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【研究ノート】

Fraud Vulnerability and Decision-Making Processes

: Possibilities for Mitigating Fraud Vulnerability

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Abstract

This literature review conceptualizes fraud victimization as the outcome of victim's decisions contextually manipulated by perpetrators, and it examines the mechanisms of vulnerability through the lens of dual-process theory. Heuristics, which are adaptive and useful in everyday life, can also function as vulnerabilities in deceptive contexts. The concentration of fraud victimization among older women is explained by the interaction between System 1 processing, family-protection norms, and strong affective motivation, combined with age-related declines in System 2 processing under deceptive conditions. Synthesizing replications of the framing effect and evidence linking fraud vulnerability, self-efficacy, and quality of life—particularly among older women—we argue that vulnerability reflects a maladaptive deployment of otherwise adaptive System 1 processes, rather than a defect in the victims themselves. We propose two preventive strategies: (1) designing choices that appeal to System 1, so that timely transitions to System 2 processing can occur; and (2) employing nudge-based choice architecture to steer automatic responses toward safer behaviors. Finally, we outline methods for reducing fraud vulnerability, based on data from a Fraud Vulnerability Assessment Application, focusing on groups identified as vulnerable, and we propose actionable nudge designs. We also discuss the potential for enhancing these interventions through AI integration.

Keywords ; *fraud vulnerability, dual process theory, system1, system2, nudge*

１. Introduction

Fraud victimization occurs through a sequence of decisions made by victims who are steered by fraudsters, culminating in the victims voluntarily handing over money or property to the perpetrators. The central question is whether such victimization stems solely from defects or errors in the victims' decision-making. I do not necessarily adopt that view. Humans, shaped by historical and cultural contexts, have developed behavioral patterns that help them adapt to society and maintain smooth interpersonal relationships (Harari, 2011). These patterns become internalized as common sense, values, worldviews, and social rules, thereby forming the foundation for efficient decision-making in daily life. In many situations, we rely on this foundation to make decisions smoothly while minimizing cognitive load (Kahneman, 2011).

Such rapid judgments, grounded in past rules of thumb and common sense, are referred to as heuristic information processing (hereafter, heuristics). Heuristics allow immediate judgments without complex calculation or deep deliberation and thus (i) reduce the effort required for decision-making, (ii) facilitate smooth interaction in social contexts, and (iii) conserve cognitive resources (Tversky & Kahneman, 1974; Kahneman, 2011).

According to Kahneman (2011), within the dual-process framework of cognitive psychology, heuristics are regarded as part of System 1, which is responsible for intuitive and automatic processing. While System 1 enables fast and energy-efficient decisions, it is also vulnerable to contextual shifts and prone to errors in non-routine or deceptive situations. In contrast, System 2 supports conscious, logical reasoning; it requires greater cognitive effort but allows for more precise judgments. Fraud schemes specifically exploit properties of System 1: fraudsters anticipate how victims will respond based on common heuristics and skillfully leverage these habitual response patterns (Watanabe & Shibutani, 2010). Prior research indicates that older adults tend to rely on heuristics more than younger adults (Shibutani & Watanabe, 2009). These findings suggest that System-1-based decision making, which is generally adaptive in everyday life, can function as a vulnerability in fraudulent contexts.

Thus, understanding fraud victimization requires a shift away from a "defective decision" model, which attributes victimization to individual shortcomings, toward a perspective that views "adaptive, System-1-based judgment styles as being exploited within fraud contexts." From this perspective, the fact that victims of the so-called "Ore-ore" scam (the "It's me"/impostor scam) are overwhelmingly older women can be interpreted as follows. When confronted with a situation in which a child or grandchild is said to be in distress, many older women—guided by values that prioritize family relationships and shaped by caregiving experience—tend to act swiftly under strong emotional motivation (Watanabe & Shibutani, 2010).

Moreover, because many older adults rely on heuristics, once they accept the scenario presented by the fraudster as true, the strategy of "quietly resolving the matter by paying a sum to help the family member and prevent the situation from spreading to others" appears socially reasonable and even natural. Few would regard such a decision, taken at face value, as seriously flawed. However, in fraud contexts, the "given situation" itself is a carefully constructed falsehood. Victimization, therefore, does not arise from a lack of decision-making ability per se; rather, reliance on heuristics reduces the likelihood of detecting the falsehood and thereby heightens the risk of harm. In particular, older women—who, through life experience and close relationships, adhere to a norm of "protecting the family" and who are inclined to decide quickly when emotionally aroused—may have this otherwise adaptive tendency exploited by fraudsters.

