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ORIGINAL RESEARCH

The Effect of Comparative Direction and Comparative Gap on Self-Deception

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Purpose: Self-deception refers to an individual holding inflated beliefs about their abilities, plays a crucial role in human behavior and decision-making. Individuals may inflate their abilities when subject to comparisons with others. This study examined the impact of social comparison on self-deception through the implementation of two behavioral experiments.

Methods: In Experiment 1, we recruited a sample of 152 undergraduate students. Participants were falsely informed that they performed better (downward comparison) and worse (upward comparison) than average on a game. Subsequently, their level of self-deception was assessed by asking them to predict their performance in a future game, with more inflated predictions indicating greater self-deception. In Experiment 2, we gathered 126 undergraduate students to broaden the current study. This experiment examined the combined effects of comparison direction and comparison gap on self-deceptive behavior.

Results: The findings showed that self-deception was more common in circumstances of upward comparison than in downward comparison or no comparison (Experiment 1). Furthermore, Individuals were more inclined to participate in self-deception when encountering a notable performance gap relative to others, particularly in scenarios involving upward social comparison (Experiment 2).

Conclusion: The findings suggested that when confronted with threatening social comparative information, people tended to use self-deception to protect themselves. Members of the large gap group experienced strong feelings of unfairness and negative emotions, which led to self-protective behaviors and a greater likelihood of self-deception.

Keywords: comparative direction, comparative gap, self-deception, self-protection, social comparison threat

Introduction

Social comparison has always been an important topic in psychological and social science research. People evaluate their achievements and abilities by comparing themselves to others.[1,2] Festinger introduced the notion of social comparison, which postulates that people satisfy their desire for self-evaluation by comparing themselves to others.[3] It has become increasingly clear that social comparison serves multiple purposes and have various effects.[2,4] There is strong evidence that making upward comparisons may both increase motivation and decrease self-esteem in the same person.[5] Specifically, the majority of recent research suggests that upward comparisons cause people to act in harmful ways (like violence, exclusion, and rudeness) and feel bad about themselves (like jealousy, animosity, and anxiety).[6–8] When people compare themselves to others, particularly when they believe their performance or standing is lower, they often experience feelings of threat or anxiety. This is referred to as the Social Comparison Threat Effect.[9] Self-deception may be significantly influenced by social comparison. Self-deception is a useful coping mechanism for those who experience unpleasant emotions and sensations of danger as a result of comparisons. This self-deception may involve overestimating one's performance and underestimating others' performance. However, a minority of studies have also found that upward comparisons can trigger positive emotions (such as inspiration) and constructive behaviors (such as helping others, self-improvement, and enhancing performance).[10–12] People who are

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driven to better themselves are more inclined to compare themselves favorably to others and participate in upward social comparisons.[13,14] In this context, self-deception may also become a notable psychological phenomenon. Self-deception can manifest as individuals overestimating their performance to satisfy their desire for self-enhancement.[15,16] Therefore, the connection between self-deception and social comparison has become a central focus of research. This not only contributes to a deeper comprehension of individuals' behavior in social comparisons but also provides valuable insights into areas such as mental health, decision-making, and social interactions.

Self-deception is a widespread phenomenon in humans, characterized by the erroneous belief in an overestimation of one's own abilities. Because of this view, people tend to have optimistic illusions, deny their shortcomings, and have a good self-concept despite overwhelming evidence.[17–19] Self-deception is an internal process aimed at protecting the self from the influence of threatening information.[20] Determining the methodology for measuring self-deception becomes essential as scholarly interest in the subject of self-deception research grows.[21] We introduced a forward-looking paradigm to examine how self-deception influences predictions about the future. Chance et al captured this type of self-deception in a controlled laboratory environment using the prospective paradigm.[18] In the group with answer shown, participants had the opportunity to potentially achieve higher scores by peeking at the answers, while the group without answer shown did not have this option. Subsequently, in order to determine if individuals in the group whose answers were shown tended to overestimate their scores when making predictions, participants were asked to estimate the number of questions of the same difficulty level that they would successfully answer. We compare these two groups on two primary measures: performance on the first test (to assess the impact of having the answers) and predictions of future performance on a similar second test lacking an answer key (to assess self-deception).[18] The findings showed that the experimental group (with answer given) predicted better performance than the control group (without answer given), indicating self-deceptive tendencies. Researchers combined the "point estimation task" with the "prospective paradigm" and assessed its reliability and validity. The results indicated that it effectively induces self-deception.[22,23]

The relationship between social comparison and self-deception has not been directly examined in prior research. However, three aspects indicate a connection between them. First, research indicates that social comparison significantly influences dishonest behavior. For example, low income alone is unlikely to promote dishonesty, but comparing oneself to higher incomes increases the likelihood of dishonest behavior.[24,25] Laboratory studies demonstrate that failure often leads to subsequent dishonesty, indicating a tendency to deceive when in a disadvantaged position.[24–26] Second, social comparison involves not only wealth and achievement but also perceptions of ability and social status. Social dominance theory posits that an individual's perception of their social status is influenced by social comparison. When comparing themselves to those of higher social status, individuals may employ self-deception as a strategy to maintain self-esteem and mitigate feelings of threat.[27] Research shows that when individuals lie to someone of higher social status, they are more likely to engage in self-deception compared to lying to someone of the same social status. This is because those of higher social status are generally better at detecting deception. In this situation, the liar employs self-deception to conceal their dishonest behavior, making it more difficult for the other person to detect the lie.[28,29] Ren employed a prospective paradigm and found that when individuals perceive their social status as lower, they tend to exhibit greater self-deception, thereby making it more difficult for others to detect their deception.[27] Third, the social comparison threat effect posits that upward comparison is more likely to induce feelings of threat, while downward comparison tends to cause less threat.[30] Self-deception is particularly prevalent when facing threats.[15,16,31] Self-protection theory, which proposes that when an individual is threatened, there is an unconscious process of self-protection.[32] Previous studies have found that when a person's abilities are threatened, some individuals resort to lying to make their performance appear better than it is, thereby helping them feel more confident. This phenomenon is referred to as "creative self-deception".[33] Participants who scored lower than their peers on tasks tend to exaggerate their performance in front of their peers and may use self-deception to maintain self-esteem.[34] When individuals experience failure, they are more likely to engage in self-deception.[25,26] These findings suggest that in scenarios involving upward social comparison, individuals are more likely to engage in self-deception.

Several elements impact social comparison situations, including the characteristics of the comparison, the orientation of the comparison, and the extent of the comparison gap. Individuals can precisely gauge their own performance compared to others through social comparison. These comparisons lead to disparities between self and others. Some

crucial decisions are made based on the judgment of differences between oneself and others. However, the question of interest to us is how one's relative performance to others influences self-deceptive behavior. Several laboratory experiments have shown a direct relationship between the size of rewards and dishonesty, where those with greater salaries are more prone to cheating compared to those with lower incomes.[24,35] Given that the extent of the comparison gap affects cheating behavior, we hypothesize that self-deceptive behavior may also be influenced by the size of the comparison gap. Hence, this research aims to investigate the influence of both the direction and the comparison gap on self-deceptive behavior.

