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Humanizing Machines: Anthropomorphization of Slot Machines Increases Gambling

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Do people gamble more on slot machines if they think that they are playing against humanlike minds rather than mathematical algorithms? Research has shown that people have a strong cognitive tendency to imbue humanlike mental states to nonhuman entities (i.e., anthropomorphism). The present research tested whether anthropomorphizing slot machines would increase gambling. Four studies manipulated slot machine anthropomorphization and found that exposing people to an anthropomorphized description of a slot machine increased gambling behavior and reduced gambling outcomes. Such findings emerged using tasks that focused on gambling behavior (Studies 1 to 3) as well as in experimental paradigms that included gambling outcomes (Studies 2 to 4). We found that gambling outcomes decrease because participants primed with the anthropomorphic slot machine gambled more (Study 4). Furthermore, we found that high-arousal positive emotions (e.g., feeling excited) played a role in the effect of anthropomorphism on gambling behavior (Studies 3 and 4). Our research indicates that the psychological process of gambling-machine anthropomorphism can be advantageous for the gaming industry; however, this may come at great expense for gamblers' (and their families') economic resources and psychological well-being.

Keywords: anthropomorphism, social cognition, mind attribution, slot machines, gambling

> They (slot machines) sit there like young courtesans,
>
> promising pleasures undreamed of,
>
> your deepest desires fulfilled, all lusts satiated.
>
> —Frank Scoblete (b. 1947)

As the quote by famous gambler Frank Scoblete suggests, players might be prone to perceive slot machines as humanlike—capable of seducing millions of people around the world with their promise of fulfilling their dreams—rather than as inanimate objects, programmed with an overall set amount of payouts. Perhaps it is not coincidental that so many anthropomorphic representations (including "sexy" women, muscular men, cartoon characters, and pharaohs) appear on slot machines in casinos and on gambling websites. It is possible that—similar to how in ancient mythology challengers perceived the sphinx as possessing a humanlike mind and intelligence—the gambling industry is selling customers a challenge against a mind rather than just a machine (or a computer algorithm).[1] Based on these observations and considering recent theorizing on anthropomorphism and social perception (Epley, Waytz, & Cacioppo, 2007), we investigated the hypothesis that anthropomorphizing slot machines would cause an increase in gambling.

Slot Machines

It is widely known that excessive gambling can have a detrimental impact on a person's life, including their health, employment, family, and interpersonal relationships (Griffiths, 2004). In recent years, we have witnessed a continuous increase in slot machine (also referred to as "fruit machines" in the United Kingdom, and "poker machines" in Australia and New Zealand; see Figure 1A for an illustration of the interface of these devices) gambling. What is more, gambling on slot machines has been described as one of the most addictive forms of gambling (Griffiths, 2004; Turner & Horbay, 2004).

Despite their harmful effects, the number of slot machines worldwide is increasing: Slot machines can be found in casinos (where they are often the most popular gambling game), racetracks, local bars, and on websites (e.g., online slot machines). Managers primarily invest in slot machines because they are profitable (even considering other gambling games such as roulette and blackjack). Modern slot machines are controlled using software that runs an algorithm designed to achieve a certain overall payback percentage, which is set at the factory when the software is written (Turner & Horbay, 2004). The

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[1] This possibility was initially conceived through the observation of a slot machine in a local bar whose interface was titled "Revenge of Cheope."

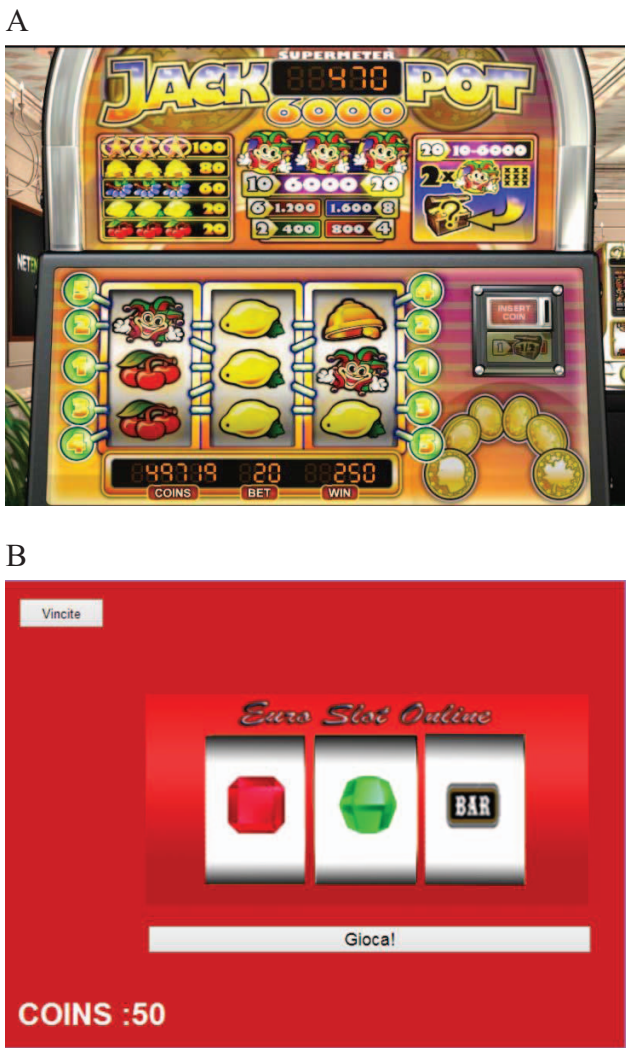

Figure 1. (A) An example of an interface similar to what we used in Study 1, Study 2, and Study 3; image by Panzerhorgen (own work; GFDL; http://www.gnu.org/copyleft/fdl.html) or CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0), via Wikimedia Commons. (B) The interface created by the authors and used for Study 4. See the online article for the color version of this figure.

payback percentage can vary (usually somewhere around 80%; for the United Kingdom, see U.K. Gambling Commission, 2013; for a U.S. state, see Pacode.com., 2015) according to national jurisdictions, but any number under 100 means that the casinos, gaming operators, and website owners are the real winners. It has been estimated that slot machines generate over 70% of the average casino's income (Chen, Shoemaker, & Zemke, 2013; Smith & Wynne, 2004).

If the reasons leading operators to invest money in slot machines are clear, more research is needed to uncover the cognitive and motivational factors that make slot machines so attractive to gamblers (Griffiths, 1994, 2004). The present research addressed this issue considering recent work on anthropomorphism and mind attribution.

Anthropomorphism

Anthropomorphism is the tendency to ascribe humanlike features, such as mind states, intentions, free will, consciousness, and emotions (Epley et al., 2007) to nonhuman agents. Targets of anthropomorphism range from inanimate objects (Chandler & Schwarz, 2010; Hart, Jones, & Royne, 2013) to religious agents (Morewedge & Clear, 2008), to all types of machines (Bartneck, Kulić, Croft, & Zoghbi, 2009), animals (Chartrand, Fitzsimons, & Fitzsimons, 2008), and nature (Sacchi, Riva, & Brambilla, 2013).