This protective, maternal tendency is rooted in the automatic and rapid reactions of System 1. It reflects an evolutionarily older information-processing system shared with other animals. A canonical analogy is the danger of encountering a mother bear with cubs: the mother's immediate aggressive behavior to protect her young is adaptive. Similarly, in humans, the instinctive judgment to defend one's family is adaptive—but in fraud contexts, that very adaptiveness can be transformed into a vulnerability.

By contrast, younger adults are more likely to employ systematic information processing, i.e., decision making based on careful and structured information gathering and analysis. Because such processing scrutinizes the veracity of the situation itself, it is presumed to increase the likelihood of detecting fraud. That said, while systematic processing is effective for complex tasks that heuristics cannot handle, it (i) consumes substantial cognitive resources, (ii) requires time and effort, and (iii) operates as a serial process, addressing only one issue at a time. Consequently, systematic processing is not continuously deployed in everyday life; in practice, System 1—such as heuristic judgments—predominates, with systematic processing serving a complementary role for decisions of greater importance. The predominance of older women among "Ore-ore" scam victims can thus be understood as the outcome of an interplay between a rapid, emotionally driven heuristic judgment tendency and fraudsters' strategies that deliberately exploit it (Shibutani & Watanabe, 2009).

Similar psychological processes are likely to apply to other fraud modalities. Therefore, a comprehensive understanding of fraud victimization requires attention not only to contextual information about specific schemes but also to the underlying decision-making processes themselves. The following sections provide a concise

overview of the development of decision-making research from this perspective.

2. Decision-Making Theories

Decision-making problems arise when individuals must choose one option from among multiple alternatives. Because real-life decision-making situations are highly complex, theoretical simplification is required, typically by organizing behavioral alternatives into mutually exclusive options. A normative framework traditionally employed in decision-making studies is said to consist of the following five steps (Shigemasu, 1995):

1. Enumerate the available alternatives and predict the outcomes associated with each.
2. When outcomes are uncertain, assign probabilities to those predictions.
3. Evaluate predicted outcomes in terms of desirability (utility).
4. Integrate probabilities and utilities to assess the "overall desirability" of each alternative.
5. Choose the alternative with the highest overall desirability.

The representative model of this normative theory is Von Neumann and Morgenstern's (1944) expected utility theory (EUT). This theory does not describe how humans actually behave but instead provides a model of how they ought to behave under the assumption of rationality (Kahneman, 2011). In EUT, the product of an alternative's utility and its probability of occurrence is called its expected utility, and the alternative with the greatest expected utility is regarded as optimal. A central limitation of this model, however, is its assumption that utilities are universally shared, a consensus that is often unattainable. Furthermore, caution is required in the operationalization of utility, as measurement outcomes may vary substantially depending on the procedures and methodologies employed (Masuda, 2023).

By the late 1950s, Simon (1957) criticized EUT as unrealistic, arguing that humans make decisions under conditions of limited cognitive capacity and time. He introduced the concept of bounded rationality, positing that humans act not by optimizing but by satisficing. Instead of exhaustively searching for the optimal option, individuals set minimum criteria and choose the first alternative that meets them. This approach acknowledges that real-world decision making is constrained by time, information, and cognitive resources. For example, rather than comparing every possible product, a person may select the first one that is affordable, reliable, and convenient. While less precise than optimization, satisficing is adaptive: it balances efficiency and adequacy, enabling individuals to make workable choices in complex or uncertain contexts. Through his studies of bounded rationality and satisficing, Simon revealed the limitations of the rational "economic man" model, and for these contributions, he was awarded the Nobel Prize in Economic Sciences in 1978.

From the 1970s through the 1980s, Kahneman and Tversky presented empirical evidence that many real-world decision-making phenomena violate the axioms of EUT, thereby exerting a significant influence on the field (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981). This spurred a wave of research on decision-making processes unexplained by rationality models, revealing that many decisions are, in fact, irrational (Watanabe & Shibutani, 2010b). Drawing on findings such as the framing effect—which induces systematic deviations from rational choice—Kahneman and Tversky proposed prospect theory, demonstrating that gains and losses exert asymmetrical influences on human decision making..

