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Abstract: Research data collected from single respondents may raise concerns regarding common method variance (CMV), which is believed to threaten the validity of findings. The primary concern is that CMV can inflate substantive relationships, such that they appear statistically significant when they are not. Thus, understanding the nature of CMV is critical, especially when one considers the popularity—and sometimes necessity—of using self-report data. Research examining CMV has found conflicting evidence about the impact of CMV. Researchers who believe CMV influences findings have proposed solutions to combat any real or perceived potential bias, including changing survey instructions and using marker variables, but few studies have examined the efficacy of these approaches. The purpose of this study is to examine the impact of these techniques and the nature of CMV using an experimental design. To conduct the experiment, multiple versions of a survey, which vary in their use of the remedial approaches, are utilized to collect data, which resulted in 1,069 usable responses. The experimental design was based on the faking literature and included instructions intended to induce or reduce the levels of CMV. Further, two different marker variables are used to determine the degree to which they create a psychological separation in substantive variables. Correlation analysis and measurement invariance are used to analyze the data. This study posits that, if CMV is a substantial concern for self-report data and these approaches are effective, then findings will differ in surveys that incorporate such approaches from surveys that do not. Results indicate few differences in experimental conditions, meaning that regardless of instructions or marker variable, substantive item correlations remained statistically similar. The results indicate this is likely due to the minimal impact of CMV, given that the proposed methods of correction did not significantly influence research findings. These findings have implications for researchers in that they do not support that CMV, or at least its proposed remedies, significantly alter findings. However, support for the null conclusions, in spite of appropriate statistical power, warrant future research examining the nature and impact of CMV.

Keywords: common method variance, experiment, same source research, marker variable, psychological separation

1. Introduction

Many social science researchers have concerns that common method variance (CMV) may create spurious inflation of covariances and observed correlations in same source perceptual data. CMV may derive from surveys in which respondents provide data for both independent and dependent variables in one time period, when the measurement method itself, rather than the actual relationships being investigated, influences findings. Scholars have called for more research on CMV and how it can be managed in self-reported data (Richardson, Simmering, and Sturman, 2009; Spector, et al., 2019). For decades, conflicting perspectives on the nature and likelihood of CMV have persisted (Richardson, et al., 2009), with some authors warning of its prevalence (e.g., Podsakoff, MacKenzie, Lee, and Podsakoff, 2003) and others arguing that its impact is overstated (e.g., Spector, 2006). Scholars have suggested procedural approaches to prevent or reduce CMV (Podsakoff, et al. 2003; Castille, Simmering, and Crawford, 2017) and introduced statistical techniques to detect or control for CMV. In this study, the authors aim to examine how survey design can influence CMV by introducing experimental manipulation into the data collection. The literature on faking in selection tests guides understanding of how one might detect systematic error in responses with the use of instructions to influence participants to respond in a particular way.

This study proposes an experimental approach to examining CMV, by manipulating a presumed cause of CMV to elucidate the nature of this error. Some prior experimentation on CMV exists, examining item priming and ordering (e.g., Johnson, Rosen, and Djurdevic, 2011; Schwarz, et al., 2017; Weijters, Geuens, and Schillewaert, 2009). In this study, the authors utilized a survey to examine implicit theories and illusory correlations, which

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are common rater effects that may lead to CMV, but have not received much attention (Podsakoff, et al., 2003). Additionally, this study employs the Confirmatory Factor Analysis (CFA) Marker Technique using two different marker variables (Williams, Hartman, and Cavazotte, 2010) to detect CMV in data. While more research is needed, the finding that correlations among study variables did not differ significantly among experimental conditions supports the argument that procedural and statistical remedies to minimize CMV may be unnecessary or ineffective. The structure of the study is an overview of CMV and rater effects, hypotheses to be tested, the method, results, discussion of findings, conclusions and implications.

2. Literature Review

2.1 Manipulating Common Method Variance through Common Rater Effects

Common method variance (CMV) is defined as systematic error variance due to rater response styles, item characteristics, and aspects of measurement that threaten the validity of study findings when measures are collected using the same or similar methods through the inadvertent introduction of bias or variance that may be created by the measurement method itself (Podsakoff et al., 2003; Podsakoff, MacKenzie, & Podsakoff, 2012). CMV cannot be directly seen or measured, so its influence on research parameters must be inferred methodologically. Indeed, it is a source of error that may be unknown even to the respondent (Kline, Sulksky, and Rever-Moriyama, 2000; Moorman and Podsakoff, 1992). As some scholars believe the presence of CMV to be minimal or unbiasing (Spector, 2006), at least in the presence of other types of error (e.g., unreliability of measures; Fuller, Simmering, Atinc, Ocal, and Babin, 2016; Lance, Dawson, and Birkleback, 2010) or within complex models (Siemsen, Roth, and Oliveira, 2010), assessing the efficacy of CMV detection techniques may be a challenge. Thus, following the literature on faking in selection tests, and recent research by Schwarz et al. (2017), the authors sought to increase the ability to detect CMV by introducing this error (or increasing it) in data through survey instructions.

