Application of the CNI Model in Moral Decision-Making Research

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Abstract

Moral decision-making refers to the process wherein individuals, when faced with conflicts between two or more moral values or moral demands, weigh the advantages and disadvantages of actions and their outcomes to make a final choice. Moral dilemmas represent a classic paradigm for investigating moral decision-making; however, the traditional moral dilemma paradigm has been subject to numerous criticisms. The unrealistic nature of moral dilemmas and the lack of effective indicators to quantify utilitarian and deontological tendencies prevent accurate explanations of moral decision-making. To address the limitations of the traditional moral dilemma paradigm, the CNI model of moral decision-making utilizes polynomial modeling methods to separately compute individuals' sensitivity to consequences, sensitivity to moral norms, and general action preferences, thereby enabling clearer identification of key factors influencing moral decision-making. Future research should continue to refine the CNI model by focusing on other factors affecting moral decision-making, the ecological validity of moral situations, and cross-cultural applicability, while further exploring the underlying psychological mechanisms of moral decision-making.

Full Text

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Abstract: Moral decision-making refers to the process by which individuals weigh the advantages and disadvantages of actions and their outcomes when facing conflicts between two or more moral values or demands, ultimately making a final choice. The moral dilemma paradigm is a classic approach for studying moral decision-making, yet traditional moral dilemmas have faced numerous criticisms regarding their lack of realism and the absence of effective metrics for quantifying utilitarian and deontological tendencies, which limits accurate interpretation of moral decision-making. To address these limitations, the CNI model of moral decision-making employs multinomial modeling to separately calculate individuals' sensitivity to consequences, sensitivity to moral norms, and general behavioral preferences, thereby enabling clearer identification of the key factors influencing moral decisions. Future research should continue to refine the CNI model by examining additional factors affecting moral decision-making, improving the ecological validity of moral scenarios, and investigating cross-cultural applicability, while further exploring the underlying psychological mechanisms of moral decision-making.

Keywords: moral decision-making; moral dilemma; CNI model; dual-process theory

Moral dilemmas represent a classic paradigm in moral psychology research. The earliest moral dilemma was the trolley problem proposed by philosopher Foot: a runaway trolley will kill five railway workers unless the participant chooses to intervene by pulling a lever to divert the trolley onto another track where it will kill one worker—would you pull the lever (Foot, 1967)? Another classic variation is the footbridge dilemma: in the same scenario, pushing a man off a footbridge would save the five workers—would you push him (Gardner, 2016; Thomson, 1976)? Greene et al. applied moral dilemmas to psychological research (Greene, Sommerville, Nystrom, Darley, & Cohen, 2001), and this paradigm has since been widely used in moral psychology.

Traditional moral dilemma paradigms measure utilitarian and deontological responses based on situations where one principle can be pitted against another (e.g., the trolley problem). To explain differences in moral dilemma judgments, Greene' s dual-process theory of moral judgment posits that moral dilemmas involve two principles: utilitarianism and deontology. Utilitarianism, associated with Mill' s moral philosophy, emphasizes maximizing overall welfare, with the judgment criterion being benefit maximization (Mill, 1992). Deontology, linked to Kant' s moral philosophy, emphasizes universal and inviolable rights and duties, with the judgment criterion being conformity to moral norms (Kant, 1957). The moral nature of participants' choices is inferred from their consistency with utilitarian or deontological principles (Greene, 2007). According to utilitarian principles, an action' s acceptability depends on its consequences; to the extent that a choice maximizes beneficial outcomes, it is morally acceptable (Conway & Gawronski, 2013). However, if the same choice reduces or fails to maximize beneficial outcomes, it is morally unacceptable. According to deontological principles, an action' s acceptability depends on its consistency with moral norms;

choices conforming to moral norms are acceptable, while those violating them are unacceptable. Viewing the trolley and footbridge dilemmas through these principles, utilitarianism would deem pulling the lever acceptable because both actions maximize benefits—killing one person is morally acceptable if it saves five lives. Deontology would deem pulling the lever unacceptable because these actions conflict with the moral norm against harming others—harming others is morally unacceptable regardless of consequences. Consequently, participants who find these actions acceptable are typically classified as making utilitarian judgments, while those who find them unacceptable are classified as making deontological judgments (Janoff-Bulman, Sheikh, & Hepp, 2009).

