

The Influence of Chinese-Western Cultural Differences on Moral Responsibility Judgments of Virtual Humans

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Abstract

In recent years, a proliferation of virtual humans with realistic human features has emerged on social networks, employing first-person narratives to gain influence, yet the underlying ethical issues have gradually surfaced. When social media virtual humans commit transgressions, how do moral judgments differ among people from diverse cultural backgrounds? Grounded in the theory of mind perception, this research investigates the influence and underlying mechanisms of Chinese-Western cultural differences on moral responsibility judgments of virtual humans through five principal experiments. The findings demonstrate that after being informed of a virtual human's immoral behavior, individuals influenced by Chinese culture, compared to those influenced by Western culture, attribute greater moral responsibility to virtual humans; however, this cultural disparity does not manifest in moral responsibility judgments concerning real humans (Experiments 1a-1c). Moreover, this cultural difference persists regardless of whether the virtual human is operated by real humans or artificial intelligence (Experiment 1c). This cultural effect is mediated by perceived mental capacity (Experiment 2). Specifically, individuals influenced by Chinese culture, relative to Western culture, perceive virtual humans as possessing higher mental capacity (particularly agency), thereby warranting greater moral responsibility. Furthermore, these heightened moral responsibility judgments lead individuals under Chinese cultural influence (compared to Western cultural influence) to exhibit stronger tendencies toward imposing moral punishment on virtual humans (Experiment 3). This research extends the targets of moral responsibility judgment and mind perception to virtual humans through empirical investigation and elucidates Chinese-Western cultural differences and their subsequent implications.

Full Text

The Influence of Cultural Differences between China and the West on Moral Responsibility Judgments of Virtual Humans

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Abstract

In recent years, numerous virtual characters with human-like features have emerged on social media platforms, gaining influence through first-person narrative perspectives. However, the underlying ethical issues have gradually surfaced. When social media virtual humans commit wrongdoings, how do people from different cultural backgrounds differ in their moral judgments? Based on Mind Perception Theory, this paper explores the influence and mechanism of cultural differences between China and the West on moral responsibility judgments of virtual humans through five main experiments. The research demonstrates that after being informed of a virtual human's immoral behavior, people under Chinese cultural influence attribute greater moral responsibility to the virtual human compared to those under Western culture; yet this cultural difference does not appear in moral responsibility judgments of real humans (Experiments 1a-1c). Moreover, this cultural difference persists regardless of whether the virtual human is driven by real humans or artificial intelligence (Experiment 1c). This cultural difference is mediated by perceived mental capacity (Experiment 2). Specifically, compared to Western culture, people under Chinese cultural influence perceive virtual humans as having higher mental capacity (particularly experience), and therefore attribute greater moral responsibility to them. Additionally, greater moral responsibility judgments of virtual humans lead people under Chinese culture (compared to Western culture) to be more inclined to impose moral punishment on virtual humans (Experiment 3). This paper extends the objects of moral responsibility judgment and mind perception to virtual humans through empirical research, revealing cultural differences between China and the West and their subsequent impacts.

Keywords: virtual humans, moral responsibility, cultural differences, mental capacity

1. Problem Statement

1.1 The Impact of Cultural Differences between China and the West on Moral Judgment

Culture significantly influences human psychology and behavior. Culture broadly refers to shared values, norms, ways of thinking, and behavioral patterns among social members. Previous research has found that cultural

differences between East and West affect moral judgment. Western culture emphasizes morality oriented toward individual freedom, rights, justice, care, and forgiveness, whereas Eastern culture emphasizes morality oriented toward collective and individual responsibility. Research indicates that Westerners prioritize an ethics of justice, while Easterners prioritize an ethics of responsibility. Individualism/collectivism culture also influences moral decision-making because it involves beliefs about whether individual or collective interests should take priority. Based on cultural psychology theories of individualism/collectivism, this paper examines the impact of cultural differences between China and the West on moral responsibility judgments of virtual humans. Compared to individualistic cultures (e.g., the United States), people in collectivistic cultures (e.g., China) exhibit higher perspective-taking ability and anthropomorphic tendencies. The question this paper seeks to answer is whether, compared to Western culture, people under Chinese cultural influence evaluate virtual humans' mental capacity more highly and consequently attribute greater moral responsibility to them for immoral behavior.

1.2 Moral Responsibility Judgment of Virtual Humans

Most scholars in previous literature define virtual humans not as actual robots or simple computer programs but as computer-generated anthropomorphic images, which, with the support of artificial intelligence technology, can communicate face-to-face with people through language, gestures, and even facial expressions. Current research on virtual humans focuses on interactions between virtual humans and real humans on social media, as well as virtual idol characteristics and endorsement effects. This paper focuses on virtual humans on social media platforms—digital characters created with computer graphics software that take a first-person perspective and occupy a space on media platforms. Compared to task-oriented AI robots and algorithmic software, virtual humans on social media platforms share and interact to gain influence, exhibiting behavior more similar to real humans and thus being more prone to immoral behavior. Although immoral behaviors by virtual humans are frequently exposed, no research has directly examined moral responsibility judgments of virtual humans, with most studies focusing on virtual entities such as AI and algorithms. Since virtual humans are also based on AI technology, we can draw on relevant research on virtual entities.

The attribution of moral responsibility is a fundamental issue in moral philosophy, traceable to Aristotle's theory, which posits that an entity must satisfy both free will and cognitive conditions to bear moral responsibility as a moral agent. The free will condition discusses whether the agent could have acted otherwise, while the cognitive condition examines whether the agent can be held morally responsible for the consequences of their actions. When discussing whether virtual entities like AI can bear moral responsibility, many scholars also mention these two basic conditions. Related literature suggests that while virtual entities possess some degree of autonomy, they lack cognitive capacity

and thus cannot be held responsible as moral agents. If a virtual entity engages in immoral behavior, the real humans behind it (such as designers or manufacturers) should be held responsible for any consequences.

However, analyzing moral responsibility attribution solely from these two conditions of moral agency is flawed. Coeckelbergh emphasized the importance of the moral patient, arguing that moral responsibility issues encompass not only what is done and whether the agent knows what they are doing, but also who is responsible to whom or what—namely, answerability. This corresponding relationship between both parties in an action provides more basis for moral responsibility attribution. For virtual entities, many behavioral consequences are difficult to explain and answer for, making objective clarification of moral responsibility attribution challenging. Nevertheless, subjectively, people still make moral judgments about these virtual entities. Based on the above analysis, this paper predicts that when making moral judgments about virtual humans, people will attribute from both moral agency and moral patient perspectives.

1.3 Mind Perception Theory

Mind refers to the capacity to think, feel, and act consciously. Mind perception—perceiving the existence of mind in other entities (such as technical devices, spiritual agents, and non-human animals)—helps understand and predict others' behaviors and intentions. According to Mind Perception Theory, mental capacity involves cognitive agency and emotional experience, including planning, self-control, and emotional feeling. Attributing cognitive agency to an entity means the observer believes the entity can act as a moral agent, like an adult, to plan, implement self-control, etc. Attributing emotional experience to an entity indicates the observer believes the entity can act as a moral patient with emotional perception capacity. These two dimensions can be perceived separately. For example, infants are perceived as having high emotional experience and low cognitive agency, while God is perceived as having high cognitive agency and low emotional experience.

Mental capacity influences moral judgment of entities and plays a role in dyadic morality. Entities with cognitive agency can make decisions and act consciously; when behaviors go wrong, they are considered responsible. Normal adults possess cognitive agency and can bear moral responsibility as moral agents. Minors lack cognitive agency and receive lighter punishment when committing moral wrongdoings. Although cognitive agency is crucial for moral responsibility judgment, emotional experience is considered the essential characteristic distinguishing humans from other entities and is often regarded as having stronger explanatory power. Psychological research shows that emotional experience plays an important role in moral decision-making. Feeling others' pain and showing empathy is one of the core elements of moral judgment. Emotional experience also plays an important role in moral agent judgment. For example, Sullivan and Wamba found that when people believe AI intentionally harms humans (vs. non-humans), they blame the AI, an effect mediated by emotional experi-

ence in mental capacity. Based on Mind Perception Theory, this paper argues that when virtual humans on social media make mistakes, if they are endowed with high mental capacity similar to normal adults, people may believe virtual humans need to bear moral responsibility similar to real humans.

1.4 Cultural Differences in Mind Perception and Moral Responsibility Judgment

Existing literature suggests that cultural differences are important factors affecting mind perception. On one hand, cultural differences influence perspective-taking ability. For example, people in collectivistic cultures (e.g., China) show higher perspective-taking ability than those in individualistic cultures (e.g., the United States). Chinese people perceive higher social cooperation attributes in AI robots than British people. Therefore, compared to Westerners, Chinese people are more likely to project their own emotions and abilities onto others and may evaluate virtual humans' mental capacity more highly. On the other hand, cultural differences influence anthropomorphic tendencies. For example, Letheren et al. found that East Asians have higher anthropomorphic tendencies than Caucasians. Western religions like Christianity and Islam believe gods have less fixed physical bodies, while Eastern religions like Buddhism and Hinduism believe gods have tangible bodies. Eastern people also endow gods with human-specific abilities. Anthropomorphic tendencies affect perception of mental capacity; subjects with higher anthropomorphic tendencies perceive higher mental capacity in the robot model Pleo. Therefore, Eastern people are more likely to anthropomorphize non-human entities and may be more inclined to believe virtual humans possess mental capacity. In summary, this paper argues that compared to Western culture, people under Chinese cultural influence may evaluate virtual humans' mental capacity more highly.

Mind Perception Theory divides mental capacity into two dimensions: cognitive agency and emotional experience. Endowing an entity with higher cognitive agency means the entity can act as a moral agent to make moral decisions and be responsible for behaviors. Research finds that emotional experience is equally crucial for moral agent judgment. Therefore, evaluation of an entity's mental capacity may influence people's moral responsibility judgments. However, current literature on moral responsibility judgment of virtual entities is divided. Some scholars argue that virtual entities cannot bear moral responsibility. Other studies show that people attribute moral responsibility to virtual entities. To reach consistent conclusions, it is necessary to deeply explore the reasons behind people's moral judgments of virtual entities. Combining the important role of mind perception in moral responsibility judgment, this paper infers that cultural differences between China and the West can influence moral responsibility judgments of virtual entities by affecting evaluations of mental capacity.

Most current research on moral responsibility of virtual entities focuses on AI and adopts moral dilemma paradigms. Traditional moral dilemmas (e.g., trolley

problems) separate rationality from intuition and are considered atypical. As more virtual humans appear in daily life, moral issues with virtual entities are no longer limited to moral dilemmas but have been replaced by more human-like immoral behaviors such as infringement and plagiarism. Therefore, this paper focuses on realistic moral scenarios of virtual humans on social media and conducts empirical research, proposing the following hypotheses:

Hypothesis 1: After seeing virtual humans engage in immoral behavior, people under Chinese culture (vs. Western culture) attribute greater moral responsibility to virtual humans.

