Up or Down?

How Culture and Color Affect Judgment

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Abstract

In the Mainland China stock market, an up-market is represented by the color of red while a down-market is represented by the color of green. Elsewhere, including the Chinese Hong Kong stock market, the color representations are the opposite. Three studies were conducted to examine the red-up-green-down effect for Mainland Chinese as well as the green-up-red-down effect for Hong Kong people. Study 1 showed that Mainland Chinese tended to predict greater economic growth (Study 1a) and higher growth in consumption trends (Study 1b) the experimental materials were presented in red than in green whereas Hong Kong participants exhibited the opposite tendencies. Study 2 found that Mainland Chinese implicitly associated red and green with up and down, respectively; Hong Kong people, however, implicitly associated green and red with up and down, respectively. Study 3 further indicated that Mainland Chinese were more likely to predict good outcomes when scenarios were presented in red whereas Hong Kong participants were more likely to predict good outcomes when scenarios were presented in green. These findings suggest that culturally specific environment cues could influence human prediction and judgment. Implications for judgment generally are discussed.

Key words: color, judgment, decision-making, environmental cues

Up or Down?

How Culture and Color Affect Judgment

Cultural beliefs, values, or self-construals greatly influence the judgment and decision making of individuals within cultures (Ji, Nisbett, & Su, 2001; Ji, Zhang, & Guo, 2008; Markus & Kitayama, 1991; Morris & Peng, 1994; Peng & Nisbett, 1999; Triandis, 1995). For example, compared with Westerners, East Asians tend to make decisions that are less unique (Kim & Markus, 1999) and to predict changes more often (Ji et al., 2001). Cultural systems have differences in meaning (Ames, 1999) conveyed in environmental cues, symbols, metaphors, assumptions, and background knowledge (Peng, Ames, & Knowles, 2001). Grounded cognition, or embodied cognition, suggests that everyday life environmental cues influence human judgment and decision-making (Barsalou, 1999, 2008; Lakoff & Johnson, 1980). Therefore, two societies that share similar values, self-view, and language but differ only in their everyday life environments may still show significant psychological variations. In the present study, we examine how culturally embedded environmental cues could cause people from two similar societies to still show variations in their judgments and predictions.

Different Environmental Cues Between Mainland China and Hong Kong

Since Hong Kong had been a British-administrated territory for more than one hundred and fifty years, environmental cues that are consistent with the Western customs rather than the traditional Chinese customs can be found everywhere (Hong, Morris, Chiu, & Benet-Martinez, 2000) . For example, Mainland China and Hong Kong are prime examples of two Chinese societies living next to each other and yet showing differences in the meanings they ascribe to the colors red and green. Specifically, in Mainland China, red signals an upward trend in the stock market and green signals a downward market. But in Hong Kong, red and green send the opposite signals.

Accordingly, Mainland China television programs customarily use red up arrows to describe increasing numbers and green down arrows to describe decreasing numbers. Hong Kong television programs, however, use the opposite. Elevators in Hong Kong's shopping malls or universities use green lights to signal up and red lights to signal down. In short, for people living in Mainland China, red is usually associated with upward, positive, and flourishing trends, whereas green is usually associated with downward, negative, and languishing trends, and the opposite is true for people living in Hong Kong.

Environmental Cues and Cognitive Processes

According to the dynamic constructivist approach to culture, human meaning is a function of knowledge activation (Hong, Morris, Chiu, & Benet-Martinez, 2000). That is, when domain-specific knowledge becomes salient, human cognitive processes or behaviors are activated accordingly. Therefore, subtle environmental cues could explicitly and implicitly influence human cognitive processes (Barsalou, 2008; Lakoff & Johnson, 1980). For example, people speak more softly when they see a picture of a library (Aarts & Dijksterhuis, 2003) and think more creatively when they see the Apple logo (Fitzsimons, Chartrand, & Fitzsimons, 2008). Thus environmental cues can activate feelings that induce consistent behaviors.

Moreover, recent research concerning the relation between colors and judgment has demonstrated similar effects as well. Color-in-context theory indicates that colors carry specific psychological meanings; that is, subtle exposure to specific colors could induce affect, cognition, and behavior consistent with ascribed meanings (Elliot & Maier, 2012). For instance, a team was shown to be alarmed by its rival wearing red because red is perceived to indicate dominance and aggression (Hagemann, Strauss, & Leißing, 2008). Similarly, teams wearing red suits tended to win more often than did teams wearing other-colored suits (Piatti, Savage, & Torgler, 2012). In addition, red has been found to undermine performance and enhance males' attraction to females (e.g., Elliot, Maier, Moller, Friedman, & Meinhardt, 2007; Elliot & Niesta, 2008). Although these findings are interesting, very few studies have actually addressed the cultural impact of color on human judgment. And yet, "the same color can have opposite meanings and, therefore, opposite implications in different contexts" (Elliot & Niesta, 2008, p.1150). Given that red and green are coupled with different expectations of direction for Mainland and Hong Kong Chinese, especially in the financial field, we expected to find that Mainland Chinese tend to associate red with up and green with down (red-up-green-down) while Hong Kong Chinese tend to associate red with down and green with up (red-down-green-up).

The Current Research

We conducted three studies to investigate the different associations between color (red vs. green) and direction (up vs. down). Specifically, we predicted that exposure to red would lead Mainland Chinese to predict a higher growth trend than would exposure to green (Study 1a and Study 1b); they would be compatible with the association of red-up, green-down. For Hong Kong Chinese, the association of red-down, green-up would be compatible (Study 2). Moreover, given that up and down have been associated with good and bad respectively (Meier & Robinson, 2006), we predicted that Mainland

Chinese would expect good outcomes when information was presented in red rather than green, and Hong Kong people would expect the reverse (Study 3).