Despite its widespread use, the traditional moral dilemma paradigm has faced numerous criticisms. A primary concern is its lack of realism (Gold, Pulford, & Colman, 2014). Researchers argue that participants often find trolley problems interesting but not thought-provoking, and unlikely to elicit the same psychological processes as real-world moral situations (Bauman, McGraw, Bartels, & Warren, 2014); the footbridge dilemma suffers similarly. Moral decision-making research should address these concerns by employing dilemmas with greater real-world relevance, thereby enhancing the realism and plausibility of moral dilemmas.

Another limitation of traditional moral dilemma paradigms is the lack of objective, effective metrics for quantifying utilitarian and deontological tendencies. Traditional paradigms treat utilitarianism and deontology as opposing principles (Zhan & Wu, 2019), assuming that as one tendency strengthens, the other weakens. Consequently, observed differences are ambiguous: it remains unclear whether moral dilemma judgments reflect purely utilitarian choices, purely deontological choices, or a combination of both tendencies (Friesdorf, Conway, & Gawronski, 2015). Traditional paradigms also fail to control and manipulate the consequential and normative aspects of utilitarian and deontological responses, weakening theoretical interpretation. For example, in the trolley problem, if the number of workers on the original track is changed from five to zero—making the action morally prohibited with costs exceeding benefits—yet the individual still chooses to pull the lever, this choice cannot be explained by either utilitarianism or deontology.

Additionally, alternative explanations exist for participants' responses in traditional moral dilemmas that may not stem from utilitarian or deontological values. Some individuals may be willing to sacrifice one life to save many, while others may sacrifice a life even when no other lives are saved. Similarly, some individuals' choice of inaction may result from decision-making difficulties or a general reluctance to take action. In other words, willingness to sacrifice or not sacrifice a life may be driven by individual preferences for action versus inaction rather than moral principles. Gawronski et al. investigated the effect of psychopathy on moral dilemma judgments, finding that psychopathic participants were more likely to choose "yes" in trolley problems compared to non-psychopathic participants (Gawronski, Armstrong, Conway, Friesdorf, & Hut-

ter, 2017). According to traditional interpretations, psychopathic participants' choices would be classified as utilitarian, yet the moral values of psychopathic individuals are often compromised, making such a simplistic classification clearly inadequate. These issues reflect the oversimplified nature and lack of objective quantification in traditional dilemma paradigms.

To address these limitations, Gawronski proposed the CNI model of moral decision-making (Gawronski et al., 2017), which uses multinomial modeling to separately calculate participants'sensitivity to consequences, sensitivity to moral norms, and behavioral response preferences, providing more accurate explanations of individual responses in moral dilemmas.

The CNI Model

The CNI model reoperationalizes utilitarianism and deontology by classifying behaviors as utilitarian when driven by consequence sensitivity—choosing action to maximize benefits—and as deontological when driven by norm sensitivity—choosing inaction due to consistency with moral norms (Gawronski et al., 2017). The model also distinguishes between utilitarianism and action preferences, and between deontology and inaction preferences, while incorporating response outcomes from moral dilemmas. Based on this framework, Gawronski established four types of moral dilemmas: (1) moral norms prohibit action, and benefits of action exceed costs; (2) moral norms prohibit action, and benefits of action are less than costs; (3) moral norms permit action, and benefits exceed costs; and (4) moral norms permit action, and benefits are less than costs (as shown in Table 1). The CNI model uses multinomial modeling to quantify three determinants of moral dilemma judgments: (1) participants' sensitivity to consequences, C (first row in Figure 1 [Figure 1: see original paper]), where higher C values indicate greater sensitivity to consequences; (2) participants' sensitivity to moral norms, N (second row in Figure 1), where higher N values indicate greater sensitivity to moral norms; and (3) participants' preference for action or inaction, I (third and fourth rows in Figure 1), where higher I values indicate greater preference for inaction, and lower I values indicate greater preference for action regardless of consequences and moral norms.