Hypothesis 2: People under Chinese culture (vs. Western culture) perceive virtual humans as having higher mental capacity, and this higher attribution of mental capacity leads them to believe that virtual humans should bear greater moral responsibility for immoral behavior.

1.5 Research Overview

In summary, this study examines the influence of cultural differences between China and the West on moral responsibility judgments of virtual humans through five experiments based on Mind Perception Theory. Experiment 1a found that people under Chinese culture (vs. Western culture) believe virtual humans should bear greater moral responsibility when they make mistakes. Experiment 1b replicated the results of Experiment 1a using different immoral scenarios and moral responsibility measurements. Experiment 1c manipulated the type of entity behind the virtual human, and the effect of cultural differences persisted regardless of whether the virtual human was driven by real humans or AI. Experiment 2 examined the mediating mechanism of perceived mental capacity; the higher perceived mental capacity of virtual humans by people under Chinese culture leads them to believe that virtual humans should bear greater moral responsibility when they make mistakes. Experiment 3 further explored how this cultural difference influences subsequent behavior (moral punishment).

Experiment 1a: The Effect of Cultural Background on Moral Responsibility Judgment

Experiment 1a aimed to examine the effect of cultural background on moral responsibility judgment. This experiment used a 2 (real human vs. virtual human) \times 2 (Chinese culture vs. Western culture) between-subjects design to investigate whether people under Chinese culture (vs. Western culture) believe virtual humans should bear greater moral responsibility after making mistakes.

2.1 Participants

We used G*Power 3.1 software to calculate the required sample size. For the two-way ANOVA applicable to this experiment, with a significance level α of 0.05

and medium effect size (f between 0.2 and 0.25), a sample size between 279 and 434 was needed to achieve 95% statistical power. To ensure sufficient sample size and maintain uniform standards, all experiments in this study recruited 100 participants per condition and used raw data for analysis. However, due to simultaneous responses and incomplete responses on online platforms, there may be 1–2 more or fewer participants than the predetermined number.

Experiment 1a recruited 200 U.S. Caucasian participants (57.50% female; M age = 29.49 years, SD age = 6.26 years) through the foreign survey platform Prolific and 200 Chinese participants (75.00% female; M age = 25.16 years, SD age = 5.21 years) through the domestic survey platform Credamo, offering small cash rewards. Participants from both cultural backgrounds were randomly assigned to the real human group or virtual human group, with 100 people in each group.

2.2 Procedure

In the real human group, U.S. (Chinese) participants saw the homepage of a Twitter (Weibo) blogger named Rico (shown in [Figure 1: see original paper]) with a brief text introduction. In the virtual human group, participants saw the homepage of a virtual blogger Rico (shown in [Figure 2: see original paper]) with the same text introduction and a definition of virtual bloggers (virtual bloggers are digital characters created with computer graphics software, given a personality defined by a first-person view of the world, and made accessible on media platforms). In fact, Rico was a fictional blogger; the profile picture used an AI-generated real human image from a free website (<https://generated.photos>), and the corresponding virtual human avatar was drawn based on the real human image.

The text introduction read: “Rico is a (virtual) blogger on Weibo/Twitter. She is often active on social media sharing her outfits and life.” Next, participants were told, “Recently, Rico posted on Weibo exposing a netizen’s private behavior, causing the netizen to suffer from cyber violence.” To measure moral responsibility judgment, participants answered two questions: “How much responsibility do you think Rico should bear for this cyber violence incident?” (7-point scale, 1 = no responsibility, 7 = great responsibility) and “How much blame do you think Rico should bear for this cyber violence incident?” (7-point scale, 1 = no blame, 7 = much blame). The two items were highly correlated ($r = 0.76$, $p < 0.001$), so their mean was used as the moral responsibility judgment score. Finally, all participants reported their gender and age. Complete manipulation and measurement materials for all experiments in this study are provided in Appendix 1.

2.3 Data Analysis and Results

A two-way ANOVA was conducted with culture type (U.S. coded as 0, China coded as 1) and blogger type (real human coded as 0, virtual human coded as 1) as independent variables and moral responsibility judgment as the dependent

variable. Results showed a significant main effect of culture type ($F(1, 396) = 4.41, p = 0.036, p^2 = 0.011$), a significant main effect of blogger type ($F(1, 396) = 7.23, p = 0.007, p^2 = 0.018$), and a significant interaction effect between culture type and blogger type on moral responsibility judgment ($F(1, 396) = 5.83, p = 0.016, p^2 = 0.015$), as shown in [Figure 3: see original paper]. Specifically, Chinese people attributed greater moral responsibility to virtual humans than Americans (M China = 5.48, SD = 1.07, 95%CI = [5.23, 5.73]; M U.S. = 4.91, SD = 1.68, 95%CI = [4.66, 5.16]; $F(1, 396) = 10.19, p = 0.002, p^2 = 0.025$). There was no significant difference in moral responsibility judgment toward real humans ($F(1, 396) = 0.05, p = 0.824$). Additionally, Chinese participants showed no significant difference in moral responsibility judgment between real and virtual humans ($F(1, 396) = 0.04, p = 0.846$). These results indicate that after seeing virtual humans engage in cyber violence, people under Chinese culture (vs. Western culture) attribute greater moral responsibility to virtual humans, supporting Hypothesis 1. Controlling for gender and age in this and subsequent experiments did not change the significance or direction of results; detailed data are provided in Appendix 4.

Experiment 1b: Replication with a Different Immoral Scenario

Experiment 1b aimed to replicate Experiment 1a' s results using another immoral scenario and another method of measuring moral responsibility, recruiting participants from another Western country. We predicted that compared to Western culture, people under Chinese culture would attribute greater moral responsibility to virtual humans for tax evasion.

3.1 Participants

Experiment 1b also used a 2 (real human vs. virtual human) \times 2 (Chinese culture vs. Western culture) between-subjects design. We recruited 199 British Caucasian participants (68.84% female; M age = 29.87 years, SD age = 6.06 years) through Prolific and 200 Chinese participants (64.50% female; M age = 26.64 years, SD age = 5.52 years) through Credamo, offering small cash rewards. Participants from both cultural backgrounds were randomly assigned to the real human group or virtual human group. Among British participants, there were 99 in the real human group and 100 in the virtual human group; among Chinese participants, there were 100 in each group.

3.2 Procedure

Similar to Experiment 1a' s manipulation and content, Chinese (British) participants in the real human group saw blogger Rico' s Weibo (Twitter) homepage and description; those in the virtual human group saw virtual blogger Rico' s Weibo (Twitter) homepage and description. Next, participants were told, "Recently, Rico was exposed for tax evasion on her income from live-streaming

product sales. She is currently under investigation.” This experiment used a four-item moral responsibility scale to measure participants’ moral responsibility judgments of Rico (7-point scale, 1 = strongly disagree, 7 = strongly agree; Cameron et al., 2010; Cronbach’s $\alpha = 0.81$). Two items were “Rico is morally responsible for her tax evasion” and “Rico should be punished for her tax evasion,” with higher scores indicating higher moral responsibility judgments. The other two items were “The tax evasion behavior should not be blamed on Rico” and “The responsibility for tax evasion should not be borne by Rico,” with higher scores indicating lower moral responsibility judgments. We averaged the scores of the first two items and the reverse-coded scores of the last two items to obtain the moral responsibility judgment score. Subsequently, participants answered a manipulation check question: “In your opinion, Rico is?” (0 = real blogger, 1 = virtual blogger). Finally, participants reported their gender and age.

3.3 Data Analysis and Results

Manipulation Check. A regression analysis was conducted using Bootstrapping (PROCESS Model 1; Hayes, 2015) with blogger type (real human coded as 0, virtual human coded as 1) as the independent variable, culture type (British coded as 0, Chinese coded as 1) as the moderator, and the manipulation check of blogger type (0 = real blogger, 1 = virtual blogger) as the dependent variable, with 5,000 samples and a 95% confidence interval. Results showed no significant main effect of culture type ($\beta = -0.32$, SE = 0.56, $p = 0.567$, 95%CI = [-1.42, 0.78]) and no significant interaction effect between blogger type and culture type ($\beta = 1.02$, SE = 1.35, $p = 0.450$, 95%CI = [-1.63, 3.58]). Only the main effect of blogger type was significant ($\beta = 6.32$, SE = 0.80, $p < 0.001$, 95%CI = [4.75, 7.90]). Specifically, in the virtual human group, 98.00% of British participants and 99.00% of Chinese participants identified Rico as a virtual blogger; in the real human group, 91.92% of British participants and 94% of Chinese participants identified Rico as a real blogger. This indicates that the manipulation of blogger type was effective and did not differ across cultures. Excluding participants who failed the manipulation check did not affect the direction or significance of the results.

Moral Responsibility Judgment. A two-way ANOVA was conducted with culture type (British coded as 0, Chinese coded as 1) and blogger type (real human coded as 0, virtual human coded as 1) as independent variables and moral responsibility judgment as the dependent variable. Results showed a significant main effect of culture type ($F(1, 395) = 8.50$, $p = 0.004$, $p^2 = 0.021$), a significant main effect of blogger type ($F(1, 395) = 28.56$, $p < 0.001$, $p^2 = 0.067$), and a significant interaction effect between culture type and blogger type on moral responsibility judgment ($F(1, 395) = 9.40$, $p = 0.002$, $p^2 = 0.023$), as shown in [Figure 4: see original paper]. Specifically, Chinese people attributed greater moral responsibility to virtual humans than British people (M China = 5.36, SD = 1.19, 95%CI = [5.12, 5.61]; M Britain = 4.61, SD = 1.66,

95%CI = [4.36, 4.86]; $F(1, 395) = 17.93$, $p < 0.001$, $p^2 = 0.043$). There was no significant difference in moral responsibility judgment toward real humans ($F(1, 395) = 0.01$, $p = 0.915$). Additionally, Chinese participants showed no significant difference in moral responsibility judgment between real and virtual humans ($F(1, 395) = 2.60$, $p = 0.108$). These results replicate Experiment 1a's findings and support Hypothesis 1 again.

Experiment 1c: The Influence of Virtual Human Agent Type

When encountering social media virtual humans, people may think about whether these virtual humans are backed by real humans or AI technology, leading to different judgments. Therefore, Experiment 1c examined whether different virtual human agent types influence moral responsibility judgments of virtual humans.

4.1 Participants

This experiment used a 3 (real human vs. virtual human powered by AI vs. virtual human powered by real humans) \times 2 (Chinese culture vs. Western culture) between-subjects design. We recruited 300 British Caucasian participants (65.00% female; M age = 30.82 years, SD age = 5.37 years) and 300 Chinese participants (68.33% female; M age = 26.78 years, SD age = 5.84 years) through Prolific and Credamo, offering small cash rewards. Participants from both cultural backgrounds were randomly assigned to the real human group, virtual AI group, or virtual real human group. Among British participants, there were 99 in the real human group, 100 in the virtual AI group, and 101 in the virtual real human group; among Chinese participants, there were 100 in each group.