2.2 Implicit Theories/Illusory Correlations

Common rater effects occur when responses to a survey are influenced by a single respondent answering all of the items on a survey, and implicit theories and illusory correlations are one way in which this effect can lead to CMV (Podsakoff, et al*.,* 2003). Prior research has addressed other common rater effects (Simmering, Fuller, Richardson, Ocal, and Atinc, 2015; Castille, et al., 2017), but not implicit theories and illusory correlations (Schwarz, et al*.,* 2017). While researchers can enact some degree of control over other potential sources of CMV, there are few means by which to avoid common rater effects when using same source data.

When using implicit theories and illusory correlations, respondents make logical connections among survey scales and therefore answer more consistently than distinct respondents would, thus potentially inflating substantive relationships (Baumgartner and Steenkamp, 2001; Meade, Watson, and Kroustalis, 2007; Salancik, 1984). This effect can create response bias when respondents distort their scores based on either the illusory correlations made due to the co-occurrence of scales in the study or implicit theories due to personal beliefs regarding construct interrelatedness (Berman and Kenny, 1976; Podsakoff, et al., 2003). Thus, responses to scale items may be based upon assumptions rather than the respondent's actual behaviors, feelings, or attitudes (Pace, 2010). While many researchers employ procedural efforts in an effort to reduce CMV (see Podsakoff, et al., 2003), such approaches cannot account for implicit theories or illusory correlations, thus leaving a gap in the literature.

An example of survey responses that are impacted by implicit theories would if respondents believe they are good employee and that good employees engage in organizational citizenship behaviors (OCBs), then respondents may report exhibiting OCBs whether they genuinely engage in them or not. Illusory correlations affect ratings by the rater imposing his/her beliefs of items/variables they expect to covary onto their responses (Podsakoff, et al., 2003; Pace, 2010). For example, if a measure of job satisfaction and a measure of OCB are in the same survey, respondents may assume that they are related and respond in a way that ensures the items are correlated. Studies have found that implicit theories and illusory correlations may influence ratings of leader behavior (Phillips and Lord, 1986), attributions of the causes of group performance (Staw, 1975), and perceptions about the relationship between employee satisfaction and performance (Smither, Collins, and Buda, 1989).

2.3 Experimental Manipulation

An experimental manipulation purports to influence specific sources of bias, which may then be observed in substantive relationships, in an approach similar to that of Schwarz et al. (2017). To manipulate CMV in survey responses, this research turned to the literature on faking in selection testing, where research is aimed at identifying job applicants who "fake" responses. Faking is providing false answers that indicate applicants have more desirable traits than they truly do (Kiefer and Benit, 2016), which reduces the validity of the test in predicting job performance. Faking experimental manipulations assign a random group of respondents taking a selection test (e.g., a personality survey) to either "fake good" or present their best selves in responses. In other words, respondents are given a cover story that may include a false purpose or incentive to fake (e.g., Robie, 2006) or obscure the purpose of the study (e.g., Birkeland, et al., 2006; Castille, et al., 2017; Ziegler, 2011). A comparable random set of respondents is asked to respond normally (e.g. Bing, et al., 2011; Schmit and Ryan, 1993; Paulhus, et al., 2003). Researchers can assess the influence of faking on personality test validity by comparing test scores from the two samples.

In the current study, rather than asking respondents to "fake good," an instructional manipulation is aimed at increasing or decreasing the common rater effects of implicit theories or illusory correlations. Specifically, different experimental groups are given different instructions targeted to influence cognitive processes and biases, such as how to respond to survey items. If groups of respondents can be influenced to answer such that they use strong implicit theories/illusory correlations (inducing CMV), and other groups can be influenced against the use of implicit theories/illusory correlations (reducing CMV), then data from these groups can be compared to determine if there are differing levels of correlation among substantive variables between them.

Following Schwarz et al. (2017), measurement invariance (MI) tests were used to compare the groups of participants in each condition. MI indicates that an instrument measures the same construct in the same way across different groups. Demonstrating MI is necessary to support the validity of inferences made when testing multi-group data (Chen, 2008; Vandenberg and Lance, 2000). Failure to demonstrate MI indicates that participants can be induced to respond differently to survey items because of the instructional manipulation.

Hypothesis 1a: Correlations among substantive variables will be stronger in the CMV inducing conditions than in the CMV reducing conditions.

Hypothesis 1b: Measurement invariance will not be indicated in the comparison of the CMV inducing conditions and the CMV reducing conditions.

2.4 Marker Variables

Researchers have increasingly turned to post hoc detection methods to verify that CMV is not biasing their data (Simmering, et al., 2015). While these techniques cannot directly measure CMV, they may provide a means for estimating the amount of CMV that may be present or biasing to substantive relationships. The CFA Marker Variable technique (Williams, et al., 2010) has received attention as a promising means of detecting CMV in data, particularly when used with a suitable marker variable (Richardson, et al., 2009).

