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The influence of red and blue font color on intertemporal choice: the mediating roles of time perception and dimensional difference comparison

Kai Zhang[1], Hui Jiang[2*] and Xiaowei Geng[3*]

Abstract

Background Intertemporal choices are the process by which people make choices about losses or gains at different points in time (near or far). To explore the relationship between font color and intertemporal choice and to examine the serial mediation of time perception and intradimensional difference comparison on the association between font color and intertemporal choice on the basis of attribute-based choice models.

Methods We randomly assigned subjects to the intertemporal choices questionnaire in a specific font color (blue vs. red) condition. The Intertemporal Choice Task, the Subjective Duration Judgment Task and the Intradimensional Difference Comparison Task were administered to a sample comprising 210 college students (103 males accounting for 49.05%). Multivariate analysis and latent variable analysis were used to explore the separate mediating roles of time perception and intradimensional difference comparison in the association between font color and intertemporal choice, and their serial mediation was also investigated. The bootstrap method was employed to test the significance of these mediating effects.

Results Compared with red font, blue font can encourage students to choose more-farsighted intertemporal choices (i.e., LL). Students who use the blue font are more likely to have shorter durations and can choose the more farsighted intertemporal choice (i.e., LL) than those who use the red font. Students using blue fonts are more likely to perceive the difference between the two options chosen across time ($\Delta payoff_{A,B}$) to be greater than the difference between the two options in the payoff dimension ($\Delta time_{A,B}$), leading to farsighted choices compared with those using red fonts. Serial mediation was also found.

Conclusion The findings revealed why font color influences intertemporal choice. This study revealed the mediating role that time perception and intradimensional difference comparison play in the association between font color and intertemporal choice.

Keywords Blue font, Red font, Time perception, Intradimensional difference comparison, Intertemporal choice

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Introduction

Intertemporal choice refers to the trade-off between the costs paid and the benefits received at different points in time [1, 2]. It is the process of choosing between a trade-off between a small reward that can be obtained in the short term and a large reward that can be obtained in the long term. Intertemporal choice has two dimensions: time and payment. The single-dimensional priority model [3] assumes that people make intertemporal decisions by comparing the two dimensions of delay and outcome and basing the intertemporal decision on the dimension with the greater difference, i.e., if they believe that the difference in waiting time is greater than the profit or loss in outcome, people will choose the option with a shorter wait, and vice versa, they will choose the option with greater profit or less loss. The Equate-to-Differentiate Model [4] is a classical theoretical model in the single dimension priority model, which argues that in intertemporal choice, people tend to compare the difference between two choices in the payoff dimension ($\Delta_{payoff\text{A, B}}$) and the time dimension ($\Delta_{time\text{A, B}}$), and if $\Delta_{payoff\text{A, B}} > \Delta_{time\text{A, B}}$, people would think that there is no difference between the two choices in the time dimension; then, they would choose the shorter option according to the difference in the payoff dimension. In turn, they choose on the basis of the difference in the payoff dimension, and vice versa ($\Delta_{payoff\text{A, B}} < \Delta_{time\text{A, B}}$) [4, 5]. According to this model, the effect of time perception on people becomes particularly important in intertemporal choice.

Previous research has shown that color affects people's decision making. Research has shown that red color suggests danger and activates the perception of danger [6], which can increase the level of arousal of the individual, which in turn causes the individual to make suboptimal decisions [7]. This effect is specific to a variety of decision-making situations, where labeling potential financial losses with a red (as opposed to black) symbol influences people's preference for financial risk [8]. More direct findings have shown that people in the red condition perform more irrationally in BART tasks (classical risky decision-making tasks) [9]. One study used the moral stroop paradigm to explore the effect of colored fonts on moral processing and reported that individuals judge green moral words faster and green immoral words slower than blue and red fonts do, revealing a metaphorical link between the green color of fonts and moral concepts [10]. If consumers were more environmentally conscious, they automatically made a connection between the appearance of green and environmental protection when shopping for goods and consider the goods to be environmentally friendly [11].

Visual perception is a fundamental element of human sensation, and color is an important component of vision, an element that also affects people's perception of time. Most research on this topic has focused on two of the three primary colors—red and blue [12]. Previous findings have shown that the color of a screen affects people's time perception (red screens are more likely to be perceived as longer than blue screens) [13, 14].According to pacemaker-accumulator model theory [15–17], the color red, which consists mainly of longer wavelengths, elicits higher levels of arousal [18–20], and the color red elicits higher levels of arousal than the color blue when brightness and saturation are equal [21]. Arousal level is an important influence when making judgments about the length of a duration [22]. High levels of arousal cause people to overestimate the duration of a period [23–28]. A recent study also concluded that red light environments (in contrast to blue light environments) cause people to overestimate time, which in turn leads to a greater preference for SS in intertemporal choice [29]. Thus, we predict that red font might lead to longer time perception than blue font, and then a greater preference for SS in intertemporal choice. Individuals using red fonts perceive longer durations than those using blue fonts and are more likely to perceive the difference between the two options chosen across time ($\Delta_{time\text{A, B}}$) to be greater than the difference between the two options on the payoff dimension ($\Delta_{payoff\text{A, B}}$), i.e., greater intradimensional differences ($\Delta_{time\text{A, B}} > \Delta_{payoff\text{A, B}}$), leading to short-sighted choices. Thus, longer time perception leads to greater intradimensional differences ($\Delta_{time\text{A, B}} > \Delta_{payoff\text{A, B}}$). According to the Equate-to-Differentiate Model [4], when the difference in the time dimension is greater than that in the payment dimension, people will be more inclined to adopt the time dimension as an indicator of intertemporal decision making and therefore more likely to choose SS.