Since the 2000s, Kahneman has synthesized his own work with prior findings into a broader framework, popularizing the idea that decision making operates through a dual process: the intuitive, automatic System 1 and the conscious, analytical System 2 (Kahneman, 2011). His work on prospect theory—demonstrating the asymmetrical impact of gains and losses and the role of framing effects—led to his receipt of the Nobel Prize in Economic Sciences in 2002. System 1 is described as implicit and automatic, fast-reacting, effortless, associative, and context-dependent, whereas System 2 is explicit, deliberate (controlled), slow-reacting, effortful, logical, and applicable across broader contexts. Humans shift between these two systems depending on the situation, employing them either unconsciously or consciously. In contemporary society, System 1 plays a central role in

many decisions, including consumer behavior (Kahneman, 2011; Thaler & Sunstein, 2008). Thus, the research paradigm has expanded substantially—from rationality models to bounded rationality, prospect theory, and ultimately, dual-process theory.

Regarding System 1, which plays a central role in human decision making, Yama (2021) argues that it consists of multiple modules, some of which are innate, shaped by evolutionary processes, and capable of operating without learning. Moreover, research has shown that automatic modules within System 1 can sometimes function in opposition to one another. As illustrated by the visual illusion in Figure 1, when System 1 operates automatically, decisions may occur outside our awareness. The figure illustrates the Shepard illusion, which causes the two tables to appear different in size; however, if one tabletop is removed, it fits perfectly on the other.

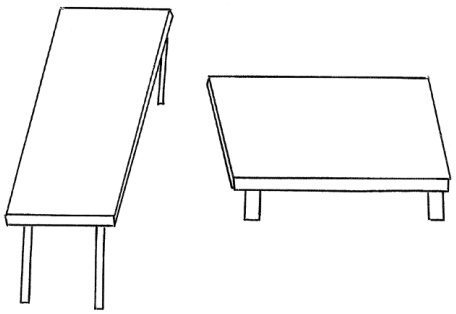

Figure1. Shepard illusion

Some might believe that no countermeasures exist against such illusions, because System 1 operates rapidly, involuntarily, and without conscious oversight. Even when individuals recognize that the tables are identical, the illusion persists, indicating that awareness alone is insufficient to override the automatic perceptual process. An analogous phenomenon may arise in deceptive cognitive contexts, where automatic judgments continue to exert influence despite conscious knowledge. Such persistence can foster the impression that corrective efforts are ineffective. Nevertheless, prior studies have proposed two main strategies for counteracting or correcting System 1. The first is to engage System 2, which can regulate or revise the outputs of System 1 through deliberation.

The second strategy involves designing “cues” or “nudges” that deliberately activate System 1’s automatic processes in desirable directions—a method widely applied in marketing and the health sciences (Takebayashi et al., 2024). For example, in online shopping, product placement order (with earlier-listed items selling more easily) and pricing schemes (where, when three similar products are presented, the middle-priced one tends to sell best) are known to strongly influence purchasing behavior. Thaler and Sunstein (2008) argue that such nudges can guide people’s behavior in desirable directions without restricting freedom. A classic example comes from Amsterdam’s Schiphol Airport in the late 1990s: to reduce high cleaning costs around men’s urinals, managers placed small fly stickers at the center of urinals. Users unconsciously aimed at the fly, reducing spillage and lowering cleaning costs by more than one million dollars. This behavioral change occurred not through deliberation but through the activation of System 1’s automatic module. For his contributions to applying psychological theories to economic behavior and for developing behavioral economics as a new academic field, Thaler was awarded the Nobel Prize in Economic Sciences in 2017. Today, research on behavioral economics and nudges is also flourishing in Japan (Takebayashi et al., 2024). Whereas consumer and economic decision-making was once assumed to depend solely on System 2’s deliberative processes, it is now evident that System 1 plays a central role in most decision-making contexts, including those related to consumption and health (Kahneman, 2011; Thaler & Sunstein, 2008).

