The Dirty–Immoral Association: Effects of Environmental Cleanliness on Moral Evaluation

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Abstract: *Morality functions as a social ideology, a code of conduct, and a standard for evaluating both personal and others' behavior. However, moral standards vary among individuals and are influenced by external factors. Such inconsistencies may lead to misperceptions, conflicts, or even criminal behaviors. According to embodied cognition theory, physical experiences, such as cleanliness, temperature, and movement, can unconsciously shape moral perceptions, judgments, and behaviors through metaphorical mapping. This study investigates the influence of environmental context on individuals' moral and legal judgments of others' behaviors. A reaction time experiment was conducted via using images of clean and dirty environments as background stimuli. Participants were presented with 10 text-based behavioral scenarios and asked to make moral or legal judgments accordingly. Response choices and reaction time were recorded for each scenario. The study involved 20 Chinese and 20 American participants to explore potential cultural differences. The results show that dirty environments significantly increased the severity of moral judgments to others, although they had no significant effect on overall reaction time. Cultural backgrounds also had impacts. American participants responded faster in clean environments. Meanwhile, the severity of Chinese participants' moral judgments was less influenced by environmental context. These findings challenge the decontextualized rational reasoning hypothesis in moral development theory and support the social intuitionist model. Furthermore, they highlight cultural differences in embodied moral cognition. The study also provides practical implications for urban design and public management. Maintaining environmental cleanliness of public places may reduce potential interpersonal conflicts, and lower violent behaviors via improving social tolerance.*

Keywords: Environmental Context, Clean, Dirty, Moral Judgment, Crime, Cultural Difference

1. Introduction

Morality is a unique ideological and behavioral normative system in human society. Its primary function is to regulate interpersonal relationships and maintain social order through the evaluation of good and evil (Zhou, 2011)[17]. Morality provides a standard for assessing the legitimacy of behavior and serves as a vehicle for humanity's deeper pursuit of goodness, justice, and progress. Moral judgment refers to the cognitive process through which individuals evaluate the goodness or badness, rightness or wrongness, of actions, events, or people based on internalized or external moral standards. It constitutes a core component of moral cognition and serves as the cognitive foundation for preserving social security. Appropriate moral judgment standards help inhibit criminal impulses through conscience mechanisms and foster social consensus, thus contributing to conflict resolution and the maintenance of social harmony (Zhan, 2019)[15]. However, moral judgment standards are not fixed. They can vary among individuals and be influenced by external factors. Divergent standards may lead to different perceptions of behaviors. This distorted cognitive framework can directly influence actions, increasing the likelihood of norm-violating or unlawful behavior, which may ultimately result in criminal activity (Bandura, 1999)[1]. Therefore, the establishment of consistent and robust moral standards is key in social governance to reduce crime rates.

As mentioned above, moral judgment is not static but highly context-dependent, which could be affected by individual differences, emotional states, situational features, socio-cultural, and environmental contexts. Among these, the influence of physical environmental factors is the focus of embodied cognition theory in moral psychology. Previous research has demonstrated that environmental cues can significantly influence moral evaluations and behavioral tendencies through mechanisms such as metaphorical associations, neural activation, and modulation of cognitive resources (Huang, 2016)[10]. Thus, investigating how environmental contexts influence moral

judgment—and uncovering the psychological and physiological mechanisms involved—is essential for social management and the promotion of social stability and harmony.

The role of environmental cleanliness in shaping moral judgments has received growing attention. Studies have found that unclean environments tend to increase the severity of moral evaluations via metaphorical associations between physical impurity and moral deviance (Schnall et al., 2008). [13]The present study further examines the impact of environmental context on individuals' judgments regarding criminal behavior, which is typically considered as the lower threshold of the morality system. Moreover, this study introduces participants of different nationalities as an independent variable to explore the moderating role of cultural differences. A reaction time experiment was employed to capture participants' judgment responses and reaction time. Compared with self-report measures, the reaction time method offers higher sensitivity and precision, allowing the detection of millisecond-level cognitive differences. This approach reveals automatic processing and unconscious cognitive mechanisms while minimizing the influence of subjective bias and conscious interference. Additionally, the findings may offer practical insights for enhancing social harmony and reducing crime rates through environmental interventions and urban design strategies.

2. Method

2.1 Participants

A total of 40 individuals participated in this study ($M = 34.84, SD = 14.61$). Twenty participants were from China, recruited at a shopping center in Shanghai. The remaining twenty participants were from the United States, recruited at a public school in Massachusetts. All participants were informed of the procedures and potential risks involved in the experiment. They voluntarily agreed to participate.

2.2 Stimuli

This study employed visual stimuli consisting of clean and dirty background images. A total of 20 images were used: 10 clean environments and 10 dirty environments. The clean images portrayed aesthetically pleasing scenes, such as clear rivers, sunny landscapes, well-organized rooms, and well-maintained public spaces. In contrast, the dirty images depicted polluted or cluttered settings, including garbage dumps, smog-filled skies, dirty rivers, and littered streets.