STUDY 1a: PREDICTIONS CONCERNING THE ECONOMIC SITUATION

Study 1a examined whether red and green would lead to different predictions about economic trends for Mainland and Hong Kong Chinese.

Method

Participants. We recruited 157 Hong Kong students (97 women, 60 men, average age = 24.5, *SD* = 5.8) from City University of Hong Kong, and 127 Mainland Chinese students from Peking University in Beijing[1] (53 women, 74 men, average age = 21.2, *SD* = 1.6).

Materials and Procedure. Study 1a was carried out in December 2010. In both conditions (red and green), participants first read a description about the 2010 economic situation. The only change in the description was that “Hong Kong economy” was used for Hong Kong participants while “Mainland China economy” was used for Mainland participants. To assure that both Mainland and Hong Kong Chinese would perceive the paragraph as a real economic description, we extracted it from a quarterly report by the People’s Bank of China (2010, p.1), with minor revisions:

> In the context of a slowdown in economy recovery, Hong Kong's (Mainland China’s) economic growth was steady in 2010 such that its GDP growth was stable, and its people were confident of an economic rebound. Additionally, there was a speedy growth of industrial production and consumption in Hong Kong (Mainland). At the same time, there was also a decrease of private investments

and exports. Nonetheless, consumer prices continued to rise, with more monetary funds for private loans.

Then, we asked participants to report probability judgments that the economic growth rate in 2011 would be *higher than*, *lower than*, or *the same as* that in 2010. The instructions indicated that the three probabilities should sum up to 100%.

For both Mainland and Hong Kong samples, half of the participants were presented with the above description in red Chinese characters and the other half in green characters. In the red condition, 79 Hong Kong participants and 64 Mainland participants read the description presented in red. In the green condition, 78 Hong Kong participants and 63 Mainland participants read the description presented in green.[2] In all three studies, the colors of the characters were selected using the RGB color model. The printer Konica Minotta C5500 was used to print red (250, 0, 0) and green (0, 250, 0). Finally, traditional Chinese characters were used for Hong Kong participants while simplified Chinese characters were used for Mainland Chinese.

Results and Discussion

For probability judgments that the economic growth rate in 2011 would be higher than that in 2010, an analysis of variance (ANOVA) showed a significant culture effect, i.e., Mainland participants predicted significantly higher probability than did Hong Kong participants, $F(1, 280) = 7.52$, $p < .01$, partial $\eta^2 = .03$. This could have occurred because the Chinese economy had maintained a high growth rate over the past thirty years. As such, Mainland Chinese were accustomed to predicting greater economic growth. Moreover, the interaction effect between culture (Hong Kong vs. Mainland China) and colors (green vs. red) was significant as well, $F(1, 280) = 10.79$, $p < .05$, partial $\eta^2 = .06$.

Specifically, for Mainland Chinese participants, higher economic growth rates were expected in the red condition (*M* = 57.94%, *SD* = 27.38) than in the green condition (*M* = 48.73%, *SD* = 23.69), $t(125) = 2.03$, $p < .05$, partial $\eta^2 = .03$; for Hong Kong participants, however, greater economic growth was expected in the green condition (*M* = 50.23%, *SD* = 22.55) than in the red condition (*M* = 41.24%, *SD* = 19.50), $t(155) = 2.67$, $p < .05$, partial $\eta^2 = .04$. For the probability that the economic growth rate in 2011 would be lower than that in 2010, the red and green conditions showed no significant difference between them for both Hong Kong ($t(125) = 1.06$, *ns*, partial $\eta^2 = .01$) and Mainland participants ($t(125) = 1.17$, *ns*, partial $\eta^2 = .01$). For the probability that the economic growth rate in 2011 would be the same as that in 2010, the red and green conditions also showed no significant differences between them for both Hong Kong ($t(125) = 1.56$, *ns*, partial $\eta^2 = .02$) and Mainland participants ($t(125) = 1.72$, *ns*, partial $\eta^2 = .02$)[3].

In short, Mainland Chinese predicted better economic growth in the red condition than in the green condition, while Hong Kong Chinese predicted the opposite. These findings offered good support for the hypothesized red-up, green-down effect for participants in Mainland China as well as a red-down, green-up effect for participants in Hong Kong. In Study 1a, the associations between colors and directions were verified by participants' predictions for the economic situation. As another crucial financial activity, predictions for consumption trends were examined in Study 1b. We attempted to replicate the findings of Study 1a by testing whether participants would show the same pattern in predicting consumption trends. Moreover, in Study 1b, we measured participants' predictions by asking them to mark points rather than report the probabilities as in Study

1a. This visual and straightforward paradigm has been used preciously for successfully investigating people's predictions of change (Ji, Nisbett, & Su, 2001).

STUDY 1b: PREDICTIONS OF TRENDS

In Study 1b, we provided four different consumption trends using four graphs. We asked participants to mark two points to predict consumption trends in the future.

Method

Participants. The same participants in Study 1a participated in Study 1b. Two Hong Kong participants failed to finish the study, so the valid sample size was 155 for Hong Kong participants (95 women, 60 men) and 127 (53 women, 74 men) for Mainland participants.

Materials and Procedure. We showed participants four graphs indicating positively accelerated growth, negatively accelerated growth, positively accelerated decay, and negatively accelerated decay—originally used to represent growth rates of hot issues such as GDP or cancer death rates (Ji, Nisbett, & Su, 2001). We focused on consumption trends for four rare metals – manganese, zinc, titanium, and chromium – to avoid the possible influence of participants' prior knowledge about GDP or cancer issues (e.g., Ji et al., 2001). On each graph, a polyline marked with three points indicated the consuming trend across the past three years. Participants were then asked to mark two points to predict the consuming trend in the next two years. In the red condition, the graph line was presented in red; in the green condition, the graph line was presented in green. Figure 1 shows the graphs.