Anthropomorphism permeates our cognitive life, as it satisfies important cognitive and motivational needs (Epley et al., 2007; Epley, Waytz, Akalis, & Cacioppo, 2008; Gray, Gray, & Wegner, 2007; Waytz, Morewedge, et al., 2010) and may have implications for our social life (Sacchi et al., 2013). Recent conceptualizations of anthropomorphism identified two main determinants: effectance motivation and sociality motivation (Epley et al., 2007). According to the former, anthropomorphism makes the agent's behavior understandable and predictable, as this behavior is considered to be driven by intentionality (Epley et al., 2007). Thus, effectance motivation refers to people's desire to understand their environments. Research has shown that individuals who have a stable need for control seem to be especially likely to endorse anthropomorphic beliefs (Epley et al., 2008). According to sociality motivation, anthropomorphism produces a sense of social connection with another humanlike mind. Sociality motivation thus refers to the fundamental need for social connection (Baumeister & Leary, 1995) as well as people's vigilance for agents (including both human and nonhuman beings) that can potentially fulfill this fundamental need. Research has found support for this prediction by showing that people who feel chronically lonely are more likely to anthropomorphize nonhuman agents (i.e., pets; see Epley et al., 2008).

Among different forms of anthropomorphization, the projection of humanlike features on inanimate objects and machines is a widespread cognitive tendency (e.g., Bartneck et al., 2009; Eyssel & Kuchenbrandt, 2012). Whereas the formation of parasocial relationships between humans and objects was once considered something peculiar to child development (Winnicott, 1953), recent evidence suggests that adults report entering into relationships with objects as well (Gardner & Knowles, 2008). Similarly, people often reason about anthropomorphized objects as if they were human beings. Research has shown that people's behavior toward technological agents follow the rules they adopt in their social lives (Nass & Moon, 2000; Waytz, Cacioppo, & Epley, 2010). For instance, human gender stereotypes can be activated merely by the presence of a male versus a female computer voice. In one study, participants rated a computerized male voice as more compelling than a computerized female voice, whereas a computerized female was rated as friendlier than a male computerized voice (Nass, Moon, & Green, 1997). Furthermore, prior findings revealed that people are prone to apply human social categories such as ethnicity to computers (Nass & Moon, 2000), and to more strongly anthropomorphize robots that belong to their own ethnic in-group (Eyssel & Kuchenbrandt, 2012).

Crucial to the purpose of the present research, slot machine anthropomorphization may have important psychological and behavioral consequences. Previous research suggested the possibility that slot machine anthropomorphism could be linked to gambling

behavior. Walker (1992) analyzed the verbalizations people made while playing with several electronic devices. Crucially, among these verbalizations were statements that suggested the "personification of the machine." Subsequent research on regular gamblers has further suggested that one of their most common verbalizations is the attribution of human features to the gambling device (e.g., attributing emotions to the device, insulting the device; Delfabbro & Winefield, 2000; see also Griffiths, 1994). A more recent study focusing on slot machine anthropomorphization also reported an interactive effect among people's feelings of power, the percentage of gambling winnings, and anthropomorphization (Kim & McGill, 2011). Those with high social power were more likely to anthropomorphize slot machines after winning than after losing. However, none of these studies experimentally tested the hypothesis that anthropomorphizing slot machines would lead people to gamble more or the reasons why such effect might occur, which leads us to the present research.

The Present Research

Building on prior research into anthropomorphism, the present research investigated the psychological and behavioral consequences of anthropomorphizing inanimate objects, particularly slot machines. Based on recent work on anthropomorphism (Aaker, Fournier, & Brasel, 2004; Epley et al., 2007; Schultz, Kleine, & Kernan, 1989; Wang, Baker, Wagner, & Wakefield, 2007), we tested the hypothesis that anthropomorphism and gambling are linked, and—more specifically—that humanizing a slot machine can increase gambling behavior. We expect that if a person has the perception that a gambling device possesses a humanlike mind, it would lead them to gamble more compared with those who have the perception that the same gambling device is based on an algorithm preprogrammed to deliver a certain number of wins and losses. The latter description is what a slot machine is in actuality: a computer algorithm that determines where the pictures on the reels will stop and when to pay out (Turner & Horbay, 2004). However, the pervasive cognitive tendency to attribute humanlike features to nonhuman entities (e.g., including machines) might lead players to perceive a gambling session as a challenge against a person rather than against a preprogrammed device.

More specifically, building on prior research suggesting that gamblers experience more excitement during gambling and higher levels of depressive moods before gambling than nonregular gamblers (Griffiths, 1995), together with the literature showing that people with a strong sense of social connection with a specific object tend to feel stronger emotions toward it (e.g., Aaker et al., 2004; Schultz et al., 1989; Wang et al., 2007), we anticipated that the emotional experience during the game could account for the relationship between slot machine anthropomorphism and gambling behavior. In particular, we expected that people exposed to an anthropomorphic description of a slot machine would experience a higher emotional reaction, which in turn would lead them to gamble longer.

Overall, the current research tested the hypothesis that anthropomorphizing slot machines would lead people to gamble more. More specifically, we tested (a) whether anthropomorphism and gambling behavior are linked, (b) whether anthropomorphizing slot machines increases gambling behavior, (c) whether anthropomorphism affects the gambling outcomes (i.e., the actual winnings), and (d) whether the emotional experience during gambling accounts for the possible link between anthropomorphism and gambling behavior.

Preliminary Study

We conducted a preliminary study to explore whether anthropomorphism could be linked to gambling behavior. To this effect, we conducted a quasi-experiment in which we asked a group of regular players and an equivalent group of nonregular players to rate slot machines on several human traits.

Method

Participants. Participants were a group of 15 regular slot machine players (one female; M age = 58.07 years, SD = 14.55) and a group of 15 nonregular slot machine players (one female; M age = 55.47 years, SD = 13.88). Both regular and nonregular players were recruited through snowball sampling among regular and nonregular slot machine players.

Materials and procedure. Participants in both groups were asked to complete a questionnaire that included a measure of participants' frequency of slot machine play (i.e., "How often do you play slot machines?"—from *less than once a year* to *every day*) and a measure of participants' expenditure on slot machines (i.e., "On average, how much money do you spend weekly playing slot machines?"). The participants were then asked to express their agreement on 15 items designed to assess their tendency to anthropomorphize slot machines (e.g., "The slot machine acts according to its own intentions" and "The slot machine experiences emotions"; adapted from Waytz, Cacioppo, et al., 2010; see the Appendix for the complete item descriptions). Responses were recorded on a 1 (*totally disagree*) to 5 (*totally agree*) scale and were averaged to create an overall index of slot machine anthropomorphization (α = .84).

Results and Discussion

All regular players indicated that they usually played at least once a week. All nonregular players indicated that they usually played less than once a year. The regular players reported an average weekly expenditure of €103.67 (SD = 124.26), with a minimum of €5 per week and a maximum of €350 per week. All nonregular players reported no weekly expenditure (€0) for slot machine play.

