean age of 22.6 years. These differences could lead to variations in economic status, which potentially influenced the degree to which rewards motivated participants and consequently their decisions regarding dishonest behavior. However, it is worth noting that a previous study that used a task with a similar reward system conducted on the same online platform found that participants exhibited dishonest behavior above the chance level (Liu & Yamada, 2024), which implied that the low level of dishonesty in Experiment 4 may not be solely attributed to inadequate incentives. Thus, it was unlikely that the differences in dishonest behavior between experiments could be attributed to participants' characteristics. Third, the complexity of the task. In contrast to the relatively straightforward lottery task employed in Experiments 5 and 6, Experiment 4 presented participants with a more intricate and less comprehensible visual task. This high complexity could have led participants to concentrate primarily on the task itself, which potentially caused them to overlook the opportunity for additional gains

through dishonest behavior, which subsequently reduced dishonest behavior in Experiment 4 (Lohse et al., 2018).

Experiment 6 appeared to exhibit a higher incidence of dishonest behavior (or more severe) compared to Experiment 5. The number of trials in Experiment 6 was intentionally decreased to elicit a higher degree of dishonest behavior. The results indicated that our improvement of the method might be efficacious. However, another difference between the two experiments was the use of different stimuli. In Experiment 6, outcomes were checked by touch, which ensured that only participants had access to this information, whereas in Experiment 5, the outcomes could theoretically be observed by others. The disparity in the risk of exposure could have accounted for the differences in the occurrence of dishonest behavior between these two experiments. Moreover, the influence, if any, of the number of trials on dishonest behavior remains uncertain, and further research should assess these findings.

As mentioned above, combining the results of Experiments 5 and 6, the level of ambiguity might be important in determining its effect on dishonest behavior. In other words, the level of ambiguity might need to reach a certain threshold to effectively influence dishonest behavior. From the perspectives of SCM theory and CD theory, this threshold seems related to the participants' moral sense. From EU theory, it seems associated with the risk of dishonest behavior being exposed. These

possibilities could be the focus of future research, which is crucial for further understanding the effect of ambiguity on dishonest behavior.

Finally, several uncontrolled variables should be considered as constraints on generalization (COG) (Simons et al., 2017) for future replication studies, such as participants' nationality and culture (Graham et al., 2016), gender rate (Dreber & Johannesson, 2008; Jung & Vranceanu, 2017; Grosch & Rau, 2017), and the incentive system (Balasubramanian et al., 2017; Kajackaite & Gneezy, 2017). Additionally, the potential impact of other factors (e.g., the visibility of the experimental place) should also be considered in future replication studies.

These findings urge a reconsideration of the link between darkness and dishonesty and suggest that diminishing ambiguity in contexts where ethical decision-making is critical—by means of formulating explicit policies and designing environments conducive to observe—can reduce dishonest behavior in real life.

Chapter 4 *The metaphorical factors' null effect on dishonesty*

4.1 Background

Shakespeare (1609) once wrote, “Mine eyes have drawn thy shape, and thine for me are windows to my breast.” In “Journey to the West,” Wu Cheng’en (1592) penned the phrase, “Mind monkey returns to the right.” Rowling (2000) remarked, “Time is Galleons.” Metaphors permeate the discourse across time and culture. Due to its widespread use, it is regarded as an important and interesting theme in literature and linguistics (e.g., Ahrens, 2010; Ibarretxe-Antuñano, 2013).

Metaphors extend beyond mere literature and linguistics and find resonance in daily life. As introduced in Chapter 1, in psychology, it has been studied and articulated as Conceptual Metaphor Theory (CM; Lakoff & Johnson, 1980). Metaphors not only aid in comprehending and expressing emotions but also affect human behavior. Specifically, it was found that the black-white metaphor has an effect on human cognition and decisions. Frank and Gilovich (1988) reported the effects of black uniforms on aggression and referee perceptions. A similar study in Japan by Uebayashi et al. (2016) found that individuals wearing white uniforms held higher moral self-perceptions of themselves than those wearing black uniforms. Beyond personal factors, such as attire, the effect of the black–white metaphor is also evident in the presence of external stimuli. Sherman and Clore (2009) noted that when there was congruence between word color and its moral content—black for immorality and white for morality—the speed of color naming accelerated compared to situations with no such alignment. These studies collectively indicated an inherent cognitive link between the black–white metaphor and morality, irrespective of the metaphor’s source, external or internal to the participants.

The black-white metaphor could also be elicited by factors other than color, such as brightness. Subtly different from the traditional black-white metaphor above, Banerjee et al. (2012) found that participants who recalled and described in detail an unethical deed from their past judged the room to be darker than the participants who recalled an ethical deed. Although Brandt et al. (2014) failed to replicate this finding, they did not completely reject Banerjee et al. (2012)'s results.

As mentioned above, darkness (dimness) and light (brightness) potentially relate to moral cognition. Therefore, individuals in darker environments may, influenced subconsciously by this association, lower their moral standards, thus becoming more prone to be dishonest. In other words, the results observed by Zhong et al. (2010) and Experiment 2 might be attributed to the metaphorical impact of darkness. Regarding this possibility, the experiments conducted by Liu (2010) provided insightful results. Although Liu (2010) reported the experimental results with precision and detail, the discussion of these results was somewhat superficial. Therefore, this chapter not only reviews Liu's (2010) experiments on metaphors but also intends to discuss the results more broadly and thoroughly.

4.2 Visual and psychological metaphor and dishonesty

According to findings from prior research, black-white metaphors may influence individuals' dishonest behaviors. Specifically, priming with black metaphors can lead individuals to perceive themselves as more immoral, potentially resulting in increased immoral behavior (i.e., dishonest behavior). Conversely, white metaphors may have the opposite effect, fostering perceptions of greater morality and thereby encouraging more moral actions (i.e., honest behavior). Liu (2021) was the first to design two experiments to test the hypothesis that black metaphors promote dishonest behavior. In these experiments, participants were either exposed to visual stimuli that might activate metaphors or were grouped under names related to psychological black-white metaphors. Liu (2021) assessed the influence of these metaphors by comparing dishonest indicators of the black and white conditions.

Since the method of Liu's (2021) two experiments were largely similar, except for the establishment of the black and white conditions, the experiments are described here side by side. The participants (visual metaphor $N = 150$; psychological metaphor $N = 176$) were recruited from the Yahoo! Crowdsourcing Service in Japan. They were provided with a link to the experimental program embedded within a survey form on the Yahoo! Crowdsourcing platform. The indicator of participants' dishonest behavior was measured by using the coin toss task, originally developed by Fischbacher and Föllmi-Heusi (2013), and later adapted for Japanese online environments by Guo et al. (2020).

In both experiments, participants were assigned to one of two conditions: the black metaphor condition or the white metaphor condition. In the visual metaphor experiment, which is Liu's (2021)

Experiment 2, different conditions were created by providing participants with stimuli of different colors. Participants were shown screens of different colors (Figure 4.1). This visual distinction commenced with the introduction for the experiment. This experiment collected dishonest indicators from participants exposed to black or white metaphors to evaluate the effect of these metaphorical factors on dishonest behavior. Conversely, in the psychological metaphor experiment (Liu's Experiment 3), participants were divided into two teams, named "Black team" and "White team." This metaphorical influence was exerted on participants by associating them with stimuli that contained metaphorical information. Participants' dishonest behaviors were subsequently evaluated under these conditions.

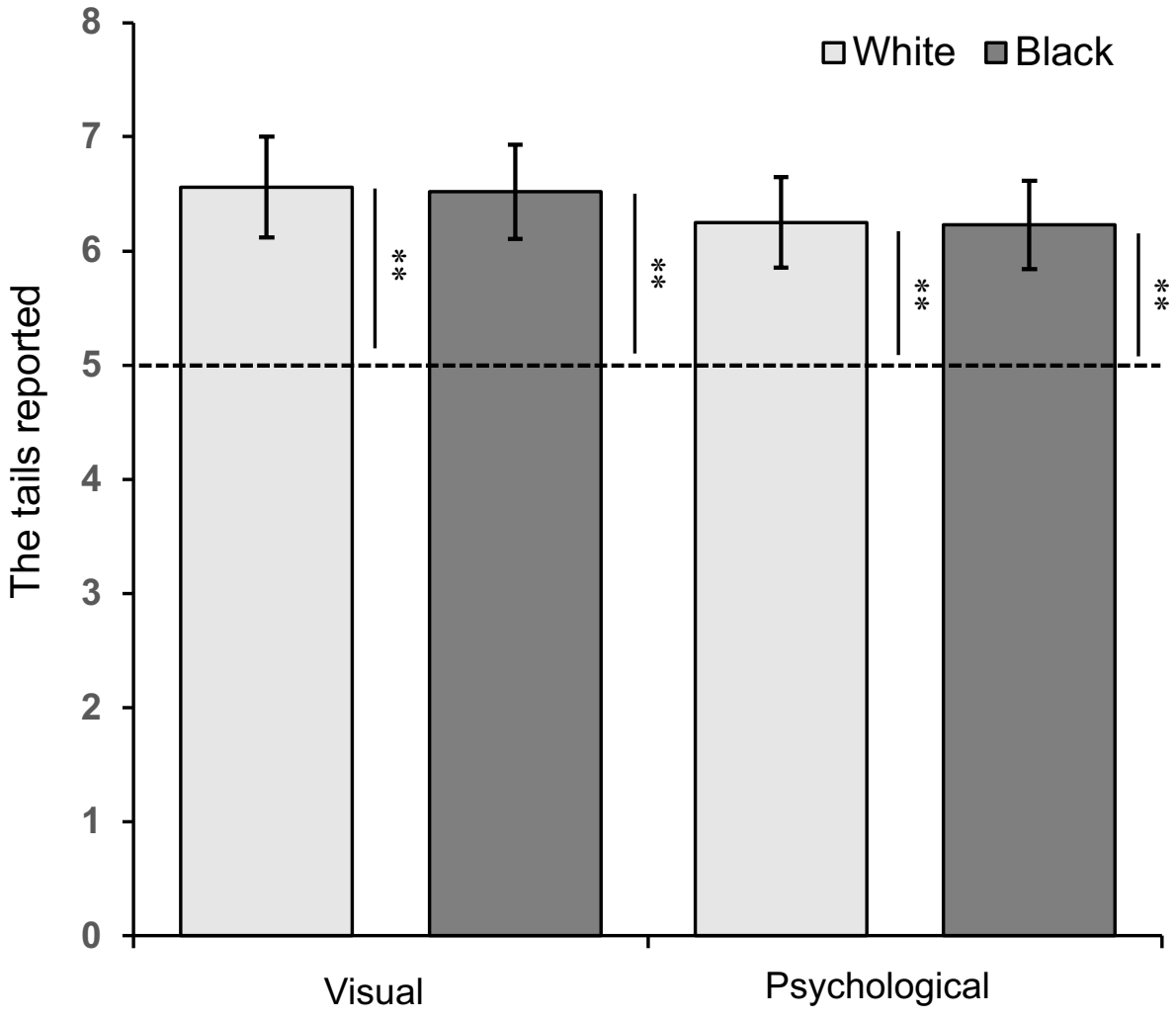
Furthermore, while rewards in both experiments were tied to the participants' self-reported score in the coin toss task, there were notable differences in the rewards system. In the visual metaphor experiment, the reward was simply the score multiplied by 10 Yen. In the psychological metaphor experiment, to emphasize the metaphor, participants were informed that the Black and White teams were in competition; every member of the team reporting the higher score would receive an additional reward of 30 Yen. Additionally, in the psychological metaphor experiment, a check was made to ensure participants could answer their team's name; those who failed to do so were excluded from the data analysis.

Figure 4.1 Screens presented under different conditions in Liu's Experiment 2

Note. Top is under dark condition.

Both experiments failed to conclude that black and white metaphors influence dishonest behavior (visual metaphor: $p = 0.552$, Cohen's $d = 0.021$; psychological metaphor: $p = 0.533$, Cohen's $d = 0.012$). Conversely, results from equivalence testing indicated that neither visual nor psychological black metaphors led participants to engage in dishonest behavior (Figure 4.2). Additionally, dishonesty was observed in all four conditions.

