Failure to Replicate the Mehta and Zhu (2009) Color Effect

IV-026

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Introduction

Mehta and Zhu (2009) reported several studies of the effects of red and blue on a series of cognitive tasks. Red was hypothesized to induce a state of avoidance motivation which was predicted to make people more vigilant and risk-averse in a cognitive task. Blue was hypothesized to induce approach motivation which was predicted to increase use of innovative, risky strategies in tasks.

Study 1a of Mehta and Zhu (2009) tested the effects of red and blue on anagram solutions. Participants solved anagrams on red, white, or blue backgrounds. Words were chosen to induce either an avoidance, neutral, or approach motivational state. Mehta and Zhu reported a significant color by word-type interaction. Anagrams were solved more quickly when the word and screen color invoked matching motivational states.

Steele et al. (2010) replicated the published procedure of the Mehta and Zhu (2009) study but did not obtain their results. Anagrams were not solved more quickly when word and screen color invoked matching motivational states.

Table 1 shows that the Mehta and Zhu words confounded length and motivational status. Steele et al. (2011) failed to produce the color effects also when words were equated for length.

Recently, we were informed that the actual procedure did not match the published procedure. The first 1 or 2 letters of the solution were underlined to provide a solution hint.

The purpose of this study was to replicate the actual procedure of Mehta and Zhu (2009) using their anagrams and solution hints.

Method

Participants
263 ASU undergraduate students participated in the study for course credit.

Apparatus
Sessions were computer-based and programmed using E-Prime software.

Procedure
Participants were asked to solve the 12 anagrams (3 = Avoidance, 6 = Neutral, 3 = Approach) used by Mehta and Zhu. The words are shown in Table 1.

Each person was exposed to the anagrams on one color background. The screen color, Red, was programmed to have the values of H[ue] S[aturation] L[ightness] = 0, 240, 120 and the screen color, Blue, was programmed to be HSL = 160, 240, 120, consistent with the Mehta and Zhu specifications.

Participants initiated each anagram problem. Anagrams were presented in randomized order. Word solution, solution time, and accuracy of the solution was recorded for each anagram.

Participants were then asked three questions about their speed-accuracy strategy on a 7-point bipolar (*Disagree*/*Agree*) scale.

Finally, participants were tested for color blindness on a short version of the Ishihara color deficiency test. Participant's data were excluded if the color deficiency test was not passed.

Only correct solutions were included in the analysis.

Results

Lack of Predicted Color by Word-Type Interaction

Table 2 shows mean solution times in seconds for anagrams as a function of screen color and word type.

The general pattern of results does not follow the Mehta and Zhu report. Avoidance words did not have the fastest solution times on red and Approach words did not have the fastest solution times on a blue background.

A Repeated Measures ANOVA was performed with Color as the Between-Subject factor and Word-Type as the Within-Subject factor. There was a Color effect, $F(2, 248) = 3.50$, $p = .03$, a clear effect of Word-Type, $F(2, 496) = 25.8$, $p < .001$, and a marginal Color by Word-Type interaction, $F(4, 496) = 1.84$, $p = .12$.

The main effect of Color was due to solution times being faster on red relative to the blue background ($p = .03$).

Word-Type had clear effects on solution times. The shorter Neutral words were solved more quickly than either Avoidance ($p < .001$) or Approach ($p < .001$). Avoidance words were solved more slowly than Approach words ($p = .04$), an effect observed in our previous work.

The possibility that the interaction effect was hidden by a few extreme scores was tested by performing a Repeated Measures ANOVA on the *log* transform of the solution times. The main effect of Color was reduced, $F(2, 248) = 2.27$, $p = .11$; the effect of Word-Type remained strong, $F(2, 496) = 44.8$, $p < .001$; and no strong Color by Word-Type interaction emerged, $F(4, 496) = 2.24$, $p = .06$.

Table 1

Anagrams from Mehta & Zhu (2009)

Avoidance		Approach		Neutral	
Prevent	[7]	Adventure	[9]	Violin	[6]
Guarantee	[9]	Advance	[7]	Drink	[5]
Obligation	[10]	Olympics	[8]	Phone	[5]
				Count	[5]
				Computer	[8]
				Ranch	[5]
[*] = Word Length					
M = 8.67		*M* = 8.00		*M* = 5.67	
SD = 1.53		*SD* = 1.00		*SD* = 1.21	

Table 2

Correct Solution Time (sec)

Color		Avoidance	Neutral	Approach
Red	*M*	13.1	9.4	10.6
	SD	(7.4)	(5.4)	(6.9)
White	*M*	15.7	9.9	13.4
	SD	(11.4)	(8.5)	(8.7)
Blue	*M*	15.6	10.2	15.6
	SD	(11.3)	(6.9)	(15.0)

Discussion

Study 1a of Mehta and Zhu (2009) was replicated using their anagrams and solution hints.

The Mehta and Zhu color-effect results were not replicated. Anagrams were not solved more quickly when the word and screen color putatively invoked matching motivational states.

Solution times were reliably quicker for the shorter-length Neutral words, suggesting that participants were engaged in the task.

Lack of statistical power is not an explanation for our results as Mehta and Zhu had 69 participants, compared to our 263.

Our results argue against the existence of the Mehta and Zhu (2009) color effect.

References

Mehta, R., & Zhu, R. J. (2009). Blue or red? Exploring the effect of color on cognitive performances. *Science, 323,* 1226-1229.

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Steele et al. 2010 Reprint

Steele et al. 2011 Reprint

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