Marker variables were introduced by Lindell and Whitney (2001) as a proxy intended to capture CMV. While the correlational marker technique developed by these authors has been criticized for its lack of accuracy, the subsequently developed CFA Marker Technique has demonstrated empirical efficacy in a number of studies (Williams, et al., 2010; Williams and McGonagle, 2016). Researchers argue that "ideal" marker variables for this test are perceptual in nature (e.g., not objective, like age or tenure), measured in the same way as the substantive variables (e.g., on a Likert scale), and theoretically unrelated to the substantive variables in the study (Simmering, et al., 2015).

Marker variables may also be useful in preventing CMV by creating proximal separation when included in a survey in between substantive items as a "cognitive 'speed bump'" (Podsakoff, et al*.,* 2003: 884). Separation can make the respondent less likely to answer all survey items in a consistent fashion for two reasons. First, the introduction of so-called filler items can cause the respondent to forget their answers to prior substantive items, making it harder to make logical links between the substantive scales on a survey. Second, if the additional items seem different from the content in the substantive items, respondents may pay more attention to all of the items, both filler and substantive, when answering because the items seem unexpected.

This study examines the degree to which marker variables might create sufficient proximal separation to reduce CMV, arguing that the mere presence of a marker variable may reduce correlations among substantive variables. Moreover, this study asserts that ideal markers variables can be either "connecting" or "disconnecting," such that the former allows a respondent to logically connect all variables (substantive and marker) in a meaningful way and the latter makes it more challenging for a respondent to find a logical connection among items. For example, a disconnecting maker placed between independent and dependent variables can create a stronger psychological separation because it is more difficult to come up with a logical reason that it might be a part of a larger theory. Thus, the introduction of a marker variable may be a procedural remedy for CMV in and of itself.

This use of marker variables creates a stimulus manipulation (McBride, 2012) which differs from the instructional manipulation previously introduced in this study. With stimulus manipulation, different experimental conditions use different stimuli. In this case, when the respondent encounters the different stimuli (e.g., presence or absence of a particular marker variable), then their behavior, interpretation, or response is posited to change accordingly.

Hypothesis 2a: Correlations among substantive variables will be stronger in conditions in which there is no marker variable than in conditions in which there is a marker variable.

Hypothesis 2b: MI will not be indicated in the comparison of the no marker variable condition and the marker variable condition

Hypothesis 2c: Correlations among substantive variables will be stronger in conditions in which there is a connecting marker variable than in conditions in which there is a disconnecting marker variable.

Hypothesis 2d: MI will not be indicated in the comparison of the connecting marker variable and the disconnecting marker variable condition.

2.5 Perceived Awareness of Research Hypothesis (PARH)

The PARH determines respondents' perceptions of the survey purpose or what the researcher was attempting to find (Rubin, Paolini, and Crisp, 2010). The current study includes the PARH as a more direct measure of our manipulation of inducing CMV, in which respondents should report higher levels of awareness of the study hypotheses than in the reducing CMV condition. Additionally, responses to the PARH may also be influenced by the presence of the two different marker variables such that a connecting marker variable should be seen as less "different" than a disconnecting marker, so that the former can better fit into a mental model of substantive items.

Beyond the manipulation check, scores on the PARH scale should indicate participants' reliance on implicit theories (Rubin, 2016). That is, if respondents feel confident that they know the relationships the researcher seeks to investigate, then they are more capable of mentally connecting those variables while answering items (i.e., implicit theories) in the way that they were instructed.

H3a: Subjects in the CMV inducing condition will report more awareness of research hypotheses than subjects in the CMV reducing condition.

H3b: Subjects exposed to the connecting marker will report more awareness of research hypotheses than subjects exposed to the disconnecting marker.

3. Method

3.1 Substantive Variables

This experiment required a model of previously studied same-source substantive variables to provide a context in which to assess the hypotheses, so the variables studied by Yang, Mossholder, and Peng (2009) were used. *Supervisory procedural justice (PJ)* is the employee's perception of the supervisor's fairness in determining outcomes (Leventhal, 1980). *Affective trust in one's supervisor (Trust)* captures an "employee's willingness to be vulnerable based on expectations that the intentions, words, or actions of their supervisor can be relied upon" (Poon, Rahid, and Othman, 2006). *Job satisfaction (JS)* is an individual's overall feelings of happiness in the job (Hackman and Oldham, 1975). These variables were investigated by Simmering et al. (2015), who found there was potential for CMV to inflate substantive relationships through implicit theories. These variables present a strong case for concern for CMV, in that each scale is perceptual, positively worded, transparent, and short enough to be easily remembered (i.e., easier to enact implicit theories). A subset of variables from Yang et al. (2009) was used to more strongly manipulate CMV, as a shorter survey provides greater opportunity for respondents to satisfice, which can increase common rater effects (Podsakoff, et al., 2012).

Notably, Yang et al*.* (2009) did not find CMV to be present at biasing levels in their data. However, they tested for bias using the correlational marker approach (Lindell and Whitney, 2001), which has a high error rate (Richardson, et al., 2009). A separate data set of these variables found possible CMV contamination with the CFA Marker approach (Simmering, et al., 2015).

3.2 Experimental Conditions and Manipulation Checks

Two experimental conditions based on CMV and three experimental conditions based on marker variables were developed to create three independent two-group randomized experiments, encompassing six separate experimental conditions, as seen in Table 1 below. These were enacted in an online survey.