Figure 4.2 The "tails" reported in each condition

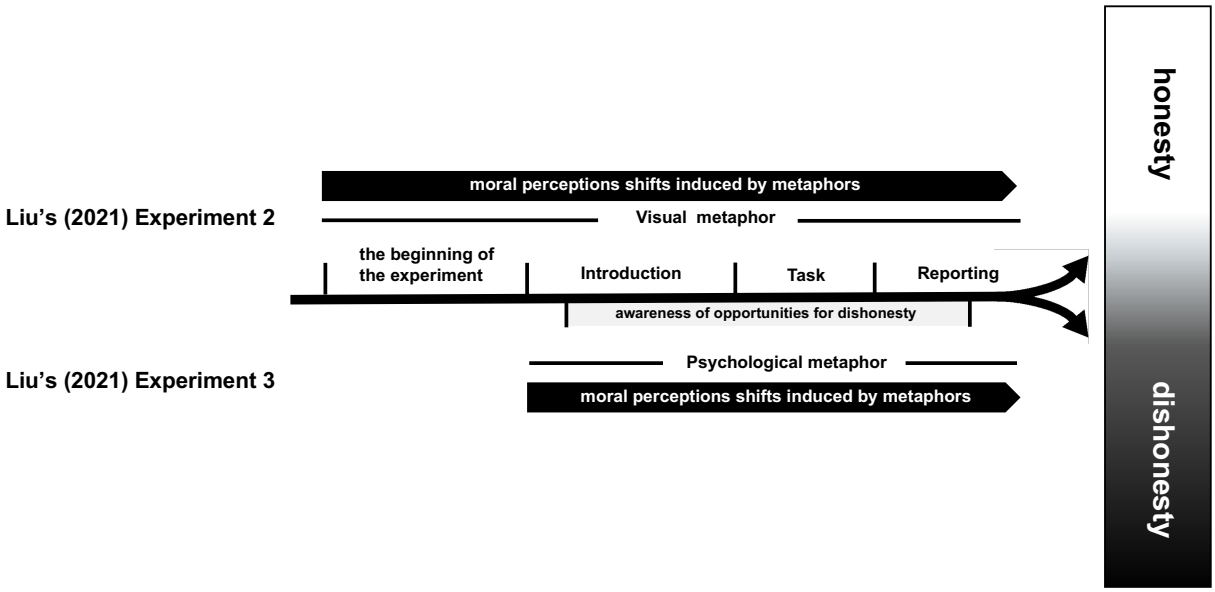


Note. **$p < .01$. Error bars represent 95% CI. The dashed line at 5 indicates the chance level.

4.3 Extended discussion of Liu's (2021) Experiment 2 & 3

Since Liu (2021) provided only a brief summary and discussion of the results, this chapter extends the discussion. Although the results of equivalence testing indicated that the metaphors had no effect, there remained many uncertainties in the experimental process. By meticulously delineating the experimental process, this chapter discusses the various possibilities for the observed results using different theoretical frameworks. Figure 4.3 depicts the detailed processes of Liu's (2021) Experiments 2 and 3.

Figure 4.3 The processes of Liu's (2021) Experiments 2 and 3



In Liu's (2021) Experiment 2, no significant difference in dishonest behavior was observed between participants exposed to black screens and those exposed to white screens. One possibility is that participants did not notice the stimuli, thus not being influenced by the black-white metaphors,

leading to no reduction in moral self-perceptions. Since there were no checks to confirm whether participants noticed the stimuli, this remains uncertain.

The second possibility is that the participants noticed the black-white metaphors, but the metaphors had no effect. As shown, participants only experienced a change in the color of their computer or smartphone screens. The perceived personal relevance of these devices varies among individuals. In studies reporting metaphor effects, clothing is often used as a metaphorical vehicle (e.g., Frank & Gilovich, 1988; Uebayashi et al., 2016). Additionally, in Experiment 1, although the effect of Personal Dressing (PD) was weaker than that of ECPP, it still showed a certain level of effect compared to other factors (Figure 2.5 (b)). Importantly, it showed a stronger effect than Social Interaction (SI), a widely recognized factor influencing dishonest behavior (Köbis et al., 2019). This result was found despite PD and SI being placed in similar positions to output variables and SI having a parent node. This suggests that the potential effect of clothing color on dishonest behavior should not be ignored, and metaphorical factors might also influence dishonest behavior. However, compared to clothing, smartphones seem to be less recognized as part of oneself. This might be because, unlike clothing, which is more difficult to remove, smartphones can be easily put down. Alternatively, clothing is an essential part of one's appearance in society, whereas phones are not necessarily so. In other words, it is common to encounter people without phones or computers, but people typically wear clothes under normal circumstances. Moreover, the fixed color of clothing can easily convey a consistent metaphorical effect, while screen colors, change in real-time during daily

use (or simultaneously present multiple colors). This variability may dilute the effect of screen colors as metaphorical stimuli, due to unstable perceptions. Overall, smartphones and computers might not exert metaphorical effects as effectively as clothing, possibly because they are not as closely associated with the individual, are not essential, and do not provide a stable perception. Additionally, in Liu's (2021) Experiment 2, since the screen color change was controlled by the experiment program rather than the participants themselves, this further weakens the connection between the metaphorical stimuli and the participant, making it highly plausible that the stimuli in Liu's (2021) Experiment 2 were ineffective. In other words, in this experiment, participants might consider that the black and white metaphors are irrelevant to them.

The third possibility is that the stimuli in Liu's (2021) Experiment 2 may have had an effect, but not strong enough to alter participants' behaviors. Existing research on black-white metaphors and morality has focused on cognitive aspects, i.e., black-white metaphors can make participants feel more or less moral. However, altering actual moral behavior undoubtedly requires a more potent influence. It is hypothesized that a reduction in moral self-perception could make dishonest behavior easier, potentially linked to SCM Theory, where a decrease in moral self-perception means there is less need to maintain a positive self-concept (since the self-concept is already less positive), thereby facilitating dishonest behavior. However, according to EU Theory, dishonesty primarily results from weighing risks against benefits. External factors such as punishment and rewards seem to affect dishonesty more significantly. Since substantial levels of dishonest behavior were observed under

both conditions in Liu's (2021) Experiment 2 (Figure 4.2), it can be inferred that individuals, both those feeling immoral under the black metaphor and those relatively moral under the white metaphor, might succumb to the lure of benefits and engage in dishonest behavior. Current results cannot rule out any possibility above, and future research on visual metaphors might need to focus on these problems. Checking participants' attention to stimuli, identifying more impactful vehicles, and developing approaches to enhance metaphorical influences are viable directions for exploration.

One possible reason for the lack of observed differences in dishonest behavior in Liu's (2021) Experiment 2 might be that the metaphorical factors were not potent enough. Consequently, Liu's (2021) Experiment 3 employed a theoretically stronger factor. This experiment shifted towards psychological metaphors, aiming to evoke more powerful metaphorical effects. Additionally, it confirmed that the participants indeed noticed the stimuli. However, there was still no difference in dishonest behavior among participants under the black and white metaphor conditions. In this experiment, the result might more likely be attributed to the metaphorical factors themselves. One possibility was that team names, as vehicles that did not have a physical presence like clothing, might be closer to participants but too intangible to have any significant effect. Moreover, the influence of metaphorical factors on moral self-perceptions might be gradual rather than instantaneous. This experiment lasted for less than 10 minutes, and participants were exposed to metaphorical stimuli midway through the experiment (Figure 4.3). This brief exposure period posed challenges for the stimuli to significantly influence dishonest behavior. Future research can explore the effect of

physical versus intangible vehicles and the duration of exposure.

Additionally, although the potential connection between black-white metaphors and morality is widely accepted, the lack of discussion regarding its generalizability suggests that future experiments should also investigate the robustness of this connection among participants before the experiment.

Although Liu's (2021) Experiments 2 and 3 did not observe a significant effect of metaphors on dishonest behavior, as the first empirical studies in this area, they provided valuable data and insights. This chapter offers a more detailed discussion of the results, presenting a broader range of perspectives and suggesting valuable directions for future research. Additionally, since the possibility that metaphors influence dishonest behavior still exists, frequently exposing oneself to unethical metaphorical stimuli in daily life may not be a wise choice. Conversely, attempts to use moral metaphors, such as white, to positively influence people in everyday life based on the findings from CM theory, may not always achieve the desired effect.

Chapter 5 *Urgent or irresistible? The effects of time pressure and incentives on cheating*

5.1 Background

Chapter 5 shifts focus to another factor within the ECPP, stress. In Experiment 1, the question concerning stress was phrased as follows: “Please evaluate your current level of stress. *Stress, for example, may stem from the time pressure because of subsequent works after the experiment.” Therefore, this chapter examines time pressure, one of the most common stress-inducing factors.

Time pressure is a public approval environmental factor that depletes cognitive resources (Gino et al., 2011). Slobounov et al. (2000) reported that time pressure increases behavioral errors in a visuomotor task. Roskes et al. (2013) found that participants under time pressure solved fewer problems in a creative insight task (Remote Associates Test, Mednick, 1962). In recent years, time pressure has been found to significantly impair inhibition and face-matching accuracy (Endres et al., 2020; Fysh & Bindemann, 2017). A meta-analysis of 125 studies has shown that time pressure generally impairs the accuracy of perceptual and cognitive tasks (Szalma et al., 2008). There is sufficient evidence to demonstrate that time pressure has some effect on human cognitive resources.

As discussed in Chapter 1, the impact of dishonesty is widely believed to be associated with cognitive resources. Dishonesty is closely related to cognitive resources, and time pressure affects them; therefore, it seems likely that time pressure affects the tendency to be dishonest. In fact, the argument regarding this issue has persisted for over a decade. According to the investigation, Shalvi et al. (2012) was the first study to report that time pressure promoted dishonest behavior and suggested that human spontaneous responses were dishonest. However, neither conceptual replication

(Foerster et al., 2013) nor direct replication (Van der Cruyssen et al., 2020) led to the same conclusion. Foerster et al. (2013) adjusted the task procedures and obtained the opposite conclusion (i.e., spontaneous responses reflected honesty). Van der Cruyssen et al. (2020) attributed the failure of replication to the overestimation of the true effect of time pressure on dishonesty and the limitations in the generality of the effect. Moreover, a few studies in economics have concluded that time pressure promotes honest behavior (Capraro, 2017; Capraro et al., 2019; Lohse et al., 2018). To summarize, three different conclusions were reported regarding the effect of time pressure on dishonesty: "promotion," "inhibition," and "no effect."

Shalvi et al. (2012) employed the "die under cup paradigm" (Fischbacher & Föllmi-Heusi, 2013). In this paradigm, participants were instructed to roll a die in a cup and report the outcome. The participants then received rewards based on the reported outcome. The rewards received were directly proportional to the outcome, meaning that a higher outcome resulted in a greater reward. Due to the experimenter's inability to observe the actual dice roll outcomes, participants could receive more rewards than they deserved by dishonestly reporting. However, Foerster et al. (2013) pointed out that the "die under cup paradigm" did not suit addressing the automaticity of dishonesty (or intuitive dishonesty: Köbis et al., 2019) because participants could generate their responses at any point following their reading of the task instructions, potentially even before the act of rolling the die. If participants generated their responses in advance, the time pressure applied when they rolled the die was ineffective (since they were not subjected to time pressure during the decision-making process).

Thus, Foerster et al. modified the experimental design. In Foerster et al. (2013), participants were assigned to one of two conditions: the “immediate report” condition, where they were instructed to report the outcomes immediately after rolling, or the “delayed report” condition, where they had to wait before submitting their report. This modification allowed Foerster et al.’s experiment to focus on the automaticity of dishonesty. However, Foerster et al. did not examine differences in time pressure between the two conditions. Therefore, the effect of time pressure on dishonesty was still not apparent.

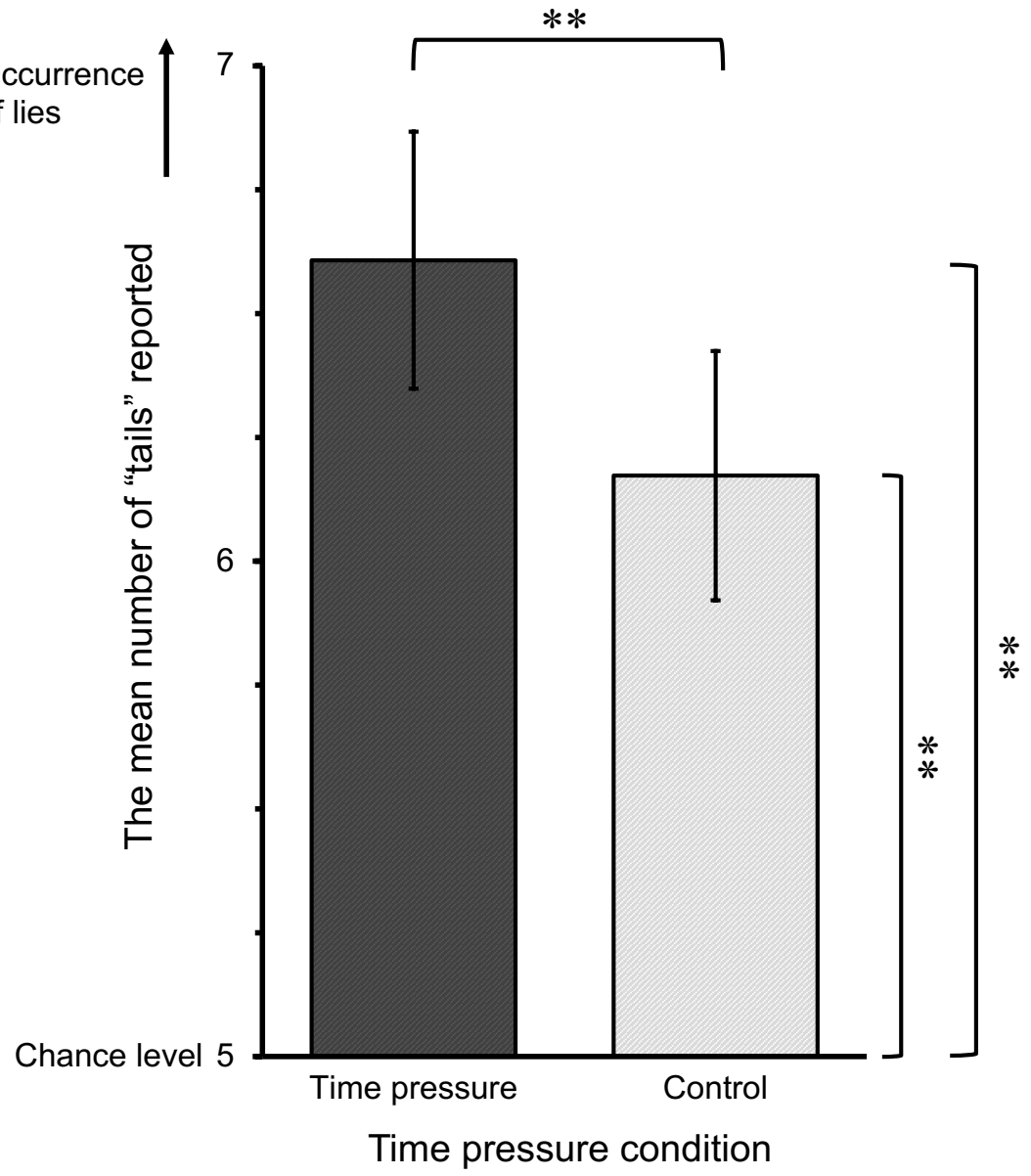
5.2 Review and extended discussion of Liu's (2021) Experiment 5