In sum, red font might lead to longer time perception than blue font, and then longer time perception leads to greater intradimensional differences (Δtime A, B > Δpayoff A, B), which leads to greater preference for SS in intertemporal choice. We predict that time perception and the comparison of intradimensional differences chain-mediate the effect of color font (red vs. blue) on intertemporal choice preferences.

The present study

According to the previous description, red/blue light has a very important influence on the decision-making of intervals, however, the influence of red/blue fonts on intervals decision-making and the mechanism behind this is not clear, however, the ordinary people often come into contact with red/blue fonts in their daily life, so we believe that the study of the influence of red/blue fonts on intervals decision-making and the mechanism behind this is very necessary. The present study aimed

to investigate the nature of the association between font color and intertemporal choice and whether time perception and intradimensional difference comparisons mediate this possible relationship. In particular, we propose the following four hypotheses for this study:

H1: Compared with red font, blue font can encourage people to choose more-farsighted intertemporal choices (i.e., larger and later, LL).
H2: People perceive that the duration is shorter when making intertemporal choices in blue font than in red font.
H3. People using blue fonts are more likely to perceive the difference between the two options chosen across time ($\Delta payoff_{A,B}$) to be greater than the difference between the two options on the payoff dimension ($\Delta time_{A,B}$).
H4. Time perception and intradimensional difference comparison play a serial mediating role in the relationship between font color and intertemporal choice. The sequence of the pathway is as follows: font of color→ time perception→ intradimensional difference comparison→ intertemporal choice. The study hypothesized path effects, as shown in Fig. 1.

We conducted one experiment to test the hypotheses that blue font can encourage employees to choose more-farsighted intertemporal choices (i.e., LL) than can red font. In the experiment of the present study, the participants completed the intertemporal choice tasks under red, blue or black font.

Method

Participants

According to the calculation of G*Power 3.1 [30], under the premise of a statistical test force of $1-\beta=0.80$, a bilateral test of $\alpha=0.05$, and a medium effect of $f=0.25$, the number of subjects subjected to one-way ANOVA was 159. A total of 210 university participants (103 males, age $M=18.62$, $SD=0.94$) were assigned randomly to one of 3 conditions: 70 each in red, blue or black font (28 males in red, 33 males in black, 42 males in blue). All the participants had no symptoms of color blindness or color weakness and had normal visual acuity or corrected visual acuity. They could not guess the purpose of the experiment. The research was reviewed and approved by the academic ethics committee of the school of education of the university before being conducted. All the participants provided written informed consent prior to the experiment.

Materials

Presentation of different color fonts

We achieve the rendering of different color fonts (red, blue and black) by editing the font color in the Word document editing questionnaire. The font colors presented in this experiment are all pure colors (according to the RGB parameters): red (255.0.0), blue (0.0.255), and black (0,0,0). Shades of red and blue have been standardized, and the brightness and saturation of red and blue have been controlled.

Intertemporal choice task

The intertemporal choice task was adapted from the monetary choice task developed by Kirby et al. [31], in which we changed the original alternative-choice paradigm into a 6-point Likert scale to represent the degree of willingness to choose, where 1=very much prefer to choose smaller and sooner (SS) and 6=very much prefer to choose LL. For example, "Would you prefer $54 today (A), or $55 in 117 days (B)?" and 1=very much prefer to choose A, 6=very much prefer to choose B.

Subjective duration judgment task

The subjective duration judgment task was adapted from the scale task developed by Zauberman et al. [32], as shown in Fig. 2. A 15 cm scale was listed on the questionnaire, and the 0 scale position represented "today". The

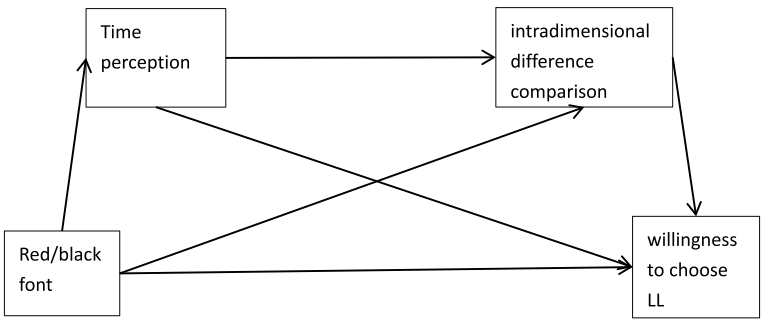

Fig. 1 Proposed chain mediation model

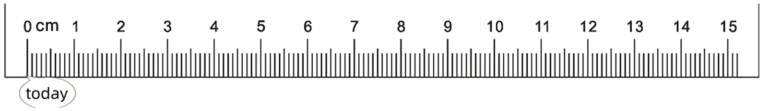

Fig. 2 Subjective duration judgment task

subjects were asked to judge the length of the period of "10 years" subjectively and to mark it on the scale.