Table 1: Sample Sizes in Experimental Conditions

CMV Manipulations	Marker Variable Manipulations	Sample Size
CMV Inducing	No Marker Variable	211
CMV Inducing	Creative Self-Efficacy as Marker	210
CMV Inducing	Attitudes towards the Color Blue as Marker	194
CMV Reducing	No Marker Variable	150
CMV Reducing	Creative Self-Efficacy as Marker	155
CMV Reducing	Attitudes towards the Color Blue as Marker	149
	Total	1,069

3.2.1 Common Method Variance

Two experimental conditions to manipulate CMV were created. The *CMV Inducing* condition intended to encourage respondents to answer items in the survey in a consistent manner, particularly by relying on implicit theories, even in the presence of seemingly unrelated items (e.g., marker variables). Instructions in this condition read, "In this survey, you will be asked to respond to several statements about your work and behaviors. The purpose of this study is to *verify the very strong relationships* among variables that have been found by various researchers." In the *CMV Reducing* condition instructions, intended to encourage respondents to consider each item as unrelated, read: "In this survey, you will be asked to respond to several statements about your work and behaviors. Several researchers have contributed items to this survey for separate purposes, *so questions should not be related to one another."*

A factual manipulation check (FMC), which asks respondents questions as to the purpose and content of the survey (Kane and Barabas, 2019), was used to verify that the above instructions were understood by respondents. The FMC read, "Which of the following correctly describes the purpose of this study?" with choices that represented the *CMV Inducing* condition ("The purpose of this study is *to verify the strong relationships that exist among workplace behaviors*. As such, there is a clear purpose to this study.") and the *CMV Reducing* condition ("Separate researchers built the content of this survey for separate purposes *so the questions should not be related to one another***.** As such, there is no clear purpose for this study."). Because the CMV manipulation was an integral part of the study, respondents who did not choose the correct answer (i.e., did not pass the manipulation check), were not allowed to continue with the survey. Thus, the FMC both reinforces the survey instruction and serves as an attention check.

3.2.2 Marker Variables

There were three experimental conditions related to the use of the marker variable. The *No Marker* condition had no marker variable included in the survey. Two ideal marker variables were used in the other conditions. *Creative Self-Efficacy (CSE)* was chosen as a connecting marker that one might find in a typical study of workplace attitudes*.* Creative self-efficacy refers to the belief that one can produce creative outcomes (Tierney & Farmer, 2002). *Attitudes towards the Color Blue (ATCB)* was chosen as a disconnecting marker that may seem randomly inserted. This is a scale intentionally developed for use as a marker variable to capture a seemingly neutral attitude regarding a color that could serve as a proxy for direct measurement of CMV (Miller & Chiodo, 2008).

3.3 Participants and Procedure

Survey participants were Amazon.com's Mechanical Turk (MTurk) workers. Participants were offered $1 USD to participate and were told they had to currently work in the U.S. and have a supervisor. While 1,837 began the survey, 63 were dropped from the survey for failing to meet the conditions of working in the U.S., 90 were dropped for not having a supervisor, and 64 dropped out after completing the consent form. 1,620 respondents proceeded to the experiment.

Respondents read the study overview, gave consent, then were randomly assigned by Qualtrics online survey software to one of the six experimental conditions. Either CMV Inducing or CMV Reducing instructions were given, followed by the manipulation check item on the next page of the survey. Those who failed the FMC (488) were not allowed to continue, but the 1,132 who passed the check continued and were paid. Data from sixty-three participants were then removed due to failing an attention check question ("For this item, please answer STRONGLY DISAGREE."), resulting in a final usable sample of 1,069. This removal of approximately 30% of our respondents is consistent with prior manipulation check research, in which typical failure rates range from 3 to 46% (Maniaci and Rogge, 2014). Research has demonstrated that including those who fail manipulation checks greatly increase noise and reduce the ability to detect differences between experimental manipulations (Oppenheimer, Meyvis, and Davidenko, 2009), underscoring the importance of including such a check.

In each survey, the scales were presented in the same order: supervisory procedural justice, affective trust in supervisor, one attention check item, marker variable (in conditions where a marker was used), and job satisfaction. To better create proximal separation, markers were placed between exogenous and endogenous variables. After the substantive and marker scales, respondents were presented with the PAHR scale, one open-ended item to assess PAHR, then items to measure demographics.

3.4 Measures

All items were measured on a 5-point Likert Scale in which 1=strongly disagree and 5=strongly agree. PJ was measured with 7 items from Colquitt (2001), with $\alpha = .88$. Five items developed by Yang and Mossholder (2006) were used to measure Trust ($\alpha = .93$). Hackman and Oldham's (1975) three-item scale to measure JS had a reliability of $\alpha = .92$. Three positively worded items from Miller and Chiodo's (2008) ATCB scale ($\alpha = .77$) was the disconnecting marker. Tierney and Farmer's (2002) 3-item measure of CSE ($\alpha = .80$) was the connecting marker. The PARH four-item scale (Rubin, et al., 2010; $\alpha = .89$) was placed after the substantive items, as recommended by Rubin. Further, one open ended PARH item read, "In one or two sentences, please write what you think this research study was about," to capture the distinction between the true hypotheses in this study (which were obscure) and the substantive model presented.