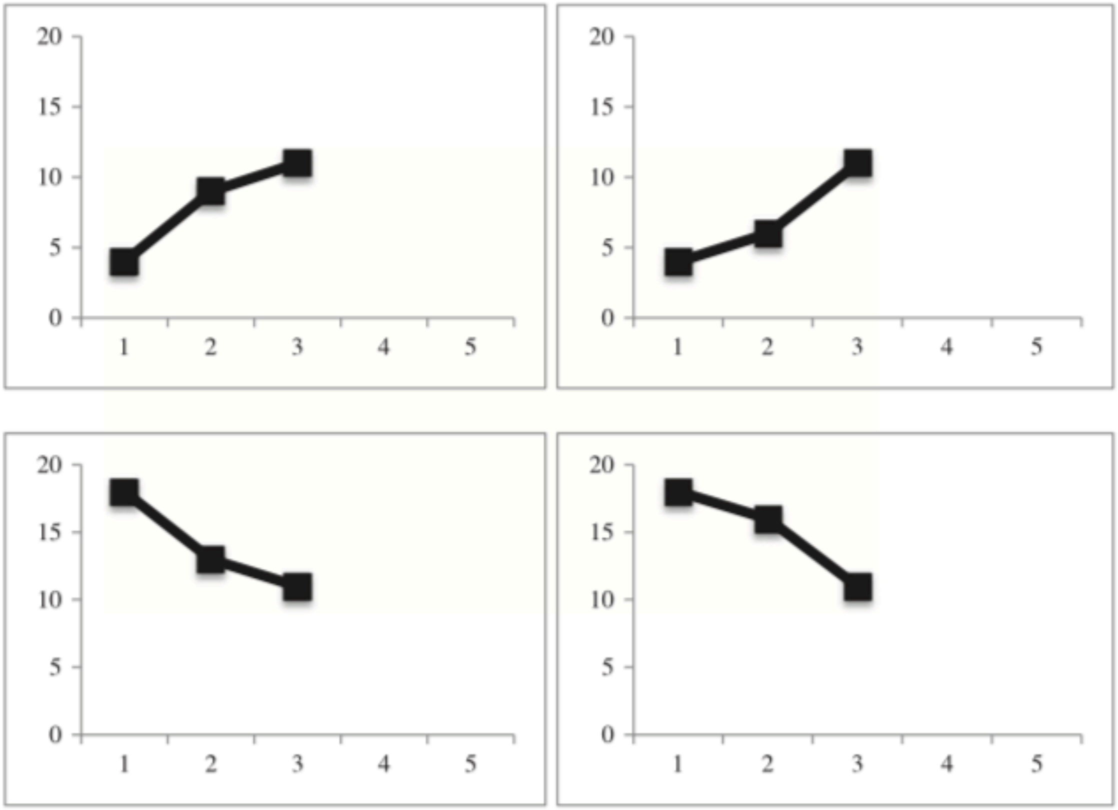

Figure 1. The graphs used in study 1b

Results and Discussion

A research assistant blind to the purpose of the study measured the two distances from the two points marked by participants to the X-axis for each graph. For data analysis, we categorized the four graphs into two types, growth graphs and decay graphs.[4] Participants' predictions for growth graphs were indexed by averaging the four distances in the two growth graphs. Similarly, predictions for decay graphs were indexed by averaging the four distances in the two decay graphs.[5]

The means of these indices were submitted to a 2 (culture) $\times$2 (color) $\times$2 (type of graph) analysis of variance with type of graph being a within-subject variable. A significant type-of-graph effect was found whereby both mainland Chinese and Hong Kong participants predicted higher consumption for the growth than decay graphs, *F*(1,

278) = 128, p <.001, partial η^2=.32. Our prediction was supported by a significant Culture × Color interaction effect $F(1, 278) = 24.34$, p <.001, partial η^2=.08, implying that regardless of growth or decay conditions, Hong Kong participants predicted higher consumption in green than in red while Mainland participants predicted higher consumption in red than in green. This was further qualified by a significant three-way interaction, $F(1, 278) = 4.10$, p <.05, partial η^2=.03. Specifically, the interaction effect between culture and color was stronger in growth graphs ($F(1, 278) = 19.66$, p <.001, partial η^2=.07) than in decay graphs ($F(1, 278) = 6.70$, p <.05, partial η^2=.02). The means are illustrated in Figure 2, broken down by culture and type of graph.

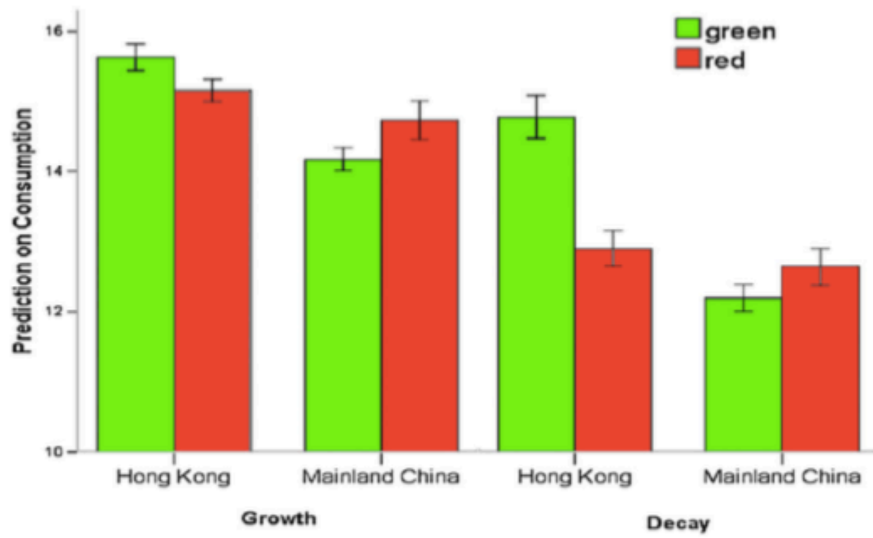

Figure 2. Predictions for consumption of rare metals by Hong Kong and Mainland Chinese participants