Intradimensional difference comparison task

The intradimensional difference comparison was measured by a visual analog scale developed by Jiang et al. [3], as shown in Fig. 3 (payoffs and delays are adjusted to correspond to the intertemporal choice task). The participants were asked to compare the difference in the time dimension (Δ_{time}) with the difference in the payoff dimension (Δ_{payoff}) on the visual analog scale. For example, when the perceived difference in the time dimension was greater than the perceived difference in the reward dimension, the subjects chose the left-hand option to indicate the relative difference, and vice versa. If the difference was not significant, the middle option was chosen. A 7-point scale was used, with options closer to the ends representing greater differences between dimensions.

Data analysis

Descriptive statistics and correlation analyses of key variables were conducted using SPSS 26.0. Using the PROCESS macro, mediating effects were analyzed using Model 4, and the serial mediation model was analyzed using Model 6. Predictors were standardized prior to analysis. Standardized coefficients were used for the results of all mediation analyses(Figs. 5, 6 and 7).

Results

Color and willingness to choose LL

The results of the experiment revealed that the willingness to choose LLs with red font ($M=2.97$, $SD=0.55$) was lower than that with black font ($M=3.63$, $SD=0.35$) and was lower than that with blue font ($M=4.13$, $SD=0.58$), $F(207)=93.77$, $p<0.01$, $\eta^2=0.48$, indicating that subjects with blue font questionnaires were more inclined to choose LLs (i.e., prospective selection). The distribution of LL willingness under the three color fonts is shown in Fig. 4(a).

Color and time perception

The results of the experiment revealed that the time perception with red font ($M=12.93$, $SD=0.60$) was greater than that with black font ($M=11.37$, $SD=0.57$) and was greater than that with blue font ($M=8.70$, $SD=0.86$), $F(209)=648.43$, $p<0.01$, $\eta^2=0.87$, suggesting that the subjects with blue-font questionnaires had shorter time perceptions. The distribution of time perception under the three color fonts is shown in Fig. 4(b).

Color and intradimensional difference comparison

The results of the experiment revealed that the intradimensional difference in red font ($M=3.41$, $SD=0.19$) was smaller than that in black font ($M=4.44$, $SD=0.21$) and was smaller than that in blue font ($M=4.81$, $SD=0.18$), $F(209)=938.36$, $p<0.01$, $\eta^2=0.99$, suggesting that subjects with blue-font questionnaires perceived greater variation in the payoff dimension than in the time dimension. The distribution of the intradimensional difference comparison under the three color fonts is shown in Fig. 4(c).

Time perception as the mediator

In the model with time perception as the mediator, to identify the mediating role of time perception, the

