Psychology Research and Behavior Management

Dovepress

open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Be Careful When Using Peer-Influence on Nudging Solicitation: Evidence of Potential Negative Effect from a Sample of Chinese University Students

Wuke Zhang[1], Pengtao Jiang[2,3], Ting Xu[1], Yuchen Ye[1]

[1]Business School, Ningbo University, Ningbo, People's Republic of China; [2]Business School, University of Nottingham Ningbo China, Ningbo, People's Republic of China; [3]School of Information Science and Engineering, NingboTech University, Ningbo, People's Republic of China

Correspondence: Yuchen Ye, Business School, Ningbo University, Ningbo, Zhejiang Province, People's Republic of China, Tel +86 13335702277, Email yeyuchen200107@163.com

Purpose: Peer information is now commonly used in solicitation. However, scholars have long focused on testing its effectiveness on increasing the donation amount without paying attention to its potential negative effects on donors. Thus, the current study employs high vs low peer donation amount (HPDA vs LPDA) information to explore its effect on "how-much-to-donate" decisions and the corresponding neural and psychological reactions at the same time.

Participants and Methods: Student samples from a Chinese university and behavioral experiments with the event-related potential (ERP) method were used in this study.

Results: The behavioral results are consistent with previous research in which HPDA was positively associated with higher donation levels. ERP results show the mechanisms behind decision-making can be summarized into a cognitive approach represented by cost-benefit analysis and an affective approach represented by reward perception. More surprisingly, in contrast to the behavioral results, LPDA elicits higher level of reward perception than HPDA.

Conclusion: The results indicate that although HPDA leads to higher levels of donation, donors do not show higher levels of reward anticipation at the neurological level, indicating the increment of donation may come at the cost of donors. Theoretical and practical implications are also discussed.

Keywords: average peer donation amount, event-related potential, ERP, "how-much-to-donate" decision, online donation, solicitation

Introduction

With the rapid development of social media and information communication technology (ICT), the proliferation of online donation platforms has become a prominent feature of contemporary philanthropy.[1] By harnessing the abundant information and active user base of social media, these platforms frequently utilize solicitation, like presenting the total amount of donations received,[2] demonstrating the number of individuals who have contributed,[3] and "peer to peer" solicitation,[4] to engender greater charitable donations. Empirical evidence has consistently demonstrated the positive influence of solicitation on charitable giving.[5–7] However, solicitation is a broad concept in the context of giving, encompassing any mere act of being solicited (asked) to donate.[6,7] This study focuses specifically on "peer effect" in solicitation and examines its impact on online charitable giving.

Peer effect, sometimes referred to as peer influence or peer pressure, is considered one of the most effective sources of social influence,[4,8,9] primarily because peer influence represents the behavior of a group that is highly similar to the person being influenced. Now, there are also online donation platforms (eg, Shuidichou, www.shuidichou.com) that use information from social platforms (eg, WeChat) to bring peer influence into the donor's decision-make process. As one of the most recently published studies on the impact of peer information on donation decisions, Ye et al[3] explored the effect of the number of donated peers on donors' willingness to donate. However, previous literature has suggested that the decision to donate or not (or the intention to donate) differs from the decision on how much to donate.[10–13] These studies

Received: 5 April 2023
Accepted: 20 July 2023
Published: 4 August 2023

have found that higher donation amount information can lead donors to give more, while lower donation amounts can reduce the amount of donation in a single charitable giving. However, these studies did not consider the effect of peer influence and paid insufficient attention to the underlying psychological mechanisms of donors' giving decisions, which limited their theoretical contribution. Thus, this research is conducted to address these research gaps. Formally, the first research question is as follows: *How the peer donation amount information (HPDA* vs *LPDA) will influence donors'* "how-much-to-donate" *decisions? And what are the underlying psychological mechanisms of this effect?*

Furthermore, previous studies related to the influence of solicitation (especially "peer effect" solicitation) on charitable donation have mostly taken the perspective of the charitable organization, using the increase in the amount donated as a predominantly standard of the effectiveness of social influence, eg, Frey and Meier[14] and Shang and Croson.[10] To the author's best knowledge, almost no research has been conducted to investigate the impact of peer influence on donors' emotions and perceptions, particularly concerning the potential negative effects (eg, lowering perceived self-efficacy, self-esteem, and overall well-being,[15–17] or even acting as a potential trigger of rumination and depression).[18,19] However, some scholars have shown their concern about this issue,

> If this type of pressure (peer pressure) (rather than providing information) shifts an individual's giving from his or her desired level, certain public goods may receive more funding at the expense of others. (p926)[8]

Since charitable donation should be a bilateral beneficial public service activity, this study plans to use a sample of college students, who are perceived as being less philanthropic[20] and donate less,[21] to answer Meer[8]'s concern. Formally, the second research question is: *Will peer donation amount information bring donors negative emotions or perceptions?*

Considering decision-making processes and the underlying psychological mechanisms are a nuanced and intrinsic psychological continuum, we intend to employ electroencephalography (EEG) tools with event-related potentials (ERP) components to better facilitate current exploration. ERP approach has a high temporal accuracy in explaining the neural bases of decision-making process.[22] Numerous studies within the field of Decision Neuroscience have demonstrated the considerable utility of ERP in investigating the psychological and neural mechanisms that underlie donation decision-making.[23,24] These findings provide a solid foundation upon which to base a study that employs ERP to explore the impact of peer donation amounts, specifically at two levels (low and high), on the psychological processes involved in determining how much to donate. Given that previous studies have also used ERP to study donation decisions,[3] it is also a suitable choice for ensuring comparability in results and discussions.

Literature Review and Hypotheses Development

Literature Review

Previous literature has been intensively focused on exploring the motivations of donors to engage in charitable giving and found that factors such as awareness of needs,[25] altruism,[11] reputation,[26] cost and benefits,[27] psychological benefits,[28] etc., could explain why people donate in different contexts. However, the most relevant to our study, ie, motivations and psychological mechanisms of donation decisions under peer influence, are much more sparsely tested. Prior studies primarily tested the main effect of peer influence on donation decision (both donation intention and how much to donate) with little discussion of potential mediators (as an exception, see Croson, Handy and Shang[29]'s study). Only about three current studies have explored the psychological mechanisms underlying peer-influenced donation decisions.[3,30,31]

As mentioned above, our team's previous work studied the effect of the number of donated peers on donors' willingness to donate and abstracted the peer-influenced donation decision mechanism into a dual-process approach, which we summarized as a cognitive approach (trust formation) and an emotional approach (reward perception).[3] As there is a paucity of research available to inform our understanding of the cognitive and psychological mechanisms that underlie the effect of peer donation amounts on donors' decisions regarding the amount to donate, it is reasonable to construct the psychological processes of the effect on the previous dual-processes approach and put forward new hypothesis through deductive reasoning.

We expect that solicitation using the amount of peer donations differs from that using the number of donated peers, especially in a laboratory setting. Using number of donated peers alone would lead donors to perceive underlying social

norms.[3,14] Previous studies have argued that although the factors influencing behavioral intentions are diverse, only suprathreshold factors may influence decisions in actual decision-making.[12] This effect is more pronounced in laboratory experiments, where other factors are strictly controlled.[3] In this case, participants focus only on the strength of social norms characterized by the number of donated peers, and the perceived rewards from conforming to the norms (eg, satisfaction of relatedness needs, etc.), then make the ultimate willingness-to-donate decision.[3] In this way, donors overlook the essential fact that charitable giving has a cost.

When the information presented contains only the average peer donation amount, the "cost" information is incorporated into the decision-making process. We anticipate that at this juncture, the donation decision-making process will shift from being primarily driven by a "reward perception" to a more balanced consideration of "costs and benefits".[32] One possible explanation of this transformation lies in cost and benefit theory, which suggests that prosocial behaviors (eg, charitable giving) consume resources and that this cost is higher for groups with limited donation budgets (eg, college students).[20,21,33,34] Naturally, donors then need to consider balancing the costs of donation with the personal and social benefits of donation. Additionally, we can also explain the transformation based on a self-control mechanism. According to the literature, self-control mainly can impact the donation decision processes in two ways: control donors from impulsive donation to calculated (rational) decision[35,36] and control one's selfish donation to "pure" altruism.[37,38] Since donors can perceive reward from donation,[3] self-control can highlight the "cost" information and prevent donors from impulsive (beyond capacity) donations. In general, other than a cognitive process of truth formation, a cost and benefit analysis process also may exist.