Research has not looked into how social comparison affects the frequency of self-deception.[33] Furthermore, there is a scarcity of research examining the significance of competence in the correlation between social comparison and self-deception.[36] The competence strongly affects self-image and self-esteem, especially in comparisons with others.[15,37] In this research, self-deception was studied by comparing how participants actually performed to how they expected to perform. The experiments consisted of three groups: a control group, an upward social comparison group, and a downward social comparison group. Subjects in the upward condition were informed that their test scores were below average, while those in the downward condition were informed that their scores were above average. On the basis of the literature, this study proposed the following hypothesis 1: Participants in the upward social comparison group were more likely to get involved in self-deception than those in the control or downward social comparison groups. This was because individuals engaging in upward comparisons tended to experience a greater sense of threat and were driven by a stronger motivation for self-enhancement, making self-deceptive behavior more likely to have occurred. Individuals also engaged in social comparison on the basis of performance. Thus, the following hypothesis 2 was proposed: Participants who were worse off than others (ie, had a large gap in performance) were more likely to have engaged in self-deception.[33]

We created two experiments to investigate the above mentioned hypotheses. Spot-the-difference was the task used in Experiment 1 to elicit different comparison direction conditions from participants. Subsequently, we measured the occurrence of self-deception using a prospective paradigm. Experiment 1 investigated the impact of comparison direction on self-deceptive behavior. To enhance the ecological validity, experiment 2 employed the Raven's Progressive Matrices (Raven) intelligence test to induce participants into different social comparison conditions. Experiment 2 examined how both the comparison direction and comparison gap jointly influence self-deceptive behavior.

Experiment 1

Method

Participants

In Experiment 1, we enrolled a total of 152 undergraduate students (43 men, 109 women; mean [*M*] ± standard deviation [*SD*] age: 20.46 ± 2.78 years). In the between-subjects research design, at least 149 participants were needed to reach an effect size of 0.3, power of 0.8, and α of 0.05, as determined in G-Power software (Version 3.1), for two-tailed tests.[38] Each participant had normal eyesight or corrected visual acuity and no history of neurological conditions or brain injuries. All participants gave written informed permission and received compensation following the experiment. The research was authorized by the local Ethics Committee.

Experimental Design

Experiment 1 employed a between-subjects approach with three comparisons (upward vs downward vs control) and two groups (answer shown vs no answer shown). The dependent variables were the participants' actual scores on Test 2 and the difference between their actual and predicted scores (actual scores were the participants' real results on Test 2, while predicted scores were their forecasts made after finishing Test 1).

Experimental Materials

Inducing Comparison Direction

Downward and upward social comparison were induced in the participants per the method of Wheeler and Argo et al[34,39] Specifically, the participants played a spot-the-difference game over 20 picture pairs. Cartoon landscapes with multiple

items were chosen because they will be sufficiently interesting and difficult for the participants.[40] They were asked to respond if there were one or two differences (by using the "F" key on the keyboard) or three or four differences (by pressing the "J" key on the keyboard), and they had a time constraint. After the game, the participants were shown their score. The researcher also displayed fabricated data on the average scores of other players, supposedly gathered from an authoritative source. Downward and upward social comparisons were then induced by showing participant scores that were lower and higher than other players average scores, respectively. Additionally, a control group was established in which the participants were not exposed to these artificially created mean scores. This spot-the-difference game is referred to as "Task 1" (Figure 1).

Measurement of Self-Deception

We utilized the "The Prospective Paradigm" to measure participants' self-deceptive behavior.[18,22,23] The discrepancy between actual and anticipated performance on the prospective paradigm suggested self-deception.[41] This paradigm consists of 120 red dot plots administered in two separate tests, referred to as Test 1 and Test 2. The red dots on both sides of the diagonally split square were placed randomly and unevenly by the experimental materials. The game was played in rounds, with participants answering whether there were more red dots on the right or left side of a square. The red dot plots were categorized into two types: those with answer shown (see Figure 2a) and those without (see Figure 2b).

Sixty red dot plots with answers were utilized in Test 1. The challenge for the participants was to estimate the number of red dots on each side. If participants believed there were more red dots on the left, they hit "F" and if they believed there were more red dots on the right, they pressed "J" (see Figure 3a). Subsequently, participants were required to respond to the "Prediction" displayed on the screen and input numerical values for their predicted scores (see the prediction interface in Figure 3a). In Test 2, participants were asked to assess the same set of 60 red dot plots without answers (see Figure 3b). It is worth noting that the values entered into the prediction interface represent predicted scores, while the scores obtained by the participants in Test 2 reflect their actual performance. The discrepancy between predicted and actual scores serves as an indicator of self-deception.

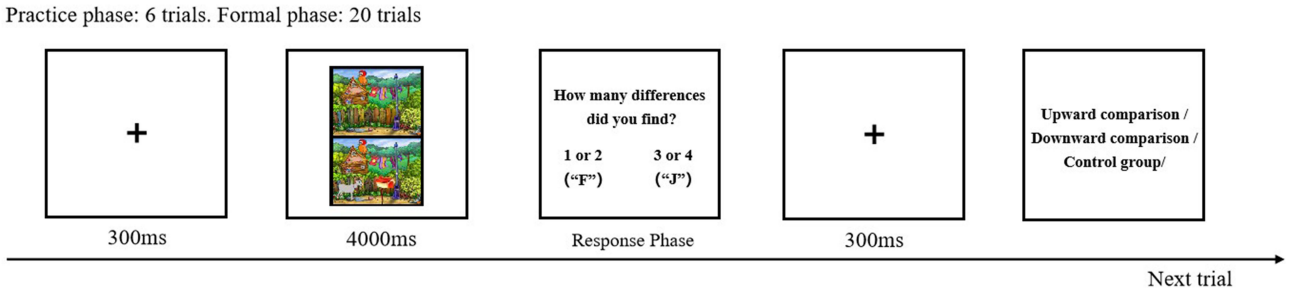

Figure 1 Social comparison Task—One trial of the spot-The-difference game.

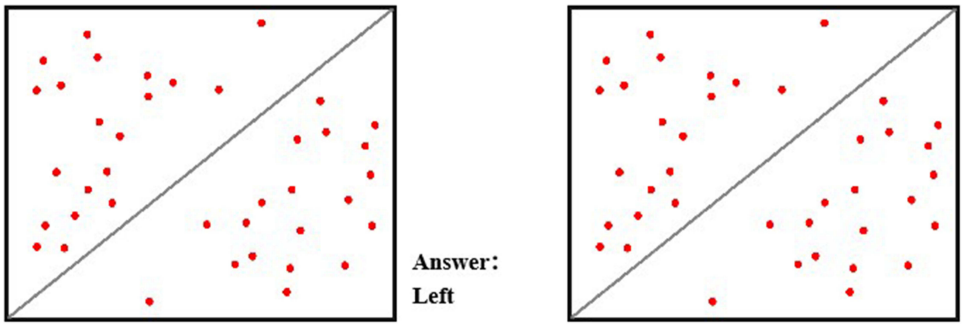

Figure 2 The red dot plot.