Table 1 Sample CNI Moral Dilemmas (Source: Gawronski et al., 2017)

Norm Prohibits Action	Norm Permits Action
Benefits > Costs	**Benefits > Costs**

Norm Prohibits Action	Norm Permits Action
You are a doctor in an area experiencing a highly contagious disease outbreak. Preliminary tests indicate that a new vaccine has not been approved by your national health department due to severe side effects. The vaccine' s side effects could cause dozens of uninfected individuals to die, but it would save hundreds of lives by preventing viral transmission. Is it appropriate to use the vaccine in this situation?	You are a doctor in an area experiencing a highly contagious disease outbreak. Preliminary tests indicate that a new vaccine has not been approved by your national health department due to severe side effects. The vaccine' s side effects could cause dozens of uninfected individuals to die, but it would save approximately the same number of lives. One of your colleagues plans to use the vaccine, but you can prevent him by reporting his plan to the health department. Is it appropriate to report your colleague' s plan to the health department in this situation?
Benefits < Costs You are a doctor in an area experiencing a highly contagious disease outbreak. Preliminary tests indicate that a new vaccine has not been approved by your national health department due to severe side effects. The vaccine' s side effects could cause dozens of uninfected individuals to die, but it would save approximately the same number of lives. Is it appropriate to use the vaccine in this situation?	**Benefits < Costs** You are a doctor in an area experiencing a highly contagious disease outbreak. Preliminary tests indicate that a new vaccine has not been approved by your national health department due to severe side effects. The vaccine' s side effects could cause dozens of uninfected individuals to die, but it would save hundreds of lives by preventing viral transmission. One of your colleagues plans to use the vaccine, but you can prevent him by reporting his plan to the health department. Is it appropriate to report your colleague' s plan to the health department in this situation?

Figure 1 Working Path Diagram of the CNI Model of Moral Decision-Making (Source: Gawronski et al., 2017)

Multinomial modeling is a statistical method wherein Multinomial Processing Tree Models aim to separate the influences of multiple factors on responses (Zhang, Chen, Wang, Ma, & Zhou, 2016; Hutter & Klauer, 2016), yielding specific parameter estimates that reflect different moral decision-making processes. This approach examines the distinct meanings of behavioral choices in

moral dilemmas with varying consequences and normative requirements—a capability lacking in other analytical methods. In social psychology, multinomial modeling has been used to study intentional and unintentional empathy for pain (Cameron, Spring, & Todd, 2017), intentional and unintentional moral evaluations (Cameron, Payne, Sinnott-Armstrong, Scheffer, & Inzlicht, 2017), and implicit measures (Meissner & Rothermund, 2013; Nadarevic & Erdfelder, 2011).

The CNI model' s three parameters—C, N, and I—correspond to the likelihood that behavioral choices are driven by consequences, moral norms, and behavioral response preferences, respectively. The model's four paths describe four possible choice scenarios. When behavior is consequence-driven, it aligns with a utilitarian response pattern, described by path C, representing consequence-driven action (first row in Figure 1). When behavior is norm-driven, it aligns with a deontological response pattern, described by path (1−C)×N, representing norm-driven action when consequences do not drive the choice (second row in Figure 1). When behavior reflects an individual preference for inaction, it aligns with an inaction response pattern, described by path (1−C)×(1−N)×I, representing inaction preference when neither consequences nor norms drive the choice (third row in Figure 1). When behavior reflects an individual preference for action, it aligns with an action response pattern, described by path (1−C)×(1−N)×(1−I), representing action preference when neither consequences nor norms drive the choice (fourth row in Figure 1).

Based on these four paths, corresponding mathematical equations can be derived to describe the probability of behavioral choices across the four dilemma types. Equations are derived by: (1) identifying all cases of action or inaction responses in a given column; (2) mapping each case to its corresponding processing path; and (3) representing these paths in a mathematical equation. For example, in dilemmas where moral norms prohibit action and benefits exceed costs, there are two paths to inaction: (1) consequences do not drive the choice but norms do, represented by path (1−C)×N; and (2) neither norms nor consequences drive the choice, representing inaction preference, path (1−C)×(1−N)×I. This probability is expressed mathematically as: p(inaction|norm prohibits action, benefits > costs) = [(1−C)×N] + [(1−C)×(1−N)×I]. Similarly, in the same dilemma type, there are two paths to action: (1) consequence-driven choice, path C; and (2) action preference when neither norms nor consequences drive the choice, path (1−C)×(1−N)×(1−I). This probability is expressed as: p(action|norm prohibits action, benefits > costs) = C + [(1−C)×(1−N)×(1−I)]. The same procedure derives equations for action and inaction responses in the other three dilemma types. Across four dilemma types and two potential responses (action vs. inaction), eight equations exist. Since the probability of action in a given dilemma type equals 1 minus the probability of inaction, there are four non-redundant equations containing three unknown parameters (C, N, I), as shown below:

(1) p(inaction|norm prohibits action, benefits > costs) = [(1−C)×N] + [(1−C)×(1−N)×I]

(2) p(inaction|norm prohibits action, benefits < costs) = C + [(1−C)×N] + [(1−C)×(1−N)×I]

(3) p(inaction|norm permits action, benefits > costs) = (1−C)×N×I

(4) p(inaction|norm permits action, benefits < costs) = C + [(1−C)×(1−N)×I]

(5) p(action|norm prohibits action, benefits > costs) = C + [(1−C)×(1−N)×(1−I)]

(6) p(action|norm prohibits action, benefits < costs) = (1−C)×(1−N)×(1−I)

(7) p(action|norm permits action, benefits > costs) = C + [(1−C)×N] + [(1−C)×(1−N)×(1−

(8) p(action|norm permits action, benefits < costs) = [(1−C)×N] + [(1−C)×(1−N)×(1−I)]

The p-values are known dependent variables in research. Using equations with the three unknown parameters C, N, and I, these parameter values can be calculated. Through maximum likelihood statistics, multinomial modeling generates estimates for the three unknown parameters, aiming to minimize differences between observed action/inaction responses across the four dilemma types and model-predicted probabilities. Model fit is assessed via goodness-of-fit statistics, reflecting statistically significant differences between empirically observed probabilities and model-predicted probabilities. Gawronski used Multitree software to construct the multinomial model; by inputting participants' summed "action" and "inaction" responses for each dilemma type (i.e., eight p-values), corresponding C, N, and I parameter estimates are obtained. For the C parameter, estimates significantly greater than zero indicate that participants' responses are influenced by consequences. For the N parameter, estimates significantly greater than zero indicate influence by moral norms. For the I parameter, estimates significantly greater than 0.5 indicate a preference for inaction, while estimates significantly less than 0.5 indicate a preference for action.

Applications of the CNI Model in Moral Decision-Making

The CNI model has received extensive validation, with numerous researchers exploring its applications in moral decision-making from various perspectives. Based on existing research, CNI model applications can be broadly categorized into three areas: studies related to individual physiological characteristics, psychological characteristics, and social factors.

Application to Individual Physiological Characteristics

Current CNI model research on physiological characteristics includes investigations of gender, testosterone, and chronic stress effects on moral decision-making.

Traditional moral dilemma research has found that utilitarian and deontological judgments are significantly influenced by gender. Valerio Capraro et al. studied gender differences in moral decision-making, finding that women are more likely than men to make deontological choices (Capraro & Sippel, 2017). Arutyunova and Alexandrov examined moral decision-making characteristics across genders in Russia, assessing 327 participants aged 16–69 and finding that men are more likely to make utilitarian choices (Arutyunova & Alexandrov, 2016). Similarly, Armstrong et al. conducted a large-scale analysis of eight studies, confirming that women are more likely than men to make deontological choices, which they interpreted as resulting from combined harm aversion and action aversion (Armstrong, Friesdorf, & Conway, 2019). These traditional paradigm findings suggest gender differences in moral dilemma judgments, with men showing greater action preferences, interpreted as stronger utilitarian tendencies but potentially reflecting stronger action preferences independent of moral reasoning.

Gawronski et al. used the CNI model to investigate gender effects on moral dilemma judgments, finding that women exhibited stronger sensitivity to moral norms and greater preference for inaction compared to men, with no significant differences in consequence sensitivity (Gawronski et al., 2017). From a traditional paradigm perspective, which focuses only on dilemmas where norms prohibit action and benefits exceed costs, action preferences are interpreted as utilitarian tendencies. Thus, gender differences were attributed to men's greater utilitarianism. The CNI model provides a more nuanced explanation, suggesting that gender differences arise from women' s greater norm sensitivity and inaction preference.