Since "cost" and "benefit" are parallel in the decision-making process, we posit that the highlight of donation cost, should also enhance donors' attention on reward perception. First, some previous studies discussed the distinctive effect of monetary and good donation information on motivational inferences.[33,39,40] These studies found that information representing amounts was more likely to evoke marketplace norms and lead donors to engage in exchange (rather than altruistic) behaviors.[40] Communal and exchange theory states that exchange (marketplace) norms are emphasized by helping others for self-interest gains, with the expectation of receiving corresponding benefits.[40] Second, compared with number of donated peers information which needs to perceive abstract expected rewards (eg, satisfaction of relatedness needs, etc.) through cognitive processing,[3,41] information on the peer donation amounts provides richer, more intuitive, and more comparable information on valence differences,[42,43] such as higher or lower amounts that directly reflect a person's level of contribution, corresponding to higher or lower potential reputation rewards,[44–46] etc. This suggests that displaying information about the peer donation amount (as compared to other non-monetary information) will further motivate donors to act in a more self-interested manner due to their enhanced perception of the rewards they will receive for donating. Therefore, the previously identified emotional process of reward perception may be further strengthened.

However, while peer donation amounts information makes cost and benefit analysis more intuitive, it inevitably leads to automatic social comparisons. In the case of LPDA, even college students with tight donation budgets can afford to make corresponding or even higher gifts. Thus, downward social comparison may occur.[47] Research generally agrees that downward social comparison may lead to positive emotional experiences (positive rewards) through the achievement of self-improvement, increased self-esteem, and well-being,[32,47–49] etc. In contrast, HPDA tends to elicit upward social comparison, which can lead to both positive and negative emotional responses.[50] Yet, studies have pointed out that unconscious upward social comparisons tend to generate negative emotions as the most natural reaction of individuals.[51] Thus, when the disclosed peer donations exceed their personal donation budgets, college donors are likely to experience negative emotions, including reduced perceived self-efficacy and a negative impact on their self-esteem, and overall well-being.[15–17] In summary, in the upward social comparison situation (HPDA), it may no longer be the perception of high or low rewards, but the arousal of negative emotions.

Behavioral Hypothesis

As mentioned above, prior empirical evidence suggested that HPDA leads donors to give more, while LPDA reduces donors' giving amounts.[10,29,32,52,53] Although the behavioral hypothesis proposed in this research is consistent with previous findings, before formally declaring the hypothesis, we must answer an important question, especially: for

HPDA, why would low-income donors (college students in current study) increase their level of giving even though they have limited donation budgets and may even under the influence of negative emotions?

The question can be answered mainly in three ways. First, in social settings, especially in the absence of objective criteria, social norms will almost dominate behavioral decisions.[54–56] Prior research has compared descriptive social norms to magnets, arguing that people will judge behavioral appropriateness by the gap between their own behavior and descriptive norms.[57] Thus, even for donors with tight giving budgets, a strong incentive to converge toward descriptive social norms may remain. Second, cognitive dissonance theory suggests that people are motivated to make efforts to resolve cognitive conflicts when they arise in the decision-making process.[58] Evidence also shows that the negative emotions brought by upward social comparison are associated with impulsive buying, which people may use as a way of de-escalating negative emotions.[51] Third, as mentioned above, self-control also has the potential to prevent donors from sinking into selfishness and donating in an altruistic way.[37,38] Information about higher peer donation amounts drives donors with tight donation budgets (eg, college students) to give out for purely altruistic motives.[33] Despite making below-average donations, these donors are also modest in their demands for personal and social gain. Therefore, we hypothesize that:

H1: Compared with the condition of LPDA, the HPDA condition will result in donors' larger donation amounts.

ERP Hypothesis

The proposed potential donation decision-making processes posited above suggest that the emotional process of reward perception, previously identified in donation contexts, is likely to persist and even intensify. Additionally, a cognitive process of cost-benefit analysis may emerge. To facilitate comparability with prior research,[3] the present study examines three distinct ERP components: P2 (cue evaluation), N2 (decision conflict detection), and P3 (reward anticipation and incentive formation).

P2 Hypothesis

P2 is a positively oriented electrophysiological ERP component that is typically observed in the frontal region of the scalp and is characterized by a peak latency of approximately 200ms following the onset of stimuli.[59] In general, it is associated with attentional processes that respond to emotional content, indicating an early automatic distribution of attention resources, which is then followed by the progressive recruitment of slow, elaborative, and semantic processing under voluntary control.[22,60] Recent studies have also demonstrated that P2 is sensitive to the emotional valuation of potential reward cues, with higher perceived rewards typically eliciting larger P2 amplitudes than lower perceived rewards.[3,61–63] Moreover, scholars have proposed that reward-related cognitive processing can be delineated into two stages, namely cue evaluation and reward anticipation, and P2 is a key index component in the cue evaluation phase.[64–66] These observations highlight the potential importance of P2 in the neural processing of decision-making involving rewards.

In the current study, LPDA suggests that donors can easily exceed the average donation level and reap the benefits of increased self-esteem, enhanced well-being, and perceived higher reputation at a lower cost.[48,49] However, the opposite is true for HPDA. Since donors with low giving budgets are likely to fail to reach the average donation level, they feel low self-efficacy and low self-esteem.[17,45] Thus, compared to the HPDA condition, donors in the LPDA condition will have higher perceived future rewards. Thus, we made a reasonable hypothesis:

H2: The LPDA condition will elicit larger P2 amplitudes than the HPDA condition.

N2 Hypothesis

Amid the burgeoning literature on electroencephalography (EEG), the N2 component has emerged as a salient point of interest. N2 is a negative component that peaks between 200–350ms following stimulus onset.[22,67] Prior investigations have documented a positive correlation between the amplitude of N2 and conflict during the decision-making process.[22,67–69] Subsequent studies, additionally, have further induced that N2 is also responsive to decisional risk,

with heightened perceived risk engendering increased difficulty in the decisional process and exacerbating conflict therein.[22,70]

In the current study, we posit that N2 can assist in distinguishing whether the cognitive process is dominated by trust formation or by cost-benefit analysis. If trust formation process still occurred in the N2 component, then HPDA condition representing higher peer trust and higher perceived quality of donation activities[71] would elicit smaller N2 amplitudes. However, based on the previous reasoning, we believe a cost and benefit analysis process may emerge. At this point, the LPDA condition would represent lower costs and higher potential personal and social rewards,[48,49] whereas the HPDA scenario would represent higher costs, lower benefits, and even the arousal of negative emotions (see the discussion in Literature Review). Therefore, the HPDA scenario will elicit greater N2 amplitudes. Formally:

H3: The LPDA condition will elicit smaller N2 amplitudes than the HPDA condition.

P3 Hypothesis

Positioned at centro-parietal recording sites, the P3 component is characterized by a positively polarized wave that emerges in the temporal vicinity of 300–600ms after stimulus onset.[72,73] Previous scholarship has purposed that P3 amplitude can mirror reward magnitude (ie, distinguishing large and small rewards), thereby indicating a conscious, top-down elaboration of the motivational significance of the outcome.[3,65,74–76] In this regard, P3 may also convey affective processes, signaling the motivational salience of reward feedback.[77] Subsequent research has shed further light on the P3 component's potential, demonstrating its sensitivity to positive social feedback among healthy individuals, which serves to underscore an encoding bias for self-affirming and desirable information.[78–80]

Indeed, P3 component is considered to be an important component in the reward anticipation stage,[64–66] corresponding to P2 but unlike P2. P3 component is more sensitive to valence differences in perceived rewards and can characterize motivational dispositions in cognitive processing and thus leads to final behavioral outcomes.[3,65,74–77]

As mentioned above, in the LPDA condition, downward social comparisons are more likely to occur because donors are well positioned to make donations that are consistent with or even higher than the average donation amount of their peers. The vast majority of prior research has demonstrated that downside social comparisons can lead to a variety of potential personal and social rewards such as increased self-esteem, increased self-efficacy, and reputational gains.[32,47–49] It is therefore predictable that donors in LPDA situations will perceive higher levels of prospective rewards. However, in the HPDA case, donors may still fall short of the average donation amount even after making additional efforts. At this point, the upward social comparison that occurs will result in donors feeling inferior to others, low self-efficacy, and low well-being.[15–17,51] Therefore, in the HPDA condition, the perceived prospective rewards will be much lower than that of the LPDA condition. Thus, the following hypothesis was proposed:

H4: The LPDA condition will elicit larger P3 amplitudes than the HPDA condition.