In short, Mainland Chinese predicted more consumption growth when information was presented in red than in green. In contrast, Hong Kong Chinese predicted the opposite. These results are consistent with the different color representations in Mainland and Hong Kong stock markets. Results support the hypothesized red-up, green-down effect for Mainland Chinese and the red-down, green-up effect for Hong Kong Chinese. However, a familiarity effect could also account for our results, that is, mere repeated exposure of the individuals to a stimulus (e.g., watch red down arrow in financial-related television programs) may lead ones to make similar judgments (e.g., red should be associated with down) in explicitly observed studies (Ecker, Zimmer, Groh-Bordin, & Mecklinger, 2007). To eliminate the explanation of a familiarity effect, we used the implicit association test (IAT) (Greenwald, McGhee, & Schwartz, 1998) in study 2 to see whether the observed effect could be identified at an implicit level, by which implicit attitudes toward color could be examined by associating colors (red/green) with directions (up/down).

STUDY 2: IMPLICIT ASSOCIATION BETWEEN COLOR AND DIRECTION

In Study 2, using the Implicit Association Test (IAT), we examined whether the association of “red-up, green-down” would be implicitly compatible for Mainland Chinese while the association of “red-down, green-up” would be implicitly compatible for Hong Kong Chinese. Compatible association refers to those associations that are congruent with participants’ beliefs, and to which they can respond quickly. The IAT is useful in assessing whether associations are compatible or not (Cunningham, Preacher, & Banaji, 2001; Fazio & Olson, 2003; Greenwald et al., 1998; McConnell & Leibold, 2001). First, the IAT examines associations at an implicit and automatic level that could minimize the social desirability effect that often appears in survey studies (Fazio, Jackson, Dunton, & Williams, 1995; Wittenbrink, Judd, & Park, 1997). Second, the IAT can examine implicit associations by effectively excluding explicit familiarity with the concepts (Dsagupta, Greenwald, & Banaji, 2003). Finally, the IAT relies on quick response tasks, which could greatly reduce the reference-group effect in cross-cultural comparisons (Heine, Lehman, Peng, & Greenholtz, 2002; Peng, Nisbett, & Wong, 1997).

Method

Participants. Study 2 participants included 74 Mainland Chinese from Peking University (38 women, 36 men, average age = 19.2, *SD* = 1.8) and 64 Hong Kong Chinese from The Chinese University of Hong Kong (44 women, 20 men, average age = 20.7, *SD* = 1.5).

Materials and Procedure.

We used pictures of different shapes in red or green as stimuli for color because the IAT calls for presenting stimuli successively. If stimuli have the same shape, and if two successive stimuli have the same color, participants cannot detect whether they are seeing a new stimulus. All stimuli are presented in Figure 3.

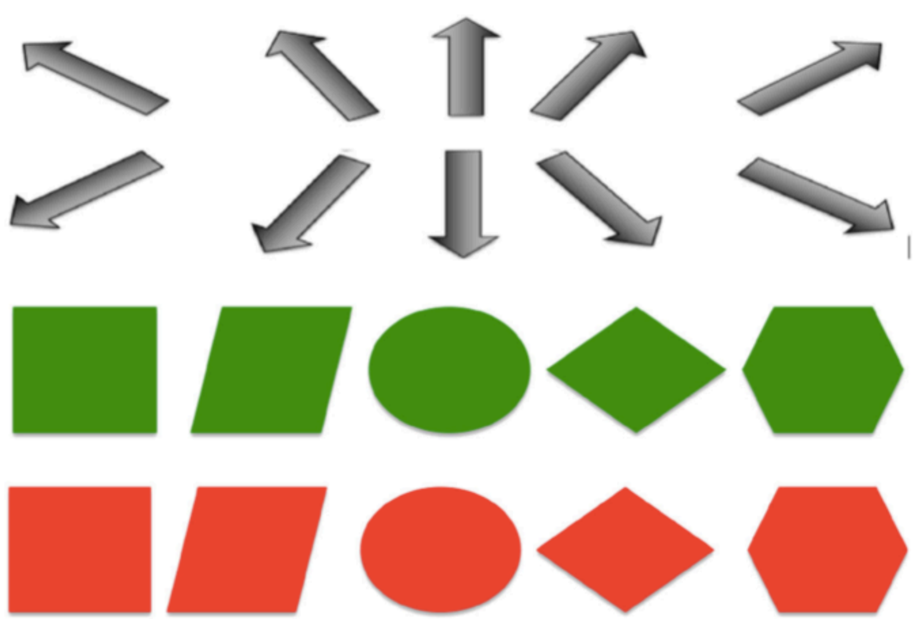

Figure 3. The pictures used in the implicit association test

The software Inquisit Lab (Millisecond Software) was used to administer the IAT on a Lenovo Thinkpad X200 with a screen size 12.1 inches. Participants were asked to categorize each picture (e.g., up vs. down) pressing the left-hand "E" key and the right-hand "I" key. The IAT included seven blocks. Blocks 1 and 2 presented color or direction (e.g., up versus down first or green versus red first). Blocks 3 and 4 presented a combination of "up red" and "down green." Block 5 was the same task as Block 1 or Block 2, but with the reversed key response options. Blocks 6 and 7 presented a combination of "up green" and "down red." Finally, to control for a sequence effect, for half of the participants, Blocks 2, 3, and 4 were switched with Blocks 5, 6, and 7, respectively. Data were analyzed for the test rounds Blocks 4 and 7 (compatible and incompatible). Blocks 1, 2, 3, 5 and 6 served as practice rounds.