Both System 1 and System 2 represent cognitive capacities acquired through evolution. System 1 was particularly adaptive in eras of gradual social change, but in today’s rapidly transforming society, it may no longer be fully adequate (Harari, 2011). Insights from psychology are also supported by neuroscience. Nagamine et al. (2009) reported that age-related decline in prefrontal cortex function reduces the systematic (deliberative) processing capacity of System 2, while relatively enhancing heuristic processing in System 1—thereby contributing to vulnerability in fraudulent contexts such as bank transfer scams. Furthermore, Shibutani and

Watanabe (2012) demonstrated that the relationship between self-efficacy and fraud vulnerability is particularly pronounced among older women. While self-efficacy often functions advantageously in younger populations, in older adults it may paradoxically increase susceptibility to fraud due to cognitive decline and social changes associated with aging.

3. Decision Making in Fraud Contexts

3.1 Framing Effects

One key assumption in decision-making theory, which analyzes the processes of choice, is the uniqueness of mathematical representation. That is, even if verbal descriptions differ, mathematically equivalent decision problems are assumed to yield the same choices. For example, the statements “the probability of winning is 20%” and “the probability of losing is 80%” are logically identical and therefore presumed to be interpreted equivalently. However, the framing effect, identified by Tversky and Kahneman challenges this assumption (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981). The framing effect refers to the phenomenon whereby preferences shift depending on whether the same mathematically equivalent decision problem is presented in a positive or a negative frame.

They presented the following hypothetical problem in a survey: An outbreak of a strange “Asian disease” is expected to kill 600 people in the United States if no action is taken. Two alternative programs are proposed, with the following scientifically estimated outcomes. Which would you choose? Options with the same expected value were presented under positive and negative frames, as follows.

Positive frame:

A) Program A: 200 people will be saved.

B) Program B: There is a 1/3 probability that 600 people will be saved and a 2/3 probability that no one will be saved.

Negative frame:

C) Program C: 400 people will die.

D) Program D: There is a 1/3 probability that no one will die and a 2/3 probability that 600 people will die.

Although the expected values are equivalent, choices diverged markedly: under the positive frame, the risk-averse Program A was chosen more frequently, whereas under the negative frame, the risk-seeking Program D was preferred. In other words, people tend to be risk-averse when outcomes are framed as “lives saved”, and risk-seeking when framed as “lives lost”. This effect has been replicated in Japan (Shibutani & Watanabe, 2010; Watanabe & Shibutani, 2012), and numerous international replications have demonstrated that the uniqueness of mathematical representation does not always hold in decision processes. A familiar analogy is the asymmetry between the “joy” of winning $100 and the “pain” of losing $100: the amounts are identical, but the psychological impact of loss is typically greater. Tversky and Kahneman (1981) attribute this asymmetry to differences in utility between the loss and gain domains; mathematically equivalent problems can evoke different preferences psychologically (Shibutani & Watanabe, 2013).

The framing effect is understood to arise from the psychological frame that is how decision makers construe the context, and is thought to be grounded in System 1, which operates intuitively and automatically (Kahneman, 2011). Consequently, neutralizing this effect through conscious effort is difficult. Indeed, many surveys show that a large proportion of respondents believe, “I will not be a victim of fraud,” yet reports indicate that many fraud victims held the same belief before being deceived (Shibutani, 2024). Regardless of such confidence, automatic System 1 information processing may generate vulnerability in fraud situations. Prior research has highlighted the role of System 1 in this mechanism (Shibutani & Watanabe, 2009; Shibutani & Watanabe, 2013; Shibutani et al., 2019; Watanabe & Shibutani, 2019a; Watanabe & Shibutani, 2019b).

3.2 Decision Processes and Fraud

There are numerous reports of individuals falling victim to fraud despite being familiar with the schemes (Shibutani, 2024). That is, even when a person understands the tactics through System 2, the logical and deliberative mode of processing, it can still be difficult to interpret the situation accurately as it unfolds, reflecting

the dominant influence of System 1. This can be illustrated by visual illusions. In the Shepard illusion (Figure 1), the two tabletops are in fact identical in size, yet they appear different. If one were to cut out and superimpose the top surfaces, System 2 would readily confirm their equality; nevertheless, the figure continues to look different. This indicates the automatic control of System 1 over visual perception (Shibutani, 2024).