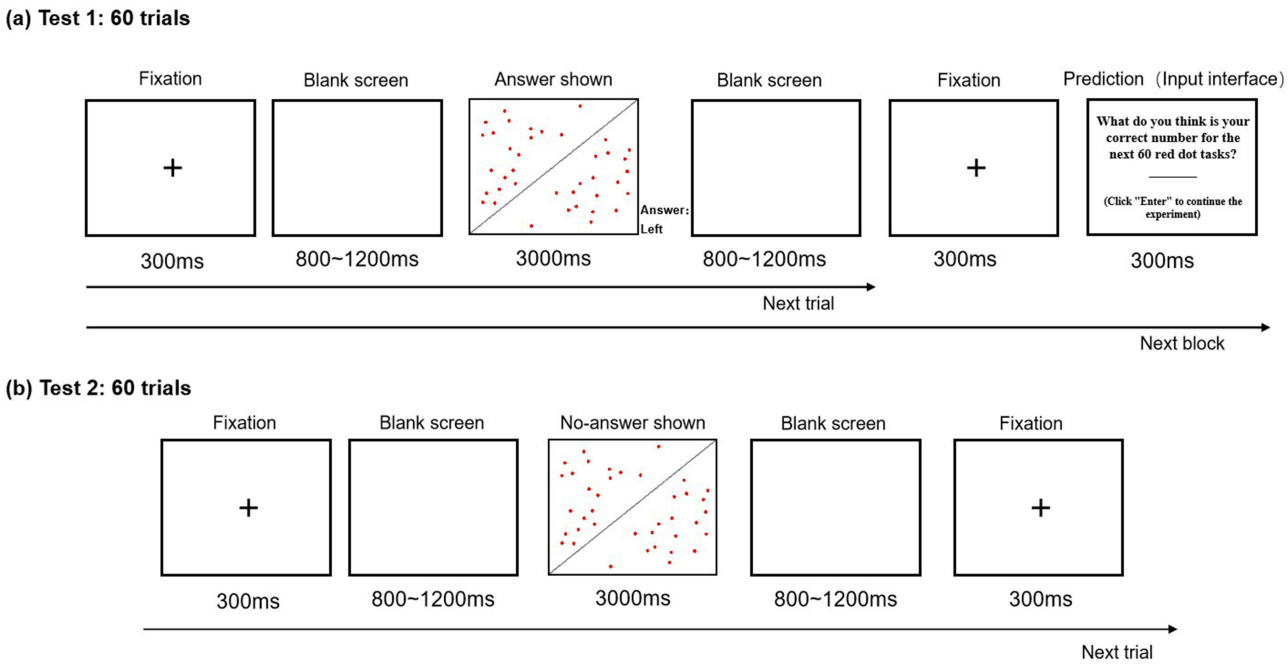

Figure 3 One trial of the prospective paradigm (**a**) The schematic illustration of a single trial in Test 1 of the forward-looking paradigm (*I*-Block). All Participants were informed that their task was to determine which side of the red-dot plots (with answer shown) had more red dots. Participants were required to respond to the "Prediction" displayed on the screen and input numerical values for their predicted scores (see the prediction interface in Figure 1a). (**b**) the schematic illustration of a single trial in Test 2 of the forward-looking paradigm (*II*-Block). All Participants were informed that their task was to determine which side of the red-dot plots (without answer shown) had more red dots.

Measuring Perceived Abilities by Using the IMI

Participants completed the IMI's six-item Perceived Competence subscale (1 = *not true at all*, 7 = *very true*), which contains questions like "I think I am pretty good at this task" and "I was pretty skilled at this task" to rate their level of competence. A higher score indicates greater perceived competence (Cronbach's $\alpha = 0.95$).[42]

Experimental Procedure

Before the experiment was carried out, everyone who participated read the instructions and filled out a questionnaire to ensure that they understood the experiment. E-prime 2.0 (Psychology program Tools, Pittsburgh, PA, USA) was the program used to conduct the tests and gather the data. They were told that this test aimed to assess the numerical sense and visual perception abilities of college students. It is a non-verbal test of numerical sense and visual perception abilities. The perceptual judgment in the test is a stable skill that cannot be improved via short-term practice. Moreover, perceptive judgment is associated with higher fluid intelligence.

Firstly, all participants completed a spot-The-difference game (see Figure 1). This task consisted of 20 trials. For 300ms during the testing process, a cross was shown in the middle of the screen. A spot-The-difference image was then shown for 4000ms. Participants were asked to identify how many differences there were between the two images within a limited timeframe. Then, they were required to make a keypress response on a subsequent response phase. If there were one or two differences, they pressed the "F" key; if there were three or four differences, they pressed the "J" key. Finally, the researchers informed the participants about their scores and showed them a bar chart labeled "Participant's Score and Average Score". They told the participants that the average score was obtained from a large sample study published in an authoritative journal, aiming to make them believe in the experiment's authenticity. This manipulation represents a social comparison variable with upward comparison manipulation: "Your score is 6, and, based on the presentation time and the difficulty level of the images, the average performance on this task is typically 10". For the downward comparison manipulation: "Your score is 16, and, based on the presentation time and the difficulty level of the images, the average performance on this task is typically 10". In the control group, they were simply told, "Your score is 10; please continue

with the following tasks".. After the spot-The-difference game, the participants rated the effort expended of the test (1 = *very effort*, 7 = *not effort at all*) and completed the IMI.

Secondly, The Prospective Paradigm was administered. The entire task consisted of 120 trials divided into two blocks (*I*-Block consisted of 60 trials, and *II*-Block also consisted of 60 trials). In the *I*-Block, for 300ms, a cross appeared in the middle of the screen. After that, for 800–1200ms, a random blank screen appeared. Subsequently, a 3000ms red-dot target stimulus was shown. At last, a black screen appeared for 1000ms (see Figure 3a). The subjects in the answer shown group were instructed that their task was to determine which side of the red-dot plots (with answer shown) had more red dots in *I*-Block. However, in the no-answer displayed group, participants observed the red dot plots without seeing the answer. If participants believed there were more red dots on the left, they clicked "F" and if they believed there were more red dots on the right, they clicked "J" (see Figure 3a). After the*I*-Block, participants were asked, "What do you think is your correct number for the next 60 red dot tasks?" In the *II*-Block, for 300ms, a cross appeared in the middle of the screen. After that, for 800–1200ms, a random blank screen appeared. Subsequently, a red-dot target stimulus (without answer shown) was delivered for 3000ms without a response provided. At last, a black screen appeared for 1000ms (see Figure 3b).

Data Analysis

The dependent variables of Test 1 score, Test 2 score, and the difference between actual and predicted scores in Test 2 were utilized to compare the answer-shown and no-answer-shown groups using an independent-samples *t*-test. The associations of comparison direction (upward vs downward vs control) and group (answer shown vs no answer shown) with the dependent variables in predicted scores and discrepancy between actual and predicted performance were found using a 3×2 between-subjects analysis of variance.