Next, we computed a t test comparing the two groups. Our results showed that regular slot machine players ascribed human traits to slot machines (M = 2.95, SD = .73) more than nonregular slot machine players (M = 1.94, SD = .62), $t(28) = 4.09$, $p < .001$, d = 1.49, 95% confidence interval (CI) [0.68, 2.30]. Furthermore, we found that the tendency to attribute a humanlike mind to gambling devices and the self-reported frequency of play were positively related, $r = .63$, $p < .001$. Thus, our preliminary study suggested that, within a community sample, gambling behavior and the tendency to attribute human traits to gambling machines might be linked.

Study 1

Study 1 was designed as the first test of our hypothesis that anthropomorphizing slot machines increases gambling behavior.

Indeed, our preliminary study leaves the question of whether slot machine anthropomorphism per se can increase people's gambling behavior completely unanswered. Thus, in Study 1, we manipulated slot machine anthropomorphism and then measured people's actual gambling behavior. We predicted that people would gamble more when they were led to perceive the machine in an anthropomorphic way.

Method

Participants and design. Eighty-five participants (36 female; *M* age = 26.26 years, *SD* = 8.12) volunteered to participate in this study. The experiment used a one-way, two-level, between-subjects design. The independent variable was being primed about slot machines anthropomorphically (vs. nonanthropomorphically). The dependent variable was the number of spins that the participants made while interacting with an authentic online slot machine.

Materials and procedure. In Study 1, the effect of slot machine anthropomorphization on gambling behavior was tested through a cover story. Participants were tested individually and were told that the study was part of a market research program. More specifically, participants were informed that the researchers were interested in the evaluation of the graphical features of slot machines. For this purpose, participants were told that they could interact with a slot machine, ostensibly to collect their impressions concerning the graphical features of the slot machine. They read a description on the history and the dissemination of the slot machine on a laptop computer screen. They were then presented with a series of seven images of slot machine interfaces, including the one they were connected to later on in the experiment. Then half of the participants (i.e., those in the anthropomorphism condition) were presented with the following text on a single slide:

> Remember that when you play with a slot machine, you don't need to implement any particular strategy. Indeed, the slot machine can decide whether you will win or lose a series of bets any time she wants. Sometimes, she may choose to make fun of you, leaving you empty-handed for several bets; other times, she might want to reward you with a win. In any case, the slot machine will always choose what will happen. You just have to start playing and see what happens.

The other half of participants (i.e., those in the nonanthropomorphism condition) were presented with the following text on a single slide:

> Remember that when you play with a slot machine, you don't need to implement any particular strategy. Indeed, the slot machine is controlled by a mathematical algorithm that is programmed to deliver a certain overall number of wins and losses. Based on this algorithm, you can win or lose a series of bets. In any case, the outcome of each turn of the reels is always run by a computer algorithm. You just have to start playing and see what happens.

These texts were based on items related to intention and cognition, which are included in the Mind Attribution Scale (Kozak, Marsh, & Wegner, 2006; see also Waytz, Cacioppo, et al., 2010) that is generally adopted to assess anthropomorphization. Participants were randomly assigned to one of the two experimental conditions. The remaining part of the instructions was identical in the two conditions. After reading it, participants were reminded that their task was to evaluate the graphical features of a slot machine interface. To complete the task, they were told they could only use two keys while interacting with a real online slot machine: "Enter" to spin the reels, or "Esc" to quit the game. Participants were told that they could spend as much time as they wanted interacting with the slot machine and that they could quit the game whenever they wanted. Participants in both conditions were presented with an actual online slot machine website[2] (see Figure 1A for an illustration of an interface similar to that used in Study 1). Every time they pressed the "Enter" button, the reels on the screen spun and the participant could see whether they had won or lost points on the slot machine interface. A custom-made application running in the background recorded the number of times each participant pressed the "Enter" key before quitting the slot machine.

When participants decided to quit the game (by pressing the "Esc" key), they were presented with a series of questions. In actuality, no questions related to the graphical features of the slot machine were asked. They were asked to complete 15 items assessing their tendency to ascribe the slot machine with human mental states such as intention, consciousness, free will, and the capacity to experience emotions (e.g., "The slot machine acts according to its own intentions"; $\alpha = .86$; see Appendix). Responses were recorded on a 1 (*totally disagree*) to 5 (*totally agree*) scale and were averaged to create an overall index of gambling machine anthropomorphism. Finally, participants' demographic data (i.e., age, sex, and nationality) were collected. At the end of the experiment, each participant was debriefed and the purpose of the study was explained in detail.

Results and Discussion

First, in order to check the effectiveness of our manipulation, we computed an independent samples *t* test on anthropomorphism scores, comparing the two experimental groups. The analysis revealed that participants anthropomorphized the slot machine more in the anthropomorphism condition ($M = 2.53$, $SD = .70$) than in the nonanthropomorphism condition ($M = 2.09$, $SD = .68$), $t(83) = 2.91$, $p = .005$, $d = .64$, 95% CI [0.20, 1.07].

Then, we computed a second *t* test comparing the two experimental conditions on the critical dependent variable, that is, the number of reel spins made by participants. The analysis showed that participants in the anthropomorphism condition spun the reels more times ($M = 31.88$, $SD = 17.64$) than the participants in the nonanthropomorphism condition ($M = 24.19$, $SD = 13.42$), $t(83) = 2.27$, $p = .026$, $d = .49$, 95% CI [0.06, 0.92]. Thus, presenting a slot machine in an anthropomorphic way increased gambling behavior. These findings suggest that presenting a gambling game in an anthropomorphic manner might affect people's gambling behavior. Indeed, a few lines of text priming participants to attribute a humanlike mind to a gambling device were enough to increase the time participants spent with the device.

Study 2

Study 1 suggested that priming people to perceive a gambling device anthropomorphically caused an increase in gambling be-

[2] To access the online slot machine, see http://www.casinoscompared.co.uk/freeplay.asp?listing=57.

havior. However, in Study 1, the only cost for participants' gambling was their time, that is, the more they chose to gamble the longer they spent conducting the experiment. Thus, an important motivational force was missing in our paradigm, namely, the possibility of winning or losing actual money on the slot machine. Indeed, Study 1 did not test whether the presence of money would change the way in which anthropomorphism affects gambling behavior. For instance, it is possible that the strong motivational force of money would reduce or even nullify the effect of anthropomorphism on gambling. To address this important limitation, in Study 2, we gave participants the chance to bet actual money to further test our prediction that slot machine anthropomorphization increases gambling behavior. Participants received an initial amount of money and were then given the chance to win (or lose) more money on the slot machine. We expected that people would gamble more when they were led to perceive the machine anthropomorphically, even when money was introduced as a reward.

Method

Participants and design. Fifty participants[3] (34 female; *M* age = 23.76 years, *SD* = 4.78) agreed to volunteer to participate in this study. Similar to Study 1, the experiment used a one-way, two-level, between-subjects design. The independent variable was being primed about slot machines anthropomorphically (vs. nonanthropomorphically). The dependent variable was the number of spins that the participants made while interacting with an authentic online slot machine.