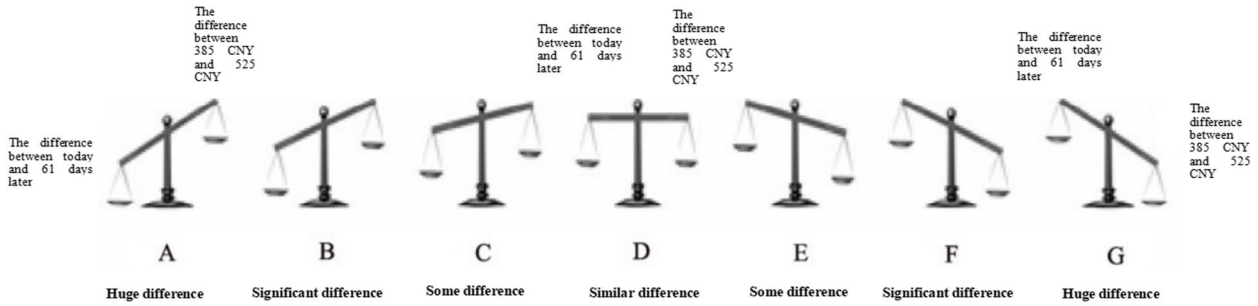

Fig. 3 Visual analog scale

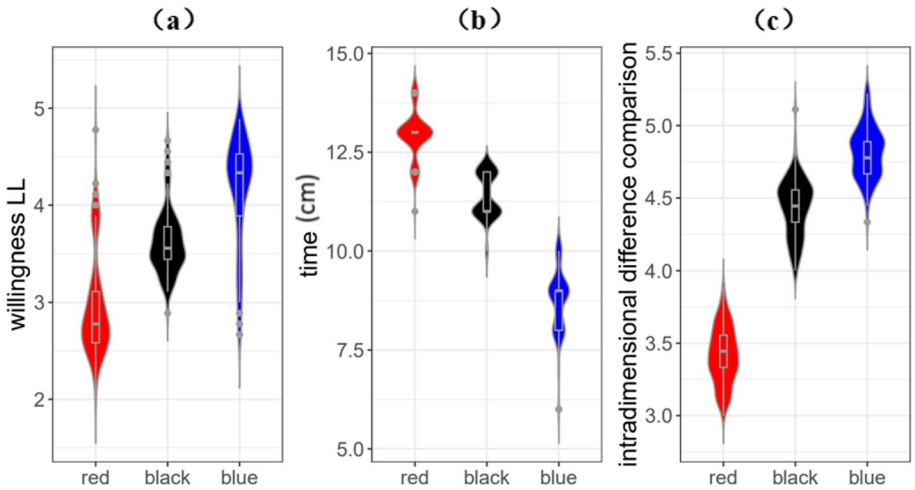

Fig. 4 Violin and box plots of the key variables under blue, red, and black (baseline) font in the experiment. The crossbar of each box represents the median; the bottom and top edges of the box represent the first and third quartiles; and the dots represent the extreme outliers. The violin-shaded areas reflect the distribution shape of the data. **a** Willingness to choose LLs, with higher values corresponding to more farsight; **b** assessment of the distance between today and 10 years from now, with higher values corresponding to longer time perception; **c** assessment of intradimensional difference comparison

bootstrap method was used to estimate the mediating effect [33, 34]. First, we examined the mediating role of time perception in the effect of red/black font (0 = black, 1 = red) on intertemporal choices. The experimental condition (red or black font) had a statistically significant negative effect on participants' willingness to choose LL ($c = -0.584$, $t = -8.45$, $p < 0.001$) and a statistically significant positive effect on time perception ($a = 0.802$, $t = 15.79$, $p < 0.001$), which means that participants using black font were more willing to choose LL and perceived the time perception to be shorter than the red font was. Furthermore, when willingness to choose LL was regressed on both font color (red or black) and time perception, the size of the experimental condition effect was regressed significantly ($c' = 0.326$, $t = 5.09$, $p < 0.001$), and time perception had a statistically significant negative influence on the willingness to choose LL ($b = -1.134$, $t = -17.72$, $p < 0.001$; see Fig. 5a). Finally, a bootstrapping procedure was used that generated a sample size of 5000 to assess the mediation effect. The results of a 95% confidence interval indicated that the indirect effect through time perception was −1.02, which was significantly different from zero (95% CI = [−1.1707, −0.8802]) [35].

Second, we examined the mediating role of time perception in the effect of black/blue font (0 = black, 1 = blue) on intertemporal choices. The experimental condition (black or blue font) had a statistically significant positive effect on participants' willingness to choose LL ($c = 0.469$, $t = 6.25$, $p < 0.001$) and a statistically significant negative effect on time perception ($a = -0.880$, $t = -21.72$, $p < 0.001$), which means that participants using blue font were more willing to choose LL and perceived the time perception to be shorter than the black font was. Furthermore, when willingness to choose LL was regressed on both font color (blue or black) and time perception, the size of the experimental condition effect was significantly reduced ($c' = -0.588$, $t = -4.87$, $p < 0.001$), and time perception had a statistically significant negative influence on the willingness to choose LL ($b = -1.202$, $t = -9.95$, $p < 0.001$; see Fig. 5b). Finally, a bootstrapping procedure was used that generated a sample size of 5000 to assess the mediation effect. The results of a 95% confidence interval indicated that the indirect effect through time perception was 1.14, which was significantly different from zero (95% CI = [0.7880, 1.4732]) [35].

Third, we examined the mediating role of time perception in the effect of red/blue font (0 = red, 1 = blue) on intertemporal choices. The experimental condition (red or blue font) had a statistically significant positive effect on participants' willingness to choose LL ($c = 0.719$, $t = 12.15$, $p < 0.001$) and a statistically significant negative effect on time perception ($a = -0.945$, $t = -33.86$, $p < 0.001$), which means that participants using blue font were more willing to choose LL and perceived the time perception to be shorter than the red font was. Furthermore, when the willingness to choose LL was regressed on both the experimental condition and the time perception, the size of the experimental condition effect was significantly reduced ($c' = -0.703$, $t = -5.50$, $p < 0.001$), and the time perception had a statistically significant negative influence on