4.2 Procedure

The manipulation method for blogger type was similar to previous experiments. However, in the real human group, participants saw a description of a real blogger: "Rico is a blogger on Weibo (Twitter)"; in the virtual AI group, participants saw a description of a virtual blogger: "Rico is a virtual blogger on Weibo (Twitter) powered by artificial intelligence and algorithms"; in the virtual real human group, participants saw a description of a virtual blogger: "Rico is a virtual blogger on Weibo (Twitter) powered by real humans." Next, participants were told, "Recently, a picture posted by Rico on Weibo was accused of infringing on a photographer's copyright. Afterwards, Rico deleted the picture and publicly apologized." Subsequently, participants reported their moral responsibility judgments of Rico using the same measurement as Experiment 1a ($r = 0.71$, $p < 0.001$). Additionally, participants in the virtual human groups answered a manipulation check question: "In your opinion, the entity powering Rico is?" (0 = real humans, 1 = artificial intelligence). Considering that socioeconomic status might influence individual moral judgments, all participants finally reported

subjective socioeconomic status (10-point scale; Adler et al., 2000), education level (5-point scale), gender, and age.

4.3 Data Analysis and Results

Manipulation Check. Among participants in the virtual groups, a regression analysis was conducted using Bootstrapping (PROCESS Model 1; Hayes, 2015) with blogger type (virtual real human coded as 0, virtual AI coded as 1) as the independent variable, culture type (British coded as 0, Chinese coded as 1) as the moderator, and the manipulation check of blogger type (0 = real humans, 1 = artificial intelligence) as the dependent variable, with 5,000 samples and a 95% confidence interval. Results showed no significant main effect of culture type ($\beta = 0.08$, $SE = 0.36$, $p = 0.829$, $95\%CI = [-0.64, 0.79]$) and no significant interaction effect between blogger type and culture type ($\beta = -0.71$, $SE = 0.68$, $p = 0.298$, $95\%CI = [-2.05, 0.63]$). Only the main effect of blogger type was significant ($\beta = 4.47$, $SE = 0.53$, $p < 0.001$, $95\%CI = [3.44, 5.51]$). Specifically, in the virtual AI group, 95.00% of British participants and 91.00% of Chinese participants believed Rico was powered by AI; in the virtual real human group, 82.18% of British participants and 81.00% of Chinese participants believed Rico was powered by real humans. This indicates that the manipulation of virtual human agent type was effective and did not differ across cultures. Excluding participants who failed the manipulation check did not affect the direction or significance of the results.

Moral Responsibility Judgment. A two-way ANOVA was conducted with culture type (U.S. coded as 0, Chinese coded as 1) and blogger type (real human coded as -1, virtual real human coded as 0, virtual AI coded as 1) as independent variables and moral responsibility judgment as the dependent variable. Results showed a significant main effect of culture type ($F(1, 594) = 95.39$, $p < 0.001$, $p^2 = 0.138$), a significant main effect of blogger type ($F(2, 594) = 21.63$, $p < 0.001$, $p^2 = 0.068$), and a significant interaction effect between culture type and blogger type on moral responsibility judgment ($F(2, 594) = 12.02$, $p < 0.001$, $p^2 = 0.039$), as shown in [Figure 6: see original paper]. Specifically, Chinese people attributed greater moral responsibility than British people regardless of whether the virtual human was powered by real humans (M China = 5.41, $SD = 1.26$, $95\%CI = [5.14, 5.68]$; M Britain = 3.78, $SD = 1.50$, $95\%CI = [3.51, 4.05]$; $F(1, 594) = 70.56$, $p < 0.001$, $p^2 = 0.106$) or AI (M China = 5.13, $SD = 1.27$, $95\%CI = [4.85, 5.40]$; M Britain = 3.80, $SD = 1.57$, $95\%CI = [3.53, 4.07]$; $F(1, 594) = 46.24$, $p < 0.001$, $p^2 = 0.072$). There was no significant cultural difference in moral responsibility judgment toward real humans ($F(1, 594) = 3.01$, $p = 0.084$). Additionally, Chinese participants showed no significant differences in moral responsibility judgment among real humans and the two types of virtual humans ($F(2, 594) = 1.83$, $p = 0.162$), with no significant differences in pairwise comparisons ($ps > 0.203$). These results indicate that after learning about copyright infringement, regardless of whether the virtual human is powered by real humans or AI, people under Chinese culture (vs. Western

culture) attribute greater moral responsibility to virtual humans. The results further support Hypothesis 1.

Experiment 2: The Mediating Role of Perceived Mental Capacity

Experiment 2 had two purposes. First, it examined whether cultural differences in moral responsibility judgments of virtual humans stem from differences in perceived mental capacity. We argued that compared to Western culture, people under Chinese culture perceive virtual humans as having higher mental capacity, and therefore virtual humans should bear greater moral responsibility after making mistakes. Second, this effect might occur because Chinese people are more familiar with virtual humans than Westerners, or because Chinese people consider immoral scenarios (e.g., tax evasion) more serious than Westerners—alternative explanations unrelated to our hypothesized mechanism. Therefore, Experiment 2 measured familiarity with virtual humans and scenario severity to rule out these alternative explanations.

Before the formal experiment, we conducted a pilot study recruiting 199 British Caucasian participants (80.40% female; M age = 30.62 years, SD age = 5.80 years) and 200 Chinese participants (77.50% female; M age = 30.89 years, SD age = 4.95 years) through Prolific and Credamo. Participants were randomly assigned to the real human group or virtual human group and rated Rico's mental capacity (7-point scale, 1 = not capable, 7 = very capable; Gray et al., 2011; Cronbach's $\alpha = 0.93$). Results showed a significant interaction effect between culture type and blogger type on mental capacity evaluation ($F(1, 395) = 38.00, p < 0.001, p^2 = 0.088$). Chinese people perceived higher mental capacity in virtual humans than British people (M China = 4.57, SD = 1.08; M Britain = 3.62, SD = 1.49; $F(1, 395) = 32.35, p < 0.001, p^2 = 0.076$), consistent with our expectations (detailed pilot study content is in Appendix 2).

5.1 Participants

The formal experiment used a 2 (real human vs. virtual human) \times 2 (Chinese culture vs. Western culture) between-subjects design, recruiting 199 U.S. Caucasian participants (71.36% female; M age = 30.62 years, SD age = 5.80 years) and 200 Chinese participants (69.00% female; M age = 27.81 years, SD age = 5.24 years) through Prolific and Credamo, offering small cash rewards. Participants from both cultural backgrounds were randomly assigned to the real human group and virtual human group. Among U.S. participants, there were 101 in the real human group and 98 in the virtual human group; among Chinese participants, there were 100 in each group.

5.2 Procedure

Consistent with previous experiments, after viewing the description of virtual or real human Rico, participants were told, "Recently, Rico was exposed for tax

evasion on her income from live-streaming product sales. She is currently under investigation.” Moral responsibility judgment was measured the same way as in Experiment 1a ($r = 0.84$, $p < 0.001$). Then, participants rated Rico’s mental capacity from two dimensions—cognitive agency and emotional experience—using 12 items (7-point scale, 1 = not capable, 7 = very capable; Gray et al., 2011; Cronbach’s $\alpha = 0.92$). Considering that people from different cultural backgrounds may have different levels of familiarity with virtual humans, we also measured participants’ familiarity with virtual humans using three items (7-point scale, “very unfamiliar/very familiar,” “not at all informed/very informed,” “know nothing at all/know a great deal” ; Cronbach’s $\alpha = 0.95$; Carlson et al., 2020). Considering that this cultural difference might stem from different judgments of the severity of the immoral event, we also measured participants’ evaluation of the severity of tax evasion: “How serious do you think the tax evasion behavior is?” (7-point scale, 1 = not at all serious, 7 = very serious). Finally, all participants reported their gender and age.

5.3 Data Analysis and Results

Moral Responsibility Judgment. A two-way ANOVA was conducted with culture type (U.S. coded as 0, China coded as 1) and blogger type (real human coded as 0, virtual human coded as 1) as independent variables and moral responsibility judgment as the dependent variable. Results showed a significant main effect of culture type ($F(1, 395) = 28.54$, $p < 0.001$, $p^2 = 0.067$), a significant main effect of blogger type ($F(1, 395) = 35.73$, $p < 0.001$, $p^2 = 0.083$), and a significant interaction effect between culture type and blogger type on moral responsibility judgment ($F(1, 395) = 11.90$, $p = 0.001$, $p^2 = 0.029$). Specifically, Chinese people attributed greater moral responsibility to virtual humans than Americans (M China = 5.62, SD = 1.27, 95%CI = [5.35, 5.89]; M U.S. = 4.40, SD = 2.07, 95%CI = [4.13, 4.68]; $F(1, 395) = 35.40$, $p < 0.001$, $p^2 = 0.082$). There was no significant cultural difference in moral responsibility judgment toward real humans ($F(1, 395) = 1.81$, $p = 0.180$). Additionally, Chinese participants showed no significant difference in moral responsibility judgment between real and virtual humans ($F(1, 395) = 3.21$, $p = 0.074$). These results again support Hypothesis 1.

Perceived Mental Capacity. A two-way ANOVA was conducted with culture type and blogger type as independent variables and perceived mental capacity as the dependent variable. Results showed a significant main effect of culture type ($F(1, 395) = 4.75$, $p = 0.030$, $p^2 = 0.012$), a significant main effect of blogger type ($F(1, 395) = 67.79$, $p < 0.001$, $p^2 = 0.146$), and a significant interaction effect between culture type and blogger type on mental capacity evaluation ($F(1, 395) = 20.60$, $p < 0.001$, $p^2 = 0.050$). Specifically, Chinese people perceived higher mental capacity in virtual humans than Americans (M China = 4.31, SD = 0.98, 95%CI = [4.09, 4.53]; M U.S. = 3.56, SD = 1.44, 95%CI = [3.34, 3.78]; $F(1, 395) = 22.40$, $p < 0.001$, $p^2 = 0.054$). There was no significant difference in mental capacity evaluation of real humans ($F(1, 395) = 2.80$, $p = 0.095$).