To address the problems in the paradigm of Shalvi et al. (2012) and make the effect of time pressure on dishonesty clear, Liu (2021) implemented modifications to the experimental task. First, Liu expanded the duration of time pressure to cover the entire task. This ensured consistent exposure to time pressure for participants throughout the experiment. Consequently, participants' decision-making process about dishonesty would invariably have been under the influence of time pressure. One possible critique of expanding the duration of time pressure to cover the entire task is the possibility of impairing participants' task comprehension (Capraro, 2019). However, while making participants perceive time pressure, the methodology also ensured an appropriate time for task comprehension by setting the time limit to be long enough. Moreover, in Experiment 2 of Van der Cruyssen (2020), participants were asked to evaluate their perceived time pressure with a five-point scale. However, since the same task as in Shalvi et al. (2012), the participants' reported outcomes may have been determined before their perceived time pressure. Thus, Liu recorded participants' perceived time pressure to reassess the relationship between perceived time pressure and dishonesty.

Liu (2021) successfully replicated the results of Shalvi et al. (2012) that time pressure could promote dishonesty (Figure 5.1), and suggested the appearance of the phenomenon may be related to the participants' perceived time pressure. In particular, participants may cheat more when they perceive intense time pressure. The results of Liu (2021) supported the "Will hypothesis," which states that cognitive control is required to resist the temptation of dishonesty (Greene & Paxton, 2009;

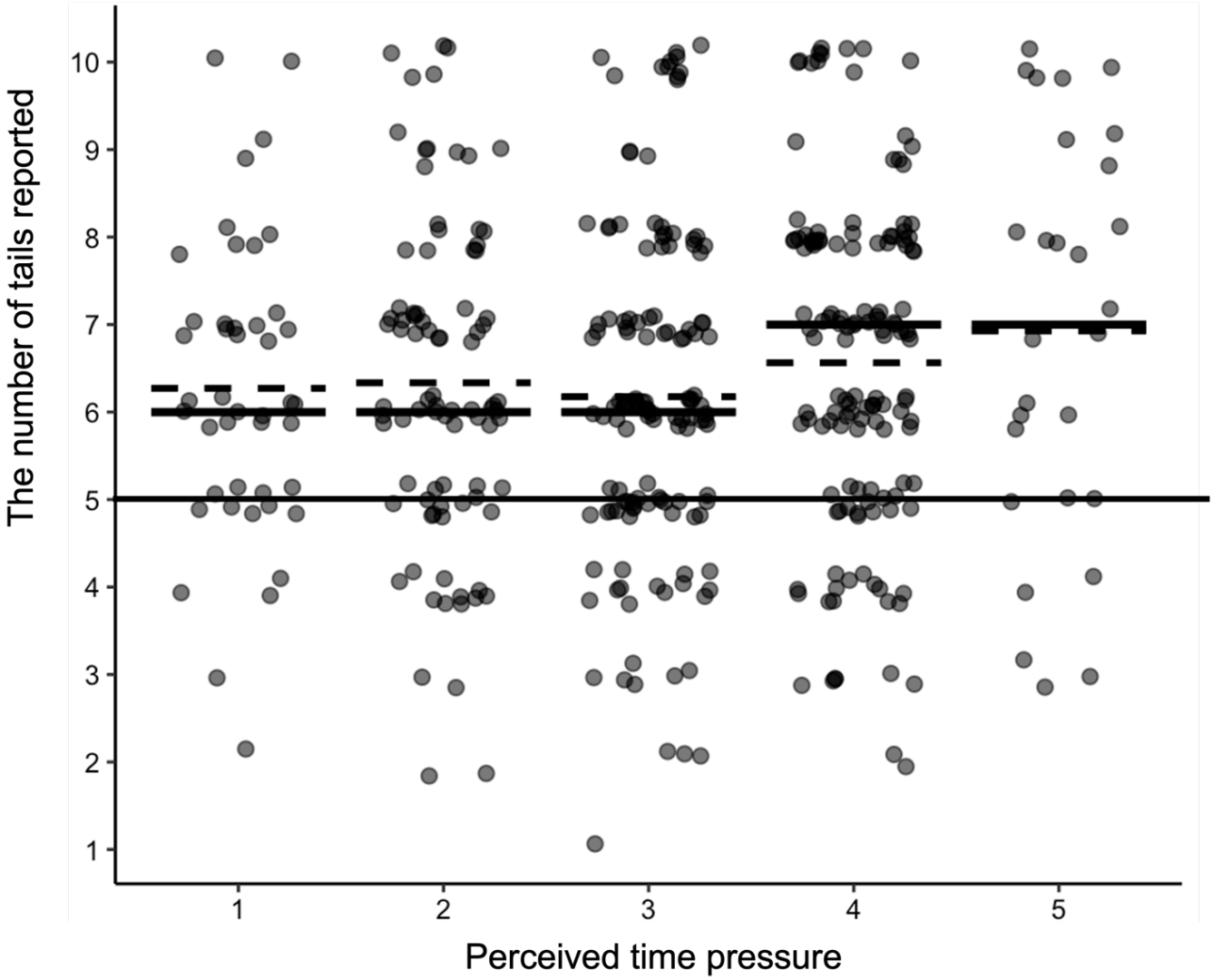
Speer et al., 2020). The analysis results of perceived time pressure showed that perceptually high time pressure might deplete more cognitive resources and make individuals incapable of resisting the temptation to cheat, thereby increasing their dishonesty (Figure 5.2).

Figure 5.1 The mean number of "tails" reported in Liu (2010).



Note. $^{**}p < .01$. Error bars represent the 95% CI.

Figure 5.2 The number of “tails” reported with each perceived time pressure score in Liu (2010).



Note. Each point represents a report. To improve the plot’s readability and prevent data point overlap, each point has been subtly and randomly jittered. It is important to note that this jittering is purely for visual clarity and does not change the actual values of the data. Across different levels of perceived time pressure, short solid lines represent the median values of “tails” reported, while dashed lines indicate the average values. The line at 5 indicates the chance level.

Despite the differences between Liu (2021) and Shalvi et al. (2012) (see more details in Table 5.1), the results were similar, suggesting the generalizability of this effect. On the other hand, it was found that a difference between the results of Liu (2021) and those of Shalvi et al. (2012). Liu (2021) found no significant difference between the task completion times with and without time pressure. By contrast, Shalvi et al. (2012) reported that participants subject to time pressure took less time to complete tasks. This difference also shows that this phenomenon is robust to the performance time. Namely, even if the participants took the same time to complete the task, the frequency of dishonest behavior might differ because of different perceived time pressures.

Table 5.1 Differences in methods between Liu (2021) and Shalvi et al. (2012).

Differences	Shalvi et al. (2012)	Liu (2021)
False purpose	not mentioned	mentioned (exploring paranormal phenomena)
Task	die under cup task	coin toss task
Reward rule	outcome of dice * 10	number of tails * 10
Currency	NIS	YEN
Number of trials	3 or 1	10
Start of time pressure	after reading introduction	before reading introduction
Environment	laboratory	online
Participants	students	crowdsourced workers

Another factor Shalvi et al. (2012) focused on was justification. When participants are asked to roll a die multiple times and report the outcome of the first roll for a reward, they tend to report the most favorable result rather than the actual outcome of the first roll (Shalvi et al., 2011). This is because participants could observe higher outcomes in subsequent rolls, which could justify dishonesty. In Experiment 1 of Shalvi et al. (2012), participants cheated whether they were under time pressure or not because they had justifications (i.e., multiple rolls). In contrast, in Experiment 2 of Shalvi et al. (2012), when there was no justification (i.e., single roll), participants not subject to time pressure were not shown to be dishonest. The results of Liu (2010) suggested that participants may cheat under both conditions because multiple trials in the experiment justified the participants. Similar to Shalvi et al. (2011), even if a given trial did not result in a "tail", the presence of a "tail" outcome in other trials might make participants more likely to justify and fraudulently report a "tail". Simultaneously, these results show that the task successfully constructed an environment where participants were free to cheat and provided sufficient motivation for dishonesty.

Furthermore, the findings from Liu (2021) and the previous studies invite more profound consideration of cognitive resources and dishonesty. As discussed in Chapter 1, the discussion on cognitive resources and dishonesty has traditionally revolved around two hypotheses: the "Grace hypothesis" and "Will hypothesis." The findings of Liu (2021) supported the Will hypothesis and seemed to challenge the Grace hypothesis. However, Speer et al. (2020) suggested an explanation aimed at reconciling two conflicting perspectives. They suggested that cognitive control was not

needed to be honest or dishonest but to help people overcome moral default. In other words, cognitive control could help ethical people cheat, and it could also help unethical people become honest (Speer et al., 2022). Moreover, Chen and Krajbich (2018) reported that time pressure allowed "less time for decision makers to update from their prior" (i.e., original intentions), which means that the prior plays a more important role in the decision when time pressure is present. Specifically, Chen and Krajbich found that prosocial participants become more prosocial under time pressure, while self-interested participants behave in a more self-interested manner. Similarly, in studies on dishonesty, if participants have different original intentions, it will naturally lead to different experimental results. That is, time pressure could prompt both dishonest and honest behavior depending on the participants' original intentions. This might explain the differing results of previous studies that supported the Grace hypothesis or Will hypothesis.

5.3 Experiment 7: Investigating the potential interaction between time pressure and incentives in dishonest behavior

The discussions in Chapter 5.2 showed the participants' original intentions may be crucial to the effect of time pressure on dishonest behavior. Regarding the factors influencing the participants' original intentions, the first one to consider was morality. However, according to the investigation, there was no evidence that participants in previous studies had different levels of morality. Thus, there might be another factor that could affect participants' original intentions. In all of the prior studies, money was used to motivate the participants. These incentives are generally based on local market prices and fluctuate according to the will of experimenters. Table 5.2 presents the incentives for each study, which vary across studies. Differences in incentives have been shown to affect dishonest behavior (e.g., Balasubramanian et al., 2017; Kajackaite & Gneezy, 2017). In addition, considering the effect of purchasing power, the strength of participants' motivation evoked by these incentives will become a more difficult and variable problem. This might have led to differences in the original intentions of the participants and led to different results.

Table 5.2. The incentive used in the prior studies

Prior studies	Currency	Incentive for cheating
Shalvi et al. (2012)	NIS (1 NIS ≈ $0.25)	up to 60 NIS
Foerster et al. (2013)	Euro €	up to € 2.50
Capraro (2017)	Dollar $	up to $ 0.20

Lohse et al. (2018)	Euro €	up to € 10
Capraro et al. (2019)	Dollar $	up to $ 0.15
Van der Cruyssen et al. (2020)	Euro €	up to € 12

Based on the above arguments, it is considered that incentives might play an important role in the effect of time pressure on dishonest behavior. Moreover, "Satisfaction with Reward" being part of the ECPP factors in Experiment 1 indirectly highlights its importance. Thus, the following hypothesis is posited:

H5: Time pressure and incentives interact with each other in dishonest behavior.

It was predicted that time pressure could promote cheating when the incentive is high level; in contrast, in the condition with a low (or no) incentive, time pressure could inhibit cheating.

Experiment 7 employed the same task as Experiment 2, thus the definition of dishonest behavior in Experiment 7 is also consistent with that in Experiment 2. Although Experiment 7 is an online experiment, which may provide participants with more methods to cheat, this experiment does not differentiate these behaviors in detail but categorizes them uniformly as dishonesty.

Methods

Ethics information

The ethics committee of Department of human sciences (psychology), Graduate School of Human-Environment Studies at Kyushu University approved the study protocol (approval number: 2022-001).