Materials and procedure. Presented on a computer screen, the participants read that the researchers were interested in their experience of playing with a slot machine. The cover story related to the evaluation of the graphics features of the slot machine was not used in Study 2 (or in the following studies). Instead, participants read a brief description on the history and the dissemination of the slot machine. Next, they were instructed that they would start their game session with 750 points and that this initial score could increase or decrease every time they spun the reels of the slot machine. Participants were informed that they had to spin the reels once at the beginning of the session; after this, they could choose how long to play for and when to stop. The amount of money participants won at the end of the experiment corresponded to the score they got on the slot machine at the time they decided to end their gambling session. The equivalence between the slot machine score and money was based on a conversion table that was always visible to participants. The maximum possible payout was €20 (for scores above 3,500 points), whereas the minimum possible payout was zero (for scores below 149 points). All participants started their game session with 750 points that corresponded on the conversion table to €5.

After being informed of the correspondence between the scores on the slot machine and money, participants were randomly assigned to read the same descriptions (anthropomorphism condition vs. nonanthropomorphism condition) of the slot machine used in Study 1. Participants were then automatically connected with a real slot machine website (see Figure 1A for an example of an interface similar to the one that was used in this study) and reminded they could interact with the slot machine as long as they wanted. However, this time, when participants decided to quit the game, they had to notify the experimenter, who could read the final score before pressing the "Esc" key. Finally, participants were asked to complete the 15 items assessing their tendency to anthropomorphize the slot machine (e.g., "The slot machine has consciousness"; $\alpha = .85$; see Appendix for the item descriptions) and to report their demographic data (i.e., age, sex, and nationality). At the end of the experiment, each participant received the amount of money they won, was debriefed, and the purpose of the study was explained in detail.

Results and Discussion

First, we checked the effectiveness of our manipulation by computing an independent samples *t* test on anthropomorphism scores, comparing the two experimental groups. The analysis revealed that participants anthropomorphized the slot machine more in the anthropomorphism condition ($M = 2.50$, $SD = .67$) than in the nonanthropomorphism condition ($M = 1.98$, $SD = .56$), $t(48) = 2.93$, $p = .004$, $d = .84$, 95% CI [0.26, 1.41].

Then, we computed a second *t* test comparing the two experimental conditions on the number of reel spins made by participants. The analysis showed that participants in the anthropomorphism condition spun the reels more times ($M = 66.69$, $SD = 33.47$) than the participants in the nonanthropomorphism condition ($M = 46.54$, $SD = 29.51$), $t(48) = 2.25$, $p = .029$, $d = .64$, 95% CI [0.07, 1.21]. Thus, replicating the findings of Study 1, we found that even when the task involved monetary reinforcement, describing a slot machine in an anthropomorphic manner increased gambling behavior.

We further investigated in an exploratory way whether our manipulation affected not only the number of spins participants made but also the amount of money (corresponding to the slot machine scores) that they won (or lost). To do so, we computed another *t* test comparing the two experimental conditions on the amount of money participants received. The analysis showed no statistically significant differences between the money lost by participants primed with the anthropomorphic slot machine ($M = 3.15$ euros, $SD = 3.25$) and those lost by participants who were primed with the nonanthropomorphic slot machine ($M = 4.38$ euros, $SD = 2.80$), $t(48) = 1.42$, $p = .162$, $d = .40$, 95% CI [−0.96, 0.16]. Unsurprisingly, we noted that on average participants of both groups completed their gaming session with less money than those given at the beginning of the experimental session (i.e., €5).

In sum, extending our previous findings, Study 2 showed that presenting a slot machine in an anthropomorphic manner increased gambling behavior, even when participants were gambling with real money. The similarity of the findings in Study 1 and Study 2 suggests that the experimental setting adopted in Study 1 (e.g., slot machine score visible on the screen without any involvement of monetary reinforcement) can be considered a good proxy to study

[3] At the end of the experiment, participants were asked whether they had ever played on a slot machine at least once in their life. Of 50 participants, 35 (70%) answered "no," whereas the remaining 15 (30%) answered "yes" (i.e., that they had played on a slot machine at least once in their life). Those who answered "yes" were then asked how often they played on slot machines. Fourteen participants reported that they played less than once per year, whereas the remaining participant ($N = 1$) reported that s/he played less than once per month. None reported a higher frequency of slot machine playing.

the motivational and emotional factors involved when gambling on a slot machine.

However, we found no evidence for a link between slot machine anthropomorphization and greater monetary losses. This remains a plausible hypothesis, considering that slot machines are programmed to achieve a certain overall payback percentage, which is always set to make the slot machine operators win over time (Pacode.com., 2015; U.K. Gambling Commission, 2013). Thus, in the long run, making people gamble more on a slot machine should result in greater monetary losses for the gamblers and greater gains for the slot machine operators.

Study 3

Study 3 aimed to further replicate the effect of slot machine anthropomorphization on gambling behavior and explore the mediating mechanism driving this effect. Thus, in Study 3, we again manipulated slot machine anthropomorphism and then measured people's gambling behavior. Furthermore, in Study 3 we tested whether the emotional experience during the game could account for the relationship between slot machine anthropomorphism and gambling behavior. More specifically, we expected that people exposed to an anthropomorphic description of a slot machine would experience a higher emotional reaction, which in turn would lead them to gamble longer.

Method

Participants and design. Eighty participants[4] (44 female; *M* age = 25.65 years, *SD* = 6.24) agreed to volunteer to participate in this study. The experiment used a one-way, two-level, between-subjects design. The independent variable was being primed about slot machines anthropomorphically (vs. nonanthropomorphically). The dependent variables were the number of spins that the participants made while interacting with an online slot machine and the participants' self-reported emotional experiences during the game.

Materials and procedure. Participants were randomly assigned to read the same descriptions (anthropomorphism condition vs. non anthropomorphism condition) of the slot machine used in Studies 1 and 2. Participants were then automatically connected with a real slot machine website (see Figure 1A for an example of an interface similar to the one that was used in this study) and were informed they could interact with the slot machine for as long as they wanted. When participants decided to quit the game (by pressing the "Esc" key), they were presented with a series of questions. First, they were asked to complete 15 items assessing their tendency to ascribe the slot machine human mental states such as intention, consciousness, free will, and the capacity to experience emotions (e.g., "The slot machine has free will"; α = .96). Next, participants rated their emotional experience during the game using three items of positive emotions (i.e., "The gaming experience was fun"; "The gaming experience was exciting"; "The gaming experience was stimulating"; α = .95) and three items of negative emotions (i.e., "The gaming experience made me angry"; "The gaming experience made me furious"; "The gaming experience was very irritating"; α = .80). Responses were recorded on a 1 (*totally disagree*) to 5 (*totally agree*) scale and were averaged to create an overall index of gambling-machine anthropomorphism, an overall index of positive emotions, and an overall index of negative emotions. Finally, participants' demographic data (i.e., age, sex, and nationality) were collected. At the end of the experiment, each participant was debriefed and the purpose of the study was explained in detail.

Results and Discussion

In order to check the manipulation effectiveness, we computed an independent samples *t* test on anthropomorphism scores, comparing the two experimental groups. The analysis revealed that participants anthropomorphized the slot machine more in the anthropomorphism condition ($M = 2.94$, $SD = .69$) than in the nonanthropomorphism condition ($M = 1.60$, $SD = .46$), $t(78) = 10.32$, $p < .001$, $d = 2.29$, 95% CI [1.72, 2.85].