Brannon et al. found a relationship between testosterone and moral dilemma judgments. Previous research indicated that higher testosterone levels correlate with stronger utilitarian tendencies. Using a double-blind design with 100 participants receiving testosterone supplements and 100 receiving placebos, results contradicted this hypothesis: testosterone-treated participants showed greater inaction in moral dilemmas. CNI model analysis revealed that testosterone influenced judgments by increasing sensitivity to moral norms, suggesting a more complex role for testosterone in moral decision-making than previously thought (Brannon, Carr, Jin, Josephs, & Gawronski, 2019).

Early research examined stress-moral decision-making relationships. One study induced stress in 25 participants using a speech task, assessed stress levels via questionnaire and heart rate, and found that stressed participants made fewer utilitarian choices and took longer to decide (Starcke, Ludwig, & Brand, 2012). Zhang et al. used the CNI model to examine chronic stress and moral dilemma judgments (Zhang, Kong, Li, Zhao, & Gao, 2018). With 197 university students completing a stress perception scale followed by moral dilemmas, results confirmed that higher chronic stress correlated with greater deontological tendencies. Traditional analysis suggested chronic stress increased deontological responses, while CNI model analysis further revealed that high-stress participants showed stronger inaction preferences, indicating that chronic stress influences

moral decision-making through inaction preference rather than through changes in norm or consequence sensitivity.

Application to Psychological Characteristics

CNI model research on psychological characteristics includes investigations of emotions, personality traits, psychopathy, psychological distance, cognitive load, and problem framing effects on moral decision-making.

Gawronski et al. used 24 moral dilemma scenarios to study incidental emotions (happiness, sadness, and anger) in moral decision-making (Gawronski et al., 2017). Participants' emotions were induced through different music, and the CNI model was used to examine how emotions influence moral dilemma judgments (Gawronski, Conway, Armstrong, Friesdorf, & Hutter, 2018). Results showed that incidental happiness reduced norm sensitivity without affecting consequence sensitivity or inaction preference (Experiments 1a and 1b), while incidental sadness (Experiments 2a and 2b) and anger (Experiments 3a and 3b) showed no significant effects. When analyzing only traditional dilemmas where norms prohibit action and benefits exceed costs, happy participants showed increased action preference, traditionally interpreted as greater utilitarianism under happiness. CNI model analysis revealed that this action preference resulted from happiness reducing norm sensitivity, with no effect on consequence sensitivity or inaction preference. For sadness and anger, traditional analysis showed no effects, and the CNI model confirmed that these emotions likely have no impact on consequence sensitivity, norm sensitivity, or inaction preference. These findings demonstrate that the CNI model provides more nuanced analysis of emotion-norm relationships, revealing the important role of emotional processing in moral judgment.

Kroneisen and Heck examined basic personality traits using the CNI model (Kroneisen & Heck, 2019). Using Gawronski' s moral dilemma materials and the HEXACO personality inventory, they found that Honesty-Humility positively correlated with norm sensitivity, Emotionality positively correlated with consequence sensitivity, and Conscientiousness was unrelated to inaction preference. This research demonstrates that the CNI model provides deeper explanations for links between basic personality traits and moral dilemma judgments, showing that moral decision-making differences can be explained by connecting specific traits to underlying moral reasoning processes (Kroneisen & Heck, 2019). Other research has examined dark personality traits and moral decision-making, finding that higher scores on psychopathy, Machiavellianism, and lack of meaning in life correlate with more utilitarian choices (Bartels & Pizarro, 2011), with further research confirming the psychopathy-utilitarianism correlation (Kahane, Everett, Earp, Farias, & Savulescu, 2015). A recent study of 62 bipolar disorder patients and 27 controls found that patients showed higher utilitarian tendencies (Larsen et al., 2019), though the authors noted that traditional paradigm limitations restrict practical and clinical implications. Early findings using traditional paradigms suggested psychopathy increases utilitarian tenden-

cies. Gawronski' s CNI model investigation of psychopathy effects (Gawronski et al., 2017) revealed that psychopathic participants showed reduced sensitivity to consequences, reduced norm sensitivity, and reduced inaction preference compared to non-psychopathic participants. Traditional analysis indicated high-psychopathy participants showed action preference, interpreted as greater utilitarianism, while the CNI model provided a more comprehensive explanation of psychopathy' s effects through these three variables.