The experiments were conducted in accordance with the guidelines of the Declaration of Helsinki (2013). As the experiment was conducted anonymously in an online environment, it was not possible to obtain signed informed consent from the participants. However, participants signed a participation agreement with the crowdsourcing service as a kind of written informed consent. In this situation, if the participants confirmed their participation in the experiment, it is considered that the consent was informed. The ethics committee approved this way to provide informed consent. The experimenter had no access to information that could identify individual participants during and after data collection. Moreover, participants could discontinue the experiment by closing the website at any time during the experiment.

Design

To test H5, it was used that a two-way mixed design with time pressure (time pressure vs. control) as a between-participant factor and incentives (none vs. low vs. high) as a within-participant factor.

Power Analysis and Participants

G*Power 3.1.9.3 was used to conduct a power analysis. The significance level α was set at 0.05, power level 1-β at 0.95, Number of groups = 2, Numbers of measurements = 3, Corr among rep measures = 0.5, Nonsphericity correction $\varepsilon = 1$, and effect size *f* at 0.25 (Cohen's medium effect). For a two-way mixed-design ANOVA, the required sample size for testing the interaction was 44, with 22 participants in each group. Thus, participants were recruited randomly from among all users of the Yahoo! Crowdsourcing Service in Japan on August 23 and August 24, 2021. Because the valid

data exceeded 44, the first 44 valid data based on the time stamp were selected. Finally, a dataset of 44 participants (male = 38, female = 5, no response = 1, M_{age} = 44.4 years, SD = 10.5) was used for the analyses.

Materials

The material of Experiment 7 is the same as that of Experiment 4.

Procedure

Participants were informed of the false purpose of exploring paranormal phenomena and psychokinesis. To collect the dishonest indicators, participants completed the coin toss task (Fischbacher & Föllmi-Heusi, 2013; Guo et al., 2020). Experiment 7 did not include any instructions regarding prohibited behavior. 44 participants were divided into two conditions (i.e., time pressure condition vs. control condition) randomly and completed the coin toss task three times to receive 0 P, 2 P, or 10 P (1 P ≈ 1 yen) for every "tail" reported. Each coin toss task consisted of ten trials, resulting in a total of 30 trials for each participant.

Guo et al. (2020) conducted a pilot study to determine the minimum time required to complete the task (minimum completion time, MCT). Specifically, they asked five colleagues without prior knowledge of the experiment to complete the task as quickly as possible and calculated the average time. The MCT represents only the time required for the coin toss and recording, without the required

time of the “psychokinesis” concentration. Thus, if the participants completed the task faster than the MCT, they were considered to have rushed through the experiment and failed to complete it in good faith. The same pilot study was conducted in Experiment 7. Based on the average time taken by the colleagues to complete the task, the MCT was determined to be 132.293 s.

The participants in the time pressure condition were asked to complete the task in 240 s, whereas no time limit was imposed in the control condition. A time limit of 240 s was considered, starting when the participants began reading the instructions and stopping after they reported their scores. This information was presented to the participants on the program’s first page. Under the time pressure condition, a digital countdown panel is consistently displayed at the upper section of the screen to apprise participants of the remaining duration. If the participant could not complete the experiment within 240 s, the program automatically closed the experiment page, and the participant was deemed to have failed to complete the experiment.

After completing the coin toss task, participants rated their perceived time pressure and reward satisfaction using the five-point Likert scales (1 = *none* to 5 = *very strong*) in a post-questionnaire. The participants answered an attention check question (ACQ, “Which month is it?”).

Data exclusion

Participants were excluded if they completed the experiment with less time than the MCT. In addition, repeated participation was prevented. Participants who could not correctly answer the ACQ were

excluded from the analyses. Participants under time pressure who could not finish the entire experiment within the limited time (240 s) were excluded from the analyses [1].

Analysis

According to the pre-registered protocol, the analyses were conducted as follows: 1) a two-way mixed-design ANOVA with time pressure (time pressure vs. control) as a between-participant factor and incentives (none vs. low vs. high) as a within-participant factor; 2) a *t*-test to test the significant difference between the mean tails reported by the participants in each condition and chance level (i.e., 5) to determine whether dishonest behavior occurred.

Pre-registration

The content was pre-registered as a protocol in the Open Science Framework (OSF, https://osf.io/jty2u).

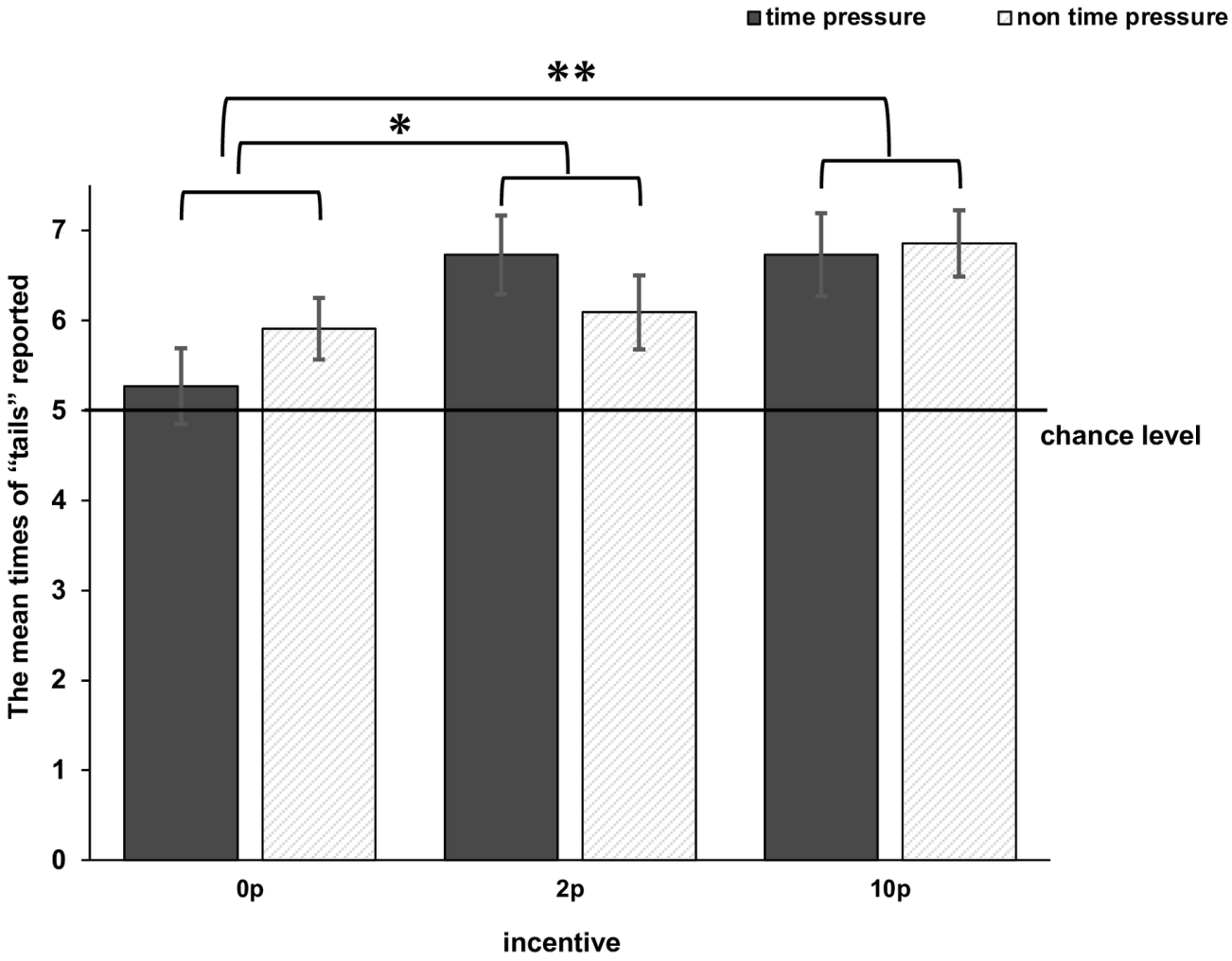
Results

The results of the analyses of the pre-registered protocol are shown in Figure 5.3. First, the interaction between time pressure and incentives was not significant in the two-way mixed-design ANOVA, $F(2, 84) = 2.30$, $p = .106$, $\eta^2_p = 0.052$. Similarly, the main effect of time pressure was not significant, $F(1, 42) = 0.01$, $p = .922$, $\eta^2_p = 0.000$. However, the main effect of incentives was significant, $F(2, 84) = 8.47$, $p < .001$, $\eta^2_p = 0.168$. The Post Hoc Tests showed that, compared to the 0 P, participants reported

more “tails” when the incentives were 2 P or 10 P (0 P vs. 2 P: $t(42) = -2.46$, $p = .047$; 0 P vs. 10 P: $t(42) = -3.69$, $p = .002$).

For the manipulation check, the difference in participants’ perceived time pressure scores between the conditions was tested by using a *t*-test. The results showed that the perceived time pressure scores in the time pressure condition were significantly higher than those in the control condition ($t(42) = 3.27$, $p = .001$, Cohen’s $d = 0.986$). Moreover, the results of the Kruskal-Wallis test showed that there were significant differences in participant reward satisfaction with different incentive conditions ($x^2(2) = 69.1$, $p < .001$, $\varepsilon^2 = 0.528$). Specifically, the results of the Dwass-Steel-Critchlow-Fligner pairwise comparisons showed that significant differences were found in every pair of incentive conditions (Satisfaction $_{0P}$ < Satisfaction $_{2P}$, $W = 6.94$, $p < .001$; Satisfaction $_{0P}$ < Satisfaction $_{10P}$, $W = 10.34$, $p < .001$; Satisfaction $_{2P}$ < Satisfaction $_{10P}$, $W = 7.77$, $p < .001$).

Figure 5.3 The mean tails reported in each condition in Experiment 7



Note. *$p < .05$, **$p < .01$. Error bars represent Standard Error.

The *t*-tests comparing the difference between the mean number of "tails" reported by the participants and chance level showed that participants cheated under all conditions except when there was simultaneous time pressure and no incentive (Table 5.3).

Table 5.3 The results of *t*-tests of "tails" in each condition and chance level

Condition	Student's *t*	*df*	*p*	Effect size (Cohen's *d*)
T * 0P	0.646	21.0	.263	0.138
T * 2P	3.950	21.0	< .001	0.842
T * 10P	3.743	21.0	< .001	0.798
C * 0P	2.664	21.0	.007	0.568
C * 2P	2.658	21.0	.007	0.567
C * 10P	5.063	21.0	< .001	1.079

Discussion

The results of the manipulation checks suggest that the conditions set in Experiment 7 were appropriate. The time limit was sufficient to allow the participants to feel different time pressures, and the incentive could evoke different levels of motivation. However, the results of the two-way mixed-design ANOVA did not support H5. It was not found that any time pressure or incentives to interact with each other during the occurrence of dishonest behavior. One possible reason for this result is that the conclusion of Chen and Krajbich (2018) may not be applicable to this experiment. A time limit was imposed on the entire experimental procedure. It allowed the participants to feel time pressure; however, it also allowed them enough time to make decisions, thus weakening the effect of the prior. On the other hand, in Chen and Krajbich's experiment, participants had to make the decision (each trial) within 2 s in the time pressure condition, suggesting that differences in the degree of time limit could lead to differences in the decision-making process. In other words, time pressure that lasts

over a period, and time pressure that suddenly appears and disappears in a flash, these two kinds of time pressures might have different influences on dishonesty. Another possible reason for this result stems from the use of a relatively large effect size in the power analysis.

Moreover, based on the nonlinear effects of incentives on dishonest behavior (Balasubramanian et al., 2017) and the instability of the effects (e.g., Kajackaite & Gneezy, 2017), further exploration of the effect of reward amount on the results of this experiment is warranted. As mentioned above, considering the purchasing power and economic status of the participants, this might be a difficult and daunting issue. Moreover, participants committed more dishonest behavior when they could win incentives, which means that the amount of rewards can affect dishonest behavior. The result is consistent with the findings in earlier studies and Experiment 1, which indicate that the presence of incentives could influence the decision-making process of social behaviors, such as dishonest and self-interested behavior (e.g., Amir et al., 2012; Capraro, 2017). This finding demonstrates that the factors within the ECPP are indeed noteworthy.

Interestingly, the main effect of time pressure was not significant. This result contradicts that of Liu (2021). There are two possible reasons for this inconsistency in results. First, although the sample size was decided by the power analysis in both studies, it varied widely due to differences in the experimental design (428 vs. 44). However, since the power (1-β) used in the power analysis was 0.95, it should be ruled out that the results of Experiment 7 were caused by Type II error. Another possible reason is that the effect of time pressure on dishonest behavior is complex and unstable. It

might be affected by a variety of factors, such as the reward amount, length of the time limit, and the task complexity.

Footnotes

[1] Unfortunately, a writing error existed in the protocol at the OSF. It was written that the limit time as 132.293 s in the “Data exclusion” section. This is an obvious writing error because the time limit cannot be equal to that of the MCT. The time limit was 240 s.