Then, we computed a second *t* test comparing the two experimental conditions on the number of reel spins made by participants. The analysis showed that participants in the anthropomorphism condition spun the reels more times ($M = 28.23$, $SD = 11.65$) than the participants in the nonanthropomorphism condition ($M = 15.63$, $SD = 8.35$), $t(78) = 5.56$, $p < .001$, $d = 1.24$, 95% CI [0.76, 1.72]. Replicating the findings of Studies 1 and 2, we again found that presenting a slot machine in an anthropomorphic manner increased gambling behavior.

We then computed a third *t* test comparing the two experimental conditions on the self-reported emotional reaction, considering both positive and negative emotions. The analysis showed that participants in the anthropomorphism condition reported higher levels of both positive ($M = 2.91$, $SD = .94$) and negative emotions ($M = 1.78$, $SD = .73$) compared with the participants in the nonanthropomorphism condition (for positive emotions, $M = 1.76$, $SD = .91$; for negative emotions, $M = 1.23$, $SD = .32$), (for positive emotions, $t[78] = 5.57$, $p < .001$, $d = 1.24$, 95% CI [0.76, 1.72]; for negative emotions, $t[78] = 4.38$, $p < .001$, $d = .98$, 95% CI [0.51, 1.44]. Thus, imbuing slot machines with human characteristics and mental states led participants of Study 3 to report a stronger emotional reaction (including both positive and negative emotions) during the gambling period.

Finally, we conducted mediational analyses to test for a possible mechanism that might account for the effects of anthropomorphism (coded as low anthropomorphism = −1, high anthropomorphism = 1) on gambling behavior. The manipulation of slot machine anthropomorphism predicted gambling behavior ($B = 6.30$, $SE = 1.13$, $p < .001$). Furthermore, the manipulation of slot machine anthropomorphism positively predicted both positive ($B = 0.58$, $SE = .10$, $p < .001$) and negative ($B = .28$, $SE = .06$, $p < .001$) emotions. Finally, when both positive and negative emotions were included in the regression equation, both positive ($B = 6.93$, $SE = .99$, $p < .001$) and negative ($B = 3.74$, $SE = 1.62$, $p = .024$) emotions predicted the gambling behavior, whereas the direct effect of the manipulation of slot machine anthropomorphism on gambling behavior was no longer significant ($B = 1.29$, $SE = 1.18$, $p = .28$).

[4] Participants were asked whether they had ever played on a slot machine at least once in their life. Out of 80 participants, 69 (86%) reported "no," whereas the remaining 11 (14%) reported they had played on a slot machine at least once in their life. Of the latter group of participants, eight reported that they played less than once per year, whereas the remaining participants ($n = 3$) reported that they played less than once per month. None reported a higher frequency of slot machine playing.

To test for mediation, we employed the bootstrapping method developed by Preacher and Hayes (2008). The analysis provided support for the mediating role of positive emotions ($B = 3.98$, $SE = 1.02$; 95% CI [2.40, 6.57]) but not of negative emotions ($B = 1.03$, $SE = 0.75$; 95% CI [–.36, 2.54]; 1,000 bootstrap resamples). This finding suggested that although slot machine anthropomorphization increased the experience of both positive and negative emotions, only the experience of positive emotions (e.g., "The gaming experience was exciting") mediated the direct effect of anthropomorphism on gambling behavior.

In sum, Study 3 further corroborates our main prediction, showing that leading people to perceive a gambling device in an anthropomorphic manner generally increases gambling behavior. Furthermore, Study 3 explores a mechanism that could account for the effect, providing initial evidence of a link between the anthropomorphism of slot machines with participants' emotional experience and their actual gambling behavior. Specifically, we found that slot machine anthropomorphism increases the experience of positive emotions (e.g., excitement, fun), which in turn leads people to gamble more.

Study 4

Across three studies, we tested the possibility that mind attribution can affect gambling behavior. We found that when people are confronted with a slot machine described in humanizing terms (e.g., "The slot machine can decide whether you will win or lose"), gambling behavior increases. We also found that this effect held even when the task involved monetary reinforcement. However, the studies conducted so far did not provide conclusive evidence related to the link between slot machine anthropomorphization and gambling outcomes (e.g., people's actual winnings). Furthermore, we found some evidence for a possible link between the self-reported emotional experience during the game and gambling behavior; however, this evidence was obtained through an ad hoc created measure of emotions. Furthermore, this scale included only high-arousal emotions (e.g., "The gaming experience was exciting"; "The game experience was very irritating"), whereas low-arousal emotions were not considered. Finally, another limitation of the studies conducted so far is the low statistical power. To address these issues, we conducted Study 4.

The aim of Study 4 was to test the predictions of the current research and its derived assumptions in a properly powered sample of participants. To do so, we first conducted an a priori power analysis for sample size estimation (using GPower 3.1; Faul, Erdfelder, Lang, & Buchner, 2007), with $\alpha = .01$ and power = .80, which suggested that the projected sample size needed to detect a medium effect size ($d = .50$) was approximately $N = 192$ for a between-groups comparison.

Thus, Study 4 tested again the main prediction of the current study, namely, that anthropomorphizing slot machines would increase gambling behavior. Furthermore, Study 4 tested the assumption that anthropomorphizing slot machines would not only affect gambling behavior but also gambling outcomes (i.e., the actual winnings). Specifically, we expected that the anthropomorphization of slot machines would make participants gamble more, which in turn would decrease participants' winnings at the slot machine. Finally, using a validated measure of emotions, Study 4 tested whether subcategories of emotions (i.e., positive and negative emotions, with high or low arousal) could account for the link between slot machine anthropomorphization and gambling behavior. Again, we expected that the self-reported emotional experience during the game would account for the effect of anthropomorphism on gambling behavior.

Method

Participants and design. Two hundred participants[5] (83 female; M age = 35.41 years, SD = 15.33) participated on a voluntary basis. Similar to our previous studies, the experiment used a one-way, two-level, between-subjects design. The independent variable was being primed about slot machines anthropomorphically (vs. nonanthropomorphically); the dependent variables were (a) the number of spins that the participants made while interacting with a slot machine, (b) the points scored by each participants at the end of the game, (c) the actual winnings of each participant (based on the scores the obtained at the end of the game), and (d) the self-reported emotions participants experienced during the game.

Materials and procedure. Participants were randomly assigned to read the same descriptions (anthropomorphism condition vs. non anthropomorphism condition) of the slot machine used in our previous studies. Because the online interface of the slot machine we used in Studies 1 to 3 was no longer available at the time we conducted Study 4, we decided to program an ad hoc slot machine interface. The interface represented a slot machine with a simple graphic, including three reels, a "play" button (that participants could use to spin the reels), and a quit icon (see Figure 1B). Furthermore, by clicking a specific button, participants could access a card depicting the winning combinations and the points that each of these combinations was worth. While gambling, participants saw the points they had scored next to the three reels. In this study, we gave participants an equivalence of candies rather than money. Similar to Study 2, the winnings were based on the actual score participants got at the time they decided to quit gambling. The equivalence between the slot machine score and the number of candies was based on a conversion table that was always kept visible to participants. The maximum payout was 10 candies (for scores above 100 points), whereas the minimum payout was zero (for scores below 9 points). All participants started their game session with 50 points that corresponded to five candies on the conversion table. Participants were told that they could interact with the slot machine for as long as they wanted and could quit the game at any time.