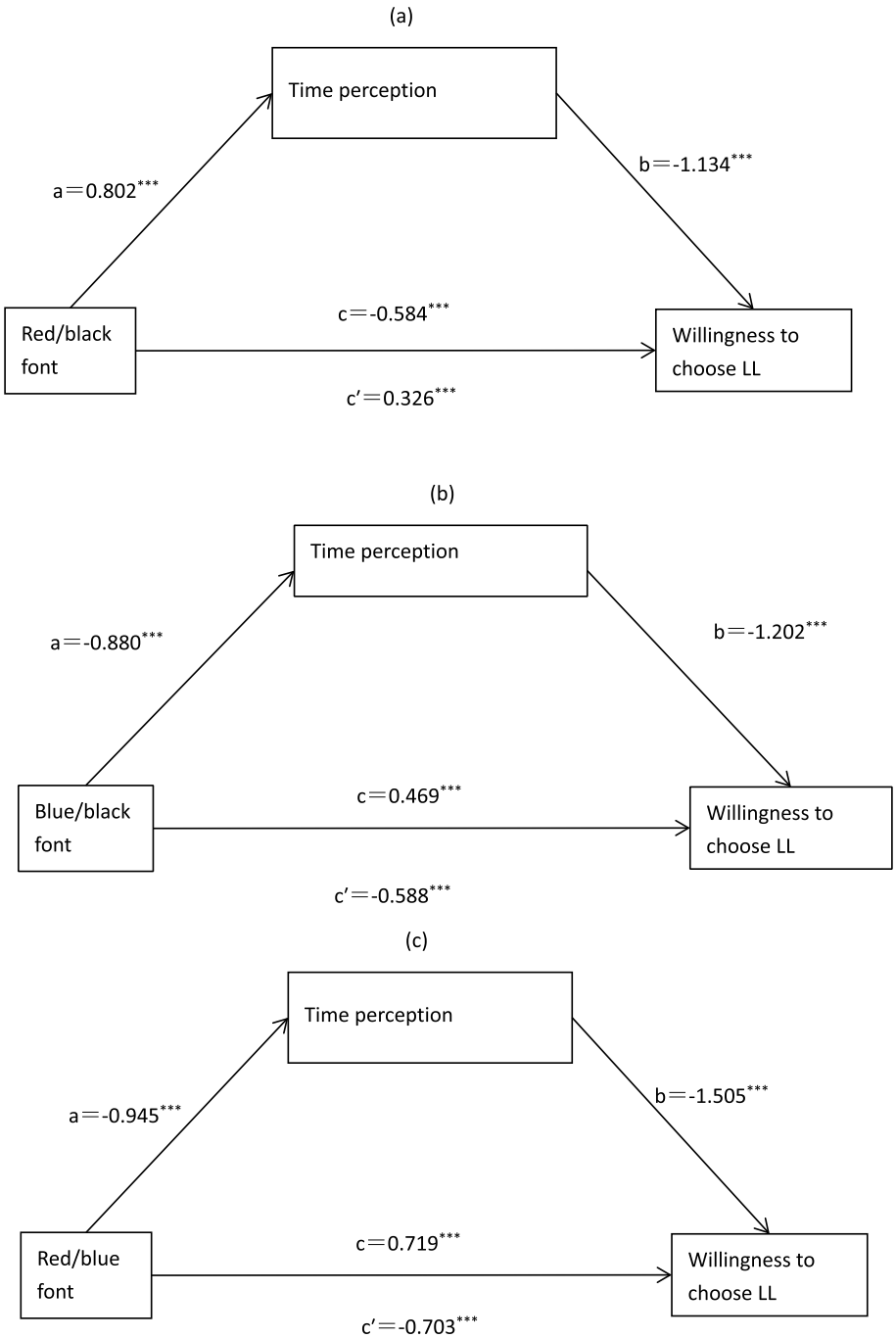

Fig. 5 Mediating effect of time perception on the influence of different color fonts on intertemporal choice

the willingness to choose LL ($b = -1.505$, $t = -11.79$, $p < 0.001$; see Fig. 5c). Finally, a bootstrapping procedure was used that generated a sample size of 5000 to assess the mediation effect. The results of a 95% confidence interval indicated that the indirect effect through time perception was 2.30, which was significantly different from zero (95% CI = [1.6594, 2.9210]) [35].

Intradimensional difference comparison as the mediator

In the model with intradimensional difference comparison as the mediator, to identify the mediating role of