Material and Methods

Subjects

To determine how many subjects are needed, we conducted a prior power analysis using G*power 3.1.[81] Set an effect size of 0.45, a power of 0.8, and an alpha level of 0.05, the result of the power analysis estimated a sample size of 22. Thus, we recruited 29 native college students (16 males, 13 females, M_{age} = 20.31, SD = 1.491) from Ningbo University through SNS (eg, WeChat, QQ) and the laboratory's subject pool. All of them were self-reported as right-handed with normal or corrected-to-normal vision and had no history of neurological disorders or mental diseases. All subjects were informed in advance that they would receive 50 yuan (approximately 7 USD) as a reward for participating in the experiment. At the same time, to better simulate the online donation situation, we will randomly select a donation amount that they filled in after the experiment and deducted it from their experimental remuneration after dividing it by 2. The deducted remuneration will be donated in their name to an online donation project in their presence. Three subjects' data were excluded due to excessive artifacts in the electroencephalogram (EEG) recordings. Ultimately, the number used for

data analysis was 26. The study was conducted following the Declaration of Helsinki and was approved by the Internal Review Board of the Academy of Neuroeconomics and Neuromanagement at Ningbo University (Report No.20210702).

Materials

The dependent variable of this study is "the amount donors willing to donate", and the independent variable is "high/low peer donation amount". The entire experiment contained 80 stimuli (40 high average peer donation amounts and 40 low average peer donation amounts). Based on observation of the existing social donation platform and facts of charitable giving spending of Chinese students,[82] we picked 46, 47, 48, 49, 50 as high peer average donation amounts (HPDA) and 3, 4, 5, 6, 7 as low peer average donation amounts (LPDA, each number would repeat 8 times in the formal experiment). Stimulus was displayed in the center of the screen in the form of 52 points, font-weight and SimSun font-type with a gray background of 270×300 pixels.

Procedures

The subjects were asked to enter a soundproof room and sit on a comfortable chair that was 100 cm away from a computer-controlled monitor (1280 × 1024 pixels) with a refresh rate of 60 Hz. Before the formal experiment started, each subject received an instruction paper noting the experiment's task, procedure, and announcements. Then, they were required to read a real story extracted from an ongoing donation project, imagine that they are currently browsing the program online and will determine how much money they will donate. Stimuli presentation and data collection through the experiment were controlled by E-Prime 3.0 (PST, Psychology Software Tools, Inc.).

As shown in Figure 1, each trial began with a black cross against a gray background for 600–800ms. Then, a target stimulus screen that presented HPDA or LPDA was shown for 1500ms. After a 400–600ms blank screen, subjects could use the keyboard provided to enter their intended donation amount (yuan) in the on-screen textbox. The experiment would continue only when the subjects pressed "enter" to confirm their decision.

In the formal experiment, each selected number (46, 47, 48, 49, 50 and 3, 4, 5, 6, 7) was repeated 8 times (80 in total with 40 in HPDA and 40 in LPDA). All the stimuli were randomly divided into 4 blocks, each with 20 trials, and these trials appeared in pseudo-random order. A formal experiment lasted for around 10 mins and during the interval of each block, subjects could take a short break. Subjects were told before the experiment that the donation amount for each trial should be made independently.

Electroencephalograph (EEG) Recording and Analysis

A 64 Ag/AgCl electrodes cap and a Neuroscan Synamp2 Amplifier (Curry7, Neurosoft Labs, Inc.) were used to record EEG data at a sample rate of 500Hz. The EEG signal was recorded at the decision screen (determining the "donation

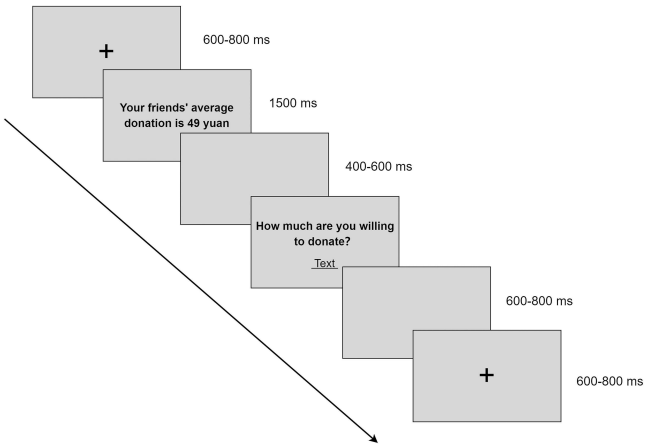

Figure 1 Single trial of the experimental procedure.

amount") of each trail and the electrode impedances were controlled below 5kΩ during the whole experiment. The left mastoid was used as reference, and the forehead location between PFz and Fz was used as the ground. Data were offline transferred to the average of the left and right mastoid references. The electrooculogram (EOG) was recorded from electrodes placed at 10mm from the lateral canthi of both eyes (horizontal EOG) and above and below the left eye (vertical EOG).

EEG data preprocessing was performed using the EEGLAB toolbox[83] and MATLAB (R2013a, The MathWorks, Inc., Natick, MA). First, they were re-referenced to the left and right mastoids average, bandpass filtered to a range of 0.1–30 Hz, epoched from −200ms to +800ms surrounding the simulation screen onset and took the baseline activity from −200ms to 0ms preceding the target. Second, independent component analysis was computed and the EOG artifacts (ICs representing eye blinks or other artifacts) were off-line corrected for all subjects, following the method provided by Semlitsch, Anderer, Schuster and Presslich.[84] Finally, the EEG recordings over each recording site for each participant were averaged within two conditions (HPDA & LPDA), respectively.

Three ERP components were analyzed according to the visual observation of grand averaged waveforms and the guideline proposed by Picton, Bentin, Berg, Donchin, Hillyard, Johnson Jr, Miller, Ritter, Ruchkin and Rugg,[85] namely P2, N2 and P3. For P2 component, we conducted a 2 (peer donation amount: high vs low) × 9 (electrodes: F1, Fz, F2, FC1, FCz, FC2, C1, Cz, C2) ANOVA in the time window of 230–280ms after the stimuli onset for its mean amplitudes. For N2 component, A 2 (peer donation amount: high vs low) × 9 (electrodes: F1, Fz, F2, FC1, FCz, FC2, C1, Cz, C2) ANOVA for its mean amplitude analysis was also executed in the time window of 280–330ms. Similarly, for P3 component, the time window of 360–410ms was selected with 9 electrodes (F1, Fz, F2, FC1, FCz, FC2, C1, Cz, C2) in the whole brain area. A 2 (peer donation amount: high vs low) ×9 (electrodes) ANOVA analysis was conducted for the P3 amplitudes. In addition, we also performed paired-samples *t*-tests to further verify the main effects and used partial eta-squared (η^2_p) values to demonstrate the effect size in ANOVA models. According to Cohen,[86] 0.05 represented a small effect, 0.1 represented a medium effect, and 0.2 represented a large effect.

Results

Behavioral Results

As shown in Figure 2, a pairwise *t*-test was performed for the donation amount between HPDA condition and LPDA condition [t(1, 25)=7.306, p < 0.001]. The result showed a significant main effect of average peer donation amount, which indicated that the amount that subjects donated in the HPDA condition (M = 28.252, SD = 14.888) was significantly higher than that in the LPDA condition (M = 8.268, SD = 8.133). Furthermore, we also conducted one-sample *t*-tests to compare the average donation amounts of subjects in HPDA condition with 48 (the mean of the stimuli) and 46 (the smallest amount presented in the condition), and the average donation amounts of subjects in LPDA condition with 5 (the mean of the stimuli) and 7 (the largest amount presented in the condition). The results revealed that subjects donated significantly lower than 48 [t(1, 25)=−6.765, p(one-tail)<0.001, M=28.252<48], and even 46 [t(1, 25)=−6.079, p(one-tail)<0.001, M=28.252<46] in HPDA condition. However, in LPDA condition, subjects donated significantly higher than 5 [t(1, 25)=2.049, p(one-tail)=0.0255<0.05, M=8.268>5], but not statistically significantly higher than 7 [t(1, 25)=0.795, p(one-tail)=0.217>0.05].