After being informed of the correspondence between scores and the winnings, participants were randomly assigned to read the same descriptions (anthropomorphism condition vs. nonanthropomorphism condition) of the slot machine used in Studies 1 to 3. The slot machine interface was loaded on a computer screen and participants could interact with it. When participants pressed the

[5] Participants were asked whether they had ever played on a slot machine at least once in their life. Of 200 participants, 138 (69%) chose the "no" option, whereas 62 (31%) reported they had played on a slot machine at least once in their life. Of the latter group of participants, 53 reported that they played less than once per year; six participants reported that they played less than once per month; two participants reported they play about once a week; and one participant reported playing several times a week. None reported a higher frequency (e.g., every day) of slot machine playing.

quit button, the ad hoc created slot machine interface generated a log file including the number of times each participant spun the reels and the total score earned.

Next, similar to previous studies, participants were asked to complete the 15 items assessing their tendency to anthropomorphize the gambling machine (e.g., "The slot machine decides everything in the game"; $\alpha = .81$; see Appendix for the item descriptions). Then, participants were asked to report their emotional experience during the game through one of the most frequently used emotion scales in the psychological literature, the Positive and Negative Affect Schedule: Expanded Form (PANAS-X; Watson, & Clark, 1994). Responses were recorded on a 1 (*not at all*) to 5 (*very much*) scale. Based on a recent study showing that the PANAS-X items may be classified along the dimensions of both valence (positive vs. negative) and arousal (high vs. low; Wyczesany & Ligeza, 2015), we averaged responses to this scale to create four overall indexes of high-arousal negative emotions (e.g., angry), low-arousal negative emotions (e.g., tired), high-arousal positive emotions (e.g., excited), and low-arousal positive emotions (e.g., calm).

Finally, participants reported their demographic data (i.e., age, sex, and nationality). At the end of the experiment, each participant received the number of candies they won and was debriefed.

Results and Discussion

Manipulation check. An independent samples *t* test was first computed on anthropomorphism scores, comparing the two experimental groups. The analysis revealed that participants anthropomorphized the slot machine more in the anthropomorphism condition ($M = 2.53$, $SD = .65$) than in the nonanthropomorphism condition ($M = 2.23$, $SD = .63$), $t(198) = 3.28$, $p < .001$, $d = .46$, 95% CI [0.19, 0.75].[6]

Outcome variables. Next, we compared the two experimental conditions on the number of reel spins participants made. Further replicating our previous findings, the analysis showed that participants in the anthropomorphism condition spun the reels more times ($M = 42.25$, $SD = 29.09$) than the participants in the nonanthropomorphism condition ($M = 30.08$, $SD = 20.45$), $t(198) = 3.42$, $p < .001$, $d = .48$, 95% CI [0.20, 0.77].

The analysis on the final score participants obtained on the slot machine showed that participants presented with the anthropomorphic slot machine lost more points ($M = 32.55$, $SD = 13.42$) than the participants presented with the nonanthropomorphic slot machine ($M = 37.40$, $SD = 11.48$), $t(198) = 2.74$, $p = .007$, $d = -0.39$, 95% CI [−0.67, −0.11]. In line with a typical algorithm governing a slot machine (Turner & Horbay, 2004), the average scores of both experimental conditions were lower than the starting point (i.e., 50 points); however, our findings show that those primed with the anthropomorphic slot machine went on playing for longer and ended up losing more slot machine points.

The two experimental conditions were also compared on the number of candies participants received based on their winnings. Again, we found that participants presented with the anthropomorphic slot machine lost more candies ($M = 2.91$, $SD = 1.28$) than the participants presented with the nonanthropomorphic slot machine ($M = 3.33$, $SD = 1.05$), $t(198) = 1.42$, $p = .012$, $d = -0.36$, 95% CI [−0.63, −0.08]. On average, participants in both conditions obtained fewer candies than what they started with at the beginning of the game (i.e., five candies), but this reduction was stronger for those primed with the anthropomorphic slot machine.

We then computed a series of *t* tests comparing the two experimental conditions on the four indices of self-reported emotional reaction considering both valence (ranging from negative to positive) and arousal (low to high). The analysis showed no significant differences for the overall indexes of high-arousal negative emotions, high-arousal positive emotions, and low-arousal positive emotions (all ps $> .064$). By contrast, the analysis showed that participants presented with the anthropomorphic slot machine reported higher levels of low-arousal negative emotions (e.g., fatigue; $M = 1.74$, $SD = .59$) than the participants presented with the nonanthropomorphic slot machine ($M = 1.56$, $SD = .51$), $t(198) = -2.25$, $p = .025$, $d = 0.32$, 95% CI [0.05, 0.61].

Mediation analyses. Next, we examined whether different types of emotions (varying along the dimensions of valence and arousal; Posner, Russell, & Peterson, 2005) mediated the relationship between the manipulation of slot machine anthropomorphization (high vs. low) and gambling behavior (see Table 1 for correlations between variables).

We used a bootstrapping procedure (Hayes, 2013) estimating direct and indirect effects with multiple potential mediators. First, we found that the slot machine manipulation (coded as low anthropomorphism = −1, high anthropomorphism = 1) predicted the dependent variable (i.e., the number of reel spins made by participants), $B = 6.04$, $SE = 1.79$, $p < .001$. However, slot machine manipulation did not predict high-arousal negative emotions ($B = .03$, $SE = .04$, $p = .422$), high-arousal positive emotions ($B = .07$, $SE = .04$, $p = .105$), or low-arousal positive emotions ($B = .13$, $SE = .07$, $p = .064$). By contrast, we found a significant association between our manipulation and low-arousal negative emotions ($B = .09$, $SE = .04$, $p = .025$).

According to Hayes (2013, Chapter 6; see also Hayes, 2009), whether an indirect effect is significant is not pertinent to the pattern of significance or nonsignificance for individual paths in a mediation model. Thus, we estimated indirect effects for all four potential mediators, even though some of the paths between the manipulation and the mediators were not statistically significant. When the four emotional clusters were included in the regression equation, high-arousal positive emotions predicted gambling behavior ($B = 9.42$, $SE = 3.05$, $p = .002$), whereas the direct effect of the manipulation of slot machine anthropomorphization on gambling outcomes decreased ($B = 5.46$, $SE = 1.75$, $p = .002$). The analysis provided support for the idea that high-arousal positive emotions ($B = .70$, $SE = .52$; 95% CI [.0072, 2.11]) mediated the relationship between slot manipulation and gambling behav-

[6] To test the possibility that our manipulation influenced only the two components of anthropomorphism (i.e., agency and experience; Gray et al., 2007; Waytz & Young, 2014), we first created an overall index of agency (12 items, $\alpha = .801$) and an overall index of experience (three items, $\alpha = .652$). Then, we meta-analytically combined the results from the effect sizes of Studies 1 to 4 ($N = 415$) considering the effects of our manipulation of slot machine anthropomorphization on the two components of anthropomorphism (i.e., agency and experience). The meta-analysis showed a significant effect on both the weighted combined *z* score for agency ratings ($z = 7.12$, $p < .001$), and experience ratings ($z = 3.81$, $p = .002$). Therefore, our manipulation affected both the attribution of agency and the attribution of experience to the slot machine.