5.4 General discussion of Chapter 5

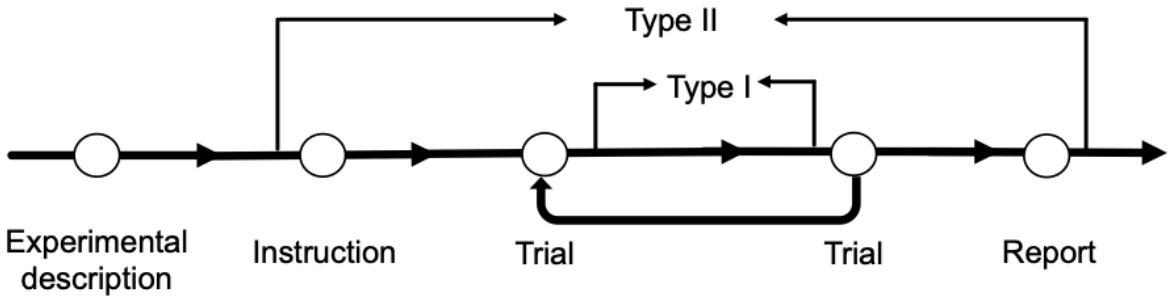
The results of Liu (2021) demonstrated that time pressure affects dishonest behavior, at least in some cases. However, this result was not replicated in Experiment 7. The effect of time pressure on dishonest behavior may be unstable, and susceptible to other factors. In addition, the results were unable to demonstrate that incentives influenced this effect. Nevertheless, it is possible to provide directions for future research by discussing the results of the present and prior studies.

First, the duration of the time pressure seems to be important in its effect on dishonest behavior. As mentioned above, time pressure lasts over a period of time, and time pressure in a flash may have different effects on dishonest behavior. When time pressure occurs in a flash, which means that when the time limit is just sufficient to complete the task, participants' prior (i.e., the original intentions such as morality and incentives) plays a major role in the decision, similar to the situation in Chen and Krajbich (2018). Moreover, when the time limit is too short, participants possibly cannot realize that it is an opportunity to increase their income by dishonest behavior (Loshe et al., 2018). This situation might happen more often when the task is complex and requires participants to think and understand it. By contrast, time pressure that lasts over a period might allow participants to consider the whole task, thus affecting their decisions, for example, the times or timing of cheating. In this case, the design of the task (such as the number of trials) could simultaneously affect participants' decisions. For example, participants might consider not cheating in a successive trial or decide on a reasonable maximum amount of incentives obtained by dishonest behavior.

Second, the timing at which the pressure started might also play an important role. As shown in Figure 5.4, the timing at which the pressure started was divided into two types: one applied to each trial (Type I) and the other applied to the whole experiment (Type II). The timing of the pressure started in Liu (2021) and Experiment 7 was the latter. Before conducting this study, it was considered that these two kinds of time pressures were essentially the same and comparable. However, it is realized now that they might work with different mechanisms, namely "an automatic tendency of dishonesty" (Foerster et al., 2013) and "time pressures affect the deliberative thinking of dishonesty." These two questions contrast with two different situations in life. In the former, people are asked to make a decision within several seconds by automatic tendency after they obtain the new information (Capraro, 2017); whereas, in the latter, people are always asked to finish some tasks in a limited time (e.g., an exam or work with a deadline). Thus, it is suggested that these two kinds of time pressure should be studied separately in future research. These two kinds of time pressure also correspond to the two kinds of duration of time pressure described above. Type I corresponds to the time pressure occurring in a flash, while Type II corresponds to the time pressure that lasts for a period of time. Furthermore, in some early studies (e.g., Capraro, 2017; Foerster et al., 2013), the contrast with the time pressure condition was not the "no time limit condition" but the "forced delay condition." Unlike the "no time limit condition," in which participants could act as they wished, in the "forced delay condition," participants had to wait for a short period before the decision (even if they already had a choice in mind). Some participants may have changed their decisions in this situation, given the extra

time. Therefore, when discussing the effect of time pressure, the "baseline" also needs to be carefully chosen and discussed.

Figure 5.4 Two types of the timing at which the time pressure started.



Third, the setting of the experiment, especially the number of trials and timing of cheating, might influence the effect of time pressure on dishonesty. To date, there are two types of trial settings in the experiments: a single trial and multiple trials. In experiments that used a single trial, the timing of the cheating was always after the trial (e.g., Shalvi et al., 2012). However, some of experiments with multiple trials required participants to report experimental outcomes as a dishonest indicator after all trials (e.g., Experiment 7). In another type of experiment with multiple trials, participants were required to report the outcome after each trial (e.g., Foerster et al., 2013). These differences in settings provided participants with different environments. In the first two types of experiments, participants could consider whether they needed to cheat according to their scores. For example, in Experiment 7, if a participant obtains a satisfactory score after the coin toss task, the participant might

stop cheating, even if the participant intended to cheat. However, there is still a difference between the two types of experiments. Multiple trials provided multiple opportunities to cheat. According to the EU Theory described in Chapter 1, multiple cheating involves different costs and benefits compared to a single cheating. The last type of experiment was quite different; participants needed to decide whether they cheated in each trial and the timing of cheating. These differences might interact with the factors mentioned above (e.g., the timing of the time pressure started, the duration of the time pressure) and then affect dishonest behavior.

In Liu (2021), it was used the time pressure that lasted over a period starting at the Type II timing. The participants were asked to finish multiple trials and report the total score after all trials. In this situation, time pressure promoted dishonest behavior. Experiment 7 had the same kind of time pressure, and the start time of time pressure. However, compared to Liu (2021), the task in Experiment 7 was more complex. Moreover, participants in Experiment 7 had more opportunities to cheat and more time to complete the task. These differences might explain why the effect of time pressure on dishonest behavior in Experiment 7 was not observable. It is recommended that researchers report details that are comparable with prior studies in their papers as completely as possible. This might help us discuss the limitations and replicability of a phenomenon.

Furthermore, the same incentive was used in Liu (2021) and the high-incentive condition in Experiment 7. However, for the same incentive, time pressure had a different effect on dishonest behavior. Admittedly, this is a remarkable counterexample to the prediction; nonetheless, it is still

not possible to assert that incentives have no effect on the process of time pressure affecting dishonest behavior. The reason, as discussed above, is that considering a broader range of incentive settings might lead to different results.

Finally, some problems should be listed as constraints on generalization (COG, Simons et al., 2017). First, participant characteristics are considered an important factor. The participants in the present study were recruited from the Yahoo! Crowdsourcing Service. As the gender ratio was not deliberately controlled, both Liu (2021) and Experiment 7 had overwhelmingly more male participants than female participants. Since the differences between males and females in dishonest behavior were found in many studies (e.g., Dreber & Johannesson, 2008; Jung & Vranceanu, 2017; Grosch & Rau, 2017), this factor might influence the results of the experiment. In addition, the mean age of the participants in the two experiments was 45.8 years and 44.4 years, respectively. This differs from studies with college students as participants, especially considering the economic situation of the participants. Second, because the incentive setting is directly related to the participants' motivation to cheat, it is also an important part of the replication. Rather than replicating the incentive setting of this study, future research should consider the market price and purchasing power of money in the local place, and then provide an incentive that is sufficient to lead participants to cheat. It is important to note that the incentive should not be so generous that it leads to all participants cheating. Otherwise, it might lead to a ceiling effect, in that it is not possible to compare indicators between conditions. Third, both Liu (2021) and Experiment 7 were conducted online; in other words, the

location of the experiment was decided by the participants, which differs from traditional laboratory experiments. In summary, when designing experiments for future replication, it is important to focus on participant characteristics, incentive settings, and the experimental environment.

Chapter 6 *General discussion*

6.1 Summary of this study

The effect of environmental factors on human behavior cannot be ignored. Although numerous environmental factors may influence dishonest behavior, research in this area remains sparse. In response, this study pioneered a new research approach that modeled multiple environmental factors to evaluate the effects of environmental factors on dishonest behavior and identified the factors that merited further attention. Subsequently, this study integrated the perspective of environmental psychology, grounded in cognitive psychology knowledge, and utilized experimental psychology methods, to verify the effects of several factors and elucidate underlying mechanisms. Although some of the experiments did not observe the predicted effects, they provided detailed reports and discussions, offering valuable directions for future research. Theoretically, this research provided new insights into our understanding of dishonest behavior, while practically, it offered innovative approaches for reducing dishonest behavior in real-life settings.

Chapter 1 reviewed the literature on dishonest behavior across psychology and related fields. It discussed the theoretical foundations of dishonest behavior from ethical and philosophical perspectives and summarized studies of fraud in economics and criminology. The chapter then focused on a review of psychological research related to dishonest behavior, spanning social, personality, physiological, and educational psychology. It also briefly mentioned an anomaly of dishonest behavior: altruistic dishonesty. Subsequently, the chapter summarized several mainstream theories. Finally, it provided a thorough overview of the experimental paradigms for dishonesty

detection. In summary, Chapter 1 serves as a comprehensive synthesis of the knowledge on dishonest behavior to date, offering a foundational understanding for this study.

Chapter 2 built on existing theories, integrated relevant research and inferred multiple factors that may influence dishonest behavior, along with their related indicators. An online experiment was conducted to collect indicators of these environmental factors and dishonest behavior (Experiment 1). Subsequently, Exploratory Graph Analysis (EGA) and Bayesian Belief Networks (BBN) were used to model these factors, clarifying their effects on dishonest behavior. The results of the calculated mutual information indicated that the effect of environmental factors on dishonest behavior was far from tremendous, suggesting that merely adjusting the environment is unlikely to suppress all dishonest behaviors. However, the findings also showed that environmental factors did have some noteworthy influence. Moreover, the findings also revealed that certain environmental factors (which were from ECPP) had a stronger influence on dishonest behavior than others. Additionally, a Psychological Network (PN) was used to compare whether the characteristics of environmental factors differed between occurrences of dishonesty and honesty. The results, based on model visual differences and centrality indices, concluded that the environmental characteristics associated with honesty and dishonesty were distinct, indicating the effect of environmental factors on dishonest behavior. The results of centrality indices also showed that stress and amenity were important for (dis)honest behavior. In summary, Chapter 2 established the groundwork and provided the direction for subsequent experiments that identified specific factors influencing dishonest behavior and

elucidated their mechanisms.

Chapter 3 focused on a factor within ECPP, brightness, conducting a series of experiments to validate its effect on dishonest behavior and elucidate its mechanisms. This chapter began by reviewing Zhong et al. (2010), which initially reported the effect of room brightness on dishonest behavior and attributed it to changes in participants' perceived anonymity. Chapter 3 highlighted the limitations and problems of Zhong et al. (2010) and discussed the improvements implemented in the design of Experiment 2 to address these concerns. Experiment 2, as a conceptual replication of Zhong et al. (2010), successfully replicated the phenomenon of brightness influencing dishonest behavior but did not support the original study's conclusions regarding perceived anonymity. This indicated that factors other than perceived anonymity might be at play in the process that brightness influenced dishonest behavior. Consequently, four experiments were conducted to test a new hypothesis that perceptual ambiguity promotes dishonest behavior. These experiments either indirectly confirmed the importance of perceptual ambiguity in dishonest behavior (Experiment 3) or directly manipulated the ambiguity of task outcomes through visual masking (Experiment 4), manipulation of stimulus appearance (Experiment 5), and weight (Experiment 6) to evaluate its effects on dishonest behavior. Overall, the results did not contradict the hypothesis, with Experiment 6 providing empirical evidence supporting the hypothesis. However, the results of Experiment 5 suggested that the effects of ambiguity were not always robust. Nevertheless, compared to the unsupported hypothesis of anonymity, ambiguity has been shown to affect dishonest behavior. These findings prompted a

reconsideration of how brightness affects dishonest behavior, suggesting that the ambiguity caused by dimness might be a plausible reason for the increases in dishonesty. However, this hypothesis still requires experimental verification. Based on the findings in this chapter, reducing ambiguity through methods such as enhancing visibility in the workplace and providing clear interpretations of new policies was considered a viable approach to reducing dishonest behavior in daily life.

Chapter 4 reviewed and expanded on two experiments reported by Liu (2021) that found no significant effects of black-white metaphors on dishonest behavior. However, according to CM Theory, such factors could influence dishonest behavior and are closely related to color temperature, a factor within the ECPP. Consequently, this chapter meticulously dissected the processes of these two experiments to identify the possible reasons for the observed null effect and to discuss whether metaphorical factors still have the potential to influence dishonest behavior. The discussion revealed that the observed results might be related to factors such as the vehicle of the metaphor, duration of exposure, and external reward systems. Although current evidence did not conclusively show that metaphors influenced dishonest behavior, the possibility remained, warranting further research. Additionally, it was advisable to minimize exposure to unethical metaphors in daily life.