ERP Results

P2 Analysis

The 2×9 two-way repeated-measures ANOVA analysis for the mean amplitudes of P2 (positive polarity: larger voltage value means larger amplitude) was conducted in the time window of 230–280ms (see Figure 3). The main effect of average peer donation amounts was observed [$F(1,25)= 5.439, p = 0.028, \eta^2_p= 0.179$], showing that encountered HPDA elicited a significantly smaller mean P2 amplitude (M = 0.919μV, SE = 0.843μV) than encountered LPDA (M = 1.664μV, SE = 0.846μV). We also performed paired-samples *t*-test (HPDA vs LPDA: t=−2.332, p = 0.028, LPDA > HPDA). The result of the *t*-test additionally supported the significant main effect of average peer donation amounts.

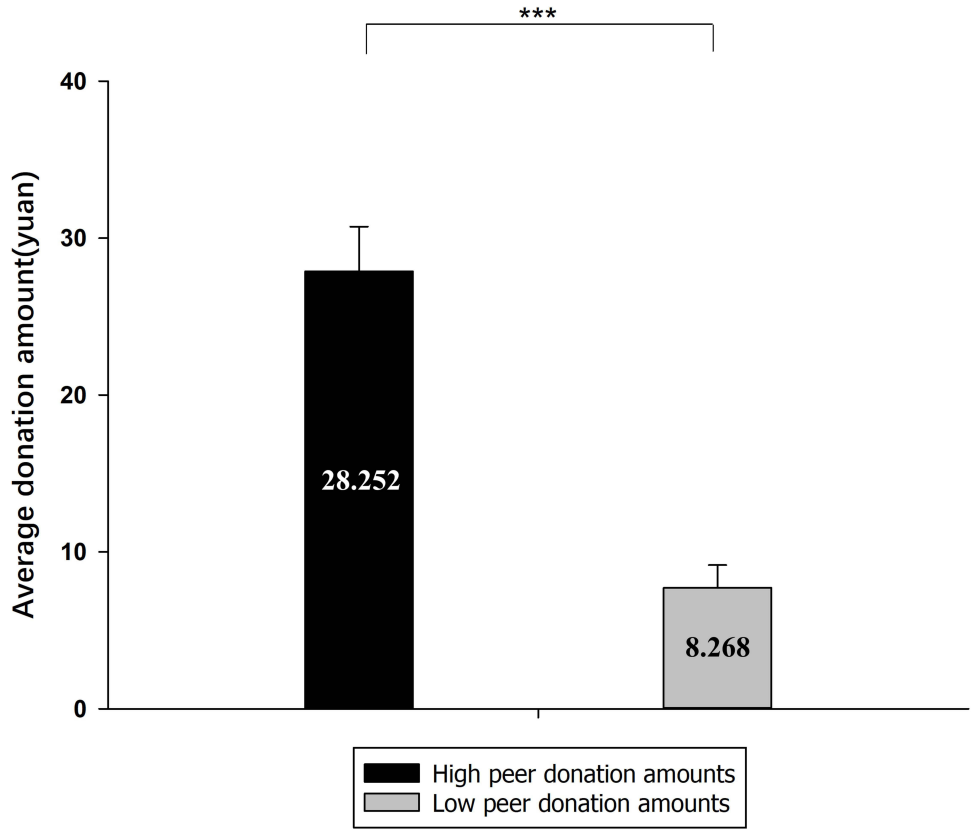

Figure 2 Behavioral results of the participants' donation amounts in peer donation amounts (high vs low): the black bar represents high peer donation amounts, whereas the grey bar represents the low peer donation amounts.
Note: ***$p < 0.001$.

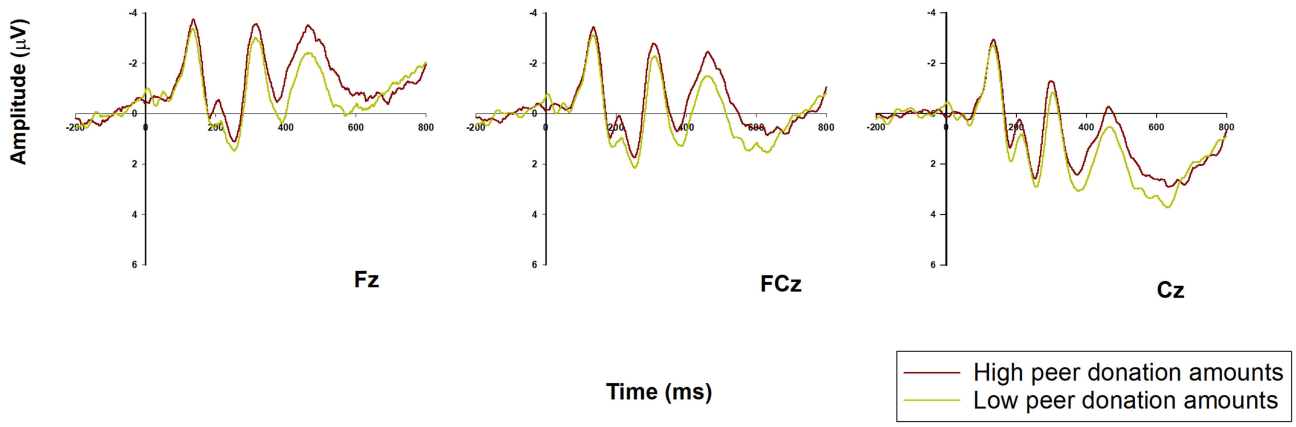

Figure 3 Grand-average P200, N200, P300 ERP waveforms in the three electrodes (Fz, FCz, and Cz): the red line represents high peer donation amounts, whereas the green line represents low peer donation amounts.

N2 Analysis

The results of two-way 2×9 repeated measures ANOVA analysis for N2 in 280–330ms were also shown in Figure 3, which suggested that the condition of LPDA (M=−1.335μV, SE = 0.906μV) elicited significantly smaller amplitudes compared to the HPDA condition (M=−2.101μV, SE = 0.853μV), F (1, 25)=4.726, p = 0.039, $\eta^2_p = 0.159$. The paired *t*-test also supported the result (HPDA vs LPDA: t=−2.174, p = 0.039, LPDA > HPDA). Since N2 is a negative polarity ERP component, a smaller voltage value means a larger amplitude.

P3 Analysis

The ERP waveform for P3 is detailed in Figure 3. The two-way 2×9 repeated measures ANOVA analysis for the average amplitudes of P3 (positive polarity: larger voltage value means larger amplitude) in the time window of 360–410ms revealed a significant main effect for the average peer donation amounts, F (1, 25) = 8.085, p = 0.009, η^2_p = 0.244. The additional paired t-test also demonstrated the main effect of the average peer donation amounts (HPDA vs LPDA: t= −2.843, p = 0.009, LPDA > HPDA). The LPDA condition (M = 1.363μV, SE = 0.796μV) elicited a significantly larger P3 mean amplitude than the HPDA condition (M = 0.208μV, SE = 0.736μV).

Correlation Analysis of P2 and P3

Since P2 and P3 are considered to be the sequential stages of reward-related processing,[66] we further test the correlation between the P2 and P3 components. A Spearman correlation analysis between the mean amplitude of P2 and that of P3 was conducted. The results showed that there was a significant positive correlation (r = 0.670, p < 0.001) between the mean amplitude of P2 and P3 in 9 electrodes (F1, Fz, F2, FC1, FCz, FC2, C1, Cz, C2), as shown in Figure 4.

Discussion

The present study employs the average peer donation amounts as the experimental stimuli to investigate how peer effects influence the donation amounts. Furthermore, the study utilizes the neural science tool of EEG with ERP components to elucidate the underlying neural and psychological mechanisms of the early-stage decision-making processes. By administering the experiment on a sample of Chinese college students, the current study replicated the behavioral findings of prior studies, uncovered the remained-salient reward perception approach, and discovered a new cost-benefit analysis approach. In the following sections, we offer a detailed discussion of each of the obtained results.