Each background image was paired with a text-based question describing an illegal behavior, i.e. driving under the influence (DUI) or theft. 10 questions were included in total. Participants were asked to assess the severity of punishment by indicating whether a heavier or lighter penalty should be imposed on the offender. Each question was randomly presented in either a clean or dirty background image. The questions were provided in either English or Chinese, depending on the participant's nationality.

2.3 Design and procedure

The present study employed a between-subjects design. The background cleanliness (clean vs. dirty) is the independent variable and participants' responses and reaction times during moral and legal judgments as the dependent variables. Participants were randomly assigned to either the clean or dirty condition. Those in the clean condition completed the judgment tasks with clean background images, while those in the dirty condition completed the same tasks against dirty background images. Chinese participants completed the task in Chinese, and American participants completed it in English.

All experimental materials were pre-programmed using PsychoPy and developed into a coherent experimental task. Prior to the experiment, participants read and signed an informed consent form. Ten moral and legal judgment questions were presented on the screen in a randomized order. Participants made their judgments by pressing the corresponding buttons, after which the program automatically moved to the next question. Upon completing all ten questions, the experiment concluded. The entire procedure took approximately ten minutes. Participants who completed the experiment received a small dessert. The software automatically recorded each participant's responses and reaction times for each trial. All data were compiled at the end of the experiment for subsequent statistical analysis.

2.4 Data analysis

Invalid data with reaction times (RTs) of less than 1 second or greater than 10 seconds were excluded through data screening and cleaning. The remaining valid reaction times were recorded as RT. In addition, participants' decisions were converted into binary-coded score data, referred to as Tolerance–Severity scores (hereafter, scores), where higher scores indicated a higher proportion of decisions favoring severe penalties. To examine the effect of environmental background on participants' decision-making, independent samples t-tests were conducted on both RT and score data between the clean and dirty groups. Furthermore, to explore the moderating effect of cultural background on moral and legal judgments, independent samples t-tests were also conducted separately for Chinese and American participants within the clean and dirty background conditions.

3. Results

3.1 T-test analysis between the dirty and clean groups

As shown in Table 1, an independent samples t-test indicated no significant difference ($t = 0.98$, $p > 0.05$) in RT between the dirty group ($M = 6.86$, $SD = 1.47$) and the clean group ($M = 6.26$, $SD = 2.28$). However, the score of the dirty group ($M = 0.61$, $SD = 0.137$) was significantly higher ($t = 2.66$, $p < 0.05$) than that of the clean group ($M = 0.48$, $SD = 0.170$).

3.2 T-test analysis of the Chinese and American participants

As shown in Table 1, among Chinese subjects, there were no significant differences in either scores ($t = 0.28$, $p > 0.05$) or reaction times ($t = 0.61$, $p > 0.05$) between the clean group (*Score: M = 0.60, SD = 0.16; RT: M = 7.72, SD = 1.48*) and the dirty group (*Score: M = 0.58, SD = 0.17; RT: M = 7.28, SD = 1.81*). In contrast, among American subjects, the dirty group obtained significantly higher scores ($M = 0.64$, $SD = 0.10$) than the clean group ($M = 0.36$, $SD = 0.07$; $t = 7.42$, $p < 0.05$). Furthermore, in the criminal law dilemma task, the clean group responded significantly faster ($M = 4.80$, $SD = 2.01$) than the dirty group ($M = 6.45$, $SD = 0.94$; $t = 2.34$, $p < 0.05$).

Table1: The Score and RT of the Dirty and Clean Groups

	Score		RT(S)	
	Dirty	Clean	Dirty	Clean
Total	0.61	0.48	66.86	6.26
Chinese	0.58	0.60	7.27	7.72
American	0.64	0.36	6.45	4.80

4. Discussion

The purpose of this experiment was to examine the effect of clean versus dirty environments on individuals' judgments of others' illegal behaviors. The independent variable was the cleanliness of the backgrounds (clean vs. dirty), while the dependent variables were participants' reaction times and key responses when making judgments in these environments. Analysis of the overall data indicated that participants in the dirty condition made significantly harsher judgments than those in the clean condition. This finding suggests that background environment can significantly influence individuals' evaluations of others' illegal actions. The dirty environments could trigger more severe and less tolerant responses. When the data were analyzed separately for Chinese and American participants, no significant differences in reaction times or key response scores were found between the two background conditions for the Chinese group. In contrast, American participants in the clean condition responded more quickly than those in the dirty condition, and their judgments in the dirty condition were harsher and took longer to make. These results indicate that American participants were more sensitive to environmental cues, whereas Chinese participants appeared less influenced by the cleanliness of the background.