Table 1
Correlations Between Variables (Study 4)

	M	*SD*	1	2	3	4	5	6	7	8
1. Slot machine manipulation	.50	.50	1	.236**	−.191**	−.178**	.057	.158*	.115	.131
2. Gambling behavior	36.16	25.82		1	−.859**	−.842**	−.021	−.031	.236**	.057
3. Slot machine score	34.97	12.69			1	−.946**	.008	.093	−.213**	−.097
4. Number of candies	3.12	1.18				1	−.009	.108	−.211**	−.092
5. High-arousal negative emotions	1.47	.54					1	.747**	.315**	−.267**
6. Low-arousal negative emotions	1.65	.55						1	.175*	−.156*
7. High-arousal positive emotions	1.90	.65							1	.234**
8. Low-arousal positive emotions	3.12	1.04								1

* $p < .05$. ** $p < .01$.

ior.[7] By contrast, high-arousal negative emotions did not predict gambling behavior ($B = .79$, $SE = 5.29$, $p = .880$), nor did they play any mediation role ($B = .02$, $SE = .27$; 95% CI [−.36, 1.01]). Similarly, low-arousal positive emotions did not predict gambling behavior ($B = -1.10$, $SE = 1.87$, $p = .556$), nor did they play any mediation role ($B = .15$, $SE = .32$; 95% CI [−1.18, .30]). Finally, low-arousal negative emotions did not predict gambling behavior ($B = -5.96$, $SE = 4.82$, $p = .22$), nor did they play any mediation role ($B = .53$, $SE = .53$; 95% CI [−2.02, .13]).

Finally, we conducted another mediation analysis to test the assumption that the gambling behavior (i.e., the number of times participants spun the slot machine reels) could account for the link between slot machine anthropomorphization and the gambling outcomes (i.e., scores earned and number of candies; see Table 1 for correlations between variables). The manipulation of slot machine anthropomorphism negatively predicted both slot machines points ($B = -2.42$, $SE = 0.88$, $p = .007$) and the number of candies earned ($B = -0.21$, $SE = 0.08$, $p = .012$). Furthermore, the manipulation of slot machine anthropomorphism predicted gambling behavior ($B = 6.08$, $SE = 1.78$, $p = .001$). Finally, when gambling behavior was included in the regression equations, gambling behavior predicted gambling scores ($B = -.42$, $SE = .01$, $p < .001$) and the number of candies earned ($B = -.04$, $SE = .002$, $p < .001$), whereas the direct effects of the manipulation of slot machine anthropomorphism on slot machine scores ($B = .15$, $SE = .47$, $p = .75$) and number of candies earned was no longer significant ($B = .03$, $SE = .05$, $p = .57$).

The analysis provided support for the mediating role of gambling behavior on both slot machine scores ($B = -2.58$, $SE = 0.72$; 95% CI [−4.17, −1.32]) and the number of candies earned ($B = -.24$, $SE = .07$; 95% CI [−.38, −.12]). These findings suggest that participants primed with the anthropomorphic slot machine finished with fewer points and lost more candies because they gambled more.

Summary. In sum, in Study 4 we replicated the main finding of the current studies in a large sample of participants, namely, gambling increases when a slot machine is displayed in an anthropomorphic manner. We also showed that the effects of slot machine anthropomorphization extend to gambling outcomes; participants primed with different descriptions of a slot machine reported different scores when gambling.

Then, unlike Study 3, Study 4 did not provide support for the hypothesis that priming participants with an anthropomorphic slot machine per se results in a stronger emotional reaction (except for low-arousal negative emotions, such as fatigue). However, we found an indirect effect of high-arousal positive emotions, such that feeling alert, confident, and excited indirectly mediated the link between slot machine anthropomorphization and gambling behavior. Finally, Study 4 showed that gambling behavior accounted for the link between slot machine anthropomorphization and gambling outcomes, that is, the more participants played, the less they won.

General Discussion

The present research tested the hypothesis that anthropomorphizing gambling devices increases gambling. Our hypothesis was based on the rationale that people might gamble more when they think they are engaged by a mind rather than just a mathematical algorithm. First, we conducted a preliminary study investigating whether gambling behavior and slot machine anthropomorphization might be linked. Accordingly, we found that regular players anthropomorphized slot machines more than nonregular players. Specifically, we found that the more people attribute a humanlike mind to gambling devices, the more frequent they report their gambling to be. Then, in Study 1, we manipulated slot machine anthropomorphization and found an increase in participants' gambling behavior. In Study 2, we replicated the findings of Study 1 and showed that the effect held when the task involved monetary reinforcement. In Study 3, we explored the possible role of self-reported emotions on the link between anthropomorphism and gambling behavior, showing that positive emotions mediated the relationship between slot machine anthropomorphization and gambling behavior. Finally, in Study 4, we extended the effects of anthropomorphism from gambling behavior to gambling outcomes, showing that participants primed with a humanized device lose more because they play longer. Furthermore, in Study 4, we found further evidence for a possible mediational role of emotions, showing that high-arousal positive emotions played a role linking anthropomorphism and gambling.

The present research substantially extends existing work on the consequences of humanizing technical devices, providing useful implications for the construct of anthropomorphism. Few works have looked at the potential consequences of anthropomorphism,

[7] A similar indirect mediational pattern of high-arousal positive emotions emerged on the number of candies participants received based on their winnings ($B = -0.026$, $SE = 0.02$; 95% CI [−0.08, −0.0004]), but not on the final score participants obtained on the slot machine ($B = -0.29$, $SE = 0.23$; 95% CI [−.91, 0.01]).

and, when they do, they are mostly limited to assessment of attitudes (e.g., Butterfield, Hill, & Lord, 2012; Chandler, Griffin, & Sorensen, 2008; Chandler & Schwarz, 2010; Sacchi et al., 2013; Tam, Lee, & Chao, 2013; Zagefka, Noor, Brown, de Moura, & Hopthrow, 2011). Furthermore, the majority of studies have considered the attribution of humanlike emotions the target of anthropomorphism (e.g., Norenzayan, Hansen, & Cady, 2008; Sacchi et al., 2013), whereas the current research explored the agent's emotional response as a function of machine anthropomorphization and its role as a mediating mechanism.