Results

Manipulation Check

Manipulation Check for Comparison Direction

There was no discernible difference in the effort put in on Task 1 between the upward, downward, and control (F (2, 149) = 0.09, p = 0.913, η_p^2=0.001). The one-way ANOVA findings demonstrate a significant difference in IMI ratings across the three groups (F (2, 149) = 54.72, p < 0.001, η_p^2=0.423). The IMI score was significantly lower in the group that engaged in upward social comparison compared to the control group (p < 0.001, 95% confidence interval [CI] = [−1.49, −0.61]) and downward social comparison group (p < 0.001, 95% CI = [−2.63, −1.63]), and the control group had a lower IMI score than the group that had a downward social comparison (p < 0.001, 95% CI = [−1.58, −0.58]), as indicated by the multiple comparison results.

Manipulation Check for Self-Deception

The answer-shown group had substantially higher Test 1 results than the no-answer-shown group (t (150) = −8.34, p < 0.001, Cohen's d = 1.36, 95% CI = [−8.81, −5.44]). Participants in the answer-shown group were more likely to overestimate their Test 2 scores (t (150) = −2.78, p = 0.007, Cohen's d = 0.45, 95% CI = [−5.72, −0.92]) and do so to a larger degree (t (150) = −2.23, p = 0.027, Cohen's d = 0.36, 95% CI = [−5.61, −0.34]). However, the answer-shown and no-answer-shown group had similar performance in Test 2 scores (t (150) = −0.54, p = 0.593, Cohen's d = 0.09, 95% CI = [−1.62, 0.93]; Table 1).

Predicted Scores

ANOVAs on predicted scores indicated that the main impact of comparison direction was significant (F (2, 146) = 9.75, p < 0.001, η_p^2=0.118). Specifically, the upward comparison group ($M \pm SD$ = 37.56 ± 7.36) had significantly higher predicted scores than the downward comparison group ($M \pm SD$ = 30.95 ± 8.72, p < 0.001, 95% CI = [2.97, 10.17]); the control group ($M \pm SD$ = 34.70 ± 5.89) had higher predicted scores than the downward comparison group ($M \pm SD$ = 30.95 ± 8.72, p = 0.036, 95% CI = [0.17, 7.38]. Group had a significant main impact (F (1, 146) = 7.36, p = 0.007, η_p^2=0.048). Predicted scores were higher for the answer-shown group ($M \pm SD$ = 36.43 ± 7.96) than for the no-answer-shown group ($M \pm SD$ = 33.11 ± 6.91, p = 0.007, 95% CI = [0.87, 5.50]). However, the interaction effect did not become statistically significant (F (2, 146) = 0.18, p = 0.835, η_p^2=0.002; Figure 4).

Table 1 Test Scores and Predicted Scores for Different Groups in Experiment 1 (M ± SD)

	No-Answer Shown (n = 73)	Answer Shown (n = 79)	*t*	*p*
Test 1 score	33.88 ± 4.29	41.00 ± 6.01	−8.34***	< 0.001
Test 2 prediction	33.11 ± 6.91	36.43 ± 7.96	−2.78**	0.007
Test 2 actual score	33.79 ± 3.50	34.14 ± 4.34	−0.54	0.593
P−A	−0.68 ± 7.34	2.29 ± 8.96	−2.23*	0.027

Notes: mean ± standard deviation, (*M* ± *SD*). P−A = the difference between the participants' actual and predicted scores. *p < 0.05. **p < 0.01. ***p < 0.001.

The Discrepancy Between the Actual and Predicted Scores

ANOVAs on the discrepancy between the actual and predicted scores indicated that the main impact of comparison direction was significant (F (2, 146) = 5.74, p = 0.004, η_p^2=0.073), showing that in the upward comparison group compared to the downward group, there was a substantially greater disparity between the actual and predicted scores (p = 0.003, 95% CI = [1.54, 9.68]). The control group's actual and predicted score differences were substantially greater than those of the downward group (p = 0.046, 95% CI = [−8.18, −0.05]). Group had a significant main impact (F (1, 146) = 5.25, p = 0.023, η_p^2=0.035). Additionally, compared to the no-answer-shown group, the answer-shown group's actual and predicted scores differed considerably more (p = 0.023, 95% CI = [−5.65, −0.42]). However, the interaction effect did not become statistically significant (F (2, 146) = 0.19, p = 0.824, η_p^2=0.003; Figure 5).

Discussion

Experiment 1 results found that individuals in the upward social comparison group scored lower on the perceived ability measure (IMI) than those in the downward social comparison group and the control group. Furthermore, the control group's participants had lower perceived ability scores (IMI) compared to those in the downward comparison group. These findings demonstrated the effectiveness of the manipulation of social comparison. To eliminate the impact of participants' effort levels in Task 1 on the dependent variable, we evaluated and compared the effort levels among the groups. The results showed no significant differences in effort levels between the groups, ruling out the effect of

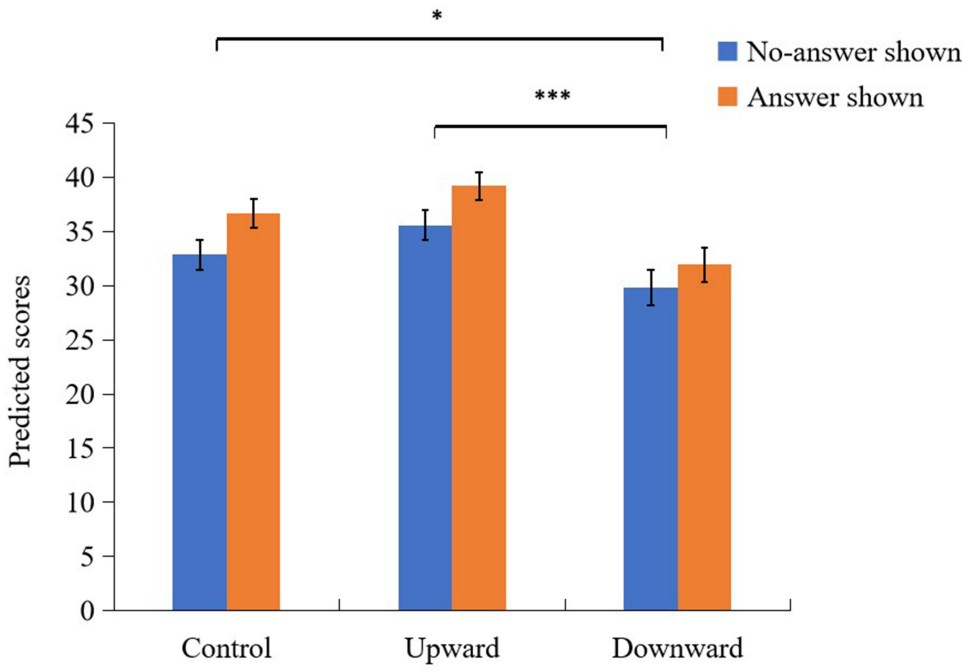

Figure 4 Predicted scores in different comparison directions (Experiment 1). *p < 0.05, ***p < 0.001. Error bars indicate standard errors of the mean.