4. Analyses

The usable sample was 54.3% male and had a mean age of 35 (min=18, max=80, SD=10.7). Most respondents (68.7%) were white/Caucasian. Respondent reported education levels were 43% with a 4-year college degree, 31.5% with some college, 14.4% with a masters degree, 7.7% with a high school diploma, and 2.9% with a doctorate or professional degree. As is common with MTurk, job categories varied widely. The mean number of years of work experience was 13.9 (min=1, max=59, SD=10.3). Control was enacted by random assignment to experimental design, and with no notable correlations among demographic variables and study variables, best practices were enacted (Carlson and Wu, 2012) by not using control variables.

Two sets of analyses were used to test hypotheses 1 and 2. First, 95% confidence intervals surrounding observed correlations in each condition were calculated and, the significance of the difference in correlations between conditions was calculated. Second, the more robust MI tests were conducted to determine the degree to which measurements of constructs were equivalent in different conditions. Demonstrating MI begins with an omnibus test of the equality of covariance matrices across the different groups of interest (Vandenberg and Lance, 2000). If covariance matrices differ across groups, an investigation into the source of the differences is necessary, testing a series of increasingly restrictive models against a baseline model (see Figure 1) to determine the level of invariance present (Vandenberg and Lance, 2000). There are three levels to investigate: (i) configural invariance (similar factor structure), (ii) metric invariance (similar factor loadings), and (iii) scalar invariance (similar item regression intercepts). Failing to establish invariance at any of the three levels indicates that the use of our manipulations regarding CMV (e.g., instructional manipulation and/or proximal separation in use of a marker variable) may have influenced responses. Hypothesis 3 was analyzed with t-tests.

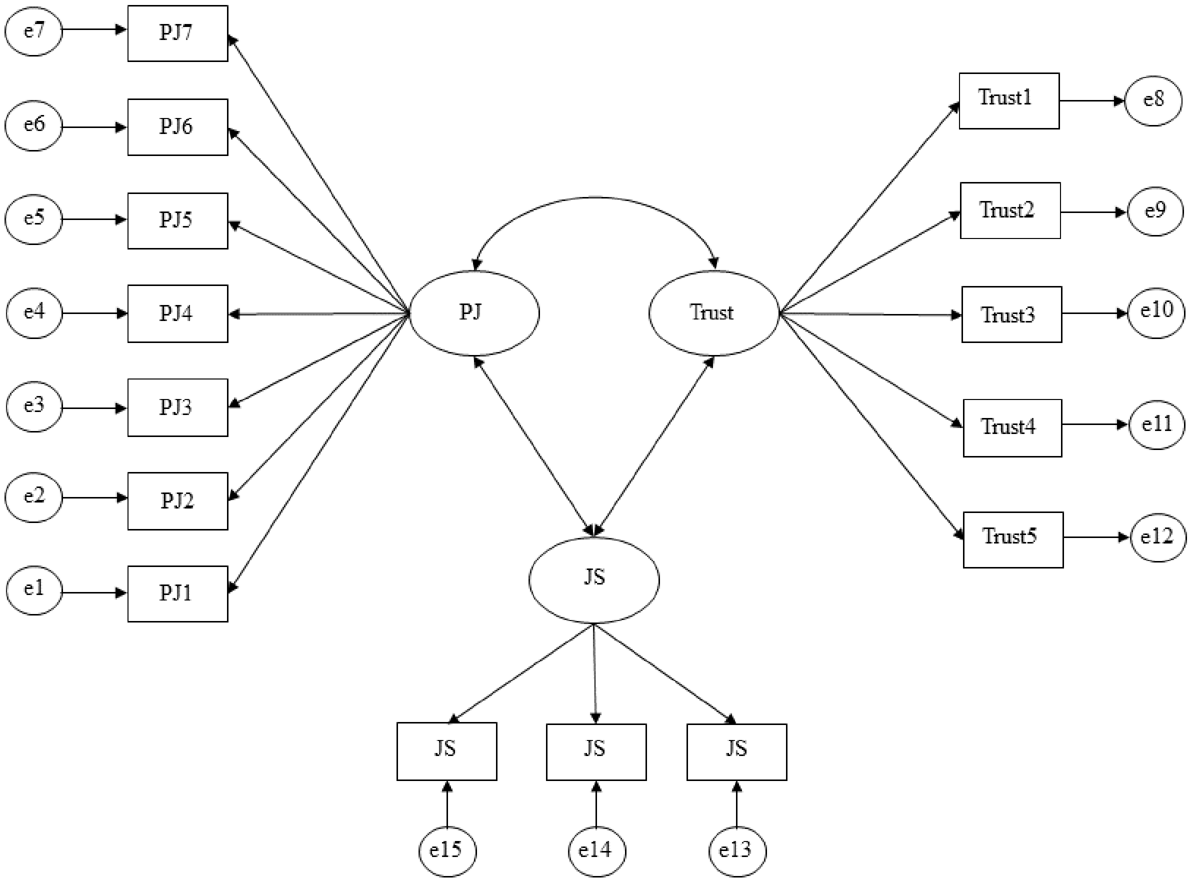

Figure 1: Configural Model

The descriptive statistics, reliabilities, and correlations among the study variables in all conditions are in Table 2. Tables 3-5 contains Fisher z-score comparisons among correlations and the confidence intervals surrounding the correlations to test Hypotheses 1a, 2a and 2c.