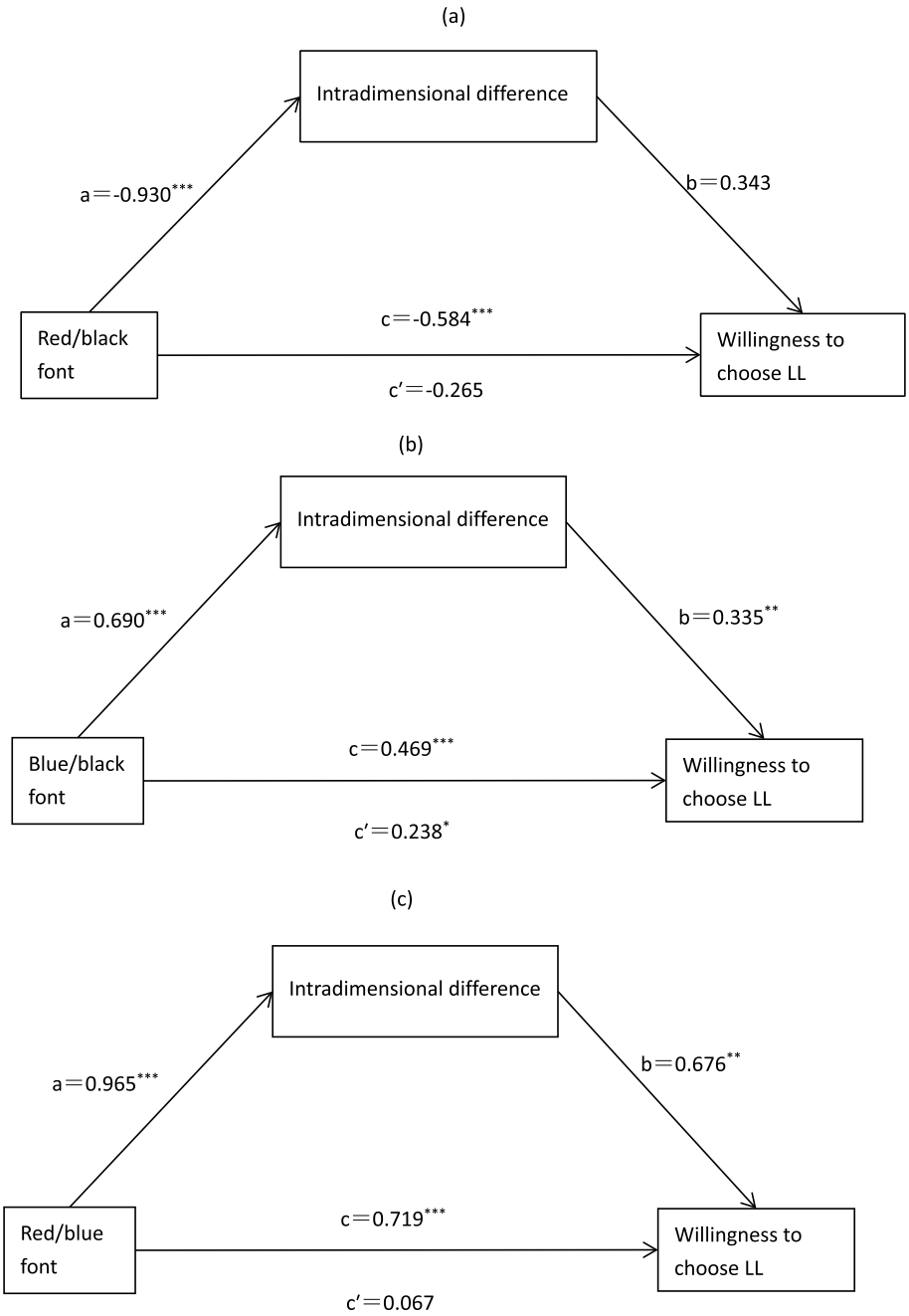

Fig. 6 Mediating effect of intradimensional difference comparison on the influence of different color fonts on intertemporal choice

the intradimensional difference comparison, the bootstrap method was used to estimate the mediating effect [33, 34]. First, we examined the mediating role of the intradimensional difference in the effect of red/black font (0 = black, 1 = red) on intertemporal choices. The experimental condition (red or black font) had a statistically significant negative effect on participants' willingness to choose LL ($c = -0.584$, $t = -8.45$, $p < 0.001$) and a statistically significant negative effect on the intradimensional difference comparison ($a = -0.930$, $t = -29.64$, $p < 0.001$), which means that participants were more willing to choose LL and that the perceived Δ_{payoff} was greater than the Δ_{time} in black font than in red font. Furthermore, when the willingness to choose LL was regressed on both the experimental condition and the intradimensional difference comparison, the size of the