The behavioral findings of the present study reveal that there exists a positive correlation between the average peer donation amount and the donations made by donors, thus lending empirical support to Hypothesis 1. Furthermore, the extent to which the HPDA (LPDA) has raised (lowered) donation levels is also an interesting yet meaningful question. Thus, t-tests were conducted. The results indicated that, firstly, although the average donation amount in the HPDA was significantly greater than that in the LPDA, it remained significantly lower than both the mean value and the lower limit

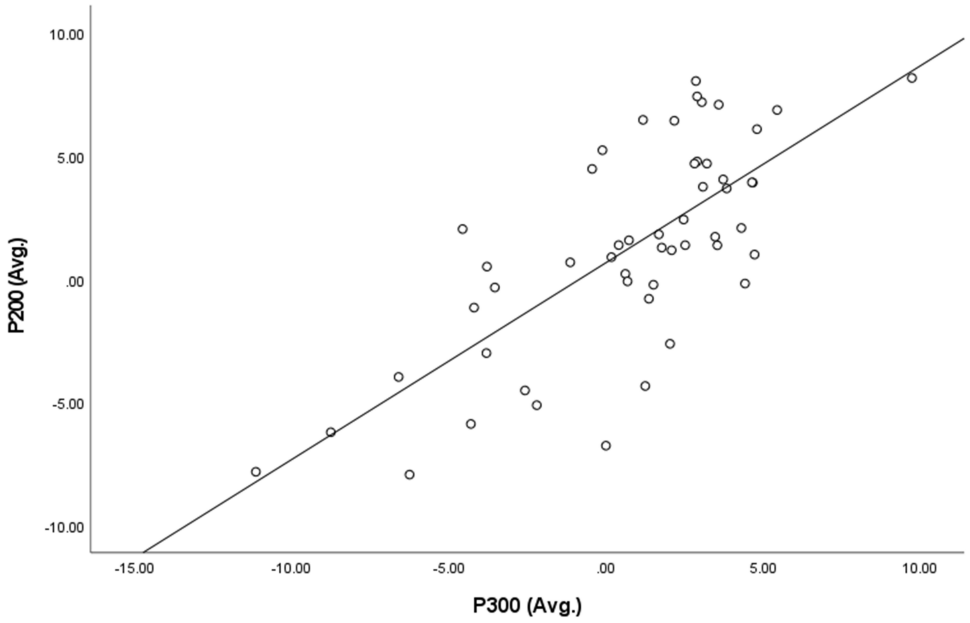

Figure 4 The result of Correlation analysis between the mean amplitude of P200 and the mean amplitude of P300: The horizontal axis is the average amplitude of P300 on the nine electrodes (F1, Fz, F2, FC1, FCz, FC2, C1, Cz, C2), and the vertical axis is the average amplitude of P200 on the nine electrodes (F1, Fz, F2, FC1, FCz, FC2, C1, Cz, C2).
Note: Avg. represents average amplitude on the nine electrodes.

of HPDA, namely 48 and 46, respectively. Secondly, the average donation amount in the LPDA was found to be significantly higher than the mean value of LPDA (5), but it failed to reach statistical significance when compared to the upper threshold (7). This result is similar to some previous studies, for example, Agerström et al[53] found that when nudging university students to donate using local social norms (ie, 73% of students in the same university donated 20 crowns), the average donation amount (20.78) is slightly higher than the proposed amount (20). Unfortunately, this study did not test the statistical significance of this difference,[53] and other similar studies also ignored the investigation of the relationship between experimental conditions and final donation results.[10,29,32]

This study will discuss these intriguing behavioral results in depth, since two contentious questions arise here: First, if higher donation leads to greater rewards under LPDA, why do donors only maintain a slightly higher level of giving than displayed information? (Q1) Second, why do donors tend to give more in the context of HPDA even when the average amount donated fails to reach the average level of descriptive social norms? (Q2) Later, we shall further expound on these questions in conjunction with the ERP results.

At the brain level, significant amplitudes of P2 were observed. The results of the ANOVA analysis demonstrated that the LPDA produced larger P2 amplitudes than the HPDA, lending robust support to H2. As previously noted, the P2 component is closely linked to the early unconscious allocation of attentional resources,[22,60] and stands as a key index component in the cue evaluation phase.[64–66] In the present study, the combination of "peer donation amount" and "how-much-to-donate decision" has the potential to evoke marketplace norms, rather than altruistic norms, which, in turn, may prompt donors to seek rewards while making donations.[40] The LPDA represented more available personal and social rewards than the HPDA,[48,49] thus eliciting a larger P2 amplitude. Additionally, the unconsciousness of the P2 component indicates that donation decisions influenced by peer donation amount showed more attention to reward information in the early decision-making period. Of particular interest, in the current study, it was essential to consider the cost (capacity) factor to discern the different rewards between the LPDA and HPDA. Therefore, we seem to be able to infer that the perception of cost has also started in the P2 stage.

N2 is an important ERP component in the current study, whose results showed that the N2 amplitude elicitation in the LPDA is significantly smaller than that in the HPDA, supporting H3. Previous reviews have shown that N2 amplitude is related to the level of conflict in the decision-making processes.[22,67–69] Some researchers made further inferences on this basis, thinking that the N2 amplitude may also be related to the perceived risk of decision-making.[22,70] Empirical research suggests that peer influence can be used as an important indicator of the perceived quality of donation activities, that is, a higher peer donation amount can indicate that the donation activity is of higher quality and more trustworthy.[71] But the actual results contradict this reasoning. The results support the existence of a cost-benefit analysis mechanism that brings decision conflicts into the overall donation decision processes. Specifically, this study finds that obvious monetary information prompts donors to consider the costs of donation decisions, leading donors to make a trade-off between existing resources and expected rewards. In the case of HPDA, the cost of obtaining the expected rewards exceeds expectations, resulting in increased decision-making conflicts. Conversely in the case of LPDA, the coexistence of more available prospective rewards and lower donation costs makes donation decisions almost conflict-free. Moreover, if we take the above-mentioned self-control perspective, the decision conflict also can source from the overcoming of self-control problem.[35–38] Compared with LPDA which only requires donors to control the donation at a suitable level (slightly higher than LPDA), the HPDA requires donors to consider whether to actively activate the self-control mechanism to prevent donations beyond their ability or give up donations, and turn to calculated donations or even "pure" altruism. Generally, in the condition of displaying peer donation amounts, the cognitive approach of peer-influenced online donation decision is characterized by a decision-conflicts-represented cost-benefits analysis process.

Following the N2 is P3 component. The analysis results indicated that LPDA indeed evoked larger P3 amplitudes. Thus, H4 was supported. Since P3 component has long been considered as a remark of reward anticipation stage which corresponds to P2 (cue evaluation stage) and forms the two-stage reward-related cognitive processing,[64–66] a correlation analysis was also conducted. The result showed significantly positive correlation between the mean amplitude of P200 and that of P300, providing another strong evidence of the existence of a reward-related processing process throughout the ERP time window. Previous studies also find that when subjects donate money, parts of the brain which are associated with reward circuitry are activated.[41,87] Therefore, our study also aligns with previous neurophysiological findings. This

paper argues that the difference in perceived expected returns between LPDA and HPDA is caused by different types of social comparisons. The LPDA brings about downward social comparisons and thus a corresponding set of personal and social benefits which lead to higher reward perception and donation motivation.[48,49] The HPDA, on the other hand, stimulates automatic upward social comparisons, which lead to a cascade of negative effects such as low self-efficacy, low self-esteem, and low well-being that correspond to lower reward perception.[16,17]

A problem naturally arises: If the P3 results represent behavioral motivation tendencies,[77] the donor should not increase their donation amount. We formally suggest our explanations for these questions here. For Q1, it can be explained by the boomerang effect.[88,89] Specifically, this effect assumes that descriptive social information will be used by donors as a reference point (anchor) for decision-making in ambiguous information situations.[57] It can also be interpreted by the self-control mechanism. As mentioned in Literature Review, self-control highlights the necessity of cost-benefit balancing in the processes of donation amount decision.[35,36] When the peer donation amount information is lower than expected, driven by the rational cost-saving motivation, the donor's donation amounts will converge to peer donation amount. However, to simultaneously obtain the expected rewards (such as self-improvement and positive social evaluation, etc.),[48] these amounts will eventually be slightly higher than the LPDA, so as to achieve a cost-benefit balance.