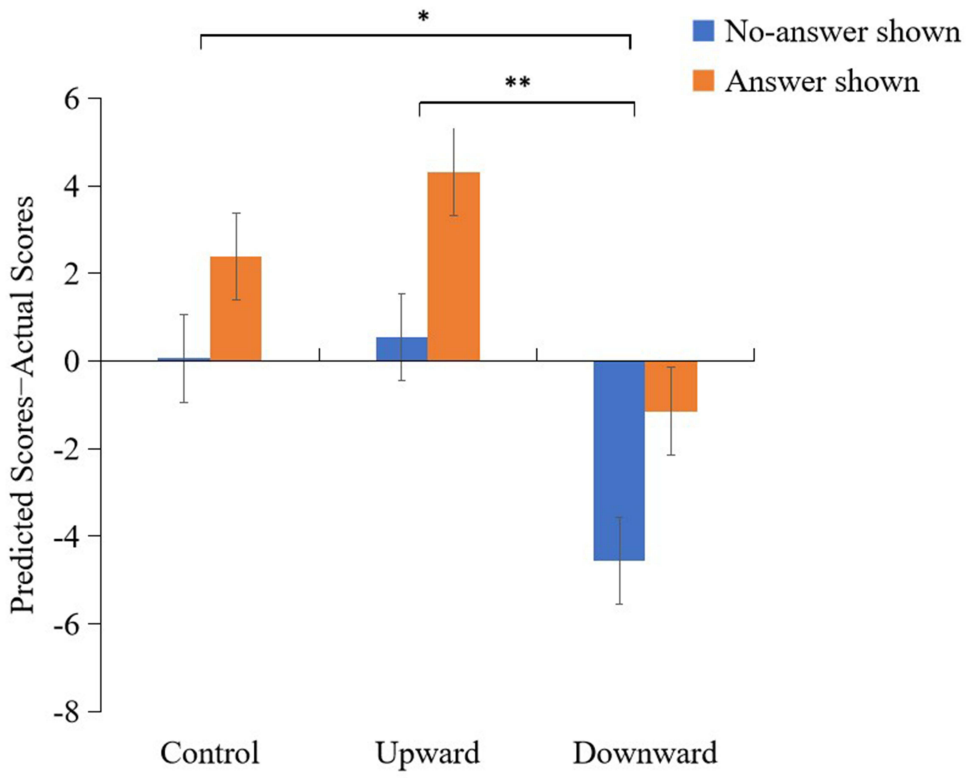

Figure 5 The difference between the actual and predicted scores in different comparison directions (Experiment 1). *$p < 0.05$, **$p < 0.01$. Error bars indicate standard errors of the mean.

participants' effort in task 1 on the dependent variable. The results of the manipulation check for self-deception indicated that, as compared to the non-answer-shown group of people, the answer-shown group had higher Test 1 and predicted scores, as well as bigger discrepancies between actual and predicted scores. This indicated that the answer-shown group attributed their (good) performance in the pretest to their abilities rather than to the hints that they were given. The results of this study were in agreement with findings of Chance et al.[18] According to the research, compared to the downward comparison group, individuals in the upward comparison group had much higher predicted scores and a bigger disparity between the actual and predicted scores. This suggests that those in the group that engaged in upward comparison were more prone to self-deception, consistent with previous research findings.[25,26,33]

Individuals evaluate their performance in relation to others as well as the degree to which they outperform or underperform others. A study on consumer dishonesty explored the impact of the direction and magnitude of differences between an individual and their peers on dishonest behavior.[34] However, similar studies have not been conducted on self-deception. Therefore, we conducted subsequent research. Experiment 2 investigated the impact of comparison direction and comparison gap on self-deception.

Experiment 2

Method

Participants

We gathered 126 undergraduate students (19 males, 107 women; mean [*M*] ± standard deviation [*SD*] age: 19.40 ± 2.34 years) for Experiment 2. In the between-subjects research design, at least 126 participants were needed to reach an effect size of 0.3, power of 0.8, and α of 0.05, as determined in G-Power software (Version 3.1), for two-tailed tests.[38] Each participant had normal eyesight or corrected visual acuity and no history of neurological conditions or brain injuries. All participants gave written informed permission and received compensation following the experiment. The research was authorized by the local Ethics Committee.

Experimental Design

The second experiment employed a between-subjects design with 2 (comparison direction: upward vs downward) × 2 (comparison gap: large vs small). The dependent variables were Self-deception enhancement scale, predicted scores and difference between the participants' actual and predicted scores (predicted scores: after completing Test 1, participants made predictions about their scores for Test 2; actual scores: participants' actual scores on Test 2).

Experimental Materials

Inducing Comparison Direction and Comparison Gap

To enhance the authenticity of Experiment 2, we manipulated the direction of comparison and the comparison gap using the Raven's Progressive Matrices (Raven) intelligence test.[43,44] First, the participants were shown an introductory video about the Raven intelligence test before the experiment. This video aimed to provide context and background information. Subsequently, the participants completed a 40-item Raven intelligence test, consisting of non-verbal logical reasoning questions. In the current experiment, we gave participants with various monetary reward ratios, which were based on their performance compared to an anonymous peer. This was done in order to control the direction of comparison and the difference in performance between the participants. Participants were divided into four groups, each representing a specific condition: upward large gap, upward small gap, downward large gap, and downward small gap. These conditions were defined by the values of X and Y in Chinese Yuan, specifically (3,7), (4.5,5.5), (7,3), and (5.5,4.5). This test was referred to as "Task 1" (Figure 6).

Self-Deception Enhancement Scale

The self-deception-enhancement (SDE) scale gauges people's unintentional propensity to provide truthful but favorably skewed self-descriptions.[45,46] It comprises 20 items, such as "My first impressions often turn out to be correct", which are scored on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*), with higher scores indicating greater self-deception. This scale was demonstrated to have strong reliability (Cronbach's $\alpha = 0.82$).[22]

Iowa–Netherlands Comparison Orientation Measure (INCOM)

A person's propensity for social comparison is gauged by the INCOM.[47] The scale consists of 11 questions and evaluates across variations individuals in social comparison processes in terms of abilities and perspectives. These items include "I often compare myself to others in terms of what we have achieved in life". Comparison orientation is indicated by the sum of the scores for the two dimensions. Higher scores indicated a greater comparison orientation. All questions were scored on a 6-point Likert scale, with 1 representing *completely disagree* and 6 representing *completely agree*. It was shown that this scale has high reliability (Cronbach's $\alpha = 0.89$).[47]

Experimental Procedure

All participants were informed that they would be completing the experiment simultaneously with another player. Upon reaching the laboratory, the researcher facilitated a meeting between the participants and an unknown player of the same sex (an experimental confederate), who was part of the experiment. Each participant completed the experiment in a separate tiny room after the meeting. Participants received the same experimental backdrop and instructions as in