Results and Discussion

Response time data were analyzed following the standard procedure (Greenwald, et al., 1998). We recoded reaction times below 300ms to 300ms and those above 3,000ms to 3,000ms: below 300ms or above 3,000ms were 11 (0.21%) and 36 (0.70%) for Hong Kong participants, and 16 (0.28%) and 59 (1.04%) for Mainland Chinese participants. We also discarded incorrect responses, such as responding "red" to a green stimulus. Three Chinese participants were also discarded from the analysis because they made more than 25% incorrect responses. As a result, valid data were obtained for 71 Mainland Chinese and 64 Hong Kong participants.

We conducted a culture (Mainland China vs. Hong Kong) × combination (compatible vs. incompatible) analysis of variance (ANOVA) to examine whether Mainland and Hong Kong Chinese would demonstrate different associations between color and direction. The results showed a significant main effect of culture, $F(1, 133) = 7.67$, $p <.01$, partial $\eta^2 =.06$, suggesting that Hong Kong participants responded faster than did Mainland Chinese. The main effect of combination was not observed, $F(1, 133) = .65$, $p =.42$, partial $\eta^2 =.005$.

Our hypothesis was supported by a significant interaction effect between culture and combination, $F(1, 133) = 10.16$, $p <.01$, partial $\eta^2 =.07$. Figure 4 displays the mean latencies for the association between color and direction. Mainland Chinese responded faster to their compatible associations of “red up” and “green down” than incompatible associations of “red down” and “green up”, $t(70) = 2.50$, $p < .05$. These results show that Mainland Chinese associated red with up and green with down. In contrast, Hong Kong Chinese responded more rapidly to their compatible associations of “green up” and “red down” than to incompatible associations of “green down” and “red up”, $t(63) = -2.09$, $p < .05$. Unlike Mainland Chinese, Hong Kong Chinese were more comfortable with the association of green up and red down.

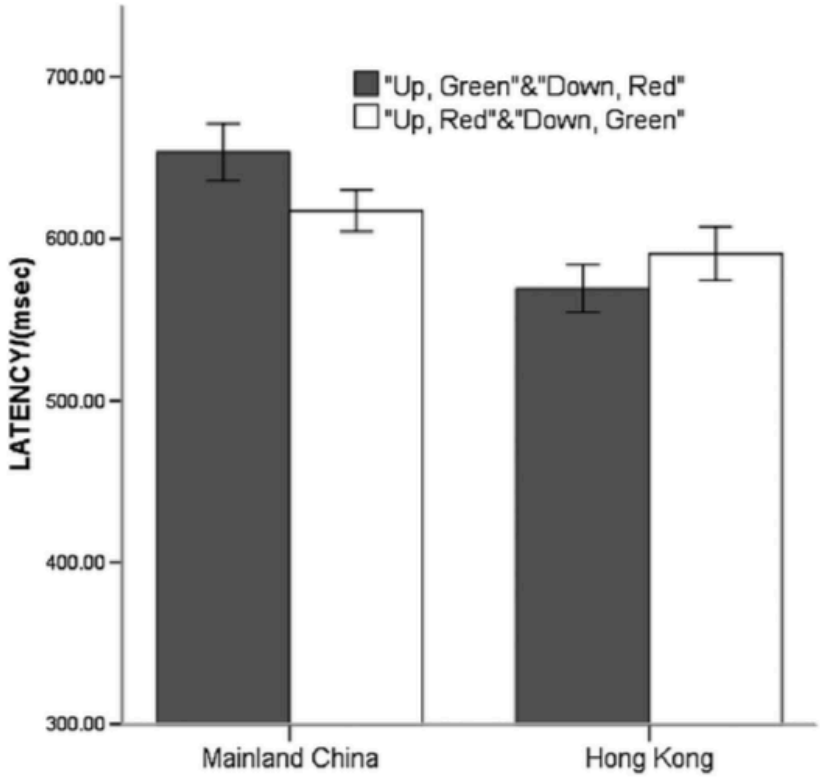

Figure 4. Mean latencies for the responses reflecting color–direction associations

In summary, Study 2 investigated the implicit association among red/green and up/down. Consistent with explicit observations (Studies 1a and 1b), results from implicit tests again confirmed the hypothesized effect as well as allowed us to tease out the concern of a possible familiarity effect.

STUDY 3: PREDICTIONS OF SOCIAL LIFE OUTCOMES

Studies 1 and 2 indicated explicitly and implicitly the red-up, green-down association for people in Mainland China and the red-down, green-up association for people in Hong Kong. Study 3 sought to verify the association by replacing up/down with good/bad. Grounded cognition research has indicated that up and down are associated with good and bad, respectively (Meier & Robinson, 2006). Given what we found in

Studies 1 and 2, it would be plausible to infer that red and green could cause Mainland and Hong Kong Chinese to generate different predictions about good or bad outcomes.

Method

Participants. We recruited 188 Hong Kong students from City University of Hong Kong (120 women, 68 men; average age = 23.8, *SD* = 5.5) and 148 Mainland Chinese students from Peking University (68 women, 80 men; average age = 21.3, *SD* = 1.5).

Materials and Procedure. Three daily life scenarios were presented to investigate to what extent study participants would predict good or bad outcomes:

(a) Li Jie will be taking an examination against fierce competition. Please predict the probability that (i) He will pass the examination (%). (ii) He will fail the examination (%).

(b) Zhang Hai has a serious rare disease. Please predict the probability that (i) He will be cured (%). (ii) He will die (%).