For Q2 and the inconsistency between P300 and behavioral results, three explanations have been put forward in Behavioral Hypothesis, namely "social norm as a magnet",[54–56] "cognitive dissonance theory"[58] and "self-control mechanism",[37,38] here we extend the "self-control mechanism" explanation and add another interpretation. First, from the self-control perspective, donors prevented themselves sink into the selfishness (excessive donation or give up) and turn into either calculated donation (following the social norm or de escalating the cognitive dissonance with monetary cost) or "pure" altruism through active self-control.[35–38] If the explanation truly stands, self-control would be an essential yet effective self-protection mechanism in dealing with negative emotions evoked by upward social comparison in peer-influenced online donation context,[90] since it can either alleviate (calculated donation) or eliminate ("pure" altruism) those negative emotions. Unfortunately, this study could not confirm the availability of self-control explanation, thus leaving a meaningful question for future research. Second, the occurrence of inconsistencies between the electrophysiological and behavioral outcomes is not uncommon in similar studies.[70] This discrepancy can be attributed, in part, to the limitations of ERP analysis, which only capture the initial stages of decision-making processes despite their high temporal resolution. The actual decision-making process is much longer, and other factors in the subsequent processes can also affect the decision-making results.

In general, this research has the following theoretical and managerial implications. First, this study successfully reproduces the behavioral results in previous research, that is, HPDA leads to high donation amount, while LPDA reduces donation amount. Second, in contrast to the psychological model proposed in the previous study,[3] the current investigation reveals that peer donation amount information heightens donors' perception of donation costs and benefits, thereby triggering a cost-benefit analysis process that generates varying degrees of decision-making conflicts. Aside from the potential conflicts generated by economically cost-benefit balance, self-control problem preceding cost-benefit analysis could also be an interpretation of the decision conflict, since not all donors can prevent themselves from sinking into selfishness. Third, this study finds that donors with tight donation budgets diverge between their donation behavior and their psychological mechanisms of donation (ie, making decisions to give higher amounts in conjunction with low prospective rewards and possibly negative emotions). At the same time, this paper also puts forward four possible explanations for this phenomenon. Although this study could not carry out further experiments to distinguish which factors caused this divergence, this valuable phenomenon still deserves further exploration. Practically, Donation platforms based on social media should be more careful about using social information, especially peer information related to donation amounts, to influence donors' donation decisions. On the one hand, such an approach may come at the cost of compromising the well-being of donors, and, on the other hand, the short-term increase in donations may come at the expense of long-term reductions in donations.

For sure, in addition to the above mentioned limitations, this study has some other limitations which could provide valuable future research directions. First concern is about robustness and realistic generalizability of the results. Since ERP research has strict requirements on the experimental environment, this study has made a lot of simplifications to the real online donation scenario and based on a limited subject group. To enhance the external validity (generalizability) of our findings, future research should complement our ERP-based experimental approach with field experiments and other methods. Also, more nuanced-

designed experiment with larger sample is needed to validate the robustness of our findings in diverse settings (eg, different incentive structures, contexts, and demographics of donors). Second, the self-control mechanism mentioned in this study is generated from two distinct strands of literature (one believes self-control can turn donors from impulsive to rational, and the other believes self-control can turn donors from selfish to altruistic). However, we use a sequential rather than parallel perspective to explain the role of self-control to prevent logical conflicts. This may provide a new theoretical perspective for subsequent research on self-control. Furthermore, the possibility of self-control as an explanation to explain Q1/2 and the decision conflicts represented by N2, and as a possible way to alleviate the negative impact of upward social comparison has not been confirmed or ruled out. This also provides a valuable path for future research. Last but not least, this research, like the previous literature, does not focus on the interaction effects between social information. However, social information often appears simultaneously in realistic donation situations, so researching interactions between information is likely to lead to valuable new findings.

Conclusion

This study aims to investigate the effects of peer donation amount on "how-much-to-donate" decisions. Behavioral and ERP results showed that donors with limited donation budgets tend to make higher donation amount decisions despite low perceived rewards and potentially negative emotions, indicating the increment of donation may come at cost of donors. However, the specific mechanism that supports this phenomenon still needs further exploration. Additionally, compared with previous "number of donated peers" study, the current study further suggests that the mechanisms behind decision-making can be summarized into a cognitive approach represented by cost-benefit analysis and an affective approach represented by reward perception.

Data Sharing Statement

The data presented in this study are available upon request from the corresponding author. The raw data are not publicly available, as they contain individually identifiable information.

Ethics Approval and Informed Consent

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Internal Review Board of Academy of Neuroeconomics and Neuromanagement at Ningbo University (Report No.20210702). Informed consent was obtained from all subjects involved in the study.

Consent for Publication

All authors have reviewed this manuscript and agreed to its publication.

Acknowledgments

We thank the editors of Psychology Research and Behavior Management and the anonymous peer-reviewers for their hard and careful work.

Funding

This work was supported by the Project of Philosophy and Social Science Key Research Base of Zhejiang Province (grant number 20JDZD024), Zhejiang Provincial Natural Science Foundation of China (grant number LQ20G020010), and the Fundamental Research Funds for the Provincial Universities of Zhejiang (grant number SJWY2020001).

Disclosure

The authors report no conflicts of interest in this work.

References

1. Erceg N, Burghart M, Cottone A, et al. The effect of moral congruence of calls to action and salient social norms on online charitable donations: a protocol study. *Front Psychol*. 2018;9:1913. doi:10.3389/fpsyg.2018.01913
2. Andreoni J. Toward a theory of charitable fund-raising. *J Polit Econ*. 1998;106(6):1186–1213. doi:10.1086/250044