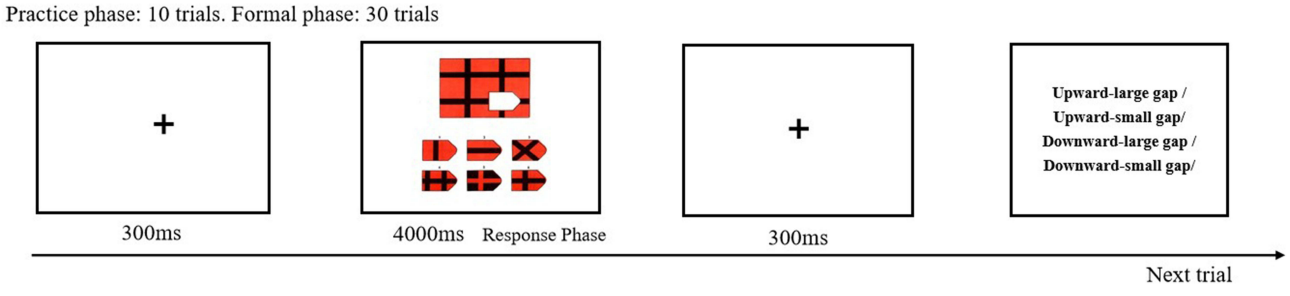

Figure 6 Social comparison Task—One trial of the Raven Intelligence Test.

Experiment 1. Before the experiment, all participants completed answered questions on the SDE scale and the INCOM scale.

Firstly, participants completed the Raven Intelligence Test (see Figure 6). This task consisted of 40 trials, including 10 practice trials and 30 formal trials. In the formal experiment, a cross was shown in the middle of the screen for 300ms during the formal experiment. A stimulus picture was then shown for 4000ms. A small part of the stimulus image was missing. Participants were required to identify and recognize which part was missing from the stimulus image from six small images presented below the stimulus picture within a limited timeframe. Then, they were required to make a keypress response on the response phase. Finally, we presented participants with different monetary reward ratios based on their performance compared to an anonymous peer. Participants were divided into four groups, each representing a specific condition: upward large gap, upward small gap, downward large gap, and downward small gap. These conditions were defined by the values of X and Y in Chinese Yuan, specifically (3,7), (4.5,5.5), (7,3), and (5.5,4.5). Participants were informed,

> Based on each participant's performance, a total of 10 Yuan from the bonus pool was distributed. You received X Yuan, while your anonymous peer received Y Yuan.

After the Raven Intelligence Test, the participants answered questions on how intensely they felt a gap in status with their peers on a 6-point scale (1 = *no feeling*, 6 = *intense feeling*), the effort expended of the test (1 = *very effort*, 7 = *not effort at all*) and completed the IMI. Secondly, participants' self-deception was assessed using the same prospective paradigm as in Experiment 1, with the distinction that only the group provided with answer shown was utilized.

Data Analysis

An ANOVA was used to compare the five groups (upward–large, upward–small, downward–large, downward–small and control group) in terms of the dependent variables of Test 1 score, Test 2 score and difference between actual and predicted scores in Test 2. The associations of comparison direction (upward vs downward) and comparison gap (large vs small) with the dependent variables in predicted scores and discrepancy between actual and predicted performance were found using a 2×2 between-subjects analysis of variance.

Results

Manipulation Check

Manipulation Check for Comparison Direction

The effort exerted on Task 1 did not notably vary between the upward and downward (t (124) = −0.04, p = 0.966, Cohen's d = 0.01, 95% CI = [−0.65, 0.62]). The upward comparison group had a lower IMI score in Task 1 compared to the downward comparison group (t (124) = −2.11, p = 0.037, Cohen's d = 0.37, 95% CI = [−0.66, −0.02]).

Manipulation Check for Comparison Gap

The difference perception score was higher in the big difference group than in the small difference group, as shown by the independent-samples t-test (t (124) = 3.06, p = 0.003, Cohen's d = 0.68, 95% CI = [0.20, 0.94]), indicating that the experimental manipulation was successful.

Manipulation Check for Self-Deception

SDE scores did not significantly differ among the four treatment groups (F (3, 125) = 1.22, p = 0.305, η_p^2=0.031). The control group in the no-answer-shown group in experiment 1 was set as the control group in experiment 2. According to the one-way ANOVA results, Test 1 score significantly differed among the five groups (F (4, 153) = 13.10, p < 0.001, η_p^2=0.260). Specifically, Test 1 results were poorer in the control group compared to the upward–large gap group (p < 0.001, 95% CI = [−18.15, −7.02]), upward–small gap group (p < 0.001, 95% CI = [−16.79, −5.51]), downward–large gap group (p < 0.001, 95% CI = [−14.78, −3.66]), and downward–small gap group (p < 0.001, 95% CI = [−17.28, −5.81]). Predicted Test 2 scores differed among the five groups (F (4, 153) = 7.76, p < 0.001, η_p^2=0.172), indicating that The control group had poorer predicted test 2 scores than the upward-large gap group (p < 0.001, 95% CI = [−16.73, −4.42]; Table 2).

Table 2 Test Scores and Prediction Scores Among the Five Groups in Experiment 2 (M ± SD)

	Control Group (n = 28)	Upward		Downward		*F*	*p*
		Large Gap (n = 33)	Small Gap (n = 31)	Large Gap (n = 33)	Small Gap (n = 29)		
Test 1 score	33.14 ± 3.82	45.73 ± 8.57	44.29 ± 7.58	42.36 ± 8.20	44.69 ± 8.39	13.10***	<0.001
Test 2 prediction	32.82 ± 4.74	43.39 ± 7.66	36.03 ± 9.82	33.91 ± 9.39	37.72 ± 9.15	7.76***	<0.001
Test 2 actual score	32.54 ± 3.44	36.64 ± 4.79	38.32 ± 3.98	37.42 ± 5.05	37.62 ± 5.38	7.17***	<0.001
P–A	0.29 ± 5.21	6.76 ± 9.09	−2.29 ± 9.64	−3.52 ±10.18	0.10 ± 9.84	6.31***	<0.001

Notes: The control group in the no-answer-shown group in experiment 1 was set as the control group in experiment 2. ***$p < 0.001$.

Predicted Scores

ANOVAs of the predicted scores showed that the comparison direction's main impact was significant (F (1, 122) = 5.86, p = 0.017, η_p^2=0.046). Specifically, the upward group ($M \pm SD$ = 39.83 ± 9.46) predicted higher scores than the downward group ($M \pm SD$ = 35.69 ± 9.40, $p < 0.05$, 95% CI = [0.71, 7.08]). The main impact of the comparative gap did not achieve statistical significance (F (1, 122) = 1.21, p = 0.273, η_p^2=0.010). The answer-shown group ($M \pm SD$ = 36.43 ± 7.96) had higher predicted scores than the no-answer-shown group ($M \pm SD$ = 33.11 ± 6.91, p = 0.007, 95% CI = [0.87, 5.50]).

Nonetheless, there was a significant interaction term between Comparison Direction and Comparison Gap (F (1, 122) = 12.05, p = 0.001, η_p^2=0.090). A simple effect analysis showed that predicted Test 2 score was greater when the comparison gap was large ($M \pm SD$ = 43.39 ± 7.66) than when it was small ($M \pm SD$ = 36.03 ± 9.82, $p < 0.001$, 95% CI = [2.89, 11.83]) in cases of upward but not downward comparison (significance indicated by $p < 0.05$; Figure 7).