Separate analyses of cognitive agency (Cronbach's $\alpha = 0.85$) and emotional experience (Cronbach's $\alpha = 0.93$) showed consistent results. ANOVA results indicated significant interaction effects between culture type and blogger type on evaluations of cognitive agency ($F(1, 395) = 10.55, p = 0.001, p^2 = 0.026$) and emotional experience ($F(1, 395) = 22.17, p < 0.001, p^2 = 0.053$). Specifically, Chinese people perceived higher cognitive agency (M China = 4.40, SD = 1.05, 95%CI = [4.17, 4.63]; M U.S. = 3.82, SD = 1.31, 95%CI = [3.59, 4.05]; $F(1, 395) = 11.84, p = 0.001, p^2 = 0.029$) and emotional experience (M China = 4.23, SD = 1.13, 95%CI = [3.96, 4.49]; M U.S. = 3.30, SD = 1.90, 95%CI = [3.03, 3.57]; $F(1, 395) = 23.66, p < 0.001, p^2 = 0.057$) in virtual humans. There were no significant cultural differences in evaluations of cognitive agency ($F(1, 395) = 1.31, p = 0.253$) or emotional experience ($F(1, 395) = 3.18, p = 0.075$) for real humans.

Mediating Role of Perceived Mental Capacity. A moderated mediation analysis was conducted using Bootstrapping (PROCESS Model 8; Hayes, 2015) with culture type as the independent variable (U.S. coded as 0, China coded as 1), blogger type as the moderator (real human coded as 0, virtual human coded as 1), perceived mental capacity as the mediator, and moral responsibility judgment as the dependent variable, with 5,000 samples and a 95% confidence interval. Results showed that the interaction effect of culture type and blogger type on moral responsibility judgment through perceived mental capacity was significant (moderated mediation: indirect effect $\beta = 0.35, SE = 0.11, 95\%CI = [0.16, 0.58]$), as shown in [Figure 5: see original paper]. Chinese people perceived higher mental capacity in virtual humans than Americans, leading to greater moral responsibility attribution (indirect effect $\beta = 0.26, SE = 0.08, 95\%CI = [0.12, 0.43]$). For real humans, the mediating effect of perceived mental capacity was not significant (indirect effect $\beta = -0.09, SE = 0.05, 95\%CI = [-0.21, 0.01]$). These results support Hypothesis 2.

When mental capacity was divided into cognitive agency and emotional experience and both were entered as mediators in a parallel mediation analysis using Bootstrapping (PROCESS Model 8; Hayes, 2015) with 5,000 samples and a 95% confidence interval, results showed that the moderated mediation effect of emotional experience was significant (indirect effect $\beta = 0.48, SE = 0.14, 95\%CI = [0.23, 0.79]$). Chinese people perceived higher emotional experience in virtual humans than Americans, leading to greater moral responsibility attribution (indirect effect $\beta = 0.35, SE = 0.11, 95\%CI = [0.16, 0.60]$). The moderated mediation effect of cognitive agency was not significant (indirect effect $\beta = -0.06, SE = 0.07, 95\%CI = [-0.20, 0.06]$). These results indicate that emotional experience, rather than cognitive agency, in mental capacity is the primary factor influencing cultural differences in moral responsibility judgments of virtual humans.

Ruling Out Alternative Explanations. A two-way ANOVA was conducted with familiarity with virtual humans as the dependent variable. Results showed only a significant main effect of culture type ($F(1, 395) = 241.70, p < 0.001$,

$p^2 = 0.380$), with no significant interaction effect between culture type and blogger type ($F(1, 395) = 0.81, p = 0.368$). A moderated mediation analysis was conducted using Bootstrapping (PROCESS Model 14; Hayes, 2015) with culture type as the independent variable, blogger type as the moderator, familiarity with virtual humans as the mediator, and moral responsibility judgment as the dependent variable, with 5,000 samples and a 95% confidence interval. Results showed that the moderated mediation effect was not significant (indirect effect $\beta = 0.38, SE = 0.19, 95\%CI = [-0.01, 0.76]$). Thus, familiarity with virtual humans can be ruled out as an alternative mediator explanation for the cultural difference.

Similarly, a two-way ANOVA was conducted with event severity as the dependent variable. Results showed only a significant main effect of culture type ($F(1, 395) = 109.08, p < 0.001, p^2 = 0.216$), with no significant interaction effect between culture type and blogger type ($F(1, 395) = 1.46, p = 0.228$). A moderated mediation analysis was conducted using Bootstrapping (PROCESS Model 14; Hayes, 2015) with culture type as the independent variable, blogger type as the moderator, event severity as the mediator, and moral responsibility judgment as the dependent variable, with 5,000 samples and a 95% confidence interval. Results showed that the moderated mediation effect was not significant (indirect effect $\beta = -0.04, SE = 0.15, 95\%CI = [-0.31, 0.29]$). Thus, event severity can be ruled out as an alternative mediator explanation for the cultural difference.

5.4 Discussion

In summary, Experiment 2 first verified the mediating role of perceived mental capacity through moderated mediation analysis. The results indicate that compared to Western culture, people under Chinese culture perceive virtual humans as having higher mental capacity and therefore attribute greater moral responsibility to them; no significant cultural difference was found in the real human group. This finding further demonstrates that cultural differences have important effects on mind perception. Second, Experiment 2 conducted a parallel mediation analysis including both cognitive agency and emotional experience in mental capacity, finding that this process was fully mediated by emotional experience rather than cognitive agency, verifying that emotional experience has stronger explanatory power. Finally, Experiment 2 ruled out alternative explanations of familiarity with virtual humans and event severity. In the final experiment, we examined moral punishment after people from different cultural backgrounds learned about virtual humans' immoral behavior.

Experiment 3: Moral Punishment

Previous experiments mainly examined the impact of cultural differences between China and the West on moral responsibility judgments of virtual and real humans. This experiment further examined the impact of cultural differences on moral punishment of virtual humans after they make mistakes. Specifically,

Experiment 3 focused on virtual humans and used another immoral scenario (plagiarism) to explore how cultural differences in moral responsibility judgments of virtual humans affect subsequent behavior (e.g., unfollowing).

6.1 Participants

This experiment recruited 101 U.S. Caucasian participants (56.44% female; M age = 29.53 years, SD age = 6.19 years) and 100 Chinese participants (64.00% female; M age = 27.43 years, SD age = 5.92 years) through Prolific and Credamo, offering small cash rewards.

6.2 Procedure

In this experiment, Chinese/U.S. participants saw the Weibo/Twitter homepage of virtual idol Rico and a new version of the text description and explanation of virtual idols: “Rico, also known as Coco, was born on March 21, 2002. She debuted as a virtual singing and dancing idol in 2021 and has attracted many fans. Her outfits are unique and at the forefront of fashion. Rico often shares her daily life on social media. Virtual idols are digital characters created with computer graphics software, given a personality defined by a first-person view of the world, and made accessible on media platforms.”

Next, participants saw a post Rico published in March this year to promote her original single, with content “Come listen to my new original album,” as shown in [Figure 7: see original paper]. Participants learned that “This single was found to have plagiarized another singer’s song. Afterwards, Rico publicly apologized for this matter.” To measure behavioral consequences, participants answered: “To what extent do you think Rico should be fined for plagiarizing?” (1 = not at all, 7 = very much) and “To what extent do you think Rico’s account should be suspended?” (1 = not at all, 7 = very much). Participants also answered: “Suppose you have been following Rico for a while, would you unfollow her?” (0 = continue to follow, 1 = unfollow). Subsequently, consistent with previous experiments, participants answered the two items measuring moral responsibility judgment ($r = 0.71$, $p < 0.001$) and evaluated Rico’s mental capacity (7-point scale; Gray et al., 2011; Cronbach’s $\alpha = 0.94$). Finally, all participants reported subjective socioeconomic status, education level, gender, and age.

6.3 Data Analysis and Results

Behavioral Consequences. A one-way ANOVA was conducted with culture type (U.S. coded as 0, China coded as 1) as the independent variable and the “fine” and “suspend account” measurements as dependent variables. Results showed that Chinese people believed virtual humans should be fined more than Americans (M China = 5.32, SD = 1.49, 95%CI = [5.02, 5.62]; M U.S. = 3.92, SD = 1.99, 95%CI = [3.53, 4.31]; $F(1, 199) = 31.83$, $p < 0.001$, $\eta^2 = 0.138$) and that their social accounts should be suspended more (M China = 4.12, SD

= 1.71, 95%CI = [3.78, 4.46]; M U.S. = 3.50, SD = 1.97, 95%CI = [3.12, 3.89]; $F(1, 199) = 5.58$, $p = 0.019$, $p^2 = 0.027$). Additionally, a chi-square analysis was conducted with the “unfollow” measurement as the dependent variable. Results showed that more Chinese than Americans chose to unfollow (66.00% vs. 45.54%; Pearson Chi-Square = 8.52, $p = 0.004$, Odds Ratio = 2.32).

Moral Responsibility Judgment and Perceived Mental Capacity. One-way ANOVAs were conducted with moral responsibility judgment and perceived mental capacity as dependent variables. Results showed that Chinese people attributed greater moral responsibility to virtual humans than Americans (M China = 5.01, SD = 1.45, 95%CI = [4.72, 5.29]; M U.S. = 4.10, SD = 1.87, 95%CI = [3.73, 4.47]; $F(1, 199) = 14.68$, $p < 0.001$, $p^2 = 0.069$) and perceived higher mental capacity (M China = 3.89, SD = 1.32, 95%CI = [3.62, 4.15]; M U.S. = 2.71, SD = 1.27, 95%CI = [2.46, 2.96]; $F(1, 199) = 41.38$, $p < 0.001$, $p^2 = 0.172$), including cognitive agency (M China = 3.99, SD = 1.36, 95%CI = [3.72, 4.26]; M U.S. = 3.19, SD = 1.35, 95%CI = [2.93, 3.46]; $F(1, 199) = 17.29$, $p < 0.001$, $p^2 = 0.080$) and emotional experience (M China = 3.78, SD = 1.60, 95%CI = [3.46, 4.10]; M U.S. = 2.23, SD = 1.60, 95%CI = [1.91, 2.54]; $F(1, 199) = 47.27$, $p < 0.001$, $p^2 = 0.192$), replicating previous experiment results.

Serial Mediation of Perceived Mental Capacity and Moral Responsibility Judgment. A serial mediation analysis was conducted using Bootstrapping (PROCESS Model 6; Hayes, 2015) with culture type as the independent variable (U.S. coded as 0, China coded as 1), perceived mental capacity and moral responsibility judgment as serial mediators, and the three behavioral consequences as dependent variables, with 5,000 samples and a 95% confidence interval. Results showed that cultural differences between China and the U.S. could positively affect moral responsibility judgment through perceived mental capacity, thereby positively affecting the “fine,” “suspend account,” and “unfollow” measurements (“fine” : indirect effect $\beta = 0.28$, SE = 0.10, 95%CI = [0.12, 0.49]; “suspend account” : indirect effect $\beta = 0.07$, SE = 0.04, 95%CI = [0.002, 0.18]; “unfollow” : indirect effect $\beta = 0.09$, SE = 0.05, 95%CI = [0.01, 0.20]).