3. Ye Y, Jiang P, Zhang W. The neural and psychological processes of peer-influenced online donation decision: an event-related potential study. original research. *Front Psychol*. 2022;13. doi:10.3389/fpsyg.2022.899233
4. Smith S, Windmeijer F, Wright E. Peer effects in charitable giving: evidence from the (running) field. *Econ J*. 2015;125(585):1053–1071. doi:10.1111/ecoj.12114
5. Andreoni J, Rao JM. The power of asking: how communication affects selfishness, empathy, and altruism. *J Public Econ*. 2011;95(7–8):513–520. doi:10.1016/j.jpubeco.2010.12.008
6. Ugur ZB. Donate more, be happier! Evidence from the Netherlands. *Appl Res Qual Life*. 2018;13:157–177. doi:10.1007/s11482-017-9512-0
7. Bekkers R, Wiepking P. A literature review of empirical studies of philanthropy: eight mechanisms that drive charitable giving. *Nonprofit Volunt Sect Q*. 2011;40(5):924–973. doi:10.1177/0899764010380927
8. Meer J. Brother, can you spare a dime? Peer pressure in charitable solicitation. *J Public Econ*. 2011;95(7–8):926–941. doi:10.1016/j.jpubeco.2010.11.026
9. Filo K, Fechner D, Inoue Y. The donors supporting charity sport event participants: an exploration of the factors driving donations. *J Sport Manag*. 2020;34(5):488–499. doi:10.1123/jsm.2019-0253
10. Shang J, Croson R. A field experiment in charitable contribution: the impact of social information on the voluntary provision of public goods. *Econ J*. 2009;119(540):1422–1439. doi:10.1111/j.1468-0297.2009.02267.x
11. Andreoni J. Philanthropy. In: *Handbook of the Economics of Giving, Altruism and Reciprocity*. Elsevier; 2006:1201–1269.
12. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991;50(2):179–211. doi:10.1016/0749-5978(91)90020-T
13. Brooks AC. What do "don't know" responses really mean in giving surveys? *Nonprofit Volunt Sect Q*. 2004;33(3):423–434. doi:10.1177/0899764004266636
14. Frey BS, Meier S. Social comparisons and pro-social behavior: testing "conditional cooperation" in a field experiment. *Am Econ Rev*. 2004;94(5):1717–1722. doi:10.1257/0002828043052187
15. Diener E. Subjective well-being. *Psychol Bull*. 1984;95(3):542. doi:10.1037/0033-2909.95.3.542
16. Kross E, Verduyn P, Demiralp E, et al. Facebook use predicts declines in subjective well-being in young adults. *PLoS One*. 2013;8(8):e69841. doi:10.1371/journal.pone.0069841
17. Fardouly J, Diedrichs PC, Vartanian LR, Halliwell E. Social comparisons on social media: the impact of Facebook on young women's body image concerns and mood. *Body Image*. 2015;13:38–45. doi:10.1016/j.bodyim.2014.12.002
18. Feinstein BA, Hershenberg R, Bhatia V, Latack JA, Meuwly N, Davila J. Negative social comparison on Facebook and depressive symptoms: rumination as a mechanism. *Psychol Pop Media Cult*. 2013;2(3):161. doi:10.1037/a0033111
19. Swallow SR, Kuiper NA. Social comparison and negative self-evaluations: an application to depression. *Clin Psychol Rev*. 1988;8(1):55–76. doi:10.1016/0272-7358(88)90049-9
20. Kottasz R. How should charitable organisations motivate young professionals to give philanthropically? *Int J Nonprofit Volunt Sect Mark*. 2004;9(1):9–27. doi:10.1002/nvsm.230
21. Yang T, Zhu J. *Philanthropy Blue Book: China Philanthropy Development Report*. Social Sciences Academic Press; 2022.
22. Jin J, Zhang W, Chen M. How consumers are affected by product descriptions in online shopping: event-related potentials evidence of the attribute framing effect. *Neurosci Res*. 2017;125:21–28. doi:10.1016/j.neures.2017.07.006
23. San Martín R, Kwak Y, Pearson JM, Woldorff MG, Huettel SA. Altruistic traits are predicted by neural responses to monetary outcomes for self vs charity. *Soc Cogn Affect Neurosci*. 2016;11(6):863–876. doi:10.1093/scan/nsw026
24. Teng Z, Nie Q, Liu Y, Guo C. Is prosocial video game exposure related to prosociality? An ERP study based on a prosocial help needed decision task. *Comput Human Behav*. 2018;79:30–39. doi:10.1016/j.chb.2017.10.014
25. Cheung CK, Chan CM. Social-cognitive factors of donating money to charity, with special attention to an international relief organization. *Eval Program Plann*. 2000;23(2):241–253. doi:10.1016/S0149-7189(00)00003-3
26. Wiepking P. For the love of mankind: a sociological study on charitable giving; 2008.
27. Chinman MJ, Wandersman A, Goodman RM. A benefit-and-cost approach to understanding social participation and volunteerism in multilevel organizations. In: *Processes of Community Change and Social Action*. Psychology Press; 2014:105–126.
28. Batson CD, Shaw LL. Evidence for altruism: toward a pluralism of prosocial motives. *Psychol Inq*. 1991;2(2):107–122. doi:10.1207/s15327965pli0202_1
29. Croson R, Handy F, Shang J. Keeping up with the Joneses: the relationship of perceived descriptive social norms, social information, and charitable giving. *Nonprofit Manag Leadersh*. 2009;19(4):467–489. doi:10.1002/nml.232
30. Park S, Shin J. The influence of anonymous peers on prosocial behavior. *PLoS One*. 2017;12(10):e0185521. doi:10.1371/journal.pone.0185521
31. Hou T, Hou K, Wang X, Luo XR. Why I give money to unknown people? An investigation of online donation and forwarding intention. *Electron Commer Res Appl*. 2021;47:101055. doi:10.1016/j.elerap.2021.101055
32. Croson R, Shang J. The impact of downward social information on contribution decisions. *Exp Econ*. 2008;11:221–233. doi:10.1007/s10683-007-9191-z
33. Zhao X, Chen B, Jin P. Inspired to donate: how donors' social class impacts charitable donations. *J Consum Behav*. 2023;22(1):3–13. doi:10.1002/cb.2042
34. Piff PK, Kraus MW, Côté S, Cheng BH, Keltner D. Having less, giving more: the influence of social class on prosocial behavior. *J Pers Soc Psychol*. 2010;99(5):771. doi:10.1037/a0020092
35. Rand DG, Greene JD, Nowak MA. Spontaneous giving and calculated greed. *Nature*. 2012;489(7416):427–430. doi:10.1038/nature11467
36. Righetti F, Finkenauer C, Finkel EJ. Low self-control promotes the willingness to sacrifice in close relationships. *Psychol Sci*. 2013;24(8):1533–1540. doi:10.1177/0956797613475457
37. Ugur ZB. Does self-control foster generosity? Evidence from ego depleted children. *J Behav Exp Econ*. 2021;90:101652. doi:10.1016/j.socec.2020.101652
38. Andreoni J, Koessler A-K, Serra-Garcia M. Who gives? On Empathy and Impulsiveness; 2017.
39. Gershon R, Cryder C. Goods donations increase charitable credit for low-warmth donors. *J Consum Res*. 2018;45(2):451–469. doi:10.1093/jcr/ucx126
40. Yin B, Li YJ, Singh S. Coins are cold and cards are caring: the effect of pregiving incentives on charity perceptions, relationship norms, and donation behavior. *J Mark*. 2020;84(6):57–73. doi:10.1177/0022242920931451