(c) Li Li and Chen Gang have been dating for one year. They seriously quarreled last week. Please predict the probability that (i) They will marry (%). (ii) They will break up (%).

Each scenario has one good and one bad outcome. Participants were asked to estimate probability (from 0% to 100%) for each outcome, with the probabilities of the two outcomes summing 100%. As in Studies 1 and 2, all characters of the scenarios were presented in either red (the red condition) or green (the green condition). For both Mainland and Hong Kong participants, half were assigned to the red condition while the other half were assigned to the green condition.

Results and Discussion

Given that probabilities of good and bad outcomes should equal 100%, we simply analyzed the probabilities of good outcomes. For Hong Kong participants, mean probabilities for the three good outcomes were 58.71%, 45.62%, and 56.07% in the green condition and 53.18%, 39.09%, and 48.18% in the red condition. For Mainland participants, mean probabilities for the three good outcomes were 57.91%, 42.35%, and 51.91% in the green condition, and 58.51%, 46.69%, and 57.23% in the red condition. An index of predicting good outcomes was created by averaging the three probabilities on good outcomes. A significant interaction effect was observed between culture and color, $F(1, 332) = 17.08$, $p < .001$, partial $\eta^2 = .05$. Figure 5 presents the results graphically. Specifically, Hong Kong participants were more likely to predict good outcomes when the scenarios were presented in green than in red, $t(186) = 3.79$, $p < .001$, whereas Mainland participants predicted more good outcomes when the scenarios were presented in red than in green, $t(146) = 2.13$, $p < .05$.

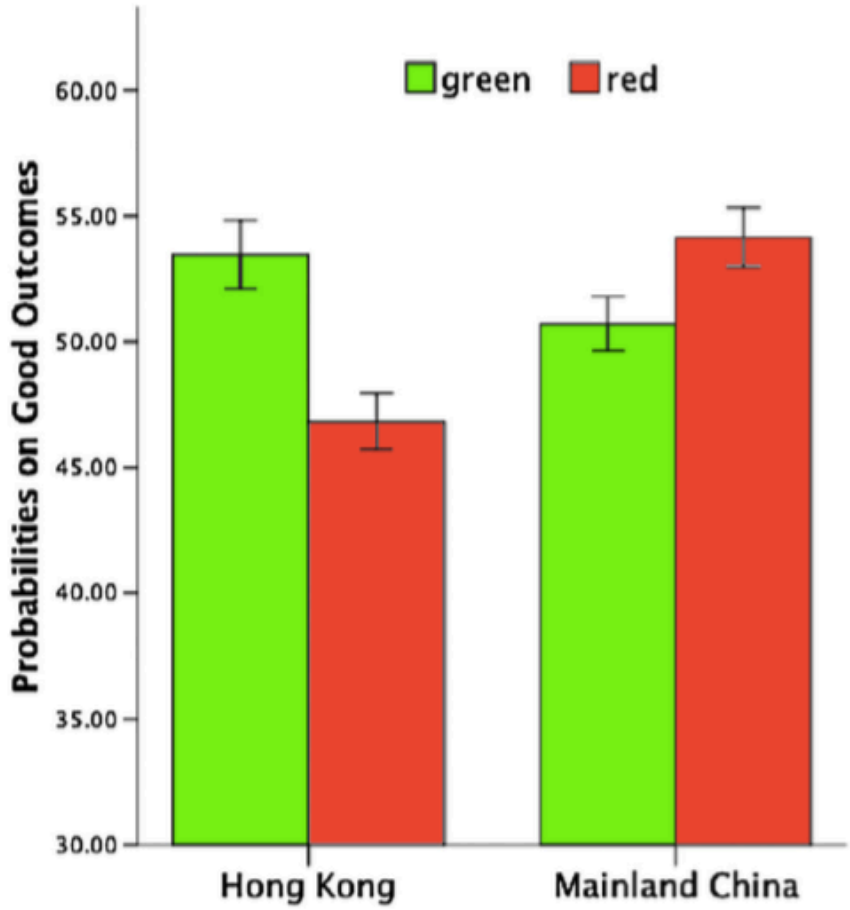

Figure 5. Mean prediction probability judgments of good results by Hong Kong and Mainland Chinese participants

Although these three scenarios could not cover all aspects of everyday life, they are common events for ordinary people. These findings confirmed that Mainland Chinese were more prone to predict good outcomes when information was presented in red than in green whereas Hong Kong Chinese tended to predict the opposite.

Study 3 further supported our contention that the colors of red and green are culturally equipped with different expectations for people who live with different environmental cues.

GENERAL DISCUSSION

Color is not only a critical feature of the visual world but also a critical symbol of social interaction. In Studies 1a and 1b, red rather than green tended to lead Mainland Chinese to predict greater economic growth and more consumption, whereas Hong Kong Chinese tended to respond in an opposite manner. Study 2 further indicated that different associations between red-green/up-down may also be shown at an implicit level. Combinations of red and up, green and down were compatible for Mainland Chinese whereas the opposite combinations were compatible for Hong Kong Chinese. Study 3 showed that Mainland Chinese participants were more likely to expect good outcomes when the scenarios were presented in red rather than in green, whereas Hong Kong participants expected the opposite outcomes. These findings suggest that the colors of red and green influence judgment and prediction in different ways, following the guidance of the environmental cues individuals live by.