According to the experimental results, a dirty environment prompted participants to make harsher judgments, a phenomenon that can be explained by the "dirty–immoral" metaphorical linkage in human cognition. This linkage refers to the systematic association between physical contamination and moral impurity in individual mental representations, formed through cultural transmission during

socialization (Ding, 2017; Zhao, 2022)[5][14]. Meta-analytic research has confirmed that physical cleanliness increases the severity of moral judgments toward others' behaviors, whereas environmental cleanliness can affect the judgement reversely (Zhong, 2010)[16]. Neurophysiological findings further explains the mechanism: research at the Max Planck Institute (Gogolla, 2019) [7]indicates that the posterior insular cortex integrates multiple negative stimuli and influences behavior through two neural pathways. Activation of the insula–amygdala pathway, in particular, can trigger avoidance behaviors strongly linked to moral harshness. This heightened neural activity unconsciously tightens moral judgment standards, increasing the likelihood of categorizing neutral behaviors as "immoral".

Another important finding of this study was that there was no significant difference in reaction times between the clean and dirty groups. The fact that the dirty context led to harsher moral judgments without producing longer reaction times may be attributed to the automatic processing properties of the "dirty–immoral" metaphorical link. Ding (2017) [5]suggests that when moral dilemmas were presented, reaction times did not change significantly between the two environments. Similarly, Schnall (2008)[13] found that participants exposed to bad odors assigned moral ratings 23% harsher to behaviors such as "eating pet dogs" than those in a clean environment, yet showed no difference in reaction times. This provides evidence that the "dirty–immoral" association results from intuitive conceptualization rather than time-consuming rational reasoning. Neuroscience research at the Max Planck Institute further indicates that the posterior insula cortex can transmit negative signals through two pathways within 300 milliseconds of receiving stimuli from dirty environments, with responses characterized by automaticity and rapidity (Grund et al, 2023)[8]. This physiological mechanism supports the conclusion that environmental effects on moral judgment occur automatically and do not influence reaction time.

Cross-cultural studies (Nisbett, 2003; Buchtel et al.,2015)[2][12] indicate that American participants tend to adopt a "rapid categorization and rule application" analytical–heuristic processing pathway. When making moral judgments, they often abstract the situation into a clear and simple rule, e.g. "This deception/harm/infidelity equals wrong", and then apply the rule directly to reach a conclusion. In contrast, Chinese participants tend to use a "contextual synthesis and relational balancing" holistic–dialectical approach. It requires integrating multiple sources of information, such as background, relationships, and consequences, before forming a judgment. Because the heuristic pathway involves fewer cognitive steps, American participants generally maintain faster reaction times in both clean and dirty contexts, whereas the integrative demands of the dialectical pathway result in consistently longer reaction times among Chinese participants.

It was also found that there was no significant difference in the key scores, i.e., the degree of harshness, among Chinese subjects in different environmental contexts. This might be related to traditional Chinese culture. Confucianism emphasizes the spiritual transcendence of "coming out of the mud and not being stained" which locates moral purity in internal cultivation rather than in the physical environment. Dirty environments are viewed as external disturbances that can be overcome rather than as symbols of moral contamination (Cui, 2000)[4]. This requires Chinese subjects to keep consistency in their moral judgments, and the dirty environment is difficult to shake their stable moral framework, so they are less affected by the environment when making moral judgments.

Some limitations could be improved in future studies. First, the sample size for each subgroup was relatively small, which may limit the generalization of the results. Second, the clean and dirty environments were simulated by picture rather than real environments. Although visual disorder can trigger emotional responses, it may not fully replicate the visceral experience of being in a clean or dirty environment. Third, although the stimuli covered moral reasoning, the content and scope were comparatively limited, and the binary response format may have constrained nuanced decision-making.

Future research could address these limitations in several ways. A larger and more diverse sample could enhance the practicability of the findings. Incorporating immersive or real-life environments, such as testing participants in physically clean or dirty environments, could strengthen ecological validity. It would also be valuable to investigate other moderating variables, such as emotional state, personality traits, and individual differences in cognitive control. Expanding the moral scenarios to include social dilemmas or fairness judgments would also yield a broader understanding of the relationship between cleanliness and morality. Moreover, a more detailed rating response could provide more accurate results.

5. Conclusion

This study examined the effect of environmental cleanliness on individuals' judgments of others'

illegal behaviors which are often considered to lie at the lower threshold of morality. The findings showed that dirty environments significantly increased the harshness of judgments, while overall reaction times remained unaffected. Cultural comparisons revealed that American participants exhibited significantly shorter reaction times in clean environments, whereas the moral harshness of Chinese participants' judgments was less influenced by environmental conditions. These results align with Haidt's (2001) [9]social intuitionist model, while challenging the "decontextualized rational reasoning" framework proposed by Kohlberg (1984)[11]. They suggest that environmental cues can directly shape moral intuitions through embodied experiences. Furthermore, the findings reveal that dirty environments appear to foster a harsher stance toward others' immoral or illegal behaviors. Given that moral tolerance is closely linked to moral outrage (Horberg, 2011), individuals with lower tolerance may experience stronger outrage when witnessing norm violations, thereby increasing the likelihood of imposing severe punishments—ranging from public shaming and cyberbullying to physical violence (Carlsmith, 2002; Darley, 2009)[3][6]. From a practical perspective, fostering clean public environments may help reduce impulsive, conflict-driven behaviors and even prevent crime. This has potential insights for urban design, public policy, and community management.

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