Jing (2019) used the CNI model to examine psychological distance effects on moral dilemma judgments, finding that psychological distance influences moral decision-making by affecting action preferences—participants in near-distance conditions preferred inaction more than those in far-distance conditions—while consequence and norm sensitivity remained unaffected. The study also found that emotion moderated the effect of near psychological distance, with emotion affecting norm sensitivity more in near-distance conditions, and positive emotions increasing norm sensitivity. Additionally, cognitive load showed no significant effect regardless of psychological distance. This research affirms the CNI model' s value in explaining behavioral choices and psychological mechanisms in moral decision-making.

In traditional moral dilemma research, consensus on cognitive load effects has been elusive. Some studies demonstrate negative correlations between cognitive load and utilitarianism, with load selectively reducing utilitarian tendencies (Conway & Gawronski, 2013), while others find no effect across 1,400 experiments in three countries (Tinghog et al., 2016). Gawronski et al. used the CNI model to investigate cognitive load effects (Gawronski et al., 2017), finding that high-load participants were less willing to accept action. CNI model analysis revealed that cognitive load influenced moral decision-making by increasing inaction preference without affecting consequence or norm sensitivity. Traditional analysis could only show weaker action preference under high load, while the CNI model provided a detailed explanation.

Gawronski et al. also examined problem framing effects, finding that focusing on moral actions increased inaction preference and decreased norm sensitivity without affecting consequence sensitivity (Gawronski et al., 2017). These effects could not be detected by traditional methods, as the two effects counteracted each other—framing increased inaction tendency while decreasing normative inhibition of action. Traditional analysis suggested framing had no significant effect, while the CNI model provided separate estimates for consequence sensitivity, norm sensitivity, and action preference, thereby avoiding the confounding inherent in traditional methods.

Application to Social Factors

CNI model research on social factors includes investigations of language context, power, and religion effects on moral decision-making.

Shin and Kim used traditional paradigms to study language context and psycho-

logical distance effects on moral dilemma judgments (Shin & Kim, 2017). Using materials adapted from Greene et al. (Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008) with Korean-English bilingual participants, Study 1 found significant differences in utilitarian decisions between native and foreign language conditions in personal dilemmas where emotional processing is more important than cognitive processing. Foreign language participants made more utilitarian choices, suggesting weaker emotional responses. Study 2 tested whether psychological distance increases the foreign language effect, finding reduced self-bias in foreign language conditions, indicating that the effect results from reduced emotional responses and increased cognitive processing, possibly due to greater psychological distance. Similar results were found in Cipolletti et al.' s early research, where bilingual participants were more likely to make utilitarian choices when facing moral dilemmas in a foreign language (Cipolletti, McFarlane, & Weissglass, 2016).

Bialek, Paruzel-Czachura, and Gawronski used the CNI model to examine foreign language effects on moral dilemma judgments (Bialek, Paruzel-Czachura, & Gawronski, 2019). With 634 participants in foreign and native language conditions responding to dilemmas in different languages and rating their comprehension, results showed that foreign language reduced consequence sensitivity and norm sensitivity without affecting action preferences. Traditional analysis found no difference between language conditions, contradicting previous findings that foreign language increases utilitarianism. This suggests that foreign language reduces moral concern—decreasing both utilitarian consequence sensitivity and deontological norm sensitivity. Two limitations of the CNI model are noteworthy: first, it focuses only on consequence sensitivity, norm sensitivity, and action preferences, potentially missing additional foreign language effects; second, conclusions depend on the construct validity of its three variables—if consequences and norms are not adequately manipulated, the validity of C and N parameters may be questioned.

Suessenbach and Moore used traditional paradigms to examine power effects on moral dilemma judgments (Suessenbach & Moore, 2015), finding that high-power participants made more utilitarian choices, especially when their own lives were threatened. Gawronski and Brannon used the CNI model to investigate power effects induced through different methods (Gawronski & Brannon, 2020). Using memory recall and social role assignment to induce high or low power experiences with Gawronski' s moral dilemma materials, results showed that high-power recall reduced norm sensitivity compared to low-power recall, without affecting consequence sensitivity or inaction preference. Social role manipulation showed no evidence of power effects on consequence sensitivity or inaction preference, but contrary to recall results, high social roles increased norm sensitivity compared to low roles. Combined analyses suggest high power increases norm sensitivity, with recall potentially being more reliable than social role manipulation.