Experiment 3 first verified the effect of cultural differences between China and the West on moral responsibility judgments of virtual humans through a plagiarism scenario. Compared to Western culture, people under Chinese culture attributed greater moral responsibility to virtual humans, replicating previous experiment results. Second, this experiment examined the behavioral consequences of cultural differences in moral responsibility judgments of virtual humans. Compared to Western culture, people under Chinese culture believed virtual humans should be fined more and have their social accounts suspended, and a larger proportion of Chinese people chose to unfollow virtual humans’ social media accounts. Finally, this experiment verified the serial mediating role of perceived mental capacity and moral responsibility judgment through a serial mediation model, further validating the robustness of our research mechanism. Previous research on moral responsibility of virtual entities mostly 停留在 attitude evaluation and perception (Awad et al., 2020; Malle et al., 2015; Young &

Monroe, 2019; Chu et al., 2019). Experiment 3 used realistic immoral scenarios and examined moral punishment of virtual entities, enriching and extending the consequences of virtual entities' immoral behavior to some extent.

7. Research Conclusions and Discussion

This paper demonstrates the influence of cultural differences between China and the West on moral responsibility judgments of virtual humans through five experiments. Experiment 1a used a cyber violence scenario triggered by privacy exposure to compare Chinese and American moral responsibility judgments of real and virtual humans. Results showed that compared to Western culture, people under Chinese culture attributed greater moral responsibility to virtual humans, supporting Hypothesis 1. Experiment 1b used a tax evasion scenario, changed the measurement method of moral responsibility, and replicated Experiment 1a's results with Chinese and British participants. Experiment 1c used a copyright infringement scenario and manipulated the type of entity behind the virtual human. Results showed that regardless of whether the virtual human was powered by real humans or AI, people under Chinese culture (vs. Western culture) attributed greater moral responsibility. Experiment 2 verified the mediating mechanism of perceived mental capacity (primarily influenced by emotional experience rather than cognitive agency), ruled out alternative explanations of familiarity with virtual humans and event severity, and supported Hypothesis 2. To further investigate the downstream effects of cultural differences, Experiment 3 used a plagiarism scenario to explore how cultural differences in moral responsibility judgments of virtual humans affect subsequent decisions. Through a serial mediation model, the study found that compared to Western culture, people under Chinese culture perceive virtual humans as having higher mental capacity; when learning about virtual humans' immoral behavior, they attribute greater moral responsibility and believe they should be punished more (fined and suspended), and more Chinese people choose to unfollow virtual humans' social media accounts.

7.1 The Influence of Cultural Differences between China and the West on Mind Perception of Virtual Humans

Culture significantly influences human psychology and behavior. With the development of virtual reality technology and the rise of the metaverse concept, more virtual humans are appearing in daily life. However, most domestic and international literature on virtual entities focuses on AI and algorithms, with few studies paying attention to virtual humans. This paper addresses the gap in virtual human literature by examining the influence of cultural differences between China and the West on perceptions and behavioral reactions toward virtual humans.

This paper extends literature on cultural differences and mind perception, verifying the influence of cultural differences between China and the West on mind perception of virtual humans. Most research on antecedents of mind perception

has examined individual differences in perceivers and targets, such as perceivers' social need motivation, subjective social status, perspective-taking ability, and anthropomorphic tendencies, as well as targets' visual appearance, emotional expression, and anthropomorphic degree. Some studies have also shown that cultural differences are important factors affecting mind perception. For example, Willard and McNamara found through cross-cultural questionnaire surveys that North Americans and Fijians have different views on God' s mental capacity; Fijians believe God' s mental capacity is similar to humans, while North Americans believe God' s mental capacity in the experience dimension is lower than humans. A recent study found that Chinese people evaluate AI robots' social cooperation more highly than British people, but it did not measure mind perception of AI robots across cultures. To fill this gap, this paper compares virtual humans with real humans to study the influence of cultural differences between China and the West on mind perception of virtual humans. Results show that compared to Western culture, people under Chinese culture endow virtual humans with higher mental capacity.

These findings support individualism/collectivism cultural psychology theory to some extent. This theory suggests that psychological cultural differences stem from different cultural value orientations. Western cultural value orientation has strong individualistic consciousness, while Eastern cultural value orientation has strong collectivistic consciousness. Compared to individualistic cultures (e.g., the United States), people in collectivistic cultures (e.g., China) exhibit higher perspective-taking ability and anthropomorphic tendencies. This paper demonstrates through five experiments that compared to Western culture (U.S./Britain), people under Chinese culture perceive virtual humans as having higher mental capacity. This finding enriches literature related to individualism/collectivism.

Additionally, this study found differences in mind perception between real and virtual humans. Experiment 2 results showed that both Chinese ($F(1, 395) = 6.85, p = 0.009, \eta^2 = 0.017$) and American ($F(1, 395) = 81.35, p < 0.001, \eta^2 = 0.171$) participants perceived virtual humans as having lower mental capacity than real humans, consistent with research on AI and robots. Therefore, this paper also compares virtual humans with real humans, expanding the scope of mind perception research in human-computer interaction.

7.2 The Influence of Cultural Differences between China and the West on Moral Responsibility Judgments of Virtual Humans

This paper extends research on moral judgment of virtual entities, verifying the influence of cultural differences between China and the West on moral responsibility judgments of virtual humans. Previous research has debated whether virtual entities can bear moral responsibility. According to classical moral responsibility theory, virtual entities lack intention and emotion and cannot bear moral responsibility. However, recent empirical studies have found that when AI makes mistakes, people still blame them, though to a lesser degree than

real humans. Coeckelbergh emphasized the importance of both moral agency and moral patient in moral judgments of virtual entities, with cognitive agency in mind perception closely related to moral agency and emotional experience closely related to moral patient. This paper introduces the concept of cultural differences, extends the research object from AI to virtual humans, examines the influence of cultural differences between China and the West on moral responsibility judgments of virtual humans, and verifies the mediating mechanism of perceived mental capacity, enriching literature on mind perception, moral responsibility judgment, and cultural differences.

In exploring the mediating mechanism, this paper divided mental capacity into cognitive agency and emotional experience dimensions, finding that emotional experience has stronger explanatory power than cognitive agency, consistent with Sullivan and Wamba's findings. They found that when AI intentionally (vs. accidentally) harms humans, people blame AI more, an effect mediated by emotional experience rather than cognitive agency. While cognitive agency includes two important antecedents of moral responsibility attribution—free will and cognition—and is generally considered to lead to greater moral responsibility when evaluated higher, increasingly more studies have found the importance of emotional experience evaluation in moral judgment. This paper's conclusions further support the non-negligible influence of emotional experience in moral responsibility judgment. Unlike Sullivan and Wamba's research, this paper focuses on the influence of cultural differences between China and the West on moral responsibility judgments of virtual humans. The findings show that compared to Western culture, people under Chinese culture attribute greater moral responsibility to virtual humans after they make mistakes. Besides discovering the mediation of perceived mental capacity, this paper also explores the moderating role of virtual human agent type and the downstream effects of cultural differences (moral punishment after virtual humans make mistakes).

7.3 Practical Implications

This research provides practical guidance for the design, operation, and ethical governance of virtual humans. As celebrity scandals have frequently erupted in recent years, more companies choose to cooperate with virtual humans for marketing activities or even create their own corporate virtual humans, such as Watsons' AI brand spokesperson Qu Chenxi and Prada perfume spokesperson Candy. However, are virtual humans truly scandal-proof? Due to technical and ethical issues, virtual humans on social platforms are still manipulated by humans behind the scenes and cannot achieve true autonomy, leading to immoral events such as plagiarism, infringement, and rape. This study finds that consumers from different cultural backgrounds have different attitudes and reactions toward virtual humans' immoral behavior. For example, in Chinese culture, when virtual humans on social media make mistakes, regardless of whether the behind-the-scenes entity is real human or AI, people believe virtual humans bear similar moral responsibility to real humans and will impose moral punishment

(e.g., unfollowing). Some researchers believe that endowing virtual entities with moral responsibility can ensure legal continuity and establish virtual entities' legal personhood status. Therefore, relevant departments need to formulate more comprehensive governance policies for such issues. Additionally, our findings can help virtual human designers and operators better understand how virtual humans are evaluated and perceived. This study finds that emotional experience evaluation determines moral responsibility judgment. Therefore, when designers endow virtual humans with more anthropomorphic appearance, emotions, and social interactions, operators should more carefully consider virtual humans' public statements and make morally acceptable behavioral expressions, while also being prepared to face related legal and ethical issues.

7.4 Research Limitations and Future Directions

Like other studies, this paper has certain limitations. As the first study to explore the influence of cultural differences between China and the West on moral responsibility judgments of virtual humans, many aspects warrant further investigation.

First, when discussing the influence of cultural differences between China and the West on moral responsibility judgments of virtual humans, Western cultural samples came from the United States and Britain because these countries represent Western culture, while China represents Eastern culture. However, many cultural difference studies have included other Eastern and Western countries, such as India, South Korea, Singapore, Canada, and Italy. Future research could explore whether similar differences exist in other Eastern and Western countries and among people with different religious beliefs (e.g., Christianity and Hinduism). Additionally, since individuals under different cultural influences have many differences, such as collectivism/individualism and holistic/analytic thinking, future research could focus on the micro individual level to examine whether these cultural differences stem from underlying individual differences.

Second, since mental capacity is related to both moral agency and moral patient judgments, virtual humans can act as moral agents to harm others and can also act as moral patients to become victims. For example, in virtual rape incidents, the perpetrator is a virtual human, but the victim could also be a virtual human. In 2007, a "virtual rape" case occurred in the online game "Second Life" developed by Linden Lab, where a female character was raped by a player using program code to control her body. In 2021, during the testing period of Meta's (formerly Facebook) metaverse platform "Horizon Worlds," a female tester experienced multiple instances of sexual harassment in the virtual world. Future research could explore people's attitudes when virtual humans become victims of immoral behavior.

Additionally, in our results, cultural differences between China and the West did not affect moral responsibility judgments of real humans, but some studies have shown that culture also influences moral judgment. Westerners emphasize

moral criteria of personal rights and independence, while Easterners emphasize social responsibility and spiritual purity. Therefore, people from different cultural backgrounds may have different moral responsibility judgments for certain immoral behaviors, such as sexual behavior. Moreover, there may be cultural differences in the degree of belief that virtual humans engage in such immoral behaviors. The four moral issues selected in this paper mainly occur on social media platforms and can avoid cultural specificity as much as possible. Future research could consider whether other moral scenarios influence cultural differences in moral responsibility judgments of virtual humans.