Many scholars have argued that people have a strong tendency to attribute mental states to nonhuman agents. Some theorists have argued that theory of mind, that is, the attribution of mental states to oneself and others, is such a pervasive force such that people cannot help but perceive mental states in objects and supernatural religious agents (Bering, 2002). In our studies, we consistently found that priming participants with an anthropomorphic slot machine led them to perceive it as more humanlike (compared with participants primed with a nonanthropomorphic machine). However, the manipulation check means provided by the nonanthropomorphic slot machine group were consistently higher than zero, thus suggesting that the anthropomorphization of an object occurs spontaneously, but it can be increased by environmental cues. Overall, our findings indicate that even trivial objects such as slot machines can—in the eyes of the perceiver—become moral agents who are conscious, act according to their own intentions, and experience emotions. Furthermore, they suggest that gambling behavior can be manipulated through targeted communication to decrease the attribution of human mind features to gambling devices. In our studies, the description of slot machines in the anthropomorphism conditions was based on some key aspects that the existing literature on anthropomorphism has considered (e.g., the anthropomorphized agent has consciousness, free will, and it is considered responsible for its actions). By contrast, the specific description of the slot machine shown in the nonanthropomorphism condition was based on descriptions of slot machines and how they function (Turner & Horbay, 2004).

Our research has shown that the consequences of slot machine anthropomorphization extend from gambling behavior to gambling outcomes. Indeed, we found that people exposed to a humanized slot machine lost more points compared with people exposed to a nonhumanized slot machine. Furthermore, anthropomorphization resulted in a greater loss of slot machine payouts (Study 4). In actuality, we found that both groups ended up with less than what they had started with, although anthropomorphism resulted in a greater loss of scores and relative payouts. As we noted, this is not surprising, considering that the payback percentage with which slot machines are set at varies usually between 70% and 90%, and thus it varies the degree to which people lose money by playing more at the slots. In any case, from a logical standpoint, on average, any payback percentage under 100% implies that people who play more at the slot machine will lose more money. This is exactly what we found when we tested this hypothesis with adequate statistical power (see Study 4): People primed with a humanized slot machine lost more slot machine payouts because they went on playing for longer.

How does anthropomorphism increase gambling? Our research was able to identify a possible mechanism that can account for the anthropomorphism/gambling-behavior link. Indeed, emotional arousal is known to increase attention (Mather, 2007). In both Study 3 and Study 4, we found that high-arousal positive emotions (e.g., feeling excited, determined, and confident) played a role in the effect of anthropomorphism on gambling behavior. Thus, in our experiments, when they believed they were playing against a mind (cf. a mathematical algorithm), people might have gambled more because of the more intense emotional experiences they underwent while gambling. In other words, our participants may have felt more engaged during the game and thus gambled longer. This finding could be in line with previous studies suggesting that the emotional quality of a person's experience with a nonhuman entity may approximate that of their experience with other human beings (Aaker et al., 2004; Schultz et al., 1989; Wang et al., 2007).

However, whereas in Study 3 we found a direct effect of the anthropomorphism manipulation on both positive and negative emotions, in Study 4, we did not replicate this finding (except for the low-arousal negative emotion cluster; e.g., fatigue). It is possible that the different measures we used in these studies (also considering the different number of items that characterized the different scales) account for these inconsistencies. Therefore, future studies should further explore the role of emotions in accounting for the link between anthropomorphism and gambling behavior.

From an applied standpoint, our research suggests some avenues for communications and interventions. We showed that it is possible to affect gambling behavior (and the related gambling outcomes) by simply framing gambling devices with different terms. Thus, when the aim is reducing gambling, we recommend framing slot machines in a mechanistic way. This implies conveying the message of what slot machines are: physical objects controlled by mathematical algorithms, which are programmed to deliver a certain amount of wins and losses. By contrast, any form of humanization (either in the form of words or images) of the slot machine should be avoided. Accordingly, our studies showed that humanizing slot machines led people to gamble and lose more, perhaps because of the psychological state (i.e., high-arousal positive emotions) that accounted for the effect of anthropomorphization on gambling. Again, when the aim is to reduce gambling, anthropomorphization of the gambling device should be prevented in order to restrain gambling behavior and the economic losses that derive from it.

There are some limitations to the present research. First, in our studies, we used a verbal description of slot machine to manipulate slot machine anthropomorphization. Future studies should test other ways to modulated people's perception of these gambling devices, perhaps through the use of anthropomorphic cues (e.g., eyes) displayed on the interface. Moreover, future studies should adopt an implicit measure of emotions or physiological recording during the gambling experience to further test for the role of emotions in accounting for the link between humanizing machines and gambling behavior.

Second, future research should also consider other potential mechanisms that are also likely to play a role in the anthropomorphism–behavior link. As we have already noted, recent work showed that nonhuman entities are more likable when they resemble concepts with which people have familiarity (i.e., humans; see Epley et al., 2007, 2008; Gray et al., 2007; Waytz, Morewedge, et al., 2010). This reason could account for the effect of anthropomorphism on gambling behavior. Furthermore, previ-

ous research has suggested that anthropomorphism satisfies effectance motivation; that is, anthropomorphizing a target makes it appear more predictable and understandable (Epley et al., 2007; see also Waytz, Morewedge, et al., 2010). Accordingly, the perceived increased sense of mastery over the machine's behavior, that is, the illusionary control related to the attribution of a humanlike mind to it might lead players to gamble more frequently. In addition to increasing a sense of efficacy, anthropomorphism can also increase a sense of connection with nonhuman agents. Magical thinking, expectations of winning, feelings of competitiveness, and perceptions of randomness might also contribute to the effect. Thus, future research should further investigate the role of these potential cognitive and affective mechanisms in accounting for the link between slot machine anthropomorphization and gambling behavior.

Finally, future research should also consider the possible individual differences that can play a role in the anthropomorphization–gambling link. For instance, it could be tested whether people with an external locus of control tend to respond more strongly to a manipulation of slot machine anthropomorphization. In this sense, the questions raised here are the beginning of a program of research investigating machine anthropomorphization and its impact on human behavior.

Conclusions

Slot machines are designed to induce people to play more and to spend as much money as possible (Griffiths, 1994, 2004). Our investigation demonstrates one of these—that anthropomorphism represents a psychological means to increase a gambler's time on the machine or, adopting an industry jargon, to encourage "playing to extinction"—that is, playing until a gambler's money is gone. In the eyes of the gaming industry, the psychological process of gambling-machine anthropomorphism is advantageous; however, this may come at great expense for gamblers' (and their families') economic resources and psychological well-being. Therefore, the present findings may also have important implications for social life. As our data suggest, one of the simplest ways to reduce gambling behavior might be to convey the message of what a slot machine actually is: not a person, not a mind, just a machine.

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(*Appendix follows*)

Appendix

Items on the Anthropomorphization Scale

1. The slot machine acts according to its own intentions.
2. The slot machine has consciousness.
3. The slot machine has free will.
4. The slot machine perceives stimuli.
5. The slot machine experiences emotions.
6. The slot machine decides everything in the game.
7. The slot machine punishes me whenever she wants.
8. The slot machine rewards me whenever she wants.
9. Whenever I play, the slot machine chooses what happens.
10. The slot machine can be kind to me.
11. The slot machine can be mean to me.
12. The slot machine can act maliciously against me.
13. The slot machine can have mercy on me.
14. The slot machine rewards whoever she wants.
15. Sometimes, the slot machine persecutes certain people.

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