Similarly, human visual perception does not generate a veridical, camera-like representation of the external world. For instance, when panning a video camera at a school sports day to keep one's child centered in the frame, the entire image may shake; by contrast, even with large head movements, human visual experience remains stable. This stability arises because the visual cortex automatically compensates incoming signals, another hallmark of System 1. Likewise, during severe turbulence on an airplane, many passengers experience intense fear. Even if one is told and understands through System 2 that "the probability of a plane crash is only one in millions," the fear does not readily subside. Thus, rational understanding via System 2 often fails to override the automatic reactions of System 1 (Kahneman, 2011; Watanabe & Shibutani, 2012).

The same applies to fraud. While vigilance is fundamental to prevention, System 2 alone may not adequately control the automatic responses of System 1. That said, System 2 can partially correct System 1. For example, many people occasionally make impulse purchases, but few do so repeatedly because System 2 intervenes with the logical inference that persistent impulsive buying would jeopardize one's finances. Hence, effective fraud-prevention measures should aim to shift processing from fast, automatic System 1 to deliberative System 2 at critical moments.

In recent years, methods that directly influence System 1 have been developed. The nudge approach (Thaler & Sunstein, 2008) designs choice environments that steer System 1's automatic modules toward desirable behaviors, thereby encouraging appropriate automatic decisions. Nudges are central to behavioral economics and have been widely applied in marketing and public policy. They are also relevant to fraud prevention. In typical special-fraud scenarios, victims—guided by values and emotions such as "protect the family"—may make instant, System 1 decisions. In such moments, prominently displaying warnings on ATM screens or at bank counters, e.g., "If someone calls asking you to transfer money, it is highly likely to be fraud", accompanied by salient visuals, can interrupt the automatic response and trigger System 2 deliberation. Similarly, inserting an automated voice alert, "This call may be a fraud attempt", at the start of incoming calls can dampen affect-driven System 1 reactions and serve as a cue to activate System 2.

There are two distinct processes for altering actions initiated by System 1. The first is to deploy System 2, which does not directly affect System 1 but can override or revise actions generated by it through deliberation. The second is to use nudges, which influence System 1 directly by steering its automatic responses toward desirable outcomes. As Thaler and Sunstein (2008) emphasize, nudges guide behavior toward beneficial ends without restricting freedom. In fraud contexts, both approaches are valuable: nudges can prevent victims from defaulting to automatic judgments, while System 2 engagement fosters the deliberate reasoning necessary to avoid harm.

To translate these theoretical insights into preventive practice, the crucial task is to design concrete, implementable interventions, determining both "what" to implement and "how" to implement it. As illustrated by the Schiphol Airport example, simple, well-designed cues can reshape automatic behavior. In fraud prevention, collaboration among law enforcement, consumer-protection agencies, and researchers is essential to develop and deploy practical, nudge-informed countermeasures.

Human decision making involves cooperation between Systems 1 and 2. System 1 comprises multiple automatic modules, some of which are innate, shaped by evolution, and capable of operating without learning (Yama, 2021). Reactions such as rapid danger avoidance and the recognition of social cues are automatically triggered by System 1 processes, operating outside conscious awareness. As with visual illusions, automatic reactions can be difficult

to suppress even when one "knows" they are misleading.

While these characteristics can trigger inappropriate reactions in fraud situations, it is also possible to guide System 1 modules in desirable directions through nudges (Thaler & Sunstein, 2008). Just as product placement and pricing can influence purchasing behavior, adjusting how warnings and information are presented in fraud-prevention contexts may reduce the vulnerability inherent in rapid, System 1 judgments. Thus, combining System 2's deliberative control with System 1 oriented interventions represents a promising approach to strengthening fraud resistance, particularly among older populations (Shibutani,2024).

Older adults are reported to be more influenced by emotional information processing and more reliant on simplifying heuristics than younger adults (Peters et al., 2007; Watanabe & Shibutani, 2010; Shibutani & Watanabe, 2011). Moreover, Shibutani and Watanabe reported significant associations between fraud vulnerability and the self-efficacy subscales "proactive behavior" and "fear of failure" in both older and younger women, whereas significant associations between fraud vulnerability and quality of life domains, including happiness, family relationships, housing environment, friendships, health, and work, were found only in older women (Shibutani & Watanabe, 2009; Shibutani & Watanabe, 2013). These findings help explain why older women exhibit particularly high victimization rates in emotionally charged frauds such as the "Ore-ore" scam. The pattern is also consistent with socioemotional selectivity theory (Carstensen et al., 1999), which posits that perceptions of future time horizons shift motivational priorities and, in turn, influence decision making (Shibutani & Watanabe, 2013).