Chapter 5 focused on two other factors from the ECPP: time pressure and rewards. The argument over the role of time pressure in promoting dishonest behavior was long-standing, with contradictory conclusions. Liu (2021) reported a conceptual replication experiment, but the discussion at that time was overly simplistic and did not delve deeply into the results. Therefore,

Chapter 5 revisited and expanded the discussion of that experiment, exploring the potential to reconcile the existing conflicting conclusions. Specifically, it suggested that under time pressure, the prior such as the participants' moral standards and the strength of their motivations might be particularly important. If participants were predisposed to honesty, time pressure might make them behave more honestly; conversely, if they were predisposed to dishonesty, time pressure might enhance their dishonest behavior. To test this hypothesis, Experiment 7 introduced rewards, another factor from ECPP, to manipulate participants' prior. However, the results did not support the hypothesis, and the promoting effect reported by Liu (2021) of time pressure on dishonest behavior was not replicated. This may indicate that the effect of time pressure is unstable and can be influenced by many factors, such as the design of the task. Additionally, Experiment 7 found the effect of rewards on dishonest behavior, further confirming that the factors within the ECPP were indeed noteworthy. In summary, Chapter 5 discussed the effect of time pressure on dishonest behavior and highlighted the importance of rewards in influencing dishonest behavior. Although the effects of time pressure may be unstable, it is still recommended to organize schedules judiciously and avoid situations where time pressure might occur, as a strategy to minimize dishonest behavior in daily life.

In summary, this study focused on environmental factors and dishonest behavior, a previously underexplored area, offering a fresh perspective. This research introduced innovative mathematical methods to explore environmental factors that might influence dishonest behavior, subsequently verifying the effect of these factors and further elucidating their underlying mechanisms through

experiments. By seven experiments and extending discussions on three prior experiments, this research contributed valuable insights and knowledge to related fields. Theoretically, the findings of this study filled a gap in the literature, validated and extended existing theories, and supplemented the current knowledge framework (see Section 6.2 for more details). Beyond the academic contributions, some results can also apply to real-life situations. Some results of this study showed the difficulties in eradicating dishonest behavior through environmental factors. However, it also suggested that several environmental factors, such as brightness and ambiguity, still could be used to affect dishonest behavior. Practical strategies based on the effects of these factors can be applied in various real-life situations. In conclusion, this study successfully combines theoretical value with practical application, making a significant contribution to the field of psychology.

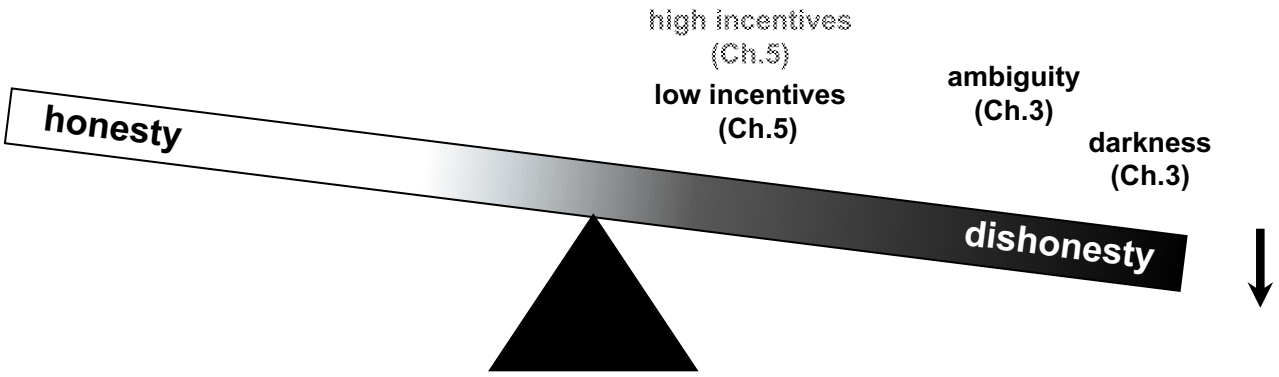
6.2 Theoretical discussion

To emphasize the theoretical contributions of this study, this section integrates all of the results to discuss and expand the existing theories. These discussions may be considered overlapping with some discussions in each chapter. However, this section synthesizes all of the findings, offering a more macroscopic and holistic view, whereas the discussions within each chapter were specific to each experiment's results, thus more detailed. Since Chapters 1 and 6 are theoretical and Chapter 2 is exploratory in purpose, the focus of this discussion will primarily concern the findings from Chapters 3, 4, and 5.

EU Theory, as a foundational theory explaining the occurrence of dishonest behavior, can provide explanations for some results of this study. The "Seesaw of Dishonesty" in Figure 6.1 shows the process of dishonest behavior. According to EU Theory, the occurrence of dishonest behavior hinges critically on the assessment that potential benefits outweigh the risks of being caught and punished (Jacobsen et al., 2018; Thielmann & Hilbig, 2018). In other words, if a factor reduces the risk of punishment or increases the benefits, individuals will tend to be dishonest. Darkness discussed in Zhong et al. (2010) and Experiment 2 can reduce the risk of punishment. The findings in Chapter 3 suggested that the effect of darkness on dishonest behavior is due to the ambiguity it creates. A primary consequence of ambiguity is reduced visibility, making the experimental outcomes harder to observe and, consequently, making participants' dishonest behavior less detectable. The difficulty in detecting dishonest behavior means a reduced risk, leading to more frequent dishonest behavior under

the same benefits. Thus, the results in Chapter 3 supported EU Theory. Furthermore, the effects of rewards discussed in Chapter 5 more directly support EU theory: dishonest behavior occurs more frequently with rewards than without. However, according to EU Theory, higher incentives should lead to more dishonest behavior than low incentives, yet our results do not align with this view. This suggests that EU Theory may not explain all instances of dishonest behavior.

Figure 6.1 “The seesaw of dishonesty” based on EU Theory



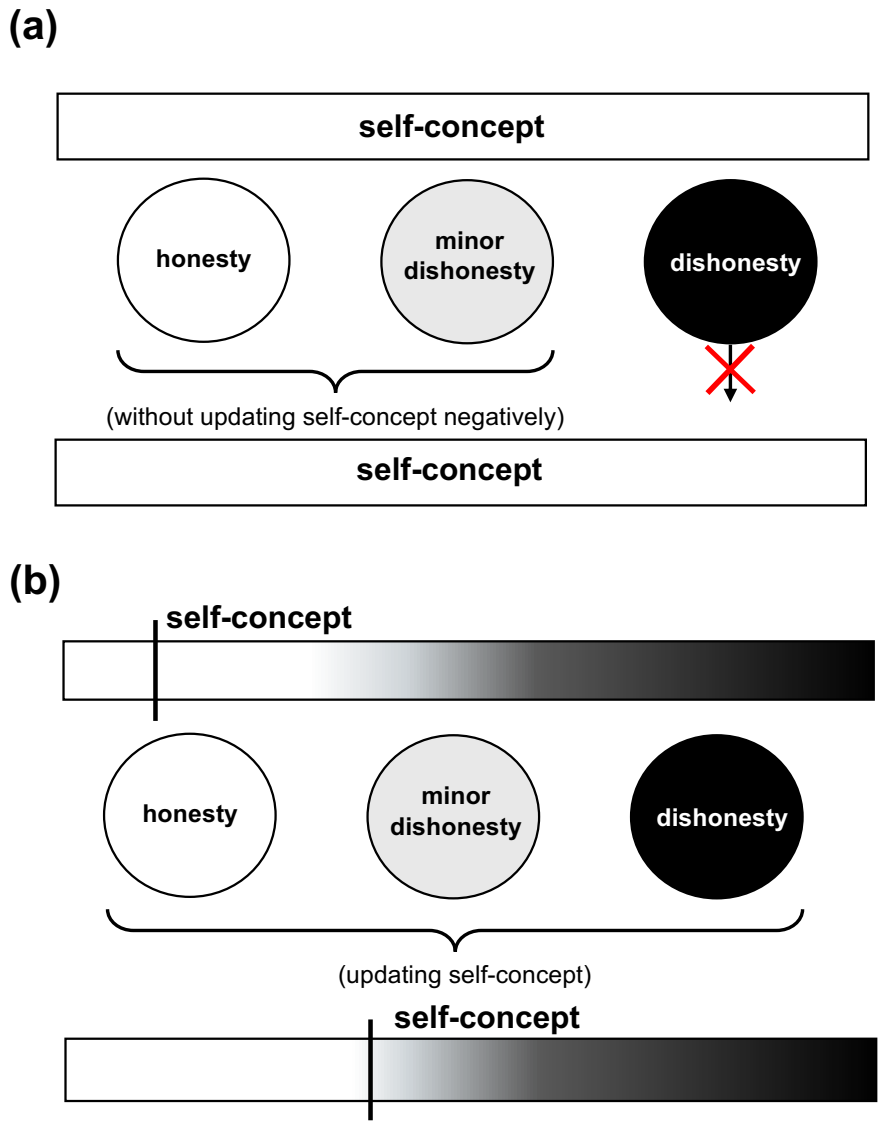
Note. The rectangle with color gradients represents the tendencies towards honesty and dishonesty. At the dishonesty side, factors identified in this study that promote dishonest behavior are listed. Throughout this study, darkness has been identified as one of the most robust factors that influence dishonest behavior. The effect of ambiguity on dishonest behavior is also highlighted. Additionally, while the effect of rewards was observed, the lack of difference between high and low incentives cannot be explained by EU Theory, and thus, the word “high incentives” is shown in gray.

SCM Theory offers a different perspective on the results of Chapter 3. SCM Theory posits

that people often need to maintain a positive self-image and therefore resist the temptations of gains from dishonest behavior (Mazar et al., 2008b). The presence of ambiguity blurs the line between honesty and dishonesty, possibly leading individuals to believe that even if they cheat, it is not profoundly immoral. As a result, such dishonesty does not overly damage their positive self-image, making it more likely to occur. Moreover, some expansive explanations are considered to need further elaboration. SCM emphasizes the band people set for dishonest behavior, suggesting that minor dishonesty within the band does not compel individuals to update their self-concept (Figure 6.2 (a)). I lean towards the view that updating one's self-concept is a gradual process, not a dichotomous one. People gradually adjust their self-concept based on their behavior, considering themselves more positive or negative, rather than categorizing themselves as entirely positive or negative due to certain actions. Thus, individuals may not avoid severe dishonest behaviors merely due to negative updates; they only need to ensure that the updated self-concept remains on the more positive side (Figure 6.2 (b)). This explanation can more reasonably explain the occurrence of dishonest behavior, particularly the occurrence of some severe instances of dishonesty. The finding of a significant level of dishonest behavior in the control condition of Experiment 6 further supported this explanation. When there is no ambiguity, dishonest behavior clearly constitutes a violation of rules, making it unlikely for individuals to avoid updating their self-concept. Participants still engaged in dishonest behavior because, even with the update, their self-concept remained on the positive side (Figure 6.2 (b)). Naturally, cheating in a psychology experiment can be classified as "minor dishonesty." However, if

considered in this way, it becomes difficult to explain the differences between conditions using SCM theory. The proposed mechanism differs subtly from original SCM theory but provides a plausible explanation within the SCM framework for the findings in Chapter 3. These theoretical discussions extend the original SCM theory to explain previously unexplained results, making a theoretical contribution.

Figure 6.2 Original SCM Theory (a) and extended SCM Theory (b)

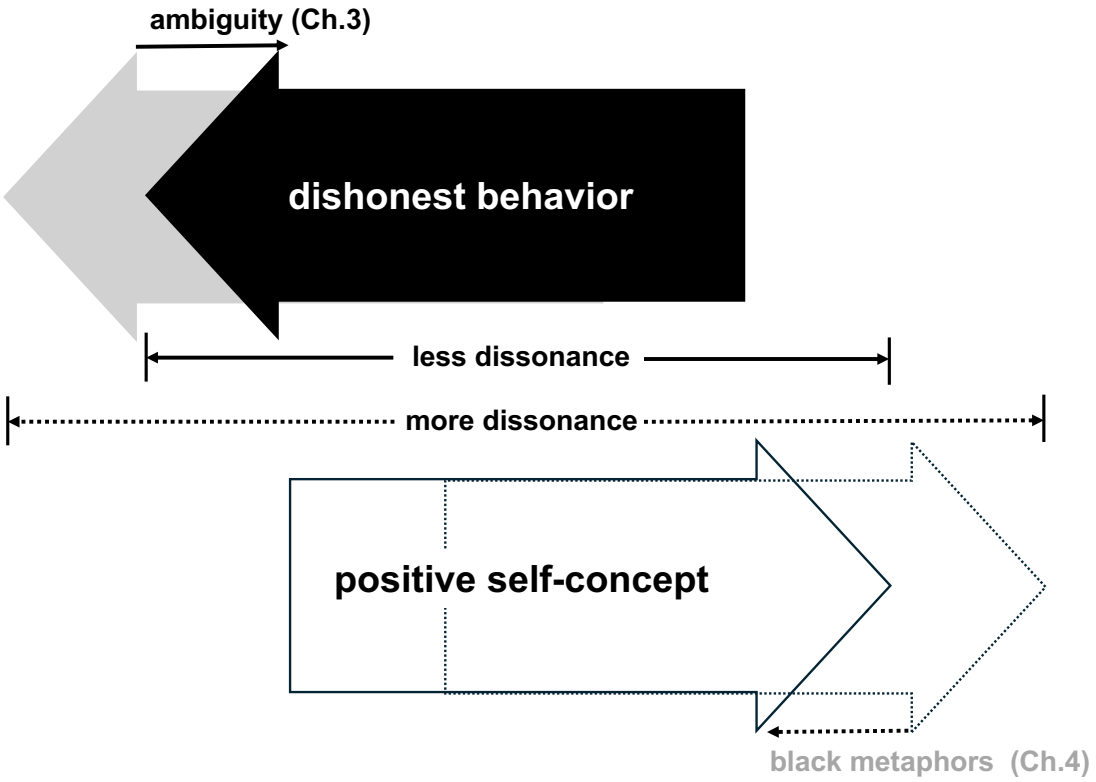


Note. (a) represents the original SCM theory, which posits that individuals avoid severe dishonest behavior and selectively engage in honest actions and minor dishonest behaviors. This is to prevent negative updates to their self-concept. The two white rectangles labeled "self-concept" at the top and bottom represent individuals' positive self-concept before and after their actions. In contrast, (b) shows the SCM theory extended in this study, suggesting that individuals' self-concept is not binary (black or white) but rather exists on a gradient. This is represented by the gradient colors in the rectangles. The vertical lines on the rectangles indicate the individual's self-concept at that time. Therefore, it is shown that the reason individuals engage in dishonest behavior is not that they can avoid updating their self-concept through minor actions, but rather that their self-concept remains relatively positive even after committing relatively severe dishonest behaviors.