41. Harbaugh WT, Mayr U, Burghart DR. Neural responses to taxation and voluntary giving reveal motives for charitable donations. *Science*. 2007;316(5831):1622–1625. doi:10.1126/science.1140738
42. Ye J, Zhou K, Chen R. Numerical or verbal information: the effect of comparative information in social comparison on prosocial behavior. *J Bus Res*. 2021;124:198–211. doi:10.1016/j.jbusres.2020.11.053
43. Vohs KD, Mead NL, Goode MR. Merely activating the concept of money changes personal and interpersonal behavior. *Curr Dir Psychol Sci*. 2008;17(3):208–212. doi:10.1111/j.1467-8721.2008.00576.x
44. Duncan B. A theory of impact philanthropy. *J Public Econ*. 2004;88(9–10):2159–2180. doi:10.1016/S0047-2727(03)00037-9
45. Kim H-M. Social comparison of fitness social media postings by fitness app users. *Comput Human Behav*. 2022;131:107204. doi:10.1016/j.chb.2022.107204
46. Nelissen RM. The price you pay: cost-dependent reputation effects of altruistic punishment. *Evol Hum Behav*. 2008;29(4):242–248. doi:10.1016/j.evolhumbehav.2008.01.001
47. Vogel EA, Rose JP, Roberts LR, Eckles K. Social comparison, social media, and self-esteem. *Psychol Pop Media Cult*. 2014;3(4):206. doi:10.1037/ppm0000047
48. Suls J, Martin R, Wheeler L. Social comparison: why, with whom, and with what effect? *Curr Dir Psychol Sci*. 2002;11(5):159–163. doi:10.1111/1467-8721.00191
49. Taylor SE, Brown JD. Illusion and well-being: a social psychological perspective on mental health. *Psychol Bull*. 1988;103(2):193. doi:10.1037/0033-2909.103.2.193
50. Collins RL. For better or worse: the impact of upward social comparison on self-evaluations. *Psychol Bull*. 1996;119(1):51. doi:10.1037/0033-2909.119.1.51
51. Liu P, He J, Li A. Upward social comparison on social network sites and impulse buying: a moderated mediation model of negative affect and rumination. *Comput Human Behav*. 2019;96:133–140. doi:10.1016/j.chb.2019.02.003
52. Shang J, Reed A, Croson R. Identity congruency effects on donations. *J Mark Res*. 2008;45(3):351–361. doi:10.1509/jmkr.45.3.351
53. Agerström J, Carlsson R, Nicklasson L, Guntell L. Using descriptive social norms to increase charitable giving: the power of local norms. *J Econ Psychol*. 2016;52:147–153. doi:10.1016/j.joep.2015.12.007
54. Klucharev V, Hytönen K, Rijpkema M, Smidts A, Fernández G. Reinforcement learning signal predicts social conformity. *Neuron*. 2009;61(1):140–151. doi:10.1016/j.neuron.2008.11.027
55. Van Teunenbroek C, Bekkers R, Beersma B. Look to others before you leap: a systematic literature review of social information effects on donation amounts. *Nonprofit Volunt Sect Q*. 2020;49(1):53–73. doi:10.1177/0899764019869537
56. Partika A. Donate, everybody's doing it: social influences on charitable giving. *Psi Chi J Psychol Res*. 2017;22(1):39–45. doi:10.24839/2325-7342.JN22.1.39
57. Schultz PW, Nolan JM, Cialdini RB, Goldstein NJ, Griskevicius V. The constructive, destructive, and reconstructive power of social norms. *Psychol Sci*. 2007;18(5):429–434. doi:10.1111/j.1467-9280.2007.01917.x
58. Harmon-Jones E, Mills J. An introduction to cognitive dissonance theory and an overview of current perspectives on the theory. In: *Cognitive Dissonance: Reexamining a Pivotal Theory in Psychology. 2nd* ed. American Psychological Association; 2019:3–24.
59. Polezzi D, Lotto L, Daum I, Sartori G, Rumiati R. Predicting outcomes of decisions in the brain. *Behav Brain Res*. 2008;187(1):116–122. doi:10.1016/j.bbr.2007.09.001
60. Correll J, Urland GR, Ito TA. Event-related potentials and the decision to shoot: the role of threat perception and cognitive control. *J Exp Soc Psychol*. 2006;42(1):120–128. doi:10.1016/j.jesp.2005.02.006
61. Martin LE, Potts GF. Reward sensitivity in impulsivity. *Neuroreport*. 2004;15(9):1519–1522. doi:10.1097/01.wnr.0000132920.12990.b9
62. Potts GF, Martin LE, Burton P, Montague PR. When things are better or worse than expected: the medial frontal cortex and the allocation of processing resources. *J Cogn Neurosci*. 2006;18(7):1112–1119. doi:10.1162/jocn.2006.18.7.1112
63. Flores A, Münte TF, Donamayor N. Event-related EEG responses to anticipation and delivery of monetary and social reward. *Biol Psychol*. 2015;109:10–19. doi:10.1016/j.biopsycho.2015.04.005
64. Broyd SJ, Richards HJ, Helps SK, Chronaki G, Bamford S, Sonuga-Barke EJ. An electrophysiological monetary incentive delay (e-MID) task: a way to decompose the different components of neural response to positive and negative monetary reinforcement. *J Neurosci Methods*. 2012;209(1):40–49. doi:10.1016/j.jneumeth.2012.05.015
65. Novak KD, Foti D. Teasing apart the anticipatory and consummatory processing of monetary incentives: an event-related potential study of reward dynamics. *Psychophysiology*. 2015;52(11):1470–1482. doi:10.1111/psyp.12504
66. Glazer JE, Kelley NJ, Pornpattananangkul N, Mittal VA, Nusslock R. Beyond the FRN: broadening the time-course of EEG and ERP components implicated in reward processing. *Int J Psychophysiol*. 2018;132:184–202. doi:10.1016/j.ijpsycho.2018.02.002
67. Folstein JR, Van Petten C. Influence of cognitive control and mismatch on the N2 component of the ERP: a review. *Psychophysiology*. 2008;45(1):152–170. doi:10.1111/j.1469-8986.2007.00602.x
68. Ma Q, Wang X, Dai S, Shu L. Event-related potential N270 correlates of brand extension. *Neuroreport*. 2007;18(10):1031–1034. doi:10.1097/WNR.0b013e3281667d59
69. Spapé MM, Band GP, Hommel B. Compatibility-sequence effects in the Simon task reflect episodic retrieval but not conflict adaptation: evidence from LRP and N2. *Biol Psychol*. 2011;88(1):116–123. doi:10.1016/j.biopsycho.2011.07.001
70. Wang Q, Meng L, Liu M, Wang Q, Ma Q. How do social-based cues influence consumers' online purchase decisions? An event-related potential study. *Electron Commer Res*. 2016;16:1–26. doi:10.1007/s10660-015-9209-0
71. Ahern KR, Duchin R, Shumway T. Peer effects in risk aversion and trust. *Rev Financ Stud*. 2014;27(11):3213–3240. doi:10.1093/rfs/hhu042
72. Yu M, Liu T, Shi J. Food is discounted more steeply than money: evidence from N2 and P3 responses in delay discounting tasks. *Neuropsychologia*. 2020;142:107469. doi:10.1016/j.neuropsychologia.2020.107469
73. Euser AS, Van Meel CS, Snelleman M, Franken IH. Acute effects of alcohol on feedback processing and outcome evaluation during risky decision-making: an ERP study. *Psychopharmacology*. 2011;217(1):111–125. doi:10.1007/s00213-011-2264-x
74. Li P, Jia S, Feng T, Liu Q, Suo T, Li H. The influence of the diffusion of responsibility effect on outcome evaluations: electrophysiological evidence from an ERP study. *Neuroimage*. 2010;52(4):1727–1733. doi:10.1016/j.neuroimage.2010.04.275

75. Leng Y, Zhou X. Modulation of the brain activity in outcome evaluation by interpersonal relationship: an ERP study. *Neuropsychologia*. 2010;48(2):448–455. doi:10.1016/j.neuropsychologia.2009.10.002
76. Wu Y, Zhou X. The P300 and reward valence, magnitude, and expectancy in outcome evaluation. *Brain Res*. 2009;1286:114–122. doi:10.1016/j.brainres.2009.06.032
77. San Martín R. Event-related potential studies of outcome processing and feedback-guided learning. *Front Hum Neurosci*. 2012;6:304. doi:10.3389/fnhum.2012.00304
78. Funkhouser CJ, Auerbach RP, Kujawa A, Morelli SA, Phan KL, Shankman SA. Social feedback valence differentially modulates the reward positivity, P300, and late positive potential. *J Psychophysiol*. 2019;34:255–267. doi:10.1027/0269-8803/a000253
79. Van der Veen F, van der Molen MJ, Van der Molen M, Franken I. Thumbs up or thumbs down? Effects of neuroticism and depressive symptoms on psychophysiological responses to social evaluation in healthy students. *Cogn Affect Behav Neurosci*. 2016;16(5):836–847. doi:10.3758/s13415-016-0435-2
80. Yao Z, Lin X, Hu X. Optimistic amnesia: how online and offline processing shape belief updating and memory biases in immediate and long-term optimism biases. *Soc Cogn Affect Neurosci*. 2021;16(5):453–462. doi:10.1093/scan/nsab011
81. Faul F, Erdfelder E, Buchner A, Lang A-G. Statistical power analyses using G* Power 3.1: tests for correlation and regression analyses. *Behav Res Methods*. 2009;41(4):1149–1160. doi:10.3758/BRM.41.4.1149
82. Beijing News. The Average Living Cost of College Students is Nearly 2000 Yuan. Why is it not enough? 2021. Available from: https://baijiahao.baidu.com/s?id=1715188732059167631&wfr=spider&for=pcfor=pc. Accessed 29 July 2023.
83. Delorme A, Makeig S. EEGLAB: an open source toolbox for analysis of single-trial EEG dynamics including independent component analysis. *J Neurosci Methods*. 2004;134(1):9–21. doi:10.1016/j.jneumeth.2003.10.009
84. Semlitsch HV, Anderer P, Schuster P, Presslich O. A solution for reliable and valid reduction of ocular artifacts, applied to the P300 ERP. *Psychophysiology*. 1986;23(6):695–703. doi:10.1111/j.1469-8986.1986.tb00696.x
85. Picton TW, Bentin S, Berg P, et al. *Guidelines for Using Human Event-related Potentials to Study Cognition: Recording Standards and Publication Criteria*. Wiley Online Library; 2000.
86. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. Academic press; 2013.
87. Moll J, Krueger F, Zahn R, Pardini M, de Oliveira-Souza R, Grafman J. Human fronto–mesolimbic networks guide decisions about charitable donation. *Proc Natl Acad Sci USA*. 2006;103(42):15623–15628. doi:10.1073/pnas.0604475103
88. Moseley A, James O, John P, Richardson L, Ryan M, Stoker G. The effects of social information on volunteering: a field experiment. *Nonprofit Volunt Sect Q*. 2018;47(3):583–603. doi:10.1177/0899764017753317
89. Bartke S, Friedl A, Gelhaar F, Reh L. Social comparison nudges—Guessing the norm increases charitable giving. *Econ Lett*. 2017;152:73–75. doi:10.1016/j.econlet.2016.12.023
90. Gailliot MT, Schmeichel BJ, Baumeister RF. Self-regulatory processes defend against the threat of death: effects of self-control depletion and trait self-control on thoughts and fears of dying. *J Pers Soc Psychol*. 2006;91(1):49. doi:10.1037/0022-3514.91.1.49