Table 2: Descriptive Statistics, Reliabilities, and Zero-Order Correlations among Study Variables

Variable Name	Mean	SD	1	2	3	4	5
1. Procedural Justice	3.84	.71	(.88)				
2. Trust	3.74	.91	.81**	(.93)			
3. ATCB[a]	3.68	.82	.19**	.15**	(.77)		
4. CSE[b]	4.01	.70	.38**	.36**	-	(.80)	
5. Job Satisfaction	3.89	.91	.61**	.62**	.14**	.43**	(.92)
6. PARH	3.01	1.06	.15**	.19**	.11*	.15**	.21**

Note. [a] N = 343 for correlations with this variable. [b] N = 365 in correlations with this variable.
N = 1,069 for all other correlations. Coefficient alpha reliabilities appear in the in the diagonals. *$p < .05$, **$p < .01$.

Hypothesis 1a predicted that correlations among substantive variables would be stronger in the CMV inducing versus the reducing conditions. However, as shown in Table 3, there were only two differences. The Trust-PJ correlation was higher in the connecting marker (CSE) condition when reducing instructions were given, opposite of predicted. Also unpredicted was the higher PJ-Trust correlation in the inducing condition when the disconnecting marker variable (ATCB) was used. Thus, H1a was not supported.

Table 3: Results of Test of Hypothesis 1a using Z-Score Comparison of Correlations

Hypothesis	Correlations	Conditions		Z-score	2-tail *p*
Hypothesis 1a		Inducing (95% CI)	Reducing (95% CI)		
No Marker		N = 210	N=149		
	PJ-Trust	.80** (.75 - .84)	.75** (.67 - .81)	1.16	.25
	PJ-JS	.56** (.46 - .65)	.63** (.52 - .72)	-1.00	.32
	Trust-JS	.55** (.45 - .64)	.53** (.40 - .64)	.26	.40
Connecting Marker		N=210	N=154		
	PJ-Trust	.83** (.78 - .86)	.77** (.70 - .83)	1.57	.12
	PJ-JS	.59** (.49 - .67)	.67** (.57 - .75)	-1.24	.22
	Trust-JS	.60** (.51 - .68)	.77** (.70 - .83)	-3.06**	.00
Disconnecting Marker		N=192	N=148		
	PJ-Trust	.87** (.83 - .90)	.77** (.70 - .83)	2.83**	.00
	PJ-JS	.60** (.50 - .68)	.67** (.57 - .75)	-1.07	.28
	Trust-JS	.60** (.50 - .68)	.70** (.70 - .83)	-1.58	.11
All Marker Conditions		N=402	N=302		
	PJ-Trust	.85** (.82 - .88)	.78** (.73 - .82)	2.76**	.01
	PJ-JS	.59** (.52 - .65)	.64** (.57 - .70)	-1.05	.29
	Trust-JS	.60** (.53 - .66)	.71** (.65 - .76)	-2.54**	.01

Note. *p < .05, **p < .01.

Hypothesis 2a was not supported; only one of the substantive correlations indicated a statistically significant difference in the presence versus absence of a marker, and this was again opposite of predicted. The Trust-JS correlation was stronger when the marker variable was present (see Table 4). While the data do not indicate a reason for this opposite finding, it is possible that a marker could confuse a respondent and cause them to revert to patterned answers based on their own personal response tendencies. Hypothesis 2c compared observed correlations in the presence of a connecting versus disconnecting marker variable, and no statistically significant differences in correlations were present, leading to the rejection of this hypothesis, as shown in Table 5.

Table 4: Results of Test of Hypothesis 2a using Z-Score Comparison of Correlations

Hypothesis	Correlations	Conditions		Z-score	2-tail *p*
Hypothesis 2a		No Marker (95% CI)	Marker (95% CI)		
Inducing Condition		N = 210	N = 402		
	PJ-Trust	.80** (.75 - .84)	.85** (.82 - .88)	-1.84	.07
	PJ-JS	.56** (.46 - .65)	.59** (.52 - .65)	-0.52	.60
	Trust-JS	.55** (.45 - .64)	.60** (.53 - .66)	-0.87	.38
Reducing Condition		N=149	N=302		
	PJ-Trust	.75** (.67 - .81)	.78** (.73 - .82)	-0.72	.47
	PJ-JS	.63** (.52 - .72)	.64** (.57 - .70)	-0.17	.87
	Trust-JS	.53** (.40 - .64)	.71** (.65 - .76)	-2.94**	.00
Ind. and Red. Conditions		N=361	N=708		
	PJ-Trust	.78** (.74 - .82)	.82** (.79 - .84)	-1.72	.09
	PJ-JS	.59** (.52 - .65)	.61** (.56 - .65)	-0.48	.63
	Trust-JS	.55** (.47 - .62)	.65** (.61 - .69)	-2.42*	.02

Note. *p < .05, **p < .01.