Implications Related to Judgment

Our research echoes the theories of grounded cognition (Bargh, 2006; Barsalou, 2008; Varela, Thompson, & Rosch, 1991) and further suggests that the linkages between cognitive processes and environmental perceptions may vary in different cultures or societies. Earlier studies on metaphorical thinking provide growing evidence that physical experiences are associated with the understanding of abstract concepts, but culturally embedded environmental differences on this linkage are largely ignored (e.g., Williams & Bargh, 2008; Zhong & Liljenquist, 2006). Our findings, however, provide an interesting illustration showing that people living in similar societies with different environmental cues may use the same symbols or objects to mean totally different things; in turn, the linkage between overt physical experiences and covert psychological processes could be different. Thus, when David Hawks translated the famous Chinese novel *Dream of the Red Chamber* and retitled it as *The Story of the Stone,* he may have selected the title not from random choice but because of his acute understanding of cultural differences about the perception of red.[6]

Our findings also open new perspectives in judgment and decision-making studies. First, it would be interesting to explore the interaction between overt environmental cues and covert judgments. Research on judgment has predominantly focused on various representations in our conceptual system, such as accessibility, anchoring, and representativeness (Kahneman, 2003), as well as other representations rooted in different culture traditions, such as West-East beliefs about change, connection, and contradiction (Ji, 2008; Ji et al., 2001; Peng & Knowles, 2003; Peng & Nisbett, 1999). Our research, however, suggests that beyond those abstract covert determinants, judgment may be influenced by other concrete overt environmental cues, for example, colors of red and green. Moreover, though previous research in consumer behavior suggests that different people may have different associations with an environmental cue, these findings are restricted to some very specific subgroups in one society such as men versus women (Wheler & Berger, 2007) or users versus nonusers of a credit card (Blackston, 1993). Our research broadens the view of the connections between environmental cues and judgments. That is, people in different societies might have different associations with culturally embedded environmental cues, which in turn, could lead to different or even opposite judgments and decisions.

Second, given that red and green are associated differently with economic growth or decay, it would be interesting to explore the interaction effect between color and culture on risk behaviors. People tend to be risk-averse when presented with a gain (or growth) option, and to be risk-seeking when presented with a loss (or decay) option (Kahneman, 2003; Kahneman & Frederick, 2002; Tversky & Kahneman, 1974; 1981). Our research gives rise to possibilities that if gain (or loss) options were presented in red (or green), people living with different environmental cues might show different patterns of risk-seeking or risk-aversion.

Limitations and Future Direction

Studies 1 and 2 reveal associations between colors (red/green) and trends (upward/downward). Inspired by previous research that up was associated with good while down was associated with bad (Meier & Robinson, 2006), we expanded the former associations to colors and valences (good/bad) in Study 3. In everyday life, however, upward trends could be associated with both good outcomes (e.g., an increase in GDP suggests good economic development) and bad outcomes (e.g., an increase in the number of foggy days suggests serious air pollution). In other words, as two different elements of an event, trend and valence could influence people's judgment independently. Therefore, the extension of Study 3 raises questions about color effects that might occur from coupling upward trends with bad outcomes and vice versa.

The current research does not address that issue directly because we tested color effects on trend prediction and valence prediction separately: in Study 1b the materials were neutral; in Study 3 predictions concerned good/bad valence rather than upward/downward trends. Thus, it would be interesting to identify joint effects in future research, which could shed light on color effects on judgment where different color connotations are simultaneously involved in a judgment context.

Conclusion

Because of different cultural environments, red and green convey different meanings, which in turn generate different psychological outcomes. Our findings verify that, at both explicit and implicit levels, Mainland Chinese tend to associate red with up and green with down, while Hong Kong Chinese associate green with up and red with down, suggesting that culturally specific environmental cues could influence prediction and judgment.

We hope that our findings stimulate future research that explores even subtler and more refined predictions of how meaning systems affect individuals. Studies could consider symbols, background knowledge, environmental cues, metaphors, and other symbolic factors that may affect behaviors. Moreover, studies in this approach may also provide more micro-level parameters to distinguish similar cultures from each other.

APPENDIX

Table A1. Mean values of prediction by gender in studies 1a, 1b, and 3

	Mainland China				Hong Kong			
	Red		Green		Red		Green	
Study	Male	Female	Male	Female	Male	Female	Male	Female
1a	55.64	61.52	48.29	49.29	43.53	39.68	54.04	48.10
1b	13.62	13.79	13.32	13.02	13.74	14.21	14.79	15.44
3	53.94	54.37	51.97	49.25	47.97	46.17	52.19	54.20

Table A2. Mean values of reaction time by gender in study 2

	Mainland China		Hong Kong	
	Male	Female	Male	Female
Up-green and red-down	648.35	658.67	572.65	565.61
Up-red and down-green	615.48	618.74	593.26	588.32

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REFERENCES

Aarts, H., & Dijksterhuis, A. (2003). The silence of the library: Environment, situational norm, and social behavior. *Journal of Personality and Social Psychology*, *84*, 18-28.

Ames, D. (1999). *Folk psychology and social inference: Everyday solutions to the problem of other minds*. Doctoral dissertation, University of California, Berkeley.

Bargh, J. A. (2006). What have we been priming all these years? On the development, mechanisms, and ecology of nonconscious social behaviors. *European Journal of Social Psychology*, *36*, 147-168.

Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral and Brian Sciences*, *22*, 577-660.

Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology*, *59*, 617-645.

Blackston, M. (1993). Beyond brand personality: Building brand relationships. In D.A. Aaker & A. L. Biel (Eds.), *Brand equity and advertising* (pp. 113-124), NJ: Erlbaum.

Cunningham, W. A., Preacher, K. J., & Banaji, M. R. (2001). Implicit attitude measures: Consistency, stability, and convergent validity. *Psychological Science*, *12*, 163-170.

Dasgupta, N., Greenwald, A., & Banaji, M. (2003). The first ontological challenge to the IAT: Attitude or mere familiarity? *Psychological Inquiry*, *14*, 238-243.

Ecker, U. K., Zimmer, H. D., Groh-Bordin, C., & Mecklinger, A. (2007). Context effects on familiarity are familiarity effects of context: An electrophysiological study. *International Journal of Psychophysiology*, *64*, 146-156.