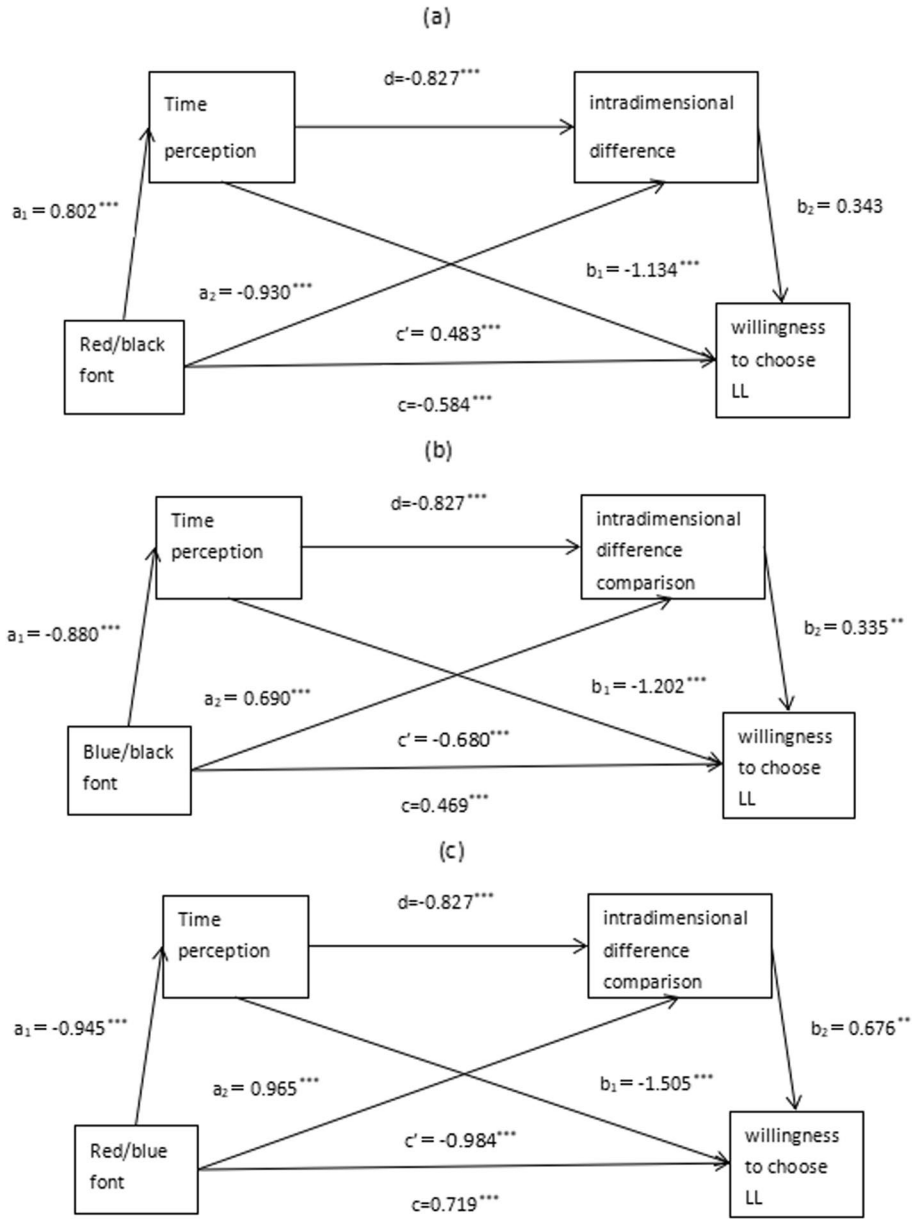

Fig. 7 Chain-mediated effects of time-perception and within-dimensional difference comparisons on the influence of different color fonts on intertemporal choice

experimental condition effect was significantly reduced ($c' = -0.265$, $t = -1.43$, $p = 0.156$), and the intradimensional difference comparison had a statistically significant positive influence on the willingness to choose LL ($b = 0.343$, $t = 1.85$, $p = 0.067$; see Fig. 6a). Finally, a bootstrapping procedure was used that generated a sample size of 5000 to assess the mediation effect. The results of a 95% confidence interval indicated that the indirect effect through the intradimensional difference comparison was −0.36, which was the same as zero (95% CI = [−0.7493, 0.0086]) [35].

Second, we examined the mediating role of the intradimensional difference in the effect of black/blue font (0 = black, 1 = blue) on intertemporal choices. The experimental condition (black or blue font) had a statistically significant positive effect on participants' willingness to choose LL ($c = 0.469$, $t = 6.25$, $p < 0.001$) and a statistically significant positive effect on the intradimensional

difference comparison ($a = 0.690$, $t = 11.21$, $p < 0.001$), which means that participants were more willing to choose LL and that the perceived Δ_{payoff} was greater than the Δ_{time} in blue font than in black font. Furthermore, when the willingness to choose LL was regressed on both the experimental condition and the intradimensional difference comparison, the size of the experimental condition effect was regressed on significance ($c' = 0.238$, $t = 2.38$, $p = 0.019$), and the intradimensional difference comparison revealed a statistically significant positive influence on the willingness to choose LL ($b = 0.335$, $t = 3.34$, $p = 0.001$; see Fig. 6b). Finally, a bootstrapping procedure was used that generated a sample size of 5000 to assess the mediation effect. The results of a 95% confidence interval indicated that the indirect effect through the intradimensional difference comparison was 0.25, which was significantly different from zero (95% CI = [0.1249, 0.3931]) [35].

Third, we examined the mediating role of the intradimensional difference in the effect of red/blue font (0 = red, 1= blue) on intertemporal choices. The experimental condition (red or blue font) had a statistically significant positive effect on participants' willingness to choose LL ($c = 0.719$, $t = 12.15$, $p < 0.001$) and a statistically significant positive effect on the intradimensional difference comparison ($a = 0.965$, $t = 43.24$, $p < 0.001$), which means that participants were more willing to choose LL and that the perceived Δ_{payoff} was greater than the Δ_{time} in blue font than in red font. Furthermore, when the willingness to choose LL was regressed on both the experimental condition and the intradimensional difference comparison, the size of the experimental condition effect was regressed on significance ($c' = 0.067$, $t = 0.31$, $p = 0.761$), and the intradimensional difference comparison revealed a statistically significant positive influence on the willingness to choose LL ($b = 0.676$, $t = 3.09$, $p = 0.002$; see Fig. 6c). Finally, a bootstrapping procedure was used that generated a sample size of 5000 to assess the mediation effect. The results of a 95% confidence interval indicated that the indirect effect through the intradimensional difference comparison was 1.05, which was significantly different from zero (95% CI = [0.4347, 1.7337]) [35].

The serial mediation model of time perception on intradimensional difference comparison

In the full model, the specific indirect effect of time perception on intradimensional difference comparison (M1→M2) is significantly positively associated ($d = -0.827$, $t = -21.21$, $p < 0.001$).

Specifically, in the direct effect model, first, we examined the mediating role of time perception and intradimensional difference comparison in the effect of red/black font (0 = black, 1 = red) on intertemporal choices. In addition, after accounting for these hypothesized mediated associations and covariates, font color was negatively associated with participants' willingness to choose LL ($c' = 0.483$, $t = 4.34$, $p < 0.001$). The specific indirect effect of font color on participants' willingness to choose LL through both mediators (time perception and intradimensional difference comparison) in series (X→M1→M2→Y) is not significant ($a_1b_1 + a_2b_2 = 1.228$, 95% bootstrapped CI: −0.0388–0.0032; see Fig. 7a).