As discussed in Chapter 1, the relationship between dishonest behavior and CD Theory (Festinger, 1957) initially stems from an extension of CD Theory itself. Unlike the original CD Theory, which emphasizes individuals' tendencies to eliminate dissonance after it arises, this study leans towards the idea that people anticipate the psychological discomfort caused by dissonance and view it as a risk (mentioned in EU Theory). This dissonance originates from the conflict between dishonest behavior and moral self-perception (Figure 6.3). Ambiguity discussed in Chapter 3 can mitigate this conflict, to reduce the risk of dissonance, then promoting dishonest behavior. Another experimental result related to CD Theory comes from Chapter 4. This chapter hypothesized that black metaphors

reduced moral self-perception, thereby making dishonest behavior more probable. This can be explained using CD Theory: a lowered moral self-perception reduces the opposition between participants' self-perception and dishonest behavior, thus minimizing the risk of dissonance and leading to more frequent dishonest behavior. However, the conclusions of Chapter 4 did not support this explanation. Yet, given the numerous limitations of the experiments discussed in Chapter 4, these findings should not be seen as conclusive evidence against CD Theory. This study proposes the possibility for extending CD theory and is the first to discuss the potential effect of dissonance on individuals before it arises.

Figure 6.3 Explanation of results based on CD Theory



Note. The black arrow at the top and the white arrow at the bottom respectively indicate the tendency to gain benefits through dishonest behavior and the tendency to maintain a positive self-concept. These two directions conflict with each other, creating strong dissonance. However, ambiguity can mitigate the severity of dishonest behavior and thus weaken the dissonance. Similarly, factors like black metaphors may negatively adjust the self-concept and likewise weaken the dissonance. When dissonance is reduced, dishonest behavior is more likely to occur. Since the effect of black metaphors is uncertain, it is indicated by a dotted line and shown in gray.

MD Theory suggests several mechanisms that facilitate dishonest behavior. The results about ambiguity from Chapter 3 appear to support "advantageous comparison" (Bandura, 1991, 2002; Bandura et al., 1996; Boardley & Kavussanu, 2011), which justifies dishonest behavior as being acceptable relative to more severe dishonesty. Compared to normal dishonest behavior, those involving ambiguity could be perceived as less severe. Advantageous comparison may also explain the findings from Chapter 5. People exhibited similar levels of dishonesty when faced with high versus low rewards; this may be due to some individuals perceiving cheating under the high rewards condition as excessively egregious, thus opting to cheat only under the low rewards condition. Consequently, despite expectations based on EU Theory that higher rewards would lead to more dishonest behavior, the dishonesty levels under the high rewards condition merely equaled those under the low rewards condition. Although the black-white metaphors discussed in Chapter 4 do not

directly relate to MD Theory, their mechanism—lowering participants' moral self-perception—effectively constitutes a form of moral disengagement. Therefore, it is suggested that if future research can find any effect of black-white metaphors on dishonest behavior, it should be proposed as a supplementary extension to MD Theory.

Although cognitive resources are widely believed to be related to dishonest behavior, the results from Experiment 7 did not support this opinion. If the time pressure applied in this experiment indeed impacted participants' cognitive resources, these results could be viewed as contradicting the prevailing views on the relationship between cognitive resources and dishonest behavior. Although Chapter 5 also presented the findings of Liu (2021) supporting the opinion, Experiment 7's results still suggested potential limitations in the explanation of CR and dishonesty. Similarly, the findings from Chapter 4 also highlight the potential limitations of the CM Theory (Lakoff & Johnson, 1980). While the link between these widely recognized theories and dishonest behavior is not being denied, given the current evidence, it is suggested, based on personal opinion, to adopt a cautious stance when discussing moral behaviors such as dishonesty within these theoretical frameworks.

As previously mentioned, this section discusses and extends traditional theories based on the results of this study. This section highlights how the findings of this study contribute to the development of psychological theories related to dishonest behavior and emphasizes the theoretical contributions of this research.

6.3 Limitations and future directions

The specific limitations of each experiment were discussed in their respective chapters; however, there were some common limitations across the study that need to be mentioned. Furthermore, based on these limitations, this section outlines future directions for research on dishonest behavior and environmental factors.

The "dishonest behavior" discussed in this study was manifested through changes in dishonest indicators. This study used the paradigm developed by Fischbacher and Föllmi-Heusi (2013) and its variants to detect this behavior. Given the widespread use of the paradigm in dishonesty-detection experiments (e.g., Bryan et al., 2013; Guo et al., 2020; Schild et al., 2021), it appears that this is generally considered representative of human "dishonesty" among researchers. However, this paradigm does not differentiate between behaviors driven by different motivations of participants or specific actions taken by participants (e.g., reporting false scores or employing strategies to achieve higher scores). This is the limitation of the current study and should be addressed in future research.

In the laboratory experiments (Experiment 2, 3, 5, and 6) of this study, participants typically conducted experiments alone in the laboratory, and as mentioned in Experiment 2, the current results may be limited to this setting. Dishonest behavior within groups remains unexplored yet valuable, given that in real life, we often interact with others. Future studies can focus on whether the effects of environmental factors on dishonest behavior differ when multiple people are present, and further verify the effect of the presence and number of other individuals.

Although this study implemented strategies such as using participants from multiple nationalities and collecting data from non-university students through a crowdsourcing platform to minimize the impact of participant characteristics on the experimental results, the participants were still predominantly from Japan and China. Given the potential influences of cultural differences (Guo et al., 2020), this remains a limitation of the study that cannot be overlooked. Future research should conduct multi-laboratory studies to broadly replicate the results of this study on a global level. This approach will help examine the generalizability of the findings and contribute to a more comprehensive understanding of dishonest behavior.

This study was conducted from 2020 to 2024, spanning the period of the COVID-19 pandemic and the subsequent post-pandemic phase. During this time, the world underwent countless changes, marking it as a distinctly unique period. The impact of the pandemic on the behavioral patterns of participants in this study, and how these patterns might differ from those before the pandemic or after its definitive end, presents a complex issue worth considering. This common limitation across all studies conducted during this period might be considered unavoidable. However, in future research, if the results of this study cannot be replicated, this issue should be considered as a potential contributing factor.

Additionally, this study developed various new tasks for detecting dishonesty. The ways of adapting paradigms to fit the research objectives may serve as a valuable reference for future studies. However, this also highlights the current low generalizability of dishonesty detection paradigms.

Moving forward, the development of various tasks and the establishment of a system for dishonesty detection paradigms—one that categorizes dishonest behaviors and provides specific tasks for each type of dishonesty—holds significant value. Such studies would greatly benefit not only psychological research on dishonesty but also related fields such as economics.

Moreover, some experiments in this study failed to detect dishonest behavior, thereby precluding a discussion of such behaviors. This highlights certain limitations of the experimental methods. Future experiments may need more careful design, particularly in aspects such as reward systems, to effectively and consistently induce dishonest behavior in participants. Additionally, providing a comparison of the occurrence of dishonest behavior in this study with previous research might help address this problem. Therefore, Table 6.1 shows a comparison between several experiments from this study and previous research that employed the same task (i.e., coin toss task). It is shown that in experiments utilizing the coin toss task, participants reported average scores between 4 and 7. Future research could try to induce the desired level of dishonest behavior by analyzing these results along with the details of each experiment.

Table 6.1 Average scores reported by participants in the experiments using the coin toss task

Experiments	The scores reported /total scores	Whether dishonesty was detected
Experiments 2 (dark)	5.96/10	Yes
Experiments 2 (light)	5.39/10	Yes
Experiments 3 (nonvisual*dark)	5.47/10	Yes
Experiments 3 (nonvisual*light)	5.31/10	No
Experiments 4 (control)	5.10/10	No
Experiments 7 (T * 0P)	5.27/10	No
Experiments 7 (T * 2P)	6.72/10	Yes
Experiments 7 (T * 10P)	6.72/10	Yes
Experiments 7 (C * 0P)	5.91/10	Yes
Experiments 7 (C * 2P)	6.09/10	Yes
Experiments 7 (C * 10P)	6.86/10	Yes
Bryan et al. (2013) Expt.3 (“cheater”)	5.23/10	No
Bryan et al. (2013) Expt.3 (“cheating”)	6.22/10	Yes
Bryan et al. (2013) Expt.3 (“baseline”)	6.31/10	Yes
Guo et al. (2020) Expt.1 (“cheater”)	4.86/10	No
Guo et al. (2020) Expt.1 (“cheating”)	5.22/10	Yes
Guo et al. (2020) Expt.1 (“baseline”)	5.33/10	Yes

These directions, combined with the research directions discussed in each chapter, form a comprehensive future outlook. Future research should consider the limitations of this study, to build a research framework for dishonest behavior, and strive to explore dishonest behavior as thoroughly as possible.

6.4 Further considerations on dishonest behavior

6.4.1 What is dishonest behavior?

Although all are reflected as changes in dishonest indicators, the "dishonest behavior" in this study may encompass various actions reflected in the experiments. For example, in the coin toss task of Experiment 2 and 7, dishonest behavior included repeatedly tossing the coin until a desirable outcome was achieved or directly reporting falsified results, which are described as cheating and lying respectively in Pascual-Ezama et al. (2020). In Experiment 3, participants might check which cup held the ball before deciding on an answer. In Experiment 6, participants might remember the position where the special ball was returned to the lottery box, or proceed to the next trial without properly mixing the balls as instructed, or identifying the special ball by its weight during the drawing. The identification of these various types of dishonest behavior came from post-experiment discussions with participants and checks of the experimental stimuli. While these behaviors are not differentiated in this study, the decision-making processes for each may subtly differ.

Dishonest behavior in real life is even more complex. Dishonest behavior often means breaking "rules," which may be clearly defined (e.g., cheating during exams is explicitly prohibited), or based on moral consensus (e.g., infidelity is not illegal but considered immoral). Additionally, it can also depend on individual moral standards (e.g., some people may feel guilty about lying to a stray cat, while others may not consider such behavior to be dishonest). Each form of dishonesty manifests in countless specific situations, resulting in a wide variety of instances of dishonest

behavior in real life that far exceed our imagination. Dishonest behavior is closely intertwined with our daily lives and is always present, yet there are very few people who truly understand it. “What is dishonest behavior?” can have different answers depending on the situation, and remains an intriguing and meaningful theme, with further investigation still needed.

6.4.2 Why do people commit dishonest behavior?

In this study, the reasons why people commit dishonest behavior may seem obvious. Participants were provided with financial incentives, and they likely committed dishonest behavior for monetary gain. However, there are still several intriguing possibilities behind this answer.

To conceal the true purpose of detecting dishonest behavior, many of the experiments in this study were described to participants as explorations of paranormal phenomena. Notably, a significant number of participants seem to be interested in parapsychology and do not reject its scientific validity. Such beliefs in supernatural phenomena may lead participants to interpret their behavior as manifestations of supernatural phenomena, rather than as subjective dishonest behavior. On the other hand, participants may also exhibit “benevolent responses” to the perceived purpose of the study. This is referred to as “demand characteristics” in psychology (McCambridge et al., 2012). Participants might believe that the experimenters aim to find the evidence of the existence of supernatural phenomena, and, out of goodwill, report higher scores. This potential altruism could be one of the motivations behind dishonest behavior.

In summary, the motivations behind dishonest behavior are likely driven not by a single factor but by multiple mechanisms, including external rewards, intrinsic beliefs, and altruism. As discussed in Chapter 2, real-life dishonest behavior often occurs in more complex and changing environments. The seemingly simple question of why people commit dishonest behavior remains a challenging topic for researchers, with a long way to go in understanding the entirety of the issue.