Table 5: Results of Test of Hypothesis 2c using Z-Score Comparison of Correlations

Hypothesis	**Correlations**	**Conditions**		**Z-score**	**2-tail *p***
Hypothesis 2c		Connecting Marker	Disconnecting Marker		
Inducing Condition		N=210	N=192		
	PJ-Trust	.83** (.78 - .86)	.87** (.83 - .90)	-1.44	.15
	PJ-JS	.59** (.49 - .67)	.60** (.50 - .68)	-.15	.88
	Trust-JS	.60** (.51 - .68)	.60** (.50 - .68)	0.00	1.00
Reducing Condition		N=149	N=154		
	PJ-Trust	.77** (.70 - .83)	.77** (.70 - .83)	0.00	1.00
	PJ-JS	.67** (.57 - .75)	.67** (.57 - .75)	0.00	1.00
	Trust-JS	.77** (.70 - .83)	.70** (.70 - .83)	1.32	.19
Ind. and Red. Conditions		(N=365)	(N=343)		
	PJ-Trust	.80** (.76 - .83)	.84** (.81 - .87)	-1.62	.11
	PJ-JS	.63** (.56 - .69)	.60** (.53 - .66)	.64	.52
	Trust-JS	.65** (.59 - .71)	.65** (.58 - .71)	0.00	1.00

Note. *p < .05, **p < .01.

Hypotheses 1b, 2b and 2d predicted that the different experimental conditions would not exhibit MI. Each of the experimental conditions (e.g., reducing vs. inducing condition) was tested for MI using AMOS 24. Results from the test of the equality of covariance matrices between experimental conditions appear in Table 6. Model fit was established using several common fit indices (Hair, et al., 2006; Hu and Bentler, 1995). As seen in Table 6 below, the models demonstrated reasonably good fit to the data across each of the experimental conditions which indicates MI. This lack of notable differences across the experimental conditions indicates no support for Hypotheses 1b, 2b, and 2d.

Table 6: Testing for Measurement Invariance across Groups

	X^2	Df	P	CFI	TLI	SRMR	RMSEA
Reducing vs Inducing	672.17	177	.00	0.96	0.95	0.05	0.05
No Marker vs. Marker	681.93	177	.00	0.96	0.95	0.05	0.05
ATCB vs. CSE	543.56	177	.00	0.96	0.94	0.04	0.05

Hypothesis 3a posited that subjects in the CMV inducing condition would report higher levels of awareness of the research hypotheses than subjects in the CMV reducing condition. An independent samples t-test indicated support for this hypothesis, with a mean score on the PARH of 3.29 in the inducing condition and a mean score of 2.34 in the reducing condition (t = -10.59; p < .00). In addition, results indicated a significant change in the relationship between PJ and Trust, which were the first items responded to after the instructions. However, there was no statistically significant difference in mean PARH between the ATCB (m = 2.92) and CSE (m = 3.00) marker conditions (t = -.96, p = .34). Hypothesis 3b was rejected, but this does indicate that the selection of a marker variable does not matter, only that a disconnecting marker does not act as a procedural remedy for CMV.

In a post hoc analysis, possible differences in substantive correlations between the two most extreme conditions—*CMV Inducing* with no marker variable vs. *CMV Reducing* with ATCB—were examined. The former should produce higher correlations than the latter, but z-scores indicated only one statistically significant difference in the three substantive correlations: Trust-JS was lower in the *CMV Inducing*/no marker condition than in the *CMV Reducing*/ATCB condition (r = .55 vs. r = .70, z = -2.30, p = .02). This finding was in the opposite direction of expectations, and this could be due to unknown effects of the marker variable on response tendencies.

5. Discussion

This study examined experimental manipulations of CMV through instructions and the presence or absence of marker variables as a means to better perceive the threat to same source data that CMV may pose. While statistically meaningful differences in correlations in experimental conditions were anticipated, and MI was not expected, the hypotheses were not supported by the data. Specifically, there were few differences in correlations (some of which were opposite of predicted) and MI was found between experimental conditions.

Hypothesis 1 focused on the examination of the efficacy of the experimental manipulations to elicit different responses from the groups; however, the hypothesis was not supported, as there were not significant difference among responses based on CMV inducing versus reducing conditions and measurement invariance was found. Hypothesis 2 focused on the use of marker variables to elicit different responses from the groups; however, none of the four hypotheses were supported, indicating that the neither the presence nor the type of marker variables utilized created a significant difference in the responses. Hypothesis 3 examined the differences between perceived awareness of the research hypothesis among the experimental groups and found support for increased awareness in the CMV inducing experimental group (3a), but not for the connecting/disconnecting marker variable (3b).