The Discrepancy Between the Actual and Predicted Scores

We utilized a 2 (comparison direction: upward vs downward) × 2 (comparison gap: large vs small) between-subjects analysis with the discrepancy between the actual and predicted scores as the variable to be analyzed. The comparison

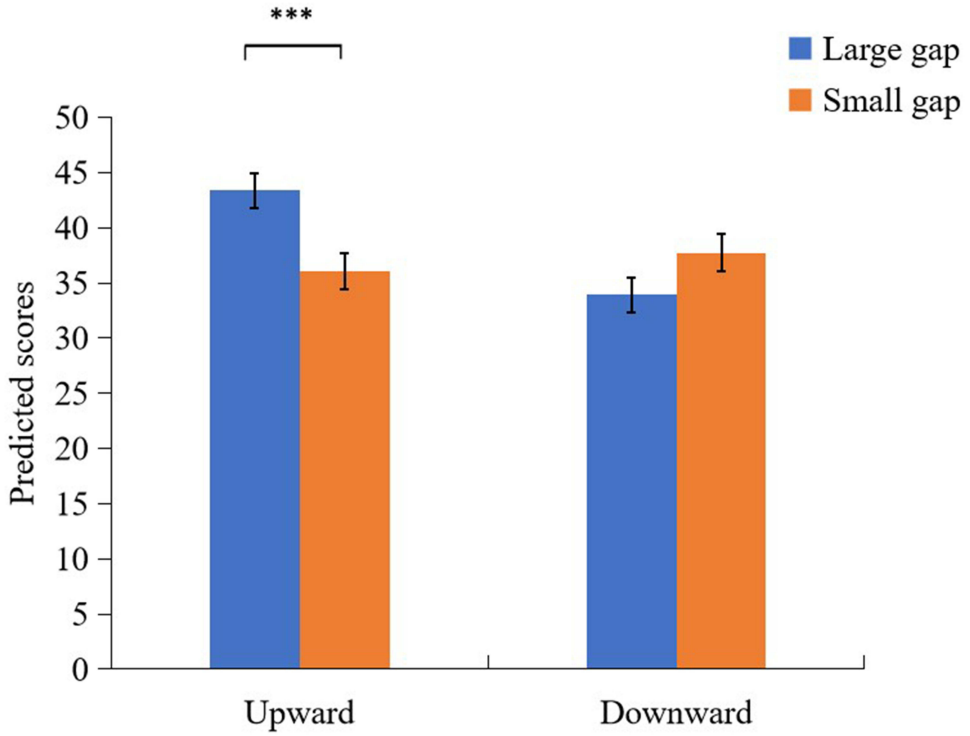

Figure 7 Predicted scores of cheaters in different comparison groups (Experiment 2). ***$p < 0.001$. Error bars indicate standard errors of the mean.

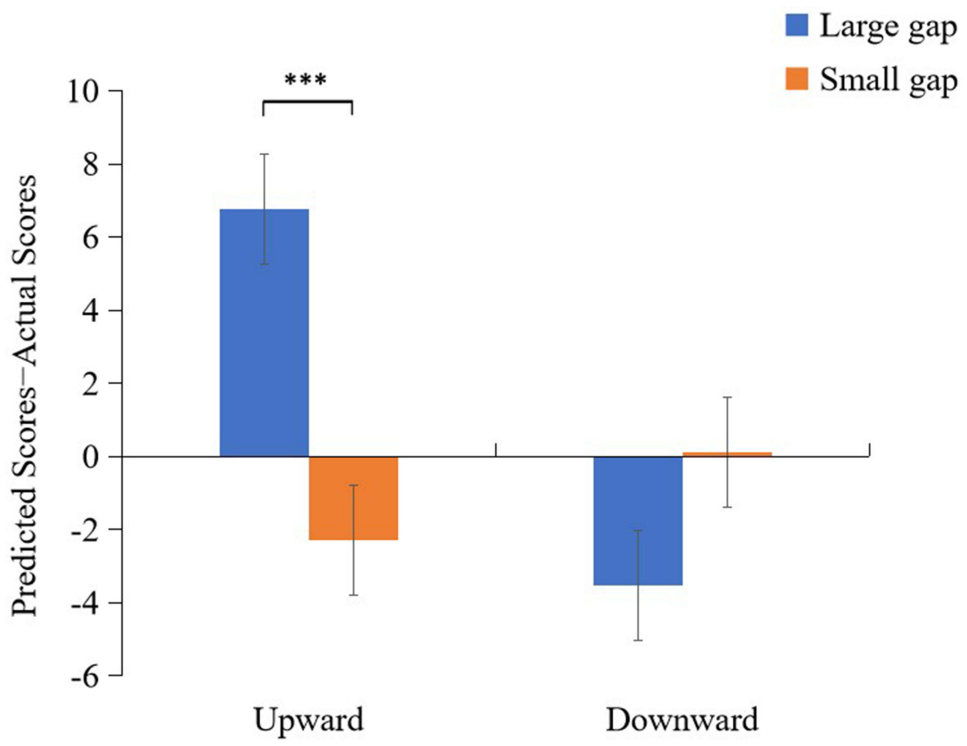

Figure 8 The difference between the actual and predicted scores in different comparison groups (Experiment 2). ***$p < 0.001$. Error bars indicate standard errors of the mean.

direction had a significant main effect (F (1, 122) = 5.19, p = 0.024, η_p^2=0.041), meaning that the upward comparison group had a substantially bigger gap between the actual and predicted scores than the downward group (p = 0.024, 95% CI = [0.52, 7.36]). The main impact of the comparative gap was unable to reach statistical significance (F (1, 122) = 2.47, p = 0.119, η_p^2= 0.020). However, the interaction between Comparison Direction and Comparison Gap was noteworthy (F (1, 122) = 13.42, $p < 0.001$, η_p^2=0.099). A simple impact analysis revealed that the discrepancy between the actual and predicted scores was bigger when the comparison gap was large than when it was small ($p < 0.001$, 95% CI = [4.25, 13.85]) in situations of upward but not downward comparison (significance indicated by $p < 0.05$; Figure 8).