Furthermore, future research could consider other moderating variables, such as virtual humans' personality, appearance, and type. Research shows that when individuals are endowed with rich emotions and depicted as emotional entities, they can be endowed with human-like minds. Therefore, future research could manipulate virtual humans' warmth and competence attributes to influence people's judgments of their mental capacity. Visual appearance and body are important clues for judging experience and also influence mental capacity evaluation. Therefore, when virtual humans' appearance becomes more realistic or when people can physically interact with virtual humans through virtual reality and holographic projection, people's judgments of virtual humans' mental capacity may also differ. Although female virtual humans account for a larger proportion on social networks, there are also many male virtual humans. This study replicated the mediation experiment using male virtual human experimental materials (see Appendix 3) and obtained consistent results. Nevertheless, many non-humanoid virtual influencers have emerged online, such as animal-type (e.g., penguin Puff) and food-type (e.g., cake Cupcake). Future research could further explore the influence of cultural differences between China and the West on moral responsibility judgments of other types of virtual entities.

Finally, considering internal validity, the virtual humans used in this paper's experiments were self-designed social media virtual bloggers or influencers, asking participants to imagine immoral scenarios. As virtual human scandal incidents increase, future research could consider using real immoral scenarios or analyzing secondary data such as comments and engagement on social media platforms to increase external validity.

In conclusion, this paper finds that: (1) Compared to Western culture, people under Chinese culture attribute greater moral responsibility to virtual humans after they make mistakes; (2) This cultural difference persists regardless of whether the virtual human is powered by real humans or AI; (3) The underlying mechanism is that people under Chinese culture (vs. Western culture) perceive virtual humans as having higher mental capacity, with emotional experience having stronger explanatory power than cognitive agency; (4) Greater moral responsibility judgments of virtual humans lead people under Chinese culture (vs. Western culture) to be more inclined to impose moral punishment on virtual humans.

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Appendix 1: Experimental Materials

Experiment 1a Manipulation and Main Measurement Materials

Chinese Experimental Materials

[Virtual Human Group Manipulation Materials]

Rico is a virtual blogger on Weibo. She is often active on social media sharing her outfits and life. (Note: Virtual bloggers are digital characters created with computer graphics software, given a personality defined by a first-person view of the world, and made accessible on media platforms.)

[Real Human Group Manipulation Materials]

Rico is a blogger on Weibo. She is often active on social media sharing her outfits and life.

[Immoral Behavior Scenario]

Recently, Rico posted on Weibo exposing a netizen' s private behavior, causing the netizen to suffer from cyber violence.

[Moral Responsibility Measurement (adapted from Gray & Wegner, 2009)]

1. How much responsibility do you think Rico should bear for this cyber violence incident? (1 = no responsibility, 7 = great responsibility)
2. How much blame do you think Rico should bear for this cyber violence incident? (1 = no blame, 7 = much blame)

U.S. Experimental Materials

[Virtual Human Group Manipulation Materials]

Rico is a virtual blogger on Twitter. She actively shares her outfit and lifestyle on social media. (Note: a virtual blogger is a digital character created in computer graphics software, then given a personality defined by a first–person view of the world, and made accessible on media platforms.)

[Real Human Group Manipulation Materials]

Rico is a blogger on Twitter. She actively shares her outfit and lifestyle on social media.

[Immoral Behavior Scenario]

Recently, Rico posted a blog on Twitter to expose the privacy behavior of a netizen, which made the netizen suffer from cyber violence.

[Moral Responsibility Measurement]

Same as Chinese version.

Experiment 1b Manipulation and Main Measurement Materials

Chinese Experimental Materials

[Virtual Human Group Manipulation Materials]

Rico is a virtual blogger on Weibo. She is often active on social media sharing her outfits and life, and she also recommends nice products through livestreaming on social media every week. (Note: Virtual bloggers are digital characters created with computer graphics software, given a personality defined by a first-person view of the world, and made accessible on media platforms.)

[Real Human Group Manipulation Materials]

Rico is a blogger on Weibo. She is often active on social media sharing her outfits and life, and she also recommends nice products through livestreaming on social media every week.

[Immoral Behavior Scenario]

Recently, Rico was suspected of tax evasion on her income in livestreaming e-commerce. Now, she is under investigation.

[Moral Responsibility Measurement (adapted from Cameron et al., 2010)]

To what extent do you agree with the following statements? (1 = completely disagree, 7 = completely agree)

1. Rico is morally responsible for her tax evasion behavior.
2. Rico should be punished for her tax evasion behavior.
3. The tax evasion behavior should not be blamed on Rico.
4. The responsibility for tax evasion should not be borne by Rico.

[Manipulation Check]

In your opinion, Rico is? (0 = real blogger, 1 = virtual blogger)

British Experimental Materials

[Virtual Human Group Manipulation Materials]

Rico is a virtual blogger on Twitter. She actively shares her outfit and lifestyle on social media and she also recommends nice products through livestreaming on social media every week. (Note: a virtual blogger is a digital character created in computer graphics software, then given a personality defined by a first-person view of the world, and made accessible on media platforms.)

[Real Human Group Manipulation Materials]

Rico is a blogger on Twitter. She actively shares her outfit and lifestyle on social media and she also recommends nice products through livestreaming on social media every week.

[Immoral Behavior Scenario]

Recently, Rico was suspected of tax evasion on her income in livestreaming e-commerce. Now, she is under investigation.

[Moral Responsibility Measurement]

To what extent do you agree with the following statements? (1 = completely disagree, 7 = completely agree)

Same items as Chinese version.

[Manipulation Check]

In your opinion, Rico is? 0 = a human blogger 1 = a virtual blogger

Experiment 1c Manipulation and Main Measurement Materials

Chinese Experimental Materials

[Virtual AI Group Manipulation Materials]

Rico is a virtual blogger on Weibo powered by artificial intelligence and algorithm. She is often active on social media sharing her outfits and life. (Note: Virtual bloggers are digital characters created with computer graphics software, given a personality defined by a first-person view of the world, and made accessible on media platforms.)

[Virtual Real Human Group Manipulation Materials]

Rico is a virtual blogger on Weibo powered by real humans. She is often active on social media sharing her outfits and life. (Note: Virtual bloggers are digital characters created with computer graphics software, given a personality defined by a first-person view of the world, and made accessible on media platforms.)

[Real Human Group Manipulation Materials]

Rico is a blogger on Weibo. She is often active on social media sharing her outfits and life.

[Immoral Behavior Scenario]

Recently, a photo posted by Rico on Weibo is accused of infringing the copyright of a photographer' s work. Afterwards, Rico deleted the photo and publicly apologized.

[Moral Responsibility Measurement (adapted from Gray & Wegner, 2009)]

1. How responsible do you think Rico is for copyright infringement? (1 = not at all, 7 = very much)
2. How much blame do you think Rico deserves for copyright infringement? (1 = not at all, 7 = very much)

[Agent Type Manipulation Check]

In your opinion, Rico is powered by? (0 = real humans, 1 = artificial intelligence)

[Subjective Socioeconomic Status Measurement (Adler et al. 2000)]

Think of this ladder as representing where people stand in your country. At the top of the ladder are the people who are the best off—those who have the most money, the most education, and the most respected jobs. At the bottom are the people who are the worst off—who have the least money, the least education, and the least respected jobs or no jobs. Where would you place yourself on this ladder? Please choose the number of the rung below (ranging from 1–10), where you think you stand at this time in your life, relative to other people in China.

[Education Level Measurement]

Please indicate your highest level of education: 1 = Junior high school and below, 2 = High school/technical secondary school/technical school/vocational

high school, 3 = College and undergraduate, 4 = Master's degree, 5 = Doctorate and above.

British Experimental Materials

[Virtual AI Group Manipulation Materials]

Rico is a virtual blogger powered by artificial intelligence and algorithm on Twitter. She actively shares her outfit and lifestyle on social media. (Note: virtual blogger is a digital character created in computer graphics software, then given a personality defined by a first-person view of the world, and made accessible on media platforms.)

[Virtual Real Human Group Manipulation Materials]

Rico is a virtual blogger powered by real humans on Twitter. She actively shares her outfit and lifestyle on social media. (Note: a virtual blogger is a digital character created in computer graphics software, then given a personality defined by a first-person view of the world, and made accessible on media platforms.)

[Real Human Group Manipulation Materials]

Rico is a blogger on Twitter. She actively shares her outfit and lifestyle on social media.

[Immoral Behavior Scenario]

Recently, a photo posted by Rico on Twitter is accused of infringing the copyright of a photographer's work. Afterwards, Rico deleted the photo and publicly apologized.

[Moral Responsibility Measurement]

Same as Chinese version.

[Agent Type Manipulation Check]

In your opinion, Rico is powered by? 0 = real humans 1 = artificial intelligence

[Subjective Socioeconomic Status Measurement (Adler et al. 2000)]

Think of this ladder as representing where people stand in your homeland. At the top of the ladder are the people who are the best off -those who have the most money, the most education and the most respected jobs. At the bottom are the people who are the worst off-who have the least money, the least education and the least respected jobs or no jobs. The higher you are on this ladder, the closer you are to the people at the very top; the lower you are, the closer you are to the people at the very bottom. Where would you place yourself on this ladder? Please choose the number of the rung below (ranging from 1–10), where you think you stand at this time in your life, relative to other people in the United States.

[Education Level Measurement]

Please indicate your highest level of education. 1 = Lower degree 2 = High school degree 3 = College degree 4 = Master' s degree 5 = Higher degree, including doctorate and law degree

Experiment 2 Main Measurement Materials

Chinese Experimental Materials

[Virtual Human Group Manipulation Materials]

Same as Experiment 1b.

[Real Human Group Manipulation Materials]

Same as Experiment 1b.

[Immoral Behavior Scenario]

Recently, Rico was exposed for tax evasion on her income from live-streaming product sales. She is currently under investigation.

[Moral Responsibility Measurement (adapted from Gray & Wegner, 2009)]

1. How much responsibility do you think Rico should bear for tax evasion? (1 = no responsibility, 7 = great responsibility)
2. How much blame do you think Rico should bear for tax evasion? (1 = no blame, 7 = much blame)

[Perceived Mental Capacity Measurement (Gray et al., 2011)]

To what extent is Rico capable of the following abilities? (1 = not capable at all, 7 = very capable) self-control, acting morally, planning, communication, memory, thought, feeling pleasure, feeling desire, feeling fear, feeling pain, feeling rage, feeling joy.

[Familiarity with Virtual Humans Measurement (Carlson et al., 2020)]

Please select the appropriate response that best describes your knowledge of virtual bloggers, such as Hatsune Miku, Luo Tianyi, Microsoft Xiaoice, etc. (Note: Virtual bloggers are digital characters created with computer graphics software, given a personality defined by a first-person view of the world, and made accessible on media platforms.) Very unfamiliar / Not at all informed / Know nothing at all Very familiar / Highly informed / Know a great deal.

[Immoral Behavior Severity Measurement]

How serious do you think the behavior of tax evasion is? (1 = not at all serious, 7 = very serious)

U.S. Experimental Materials

[Virtual Human Group Manipulation Materials]

Same as Experiment 1b.

[Real Human Group Manipulation Materials]

Same as Experiment 1b.