6.4.3 Dishonesty close to us

Dishonesty is not merely a subject of study for the researchers. Throughout this research, the understanding of dishonest behavior has continually changed, influenced both by the study's findings and experiences during the research process. Although the following discussion may be somewhat subjective, it is believed that it will help readers better understand the significance of this study and resonate with its findings. In recent years, psychology has been considered to be facing a reproducibility crisis (Kekecs et al., 2023; Yamada, 2018). Some of the irreproducible research results have been attributed to academic misconduct in the original experiments. Such academic misconduct ranges from selective reporting to data fabrication, causing considerable distress among researchers. Even the mere suspicion of academic misconduct can significantly affect subsequent research. When part of this dissertation was submitted to a journal, a reviewer commented, "…I am not sure whether it is safe to base your rationale specifically on Gino's work considering the recent events..." It is noteworthy that the cited works by Gino had not been retracted at that time (and they remain

unretracted to this day). While it is unclear how much this opinion influenced the decision, the paper was ultimately not accepted by the journal. This example embodies the negative impact of dishonesty on our field.

Fortunately, several strategies have been developed to address this problem. Many journals now require data transparency and the adoption of open science initiatives, such as those promoted by the Open Science Framework (OSF). These measures curb academic misconduct by significantly raising the possibility of detecting dishonest behavior; this is an example of effectively creating a high-visibility environment. Although the effectiveness of these new methods requires further investigation, they highlight the potential effect of the environment on academic dishonesty and emphasize the value of this research.

6.4.4 Can the environment reduce dishonest behavior?

While it is theoretically possible to use the environment to reduce dishonest behavior, in practice, it is a challenging effort. During the research process, several psychologists criticized this study, suggesting that although it appears highly useful at first glance, its practical applicability may be far lower than expected. As discussed in Experiment 1, it is extremely difficult to eradicate all dishonest behaviors by controlling the environment. However, the value of using environmental factors to reduce dishonest behavior remains considerable.

Due to individual differences, individuals might have different motivations for dishonest

behavior even facing the same situations. This difference can divide the participants' motivations for dishonest behavior into three types. The first type is extremely strong motivations, which means dishonest behavior will always occur. This is typically due to low moral standards or a strong desire for gain. The second type consists of moderate motivations, causing individuals to waver between honesty and dishonesty. These individuals weigh the risk of detection against the potential benefits to decide whether to be honest or dishonest. The third type includes quite weak motivations, meaning individuals will not commit dishonest behavior. This is generally due to high moral standards or because the benefits are not tempting enough. The environment seems to have little effect on the first and third types. However, it is considered that the environment still can influence the second type. By increasing the risk of detection (e.g., enhancing visibility) and raising moral self-perception (e.g., emphasizing moral reminders (Guo et al., 2020)), it is possible to guide the second type of individuals to be honest.

Therefore, it is considered that it is still possible to reduce, and even reverse, the prevalence of dishonest behavior by changing the environment.

6.5 Conclusion

In summary, this study explored factors that could influence dishonest behavior and tested (or discussed) the effects of factors such as brightness, time pressure, rewards and black-white metaphor, and elucidated their mechanisms through experiments and theoretical discussions. The results indicate that the environmental characteristics differ between the occurrence of honest and dishonest behaviors. Factors included in the ECPP seem to exert stronger effects compared to other factors. The study also found promoting effects of darkness, time pressure, and rewards on dishonest behavior. While the effect of darkness on dishonest behavior appears to be robust, the mechanism may involve not just anonymity but also the ambiguity created by dim lighting. On the other hand, the influence of time pressure on dishonest behavior may not be robust, it seems to be related to the subjective sense of urgency it creates. Rewards do induce dishonest behavior, though it cannot be definitively stated that their effects interact with time pressure. Although many questions regarding the effects of environmental factors on dishonest behavior, such as the effect of metaphor, remain unresolved, the findings of this study have contributed to their clarification, paved the way for further studies, and discussed strategies for reducing dishonest behavior in real life.

No matter how hard morally upright individuals strive, dark aspects of human nature, such as criminal behavior, will never be completely eliminated. However, the environment remains our eternal ally in protecting us from the temptations and adverse effects of dishonest behavior.

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Supplementary material 1

The original Japanese text utilized in the experiment I.

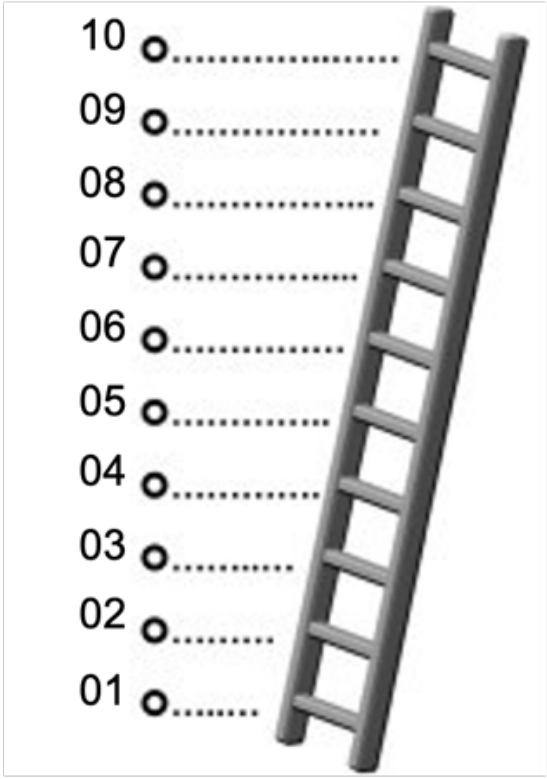
Q1. 現在は何曜日ですか。
1.月, 2.火, 3.水, 4.木, 5.金, 6.土, 7.日
Q2. 現在は今月の上旬，中旬，下旬，どちらでしょうか。
1.上, 2.中, 3.下
Q3. 現在は何時でしょうか。
0〜3, 3〜6, 6〜9, 9〜12, 12〜15, 15〜18, 18〜21, 21〜24
Q4. 現在はどこにいらっしゃいますか。＊現在の状況に合わせてご判断ください。例えば，家でお仕事する場合，現在の気分によって，１か２を選んでください。その他の場合も気分に合わせて選んで下さい。例えば，通勤電車におり，楽な気分であれば，３を選んで下さい。
1.家, 2.仕事場＆学校, 3.その他の気楽な場所 (e.g., 公園，スーパーなど), 4.その他の気重の場所 (e.g., 通勤電車など)
Q5. 現在は室内におるか，それとも室外におるか。
1.室内, 2.室外
Q6. 現在の実験場所の属性を評価してください。
1.自然 (公園，農地など), 2.人造 (建物，車など)
Q7. 現在の実験場所の広さを主観的に評価してください。
1.狭い, 2.やや狭い, 3.どちらでもいえない, 4.やや広い, 5.広い
Q8. 現在の実験場所に仕切りなど，外界の影響を遮れるものはあるでしょうか
1.なし, 2.一つのみある, 3.二，三つある, 4.三つ以上ある
Q9. 現在の実験場所はあなたにとって，どのくらいに熟知と言えるでしょうか。
1.全く知らない, 2.あまり知らない, 3.どちらでもいえない, 4.知っている, 5.十分に知っている
Q10. 現在の実験場所に，あなた以外に，他の人はおるでしょうか。
1. いない, 2. 一名, 3.二、三名, 4.三名以上

Q11. あなたは現在どのくらいに他人からの影響を受けていると考えているでしょうか。＊複数名がおる場合，最も影響力が強いと思う方を評価してください。
1.全く受けていない, 2.あまり受けていない, 3.どちらでもいえない, 4.ある程度に受けている, 5.非常に受けている
Q12. 現在の実験場所において，主観的な温度を評価してください。
1.寒い, 2.やや寒い, 3.どちらでもいえない, 4.やや暑い, 5.暑い
Q13. 現在の実験場所の照明条件，主観的な明るさを評価してください。
1.暗い, 2.やや暗い, 3.どちらでもいえない, 4.やや明るい, 5.明るい

Q14. 現在の実験場所の照明条件，主観的な色温度を評価してください。
1.冷たい (白っぽい), 2.どちらでもいえない, 3.暖かい (黄色っぽい)
Q15. 現在の実験場所において，快適さを評価してください。
1.不快, 2.やや不快, 3.どちらでもいえない, 4.やや快適, 5.快適
Q16. 現在の天気について，下の選択肢から最も適切なことを選んで下さい。
1.晴れ, 2.雨, 3.曇り, 4.雪
Q17. 現時点で着ている服の色の種類は？
1.単一色, 2.複合的な色 (二種類以上の色)
Q18. 最も現在の服装を代表できる色とは？＊複数の種類の色がある場合，現時点の気分で評価してください。
1.白, 2.黒, 3.その他の明るい色 (赤，黄など), 4.その他の暗い色 (グレー, 青など)
Q19. 現在の服装の露出度を評価してください。
1.低い, 2.やや低い, 3.どちらでもいえない, 4.やや高い, 5.高い
Q20. 帽子，手袋，アクセサリーなどのご着用は？
1.あり, 2.なし
Q21. あなたの健康状態について，以下の選択肢から，最も適切なことを選んで下さい。＊本研究で軽度疾患と重大疾患の分け方は，日常生活に顕著な支障が生じるかどうかである
1.健康, 2.軽度の慢性疾患, 3.重大な疾患もしくは障害, 4.回答なし
Q22. 現在，薬物を使用しているでしょうか (特に生活習慣，精神状態に影響する薬を指します)。
1.あり, 2.なし
Q23. 現在，市販のサプリメントを使用しているでしょうか（特に生活習慣，精神状態に影響する健康食品を指します)。
1.あり, 2.なし
Q24. あなたは飲酒しますか。
1.飲まない, 2.週 1 〜2 回, 3.週 3〜4 回, 4.週 4 回以上
Q25. あなた現在，どのくらいアルコールの影響を受けているでしょうか。
1.影響なし, 2.影響はわずか, 3.ある程度に影響されている, 4.影響されている, 5.強く影響されている
Q26. 最近 1 ヶ月，あなたの平均睡眠時間を選択してください。
1.<4h, 2.4~6h, 3.6~8h, 4.8~10h, 5.>10h
Q27. あなたの昨日の睡眠時間を選択してください。
1.<4h, 2.4~6h, 3.6~8h, 4.8~10h, 5.>10h
Q28. 現時点眠気の程度を選択してください。
1.低い, 2.やや低い, 3.どちらでもいえない, 4.やや高い, 5.高い
Q29. 現時点で，食事に関して回答してください。
1.食後 1h 未満, 2.食後 1〜2h, 3.食後 2〜3h, 4.食後 3〜4h, 5.食後 4h 以上

Q30. 現時点渇きの程度を選択してください。
1.低い, 2.やや低い, 3.どちらでもいえない, 4.やや高い, 5.高い
Q31. 現時点尿意の程度を選択してください。
1.なし, 2.弱い, 3.強い
Q32. 現時点の満腹感を評価してください。
1. 低い, 2.やや低い, 3.どちらでもいえない, 4.やや高い, 5.高い

Q33. 現時点のストレスを評価してください。＊ストレスとは，例えば，実験の後に別の予定が入るためのタイムプレッシャーによる圧迫感。
1.低い, 2.やや低い, 3.どちらでもいえない, 4.やや高い, 5.高い
Q34. 現時点の長期にわたって慢性的なストレスを評価してください。＊長期にわたって慢性的ストレスとは，例えば，来月に資格テストがあること，のようなことによる圧迫感。
1.低い, 2.やや低い, 3.どちらでもいえない, 4.やや高い, 5.高い
Q35. 本実験の報酬への満足度を評価してください。
1.非常に不満, 2.やや不満, 3.どちらでもいえない, 4.やや満足, 5.非常に満足
Q36.この梯子は日本の人々が社会でどこに位置しているかを表していると考えてほしい。あなたはどこに位置すると思うかを評価してください。
1, 2, 3, 4, 5, 6, 7, 8, 9, 10



Supplementary material 2

Below are the default settings of EGAnet (version 2.0.6).

```
corr = c("auto"),
na.data = c("pairwise"),
model = c("glasso"),
algorithm = c("walktrap"),
uni.method = c("louvain"),
plot.EGA = TRUE,
verbose = FALSE,
```

The EGA results outputted by R

```
> summary(ega_results)
Model: GLASSO (EBIC with gamma = 0.5)
Correlations: auto
Lambda: 0.09122007120109 (n = 100, ratio = 0.1)
Number of nodes: 36
Number of edges: 162
Edge density: 0.257
Non-zero edge weights:
      M    SD   Min   Max
  0.024 0.151 -0.524 0.817
----
Algorithm:  Walktrap
Number of communities:  8
 Q1  Q2  Q3  Q4  Q5  Q6  Q7  Q8  Q9 Q10 Q11 Q12 Q13 Q14 Q15
Q16 Q17
   1   1   1   2   2   2   3   2   2   4   4   3   3   3   3   1   5
Q18 Q19 Q20 Q21 Q22 Q23 Q24 Q25 Q26 Q27 Q28 Q29 Q30 Q31 Q32 Q33
Q34
   5   2   2   6   6   6   2   2   7   7   3   8   3   3   8   3   3
Q35 Q36
   3   3
----
Unidimensional Method: Louvain
Unidimensional: No
----
TEFI: -41.278
```