Discussion

Experiment 2 results found individuals in the upward social comparison group scored lower on the perceived ability measure (IMI) than those in the downward social comparison group. The finding demonstrated the effectiveness of the manipulation of social comparison. We evaluated and compared the effort levels of the upward and down comparison groups. The results showed no significant differences in effort levels between the two groups, ruling out the effect of participants' effort in task 1 on the dependent variable. The large gap group had much higher scores in difference perception compared to the group with a smaller gap. This indicates the efficacy of manipulating the gap in comparison. According to the research, compared to the downward comparison group, individuals in the upward comparison group had much higher predicted scores and a bigger disparity between the actual and predicted scores. The findings were in line with those obtained in Experiment 1. Participants in the upward comparison condition were more motivated to participate in self-deceptive conduct, possibly because it elicited a perceived threat, leading them to engage in self-deception to retain a good self-image.[33]

Based on the importance of the interaction term between Comparison Direction and Comparison Gap, participants reported a greater level of threat when there was a wider difference between themselves and their more advantaged peers. As a result, they were more likely to engage in self-deception. However, this pattern did not apply to comparisons with

less advantaged peers. Individuals were more prone to participate in self-deception if they were in a less favorable position compared to others. This discovery aligned with the results of a research.[34]

General Discussion

Self-Deception More Likely in Upward Comparison

Both behavioral studies consistently demonstrated that upward comparison facilitated self-deception. The behavioral results indicated that individuals, when comparing themselves to those who scored higher than them, experienced a perceived threat, which concurrently stimulated the participants' motivation to self-enhance and consequently actively maintain a positive self-image. This finding aligns with existing literature.[33] Firstly, the Social Comparison Threat Effect can provide an explanation for the results of this study.[30] This effect posits that upward social comparisons can evoke feelings of threat or anxiety. This sense of threat, in turn, triggers self-deception as a way to manage the emotional distress associated with unfavorable comparisons. Specifically, social comparison may trigger a sensation of threat, thereby prompting individuals to get involved in self-deception in order to maintain their self-esteem.[33,48,49] For example, Lockwood et al's research supports this phenomenon, as they found that upward comparisons can lower an individual's self-evaluation.[5] When individuals perceive their performance as inferior to others, they may resort to self-deception as a coping mechanism to alleviate feelings of inadequacy and maintain their self-esteem. Moreover, when someone's personal interests or self-esteem are at risk, particularly in competitive settings, they tend to become more actively involved in self-assessment.[50–52]

Additionally, other research suggests that people are more inclined to get involved in social comparison when they are highly sensitive to comparing the information presented.[50,53] One's abilities are a significant factor in influencing self-esteem. Specifically, negative social comparison information may be processed in a non-defensive and objective manner. However, if negative social comparison information is highly relevant to individuals' core values, it may be processed defensively.[16,30,54] Self-protection is a reflex triggered when facing threats, which includes self-deception, overestimating oneself, underestimating others, and filtering out negative or irrelevant information.[32] When someone has failures, they are more prone to engage in self-deception.[25,26] From the perspective of self-enhancement, individuals tend to think that they are better than average and expect positive outcomes.[55,56] People also commonly believe they are better than others in the field of social psychology.[57] Individuals often want to maintain a positive self-perception while interacting with others and hold unjustifiably positive evaluations of themselves, others, or the future.[58,59] Many theories in psychology (ie, self-defensive mechanism, self-serving bias) and economics (ie, overconfidence theory) are based on an assumption that individuals seek to better themselves.[60,61] Moreover, Upward comparisons introduce cognitive vagueness in an individual in relation to their beliefs that they are 1) better than others and 2) continually self-improving. This triggers a sense of threat that prompts self-deception.[33] Additionally, Cummins' study highlighted the relationship between social status and self-deception, indicating that people are more likely to engage in self-deception when dealing with others who hold a higher social position.[28]

In summary, upward social comparisons heighten feelings of threat, which in turn induce self-enhancement motivation, leading individuals to overestimate their abilities. Additionally, upward comparisons trigger self-protective motivation, causing individuals to exaggerate their capabilities to maintain a positive self-image, thereby increasing the likelihood of self-deception.

Larger Gap Intensifies the Promoting Effect of Upward Social Comparison on Self-Deception

The research findings revealed a significant interaction between the direction of comparison and the magnitude of the gap. To begin, our findings showed that, in the setting of upward social comparison, people who were in the larger gap group were more likely to exhibit self-deceptive behavior. This outcome may be clarified by considering the concept of social comparison threat. Based to the Social Comparison Threat Effect, upward comparison is more inclined to elicit threat effects because individuals are comparing themselves to others who outperform them, potentially challenging their self-esteem. When the comparison gap greatly increases, this sense of threat may

escalate as people perceive a wider difference, in line with the findings of Wakeman et al.[33] Therefore, those in the group with a greater gap are more likely to use self-deception as a psychological coping mechanism in order to protect their self-esteem and reduce feelings of threat. Moreover, if someone was in a less favorable position than others, they were more prone to self-deception. When participants were compared to peers in better conditions, the greater the disparity, the more pronounced the sense of threat, making self-deception more likely. However, this situation did not exist when compared to peers in worse conditions. This finding aligned with a study on consumer behavior.[34] Furthermore, the research findings align with the study by Gneezy, who highlighted a positive correlation between the magnitude of incentives and deceptive behavior.[35] In this study, participants in the larger gap group may have been more incentivized in terms of self-enhancement motivation due to the greater challenge they perceived. This self-enhancement incentive may make individuals more likely to get involved in self-deception in order to preserve their self-esteem and self-image. In summary, the results of this study shed light on the significant influence of comparison gaps in upward social comparison contexts. Participants in the larger gap group exhibited a higher tendency to get involved in self-deception, presumably to avoid social comparison and satisfy their need for self-improvement. These results not only enhance our comprehension of the correlation between social comparison and self-deception but also provide valuable insights for the field of psychology, especially in comprehending the psychological mechanisms individuals employ when faced with challenges and competition.

This study investigated the impact of social comparison on self-deception, which held significant value in research. Firstly, previous research primarily focused on self-deception through social status comparison. In contrast, this study introduced ability-based social comparison, which could scientifically and reasonably explain real-life situations. This research helped individuals gain a clear understanding of their own boundaries and improve their physical and mental health. Secondly, by exploring the factors influencing the contexts in which self-deception frequently occurred, this study assisted individuals in monitoring and identifying instances of self-deception. Finally, this research integrated the social comparison threat effect and self-protection theory, revealing how individuals comprehensively evaluated themselves in social comparisons. This integration not only deepened the understanding of the social comparison process but also provided new perspectives for further research.

Limitations and Recommendations for Future Research

This research offers fresh insights into how social comparison affects self-deception. This study provides novel findings on the impact of social comparison on self-deception. However, several limitations should be acknowledged. Firstly, laboratory experiments may significantly differ from real-world conditions. Therefore, future research could employ implicit association tests to generate findings with higher ecological validity. Secondly, our participants were primarily university students. To generalize the study's results more effectively, future research could recruit more representative samples, including individuals of varying ages, genders, and occupational backgrounds, to validate the generalizability of the findings.

Conclusion

In conclusion, this research used two behavioral experiments to investigate how social comparison affects self-deception. The findings suggested that when confronted with threatening social comparative information, people tended to use self-deception to protect themselves. Members of the large gap group experienced strong feelings of unfairness and negative emotions, which led to self-protective behaviors and a greater likelihood of self-deception.

Declaration of Helsinki

This research was conducted in compliance with the Declaration of Helsinki and was approved by Hunan Normal University's ethical committee (*No*.: 2023-456).

Data Sharing Statement

The data from this research are accessible from the corresponding author upon request.

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Disclosure

The authors declare that they have no known conflicting interests or interpersonal relationships that might have influenced the work presented in this study.

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