[Immoral Behavior Scenario]

Recently, Rico was suspected of tax evasion on her income in livestreaming e-commerce. Now, she is under investigation.

[Moral Responsibility Measurement (adapted from Gray & Wegner, 2009)]

Same as Chinese version.

[Perceived Mental Capacity Measurement (Gray et al., 2011)]

Same as Chinese version.

[Familiarity with Virtual Humans Measurement (Carlson et al., 2020)]

Same as Chinese version.

[Immoral Behavior Severity Measurement]

Same as Chinese version.

Experiment 3 Manipulation and Main Measurement Materials

Chinese Experimental Materials

[Virtual Human Experimental Materials]

Rico, also known as Coco, was born on March 21, 2002. She debuted as a virtual singing and dancing idol in 2021 and has attracted many fans. She has her own dressing style and always follows the latest fashion. Rico often shares her daily life on social media. (Note: Virtual idols are digital characters created with computer graphics software, given a personality defined by a first-person view of the world, and made accessible on media platforms.)

[Immoral Behavior Scenario]

Rico released an original single in March this year. However, this single was found to have plagiarized another singer' s song. Afterwards, Rico made a public apology.

[Moral Punishment Measurement]

1. Fine: To what extent do you think Rico should be fined for plagiarizing? (1 = not at all, 7 = very much)
2. Account suspension: To what extent do you think Rico' s Weibo account should be suspended? (1 = not at all, 7 = very much)

3. Unfollow: Suppose you have been following Rico for a while. Will you choose to unfollow Rico for her plagiarizing? (0 = continue to follow, 1 = unfollow)

[Moral Responsibility Measurement (adapted from Gray & Wegner, 2009)]

1. How much responsibility do you think Rico should bear for plagiarizing? (1 = no responsibility, 7 = great responsibility)
2. How much blame do you think Rico should bear for plagiarizing? (1 = no blame, 7 = much blame)

[Perceived Mental Capacity Measurement]

Same as Experiment 2.

[Subjective Socioeconomic Status Measurement (Adler et al. 2000)]

Same as Experiment 1c.

[Education Level Measurement]

Same as Experiment 1c.

U.S. Experimental Materials

[Virtual Human Experimental Materials]

Rico is a virtual influencer who debuted last year, below is her detailed information. Rico, also known as Coco, was born on March 21, 2002. She debuted as a virtual singing and dancing influencer in May 2021 and has attracted a lot of fans. She has her own dressing style and always follows the latest fashion. Rico often shares her daily life on social media. (Note: a virtual influencer is a digital character created in computer graphics software, then given a personality defined by a first – person view of the world, and made accessible on media platforms.)

[Immoral Behavior Scenario]

The virtual influencer Rico released her original EP in March this year. However, it was found that this EP was plagiarized from another singer. And later, Rico made a public apology.

[Moral Punishment Measurement]

Same as Chinese version.

[Moral Responsibility Measurement]

Same as Chinese version.

[Perceived Mental Capacity Measurement]

Same as Experiment 2.

[Subjective Socioeconomic Status Measurement]

Same as Experiment 1c.

[Education Level Measurement]

Same as Experiment 1c.

Appendix 2: Pilot Study: Cultural Differences in Perceived Mental Capacity

The pilot study aimed to test whether there are significant cultural differences in evaluations of virtual humans' mental capacity. In this experiment, we used British samples to represent Western culture. We predicted that compared to Western culture, people under Chinese culture would evaluate virtual humans' mental capacity more highly.

The experiment recruited 199 British Caucasian participants (80.40% female; M age = 30.62 years, SD age = 5.80 years) and 200 Chinese participants (77.50% female; M age = 30.89 years, SD age = 4.95 years) through Prolific and Credamo, offering small cash rewards. Among British participants, there were 104 in the real human group and 95 in the virtual human group; among Chinese participants, there were 100 in each group. Consistent with Experiment 1a' s manipulation and content, Chinese (British) participants in the real human group saw blogger Rico' s Weibo (Twitter) homepage; those in the virtual human group saw virtual blogger Rico' s Weibo (Twitter) homepage. Then, to measure perceived mental capacity, participants rated Rico' s mental capacity from cognitive agency (Cronbach' s $\alpha = 0.88$) and emotional experience (Cronbach' s $\alpha = 0.95$) dimensions (7-point scale, 1 = not capable, 7 = very capable; Gray et al., 2011; Cronbach' s $\alpha = 0.93$), with random presentation order for each item. Finally, all participants reported gender and age.

A two-way ANOVA was conducted with culture type (British coded as 0, Chinese coded as 1) and blogger type (real human coded as 0, virtual human coded as 1) as independent variables and perceived mental capacity as the dependent variable. Results showed a significant main effect of culture type ($F(1, 395) = 3.88, p = 0.049, p^2 = 0.010$), a significant main effect of blogger type ($F(1, 395) = 48.59, p < 0.001, p^2 = 0.110$), and a significant interaction effect between culture type and blogger type on mental capacity evaluation ($F(1, 395) = 38.00, p < 0.001, p^2 = 0.088$). Chinese people perceived higher mental capacity in virtual humans than British people (M China = 4.57, SD = 1.08, 95%CI = [4.34, 4.80]; M Britain = 3.62, SD = 1.49, 95%CI = [3.39, 3.86]; $F(1, 395) = 32.35, p < 0.001, p^2 = 0.076$). Chinese people perceived similar mental capacity in virtual and real humans ($F(1, 395) = 0.33, p = 0.568$).

When mental capacity was divided into cognitive agency and emotional experience dimensions, there were significant interaction effects between culture type and blogger type on both cognitive agency ($F(1, 395) = 12.26, p = 0.001, p^2 = 0.030$) and emotional experience ($F(1, 395) = 52.25, p < 0.001, p^2 = 0.117$). Specifically, Chinese people perceived higher cognitive agency (M China = 4.76,

SD = 1.01, 95%CI = [4.52, 5.00]; M Britain = 4.20, SD = 1.45, 95%CI = [3.95, 4.45]; $F(1, 395) = 10.32$, $p = 0.001$, $p^2 = 0.025$) and emotional experience (M China = 4.38, SD = 1.33, 95%CI = [4.11, 4.66]; M Britain = 3.04, SD = 1.93, 95%CI = [2.76, 3.33]; $F(1, 395) = 44.70$, $p < 0.001$, $p^2 = 0.102$) in virtual humans. Chinese people perceived no significant differences in cognitive agency ($F(1, 395) = 0.51$, $p = 0.475$) or emotional experience ($F(1, 395) = 2.49$, $p = 0.115$) between virtual and real humans.

After controlling for age and gender, the interaction effect between culture type and blogger type on mental capacity evaluation remained significant ($F(1, 393) = 37.76$, $p < 0.001$, $p^2 = 0.088$), including cognitive agency ($F(1, 393) = 11.85$, $p = 0.001$, $p^2 = 0.029$) and emotional experience ($F(1, 393) = 52.59$, $p < 0.001$, $p^2 = 0.118$). Specifically, Chinese people perceived higher mental capacity in virtual humans than British people ($F(1, 393) = 32.43$, $p < 0.001$, $p^2 = 0.076$), including cognitive agency ($F(1, 393) = 10.22$, $p = 0.002$, $p^2 = 0.025$) and emotional experience ($F(1, 393) = 45.11$, $p < 0.001$, $p^2 = 0.103$). Chinese people perceived no significant differences in mental capacity ($F(1, 393) = 0.32$, $p = 0.579$), cognitive agency ($F(1, 393) = 0.34$, $p = 0.558$), or emotional experience ($F(1, 393) = 2.13$, $p = 0.145$) between virtual and real humans. Therefore, controlling for age and gender did not affect the significance of results. These results indicate that compared to Western culture, people under Chinese culture perceive virtual humans as having higher mental capacity.

Appendix 3: Replication of Mediation Experiment with Male Experimental Materials

Since the virtual and real human experimental materials used in the main text were female, this experiment aimed to replicate the mediation effect results using male experimental materials. The main text has already shown that cultural differences between China and the West do not affect moral responsibility judgments of real humans. Therefore, this experiment focused on moral responsibility judgments of virtual humans. We argued that using male experimental materials would not change the cultural differences in moral responsibility judgments of virtual humans.

The experiment recruited 101 U.S. Caucasian participants (49.50% female; M age = 34.48 years, SD age = 8.58 years) and 100 Chinese participants (56.00% female; M age = 31.49 years, SD age = 7.65 years) through Prolific and Credamo, offering small cash rewards.

Consistent with Experiment 2' s manipulation, this experiment used a male virtual idol (as shown in the figure) and related description: "Rico is a 21-year-old [virtual] idol. Rico' s fan count exceeded 100,000 within just one year. He shares various things happening in his life on social media. His post content sparks intense discussion in the comment section, and he continuously receives thousands of private messages, interacting with fans worldwide by replying to these messages. Virtual idols are digital characters created with computer graphics

software, given a personality defined by a first-person view of the world, and made accessible on media platforms.”

Consistent with Experiment 2, after viewing the description of virtual human Rico, participants were told, “Recently, Rico was exposed for tax evasion on his income from live-streaming product sales. He is currently under investigation.” This experiment used the same four-item moral responsibility scale as Experiment 1b to measure participants’ moral responsibility judgments of Rico (7-point scale, 1 = completely disagree, 7 = completely agree; Cameron et al., 2010; Cronbach’s $\alpha = 0.81$). Similarly, to measure perceived mental capacity, participants rated Rico’s mental capacity from cognitive agency (Cronbach’s $\alpha = 0.92$) and emotional experience (Cronbach’s $\alpha = 0.96$) dimensions (7-point scale, 1 = not capable, 7 = very capable; Gray et al., 2011; Cronbach’s $\alpha = 0.94$). Finally, all participants reported subjective socioeconomic status, education level, gender, and age.

A one-way ANOVA was conducted with culture type (U.S. coded as 0, China coded as 1) as the independent variable and moral responsibility judgment as the dependent variable. Results showed that Chinese people attributed greater moral responsibility to virtual humans than Americans (M China = 5.46, SD = 1.24, 95%CI = [5.22, 5.71]; M U.S. = 4.93, SD = 1.56, 95%CI = [4.62, 5.24]; $F(1, 199) = 7.23$, $p = 0.008$, $p^2 = 0.035$). A one-way ANOVA with mental capacity evaluation as the dependent variable showed that Chinese people perceived higher mental capacity in virtual humans than Americans (M China = 3.97, SD = 1.39, 95%CI = [3.69, 4.24]; M U.S. = 3.32, SD = 1.61, 95%CI = [3.00, 3.64]; $F(1, 199) = 9.40$, $p = 0.002$, $p^2 = 0.045$), including cognitive agency (M China = 4.12, SD = 1.50, 95%CI = [3.82, 4.42]; M U.S. = 3.68, SD = 1.52, 95%CI = [3.38, 3.98]; $F(1, 199) = 4.20$, $p = 0.042$, $p^2 = 0.021$) and emotional experience (M China = 3.82, SD = 1.45, 95%CI = [3.53, 4.10]; M U.S. = 2.95, SD = 2.01, 95%CI = [2.56, 3.35]; $F(1, 199) = 12.26$, $p = 0.001$, $p^2 = 0.058$).