Second, we examined the mediating role of time perception and intradimensional difference comparison in the effect of red/black font (0 = black, 1 = blue) on intertemporal choices. In addition, after accounting for these hypothesized mediated associations and covariates, the color of the font was negatively associated with participants' willingness to choose LL ($c' = -0.680$, $t = -5.49$, $p < 0.001$). In support of our hypotheses, the specific indirect effect of the color of the font on participants' willingness to choose LL through both mediators (time perception and intradimensional difference comparison) in series (X→M1→M2→Y) is also significant ($a_1b_1 + a_2b_2 = 1.289$, 95% bootstrapped CI: 0.0110–0.1247; see Fig. 7b).

Third, we examined the mediating role of time perception and intradimensional difference comparison in the effect of red/black font (0 = red, 1 = blue) on intertemporal choices. In addition, after accounting for these hypothesized mediated associations and covariates, the color of the font was negatively associated with participants' willingness to choose LL ($c' = -0.984$, $t = -5.38$, $p < 0.001$). In support of our hypotheses, the specific indirect effect of the color of the font on participants' willingness to choose LL through both mediators (time perception and intradimensional difference comparison) in series (X→M1→M2→Y) is also significant ($a_1b_1 + a_2b_2 = 2.075$, 95% bootstrapped CI: 0.0177 to 0.2133; see Fig. 7c).

The present experiment proved that, compared with red and black fonts, blue fonts can encourage individuals to make farsighted choices (i.e., delayed but larger payments) and further revealed that time perception and interdimensional difference comparisons in sequence and their separate mediating effects were statistically significant. In other words, on the blue font questionnaire, individuals feel that Δ money is greater than Δ time because they perceive time to be shorter, and in the intertemporal choice, individuals prefer the far-sighted choice.

Discussion

In this study, we found that participants who used red fonts chose SS more often than those who used blue fonts did, which is consistent with the statement in Hypothesis 1. We also demonstrated that red fonts increase

individuals' perception of time, which validates Hypothesis 2. There have been studies on intertemporal decision-making that have argued that people make intertemporal decisions based on two different perspectives, one based on options (choosing between SS and LL), and the other comparing the time and payment differences between the options and choosing the dimension with the greater difference as the criterion for decision-making, which is the perspective of the Equate-to-Differentiate Model (Comparing the differences in time and payment between SS and LL options, the SS option is chosen when time is used as a decision criterion) [4]. Compared with blue fonts, red fonts make people more likely to perceive larger differences in the time dimension between the two options of an intertemporal choice (Δtime A,B) than in the payoff dimension (Δpayoff A,B), this result is highly correlated with the theory of Equate-to-Differentiate Model, which is consistent with Hypothesis 3. The results of the study also demonstrated that the red font (rather than the blue font) made participants choose SS more because users of the red font felt that it lasted longer and thus perceived a greater time difference than a payoff difference, which is consistent with Hypothesis 4.

Our study revealed that red color is associated with longer time perception. This finding is consistent with those of previous studies. Previous evidence suggested that red screens lead to a longer perception of time than blue screens do [13, 14].

The present research makes several contributions. First, the results of this study provide new findings on the effect of font color on intertemporal choice, adding to previous work on the effect of light color on intertemporal choice [29]. Second, the results of the present study revealed that time perception plays a mediating role in the influence of color on intertemporal choice, which complements and complements the mechanism of color's influence on intertemporal choice in previous studies [29]. Third, since words of various colors are often seen in daily life, the results of this study can inform the design of textual environments that help people with distance vision in daily life. For example, applying research findings to user interface design to encourage investment behavior. Use blue fonts on insurance companies' web pages to encourage users to invest in insurance, and use blue fonts on banks' promotional materials for financial products to encourage people to invest.

However, there are limitations to this study. First, this study was conducted under laboratory conditions and cannot fully model the effect of font color on people's intertemporal choices under natural conditions. Second, the participants in this study were college students and could not be representative of other occupations and ages. In the future, we will consider conducting experiments in real-life situations with representative occupations and different age groups to ensure that the effects found in this study are stable. Additionally, we considered linking the findings to the cognitive and emotional impact of color (e.g., red signals a sense of urgency, whereas blue signals calmness and encourages deeper thought). In addition to this, the cultural significance of the influence of the color red/blue on intertemporal decision-making should be further investigated. In particular, it is possible to explore, in conjunction with previous research [36], whether color may further affect people's temporal distance perception by influencing mood.

Conclusions

In conclusion, this study provides empirical evidence for the pathways linking font color to intertemporal choice in a Chinese population. Red font was associated with shorter sight both directly and indirectly. More specifically, the main contribution of the present study is to shed light on the independent and accumulative mediating role of time perception and intradimensional difference comparison in the color–intertemporal choice linkage. It is thus possible that this linkage is partially due to the causal link between time perception and intradimensional difference comparison.

Abbreviations

LL Larger and later
SS Smaller and sooner

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40359-024-02332-1.

Supplementary Material 1.

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Authors' contributions

KZ was responsible for the conceptualization, methodology, writing of the original draft, data analysis, and revision of the paper. HJ was responsible for the revision of the paper. XWG was responsible for the revision of the paper and guidance of the application of the statistical methods. All the authors have read and approved the final manuscript.

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Data availability

Data is provided within the supplementary files.

Declarations

Ethics approval and consent to participate
The studies involving human participants were reviewed and approved by the Ludong University Ethics Committee. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin. In addition, this study followed the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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Publisher's Note

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