Research has demonstrated correlations between religiosity and deontological

choices (Barak-Corren & Bazerman, 2017; McPhetres, Conway, Hughes, & Zuckerman, 2018), with tendencies to seek religious guidance in daily life positively predicting deontological choices (Szekely, Opre, & Miu, 2015). Korner et al. used the CNI model to investigate individual differences in moral dilemma judgments, finding across four studies that religious participants showed lower consequence sensitivity than non-religious participants (Korner, Deutsch, & Gawronski, 2020). Thus, the CNI model provides further explanation for traditional findings, showing that religious individuals' greater deontological tendencies result from reduced consequence sensitivity.

Traditional Moral Dilemma Models and the CNI Model

The utilitarian and deontological principles in moral dilemma judgment have long histories (Candee & Puka, 1984), yet traditional paradigms have proven inadequate through extensive research. First, traditional paradigms oversimplify the relationship between utilitarianism and deontology as purely oppositional, lacking effective metrics to quantify both tendencies. This ambiguity prevents determining whether observed differences reflect utilitarian tendencies, deontological tendencies, or some combination. Second, traditional paradigms confound deontological tendencies with inaction preferences and utilitarian tendencies with action preferences (Gawronski, Conway, Armstrong, Friesdorf, & Hütter, 2016), compromising accurate interpretation. Since utilitarianism concerns only consequences, action choices driven by action preferences rather than consequence focus should be questioned as utilitarian. Similarly, since deontology concerns only norm consistency, inaction choices driven by inaction preferences rather than norm focus should be questioned as deontological. Third, conceptually, utilitarian judgments involve consequence sensitivity while deontological judgments involve norm sensitivity, requiring operational definitions and manipulations of both consequences and norms. Traditional paradigms provide vague experimental manipulations of these elements and focus only on dilemmas where norms prohibit action and benefits exceed costs, leading to insufficient understanding of underlying psychological processes.

Dual-process theory is a classic theory of moral decision-making (Tian, Yang, Zhang, & Zhang, 2011). Greene conducted extensive empirical research on the neural mechanisms of moral decision-making (Greene, 2003; Greene et al., 2001), proposing the dual-process theory of morality (Greene, Nystrom, Engell, Darley, & Cohen, 2004). This theory posits that moral decision-making involves both emotional intuition and deliberative cognition (Xie & Luo, 2009)—a rapid, unconscious "emotional" system and a slow, conscious "cognitive" system (Wang, Fang, & Jiang, 2011). Moral problem processing may involve more emotional or more cognitive factors (Tian et al., 2011; Zhong, Zhan, Li, & Fan, 2017), with moral decisions resulting from competition between these systems (Tang, Lu, Liu, & Peng, 2015). Dual-process theory suggests deontological choices depend on intuitive emotional responses, while utilitarian choices depend on cognitive processing (Yu, Peng, Han, Chai, & Bai, 2011; Zhang, Li, & Wu,

2020). Thus, action choices in moral dilemmas are considered utilitarian and primarily cognitive, while inaction choices are considered deontological and primarily emotional (Tian et al., 2011). However, reasoning is not purely cognitive or emotional (Xiao, Luo, & Yu, 2009); moral decisions may also be influenced by other factors such as individual action/inaction preferences, which cannot be simply categorized as cognitive or emotional outcomes. The CNI model identifies and incorporates this important factor of behavioral response preferences to explain moral decisions.

Value of the CNI Model

First, compared to traditional paradigms, the CNI model's primary advantage is clearer identification of important factors influencing moral dilemma judgments. Traditional paradigms combine consequence sensitivity, norm sensitivity, and behavioral preferences into a single outcome, making them unable to detect effects when factors influence these components in complementary ways. For example, in Gawronski et al.' s framing study (Gawronski et al., 2017), traditional analysis showed no framing effect, while CNI analysis revealed counteracting effects: focusing on whether an action was performed decreased norm sensitivity and increased inaction preference compared to focusing on action acceptability. In traditional analysis, the former increased action acceptance while the latter decreased it; when both occurred simultaneously, effects canceled out, rendering traditional methods insensitive to framing' s actual influence. The CNI model provides further analysis of traditional results, effectively avoiding confounding among internal variables.