Elliot, A. J., & Maier, M. A. (2012). Color-in-context theory. *Advances in Experimental Social Psychology*, *45*, 61-125.

Elliot, A. J., Maier, M. A., Moller, A. C., Friedman, R., & Meinhardt, J. (2007). Color and psychological functioning: The effect of red on performance attainment. *Journal of Experimental Psychology: General*, *136*, 154-168.

Elliot, A. J., & Niesta, D. (2008). Romantic red: Red enhances men's attraction to women. *Journal of Personality and Social Psychology*, *95*, 1150-1164.

Fazio, R. H., Jackson, J. R., Dunton, B. C., & Williams, C. J. (1995). Variability in automatic activation as an unobtrusive measure of racial stereotypes: A bona fide pipeline? *Journal of Personality and Social Psychology*, *69*, 1013-1027.

Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition research: Their meaning and use. *Annual Review of Psychology*, *54*, 297-327.

Fitzsimons, G. M., Chartrand, T. L., & Fitzsimons, G. J. (2008). Automatic effects of brand exposure on motivated behavior: How apple makes you "think different". *Journal of consumer research*, *35*, 21-35.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, *74*, 1464-1480.

Hagemann, N., Strauss, B., & Leißing, J. (2008). When the referee sees red... *Psychological Science*, *19*, 769-771.

Heine, S. J., Lehman, D. R., Peng, K., & Greenholtz, J. (2002). What's wrong with cross-cultural comparison of subjective Likert scales? The reference-group effect. *Journal of Personality and Social Psychology*, *82*, 903-918.

Hong, Y., Morris, M. W., Chiu, C., & Benet-Martinez, V. (2000). Multicultural minds: A dynamic constructivist approach to culture and cognition. *American Psychologist*, *55*, 709-720.

Ji, L. J. (2008). The leopard cannot change his spots, or can he? Culture and the development of lay theories of change. *Personality and Social Psychology Bulletin*, *34*, 613-622.

Ji, L. J., Nisbett, R. E., & Su, Y. J. (2001). Culture, change and prediction. *Psychological Science*, *12*, 450-456.

Ji, L. J., Zhang, Z. Y., & Guo, T. Y. (2008). To buy or to sell: Cultural differences in stock market decisions based on price trends. *Journal of Behavioral Decision Making*, *21*, 399-413.

Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *American Psychologists*, *58*, 697-720.

Kahneman, D., & Frederick, S. (2002). Representativeness revisited: Attribute substitution in intuitive judgment. In T. Gilovich, D. Griffin, & D. Kahneman (Eds.), *Heuristics and biases: The psychology of intuitive judgment* (pp. 49-81). New York: Cambridge University Press.

Kim, H., Markus, H. R. (1999). Deviance or uniqueness, harmony or conformity? A cultural analysis. *Journal of Personality and Social Psychology*, *77*, 785-800.

Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: University of Chicago Press.

Markus, H., & Kitayama, S. (1991). Culture and self: Implications for cognition, emotion, and motivation. *Psychological Review*, *98*, 224-253.

McConnell, A. R., & Leibold, J. M. (2001). Relations among the implicit association test, discriminatory behavior, and explicit measures of racial attitudes. *Journal of Experimental Social Psychology*, *37*, 435-442.

Meier, B. P., & Robinson, M. D. (2006). Does "feeling down" mean seeing down? Depressive symptoms and vertical selective attention. *Journal of Research in Personality*, *40*, 451-461.

Morris, M. W., & Peng, K. (1994). Culture and cause: American and Chinese attributions for social and physical events. *Journal of Personality and Social Psychology*, *67*, 949-971.

Peng, K., Ames, D., & Knowles, E. D. (2001). Culture and human inference: Perspectives from three traditions. In D. R. Matsumoto (Ed.), *Handbook of culture and psychology* (pp. 245-264). New York: Oxford University Press.

Peng, K., & Knowles, E. D. (2003). Culture, education, and the attribution of physical causality. *Personality and Social Psychology Bulletin*, *29*, 1272-1284.

Peng, K., & Nisbett, R. E. (1999). Culture, dialectics, and reasoning about contradiction. *American Psychologists*, *54*, 741-754.

Peng, K., Nisbett, R. E., & Wong, N. Y. C. (1997). Validity problems comparing values across cultures and possible solutions. *Psychological Methods*, *2*, 329-344.

Piatti, M., Savage, D., & Torgler, B. (2012). The red mist? Red shirts, success and team sports. *Sport in Society*, *15*, 1209-1227.

The People's Bank of China. (2010). The analysis of China's macroeconomic situation in the third quarter of 2010 (in Chinese). *www.chinabond.com.cn/Info/9853802*

Triandis, H.C. (1995). *Individualism and collectivism.* Boulder, CO: Westview.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, *185*, 1124-1131.

Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science*, *211*, 453-458.

Varela, F. J., Thompson, E., & Rosch, E. (1991). *The embodied mind: Cognitive science and human experience*. Cambridge, MA: MIT Press.

Wheeler, S. C., & Berger, J. (2007). When the same prime leads to different effects. *Journal of Consumer Research*, *34*, 357-368.

Williams, L. E., & Bargh, J. A. (2008). Experiencing physical warmth promotes interpersonal warmth. *Science*, *322*, 606-607.

Wittenbrink, B., Judd, C. M., & Park, B. (1997). Evidence for racial prejudice at the implicit level and its relationship with questionnaire measures. *Journal of Personality and Social Psychology*, *72*, 262-274.

Zhong, C. B., & Liljenquist, K. (2006). Washing away your sins: Threatened morality and physical cleansing. *Science*, *313*, 1451-1452.

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