A mediation analysis was conducted using Bootstrapping (PROCESS Model 4; Hayes, 2015) with culture type as the independent variable (U.S. coded as 0, China coded as 1), perceived mental capacity as the mediator, and moral responsibility judgment as the dependent variable, with 5,000 samples and a 95% confidence interval. Results showed that the mediating effect of perceived mental capacity was significant (indirect effect $\beta = 0.16$, SE = 0.06, 95%CI = [0.05, 0.29]). A parallel mediation analysis with cognitive agency and emotional experience as mediators showed that the mediating effect of emotional experience was significant (indirect effect $\beta = 0.31$, SE = 0.12, 95%CI = [0.11, 0.57]), but the mediating effect of cognitive agency was not significant (indirect effect $\beta = -0.07$, SE = 0.06, 95%CI = [-0.20, 0.01]). These results indicate that emotional experience, rather than cognitive agency, in mental capacity is the main factor influencing cultural differences in moral responsibility judgments of virtual humans, replicating Experiment 2’s results.

After controlling for subjective socioeconomic status, education level, gender, and age, the main effects of culture type on moral responsibility judgment ($F(1,$

195) = 8.79, $p = 0.003$, $p^2 = 0.043$) and mental capacity evaluation ($F(1, 195) = 12.59$, $p < 0.001$, $p^2 = 0.061$), including cognitive agency ($F(1, 195) = 4.80$, $p = 0.030$, $p^2 = 0.024$) and emotional experience ($F(1, 195) = 17.75$, $p < 0.001$, $p^2 = 0.083$), remained significant. The mediating effect of perceived mental capacity remained significant (indirect effect $\beta = 0.19$, $SE = 0.07$, $95\%CI = [0.07, 0.34]$), and parallel mediation analysis showed that emotional experience (indirect effect $\beta = 0.37$, $SE = 0.12$, $95\%CI = [0.16, 0.63]$) rather than cognitive agency (indirect effect $\beta = -0.07$, $SE = 0.06$, $95\%CI = [-0.21, 0.02]$) mediated the effect. Therefore, controlling for subjective socioeconomic status, education level, gender, and age did not affect the significance of results.

Appendix 4: Data Results After Controlling for Age and Gender

Experiment 1a Data Results After Controlling for Age and Gender

A regression analysis was conducted with culture type (U.S. coded as 0, China coded as 1) as the independent variable, blogger type (real human coded as 0, virtual human coded as 1) as the moderator, moral responsibility judgment as the dependent variable, and gender and age as control variables. The interaction effect between culture type and blogger type remained significant ($\beta = 0.61$, $SE = 0.25$, $p = 0.017$, $95\%CI = [0.11, 1.11]$). In the real human group, cultural differences were not significant ($\beta = 0.07$, $SE = 0.19$, $p = 0.725$, $95\%CI = [-0.30, 0.43]$). In the virtual human group, Chinese people attributed greater moral responsibility to virtual humans ($\beta = 0.68$, $SE = 0.19$, $p < 0.001$, $95\%CI = [0.31, 1.04]$). In the Chinese participant group, there was no significant difference in moral responsibility judgment between virtual and real humans ($\beta = -0.03$, $SE = 0.18$, $p = 0.858$, $95\%CI = [-0.39, 0.32]$). These results are consistent with the original findings.

Experiment 1b Data Results After Controlling for Age and Gender

A regression analysis was conducted with culture type (British coded as 0, China coded as 1) as the independent variable, blogger type (real human coded as 0, virtual human coded as 1) as the moderator, moral responsibility judgment as the dependent variable, and gender and age as control variables. The interaction effect between culture type and blogger type remained significant ($\beta = 0.80$, $SE = 0.25$, $p = 0.002$, $95\%CI = [0.31, 1.30]$). In the real human group, cultural differences were not significant ($\beta = -0.004$, $SE = 0.18$, $p = 0.982$, $95\%CI = [-0.36, 0.35]$). In the virtual human group, Chinese people attributed greater moral responsibility to virtual humans ($\beta = 0.80$, $SE = 0.18$, $p < 0.001$, $95\%CI = [0.44, 1.16]$). In the Chinese participant group, there was no significant difference in moral responsibility judgment between virtual and real humans ($\beta = -0.28$, $SE = 0.18$, $p = 0.121$, $95\%CI = [-0.63, 0.07]$). These results are consistent with the original findings.

Experiment 1c Data Results After Controlling for Age, Gender, Education Level, and Subjective Socioeconomic Status

An ANOVA was conducted with culture type (British coded as 0, China coded as 1), blogger type (real human coded as 0, virtual human coded as 1), gender, and education level as independent variables, age and socioeconomic status as covariates, and moral responsibility judgment as the dependent variable. The interaction effect between culture type and blogger type remained significant ($F(2, 587) = 12.13, p < 0.001, p^2 = 0.040$). In the real human group, cultural differences were not significant ($F(1, 587) = 2.68, p = 0.102$). In the virtual real human group, Chinese people attributed greater moral responsibility to virtual humans ($F(1, 587) = 64.83, p < 0.001, p^2 = 0.099$). In the virtual AI group, Chinese people attributed greater moral responsibility to virtual humans ($F(1, 587) = 42.94, p < 0.001, p^2 = 0.068$). In the Chinese participant group, there were no significant differences in moral responsibility judgment among the two types of virtual humans and real humans ($F(2, 587) = 1.77, p = 0.171$), with no significant differences in pairwise comparisons ($ps > 0.221$). These results are consistent with the original findings.

Experiment 2 Data Results After Controlling for Age and Gender

A regression analysis was conducted with culture type (U.S. coded as 0, China coded as 1) as the independent variable, blogger type (real human coded as 0, virtual human coded as 1) as the moderator, gender and age as control variables, and moral responsibility judgment as the dependent variable. The interaction effect between culture type and blogger type remained significant ($\beta = 0.94, SE = 0.28, p < 0.001, 95\%CI = [0.39, 1.48]$). In the real human group, cultural differences were not significant ($\beta = 0.28, SE = 0.20, p = 0.162, 95\%CI = [-0.11, 0.67]$). In the virtual human group, Chinese people attributed greater moral responsibility to virtual humans ($\beta = 1.22, SE = 0.20, p < 0.001, 95\%CI = [0.83, 1.61]$).

A regression analysis was conducted with perceived mental capacity as the dependent variable. The interaction effect between culture type and blogger type remained significant ($\beta = 0.98, SE = 0.22, p < 0.001, 95\%CI = [0.54, 1.42]$). In the real human group, cultural differences were not significant ($\beta = -0.15, SE = 0.16, p = 0.357, 95\%CI = [-0.46, 0.17]$). In the virtual human group, Chinese people perceived significantly higher mental capacity in virtual humans ($\beta = 0.83, SE = 0.16, p < 0.001, 95\%CI = [0.52, 1.14]$).

When mental capacity was divided into cognitive agency and emotional experience, a regression analysis was conducted with cognitive agency as the dependent variable. The interaction effect between culture type and blogger type remained significant ($\beta = 0.74, SE = 0.23, p = 0.002, 95\%CI = [0.27, 1.20]$). In the real human group, cultural differences were not significant ($\beta = -0.08, SE = 0.17, p = 0.618, 95\%CI = [-0.42, 0.25]$). In the virtual human group, Chinese people perceived significantly higher cognitive agency in virtual humans ($\beta = 0.65, SE$

= 0.17, $p < 0.001$, 95%CI = [0.32, 0.98]). A regression analysis was conducted with emotional experience as the dependent variable. The interaction effect between culture type and blogger type remained significant ($\beta = 1.22$, SE = 0.27, $p < 0.001$, 95%CI = [0.70, 1.75]). In the real human group, cultural differences were not significant ($\beta = -0.21$, SE = 0.19, $p = 0.274$, 95%CI = [-0.59, 0.17]). In the virtual human group, Chinese people perceived significantly higher emotional experience in virtual humans ($\beta = 1.01$, SE = 0.19, $p < 0.001$, 95%CI = [0.64, 1.39]).

The moderated mediation effect of perceived mental capacity remained significant (indirect effect = 0.35, SE = 0.11, 95%CI = [0.16, 0.59]). In the real human group, the mediating effect of perceived mental capacity was not significant (indirect effect = -0.05, SE = 0.05, 95%CI = [-0.17, 0.45]). In the virtual human group, the mediating effect of perceived mental capacity was significant (indirect effect = 0.29, SE = 0.09, 95%CI = [0.14, 0.48]). A parallel mediation analysis with cognitive agency and emotional experience as mediators showed that the moderated mediation effect of emotional experience remained significant (indirect effect = 0.47, SE = 0.14, 95%CI = [0.22, 0.78]). In the real human group, the mediating effect of emotional experience was not significant (indirect effect = -0.08, SE = 0.07, 95%CI = [-0.22, 0.04]). In the virtual human group, the mediating effect of emotional experience was significant (indirect effect = 0.39, SE = 0.12, 95%CI = [0.19, 0.64]). The moderated mediation effect of cognitive agency was not significant (indirect effect = -0.05, SE = 0.06, 95%CI = [-0.19, 0.07]). The significance and direction of all results were consistent with the original findings.

Experiment 3 Data Results After Controlling for Age, Gender, Education Level, and Subjective Socioeconomic Status

ANOVAs were conducted with culture type (U.S. coded as 0, China coded as 1), gender, and education level as independent variables, age and socioeconomic status as covariates, and “fine” ($F(1, 192) = 29.90$, $p < 0.001$, $p^2 = 0.135$), moral responsibility judgment ($F(1, 192) = 10.52$, $p = 0.001$, $p^2 = 0.052$), and perceived mental capacity ($F(1, 192) = 35.16$, $p < 0.001$, $p^2 = 0.155$; cognitive agency: $F(1, 192) = 11.46$, $p = 0.001$, $p^2 = 0.056$; emotional experience: $F(1, 192) = 44.63$, $p < 0.001$, $p^2 = 0.189$) as dependent variables. The main effects of culture type were all significant. However, when “suspend account” was the dependent variable, the main effect of culture type was marginally significant ($F(1, 192) = 3.47$, $p = 0.064$, $p^2 = 0.018$). When “unfollow” was the dependent variable, with culture type, gender, and education level as categorical independent variables and age and socioeconomic status as covariates, the main effect of culture type was also significant ($B = 0.83$, SE = 0.34, Wald $\chi^2 = 5.93$, $p = 0.015$, $\text{Exp}(B) = 2.30$). Therefore, the results are basically consistent with the original findings.

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

Source: ChinaXiv – Machine translation. Verify with original.