Second, the CNI model enhances replicability and precision. Because traditional paradigms combine different influences, their measurements are ambiguous, potentially causing replication failures. Ambiguous measurements can inflate initial effect size estimates, compromising power analyses. Additionally, when sampling error varies across studies, different measurement sources may reduce replicability. For instance, in Gawronski et al.' s psychopathy study (Gawronski et al., 2017), CNI analysis showed replicable effects on consequence sensitivity, norm sensitivity, and inaction preference, while traditional analysis found significant effects only in the second experiment. Similarly, in their cognitive load study, CNI analysis showed replicable effects on inaction preference, while traditional analysis yielded unstable results. Thus, the CNI model provides better methods for studying moral dilemma judgments by addressing replicability issues and improving researchers' ability to distinguish genuine effects.

Third, the CNI model resolves traditional paradigms' confounding of utilitarianism, deontology, and behavioral preferences. By manipulating consequences and norms, the CNI model separately estimates utilitarian consequence sensitivity, deontological norm sensitivity, and behavioral preferences. This yields more precise detection of experimental effects with less measurement error and provides more accurate explanations of traditional paradigm results.

Limitations and Future Directions of the CNI Model

Despite extensive validation and its status as an advanced method in moral decision-making research, the CNI model has limitations.

First, the CNI model' s limited focus on consequences, norms, and behavioral preferences may miss additional influences on moral dilemma judgments. For example, in Białek et al.' s foreign language study (Bialek et al., 2019), contrary to previous findings that foreign language increases utilitarianism, CNI analysis found that foreign language reduced consequence and norm sensitivity without affecting behavioral preferences. This suggests foreign language reduces moral concern in ways the CNI model cannot capture. Future research should modify the CNI model to observe other influencing factors and ensure adequate manipulation of consequences and norms. Any conclusions depend on the construct validity of the three variables; inadequate manipulation would question whether C and N parameters truly reflect consequence and norm sensitivity.

Second, the CNI model uses artificial moral dilemma scenarios. Like traditional paradigms, researchers use simple stories and responses to infer moral decision-making mechanisms, but real-life situations are more complex. This simplification may sacrifice ecological validity. Future research should consider how to maximize scenario authenticity.

Third, the CNI model is unsuitable for individual difference research. While appropriate for group comparisons (e.g., experimental groups or groups with known characteristics), it is not ideal for individual differences because it requires analysis at the individual level rather than aggregated group data. With Gawronski et al.' s 24 dilemmas providing limited trials (Gawronski et al., 2017), small observation numbers often yield poor individual-level model fit and unreliable estimates (Korner et al., 2020). To address this, researchers have developed larger dilemma sets for individual research (Korner et al., 2020), though this risks fatigue effects. Thus, studies must balance unreliable parameter estimates from few dilemmas against increased fatigue from many dilemmas.

Fourth, the CNI model does not completely refute traditional moral dilemma paradigms. Fundamentally, it only reoperationalizes utilitarianism and deontology and creates new dilemma materials, making direct comparison with traditional paradigms difficult and lacking decisive evidence to overturn traditional theoretical assumptions. Future research should refine the CNI model or develop new models for direct comparison with traditional paradigms to further explore moral decision-making mechanisms.

Fifth, the CNI model's applicability in Chinese cultural contexts requires investigation. Developed by Western scholar Gawronski, the model has been validated by Western researchers, providing deeper insights into moral decision-making factors and mechanisms. However, East-West cultural differences may lead to different moral cognitions and potentially different underlying psychological mechanisms (Zhan & Wu, 2019). The CNI model' s applicability to Eastern

cultures requires cross-cultural research. Currently, few Chinese studies have applied the CNI model, and no strong evidence supports its applicability in China. Future research should supplement cross-cultural studies to further validate the model' s effectiveness and improve it.

The CNI model uses multinomial modeling to separately calculate participants' sensitivity to consequences, sensitivity to moral norms, and behavioral response preferences, enabling clearer identification of important factors influencing moral decision-making. Compared to traditional moral dilemma paradigms, the CNI model more accurately explains individual responses in moral dilemmas. Although the CNI model addresses some limitations of traditional paradigms and researchers have investigated moral decision-making mechanisms using it, controversies and contradictions remain, and the precise mechanisms of moral decision-making require further exploration.

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Note: Figure translations are in progress. See original paper for figures.