4. Theory and Practice

Our research-and-implementation group is engaged in reducing fraud cases through a large-scale, data-driven approach (Shibutani, 2024; Watanabe,; Watanabe & Shibutani, 2019a ; Watanabe & Shibutani, 2019b; Watanabe & Shibutani, 2014). Using a Fraud Vulnerability Assessment App, we have empirically examined "individual fraud vulnerability" long noted by police and consumer support centers, grounding them in psychometrically validated based on large scale survey data (Shibutani, 2024; Shibutani & Watanabe, 2010). The app simultaneously provides engaging learning opportunities for app users and enables efficient targeting by identifying highly vulnerable subgroups for focused interventions.

On the scholarly side, our work seeks to systematically elucidate the psychological characteristics and decision processes that shape fraud rvulnerability in older adults. Three findings are especially informative for understanding concentrated victimization: (i) the relative dominance of emotional information processing (Carstensen et al., 1999); (ii) age-related prefrontal functional decline and an associated reduction of the deliberative processing (Nagamine et al., 2009); and (iii) the association between self-efficacy and fraud vulnerability among older women (Shibutani & Watanabe, 2013). In short, fraud victimization is not simply a matter of "defective decision making". Rather, adaptive, System 1 based judgment styles are cleverly exploited by fraudsters.

The distinction between theory and practice is crucial. Theoretically, psychological research highlights mechanisms—such as the framing effect, emotional salience, and age-related cognitive shifts—that increase vulnerability. Practically, however, interventions must translate these mechanisms into actionable strategies that can interrupt or redirect System 1 processes at critical moments. For example, while theory identifies the importance of engaging System 2 deliberation, in practice this requires concrete cues—such as ATM warnings, automated phone alerts, or interactive learning modules that trigger a shift from automatic to reflective processing.

A key agenda for future work is to empirically identify mechanisms that prompt transitions from System 1 to System 2 at critical junctures, and to operationalize these findings in practical fraud-prevention measures. Building on our app as a platform, further development, potentially incorporating AI to detect emerging fraud

patterns, may enable more timely, personalized, and effective interventions. Ultimately, bridging the gap between theoretical insight and real-world application is essential to strengthen fraud resistance, particularly in vulnerable older populations.

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詐欺脆弱性と意思決定

:脆弱性の改善の可能性

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要旨

本研究は，詐欺被害を「被害者の連続的な意思決定が詐欺師によって文脈的に操作された結果」と捉え，二重過程理論に基づいて脆弱性の機序と改善方法を検討し，今後の研究に繋げることを目的とする文献考証研究である．日常生活においては適応的に機能するヒューリスティックス（システム 1）が，非日常的かつ欺瞞的な状況下では脆弱性として作用する．特に高齢女性に被害が集中する理由は，家族保護規範や情動動機づけの強さ，加齢による熟慮的処理（システム 2）の低下と関連づけて説明されている．フレーミング効果の知見や，脆弱性と自己効力感・QOL との関連（高齢女性で顕著）を踏まえると，脆弱性は「欠陥」ではなく，適応的判断様式の不適応として位置づけられる．予防方策の柱としては，①単なる注意喚起に依存せずシステム 1 からシステム 2 への移行を促す設計，②ナッジ等を用いて自動反応を望ましい方向へ導く戦略，の二点が提案されている．これらの理論的妥当性は確認されているものの，理論がそのまま具体的な改善策に直結しない点が，実際の予防対策における課題となっている．さらに，大規模データを活用した実証研究を通じ，重点的な介入対象の同定と，実装可能な介入方策の構築が必要とされている．しかし，詐欺手口は絶えず進化しており，現行の対策だけでは十分に対応できていない．したがって，既存の知見に AI を応用し，社会変化に順応可能な柔軟な対策を構築することが課題である．

キーワード: *詐欺脆弱性，二重過程理論，システム 1，システム 2，ナッジ*