There could be varying reasons for this lack of support for most of the hypotheses. The experimental manipulations may have been weak, possibly resulting in respondent insufficient effort/careless responding in which items are answered without regard to instructions (Huang, Liu, and Bowling, 2015). However, the manipulation checks did not allow participants to continue the survey after failing, so remaining participants appeared to follow the manipulation instructions. Further, support for hypothesis 3a, in which participants in the inducing condition reported higher levels of PARH indicates that this manipulation was successful. As anticipated (Oppenheimer et al., 2009), this study had a high level of attrition (30%), yet this may be beneficial, as it increases the likelihood of surveying only those participants who accurately perceived the manipulation. If the majority of the respondents correctly answer the FMC, then null results are less likely related to the theory and are more likely related to the treatment being relatively imperceptible. Conversely, if more respondents answer the FMC correctly and no significant treatment is found, then results may be attributed to a fault in the theory or manipulation (Kane and Barabas, 2019). Here, however, the researchers believe the fault lies in the lack of impact of CMV, not with our manipulation—increasing evidence indicates that CMV is neither as pervasive nor as biasing as once believed (Fuller, et al., 2016; Lance, et al., 2010).

To seek meaning from answers to the qualitative item (Campbell, 2020), exploratory text-analysis was conducted using RapidMiner software, which identifies the most important terms used in the responses. Table 7 shows differences in experimental conditions. In the CMV *Inducing* conditions, “relationship” was the most important word, with “relationship with a supervisor” the second-most important term in two conditions. Conversely, in two of the three CMV *Reducing* conditions, “relationship” was either much lower on the list or absent from the top ten most important terms (yet, surprisingly, appearing as the top response when CSE was used as a marker). Finally, “color” was the fourth most frequent response in one of the ATCB conditions, indicating it was memorable and/or distinctive to respondents. These results provide additional evidence to support the effectiveness of manipulations and again points to the low influence of CMV.

Table 7: Top Ten Most Important Terms by Condition from Text Mining of Open-Ended Item Responses[a]

Condition	No Marker	ATCB as Marker	CSE as Marker
CMV Reducing Conditions	job peopl feel employe work satisfact workplac attitud relationship_supervisor view_supervisor	work peopl feel color feel_supervisor studi think attitud survei research	relationship feel work feel_supervisor relationship_supervisor job attitud i_idea research studi
CMV Inducing Conditions	relationship relationship_supervisor work workplac feel job research behavior studi employe	relationship relationship_supervisor studi work research workplac think see job i_think	relationship work workplac job feel studi think i_think employe satisfact

Note. [a] The top 10 words (or stems) are listed in order of importance. Results that appear to be incomplete words are representative of a variety of words that might begin with a stem (e.g., “peopl” may represent “people,” “people’s”).

Previous research supports the finding that CMV is not pervasive and must be present at extreme levels to impact outcomes. Lance et al. (2010) found that imperfect scale reliabilities (like those in Table 2) can offset inflation in correlations due to CMV, and Fuller et al. (2016) showed that only very high CMV (i.e., 70%) biased correlations. The correlations (collapsed across conditions) among the current study variables are high (PJ-Trust = .81, PJ-JS = .61, Trust-JS = .62) compared to Yang et al.'s (2009) correlations (PJ-Trust = .71, PJ-JS = .25, and Trust-JS = .22). Simmering et al. (2015) reported stronger correlations than did Yang et al. (2009), but lower than correlations in this study (PJ-Trust = .74, PJ-JS = .51, and Trust-JS = .47). The current study manipulations likely impacted subjects' responses, but not in a way that differed among conditions. Thus, it is not known whether this data contains CMV, only that CMV does not differ between experimental conditions.

There were a number of limitations in the current study, each of which suggests future research directions. First, despite using manipulation checks, it may be too challenging for most respondents to answer in a CMV reducing manner, as doing so would require them to individually consider each item without making any judgments regarding surrounding items. Thus, researchers should continue to investigate different inducing and reducing CMV manipulations. Second, the different markers did not create a difference in correlations among substantive variables, which may indicate that markers may not influence responses. Yet, responses to the open-ended item indicates this doesn't negate their effectiveness—the presence of marker variables created variation, perhaps by creating "cognitive speedbumps," but not to the extent of changing correlations or constructs. Third, respondents who failed the FMC regarding the study purpose were not allowed to continue. It could be fruitful to repeat the study and allow those who missed the manipulation to continue and compare responses. Finally, although this study indicates null findings, these were not predicted. The sample sizes of conditions provided appropriate statistical power for the stated hypotheses; however, future research positing null findings should be designed following best practices (e.g., Cashen and Geiger, 2004) to further explore potential null relationships.

6. Conclusions

The findings of this experiment are meaningful for researchers and reviewers as they provide more evidence to address the current debate regarding the nature and likelihood of CMV. In this study, procedural remedies were used that were previously purported to help control for CMV (Podsakoff, et al., 2012), but correlations among study variables did not differ significantly between experimental conditions.

Recent research (i.e., Spector, et al., 2019) has encouraged a more sophisticated understanding of method variance beyond the assumption that it is necessarily present and biasing. The current study provides more evidence of the elusive nature of CMV. The lack of significant findings in this study could indicate that either (a) the corrective measures do not actually correct for CMV or (b) CMV does not exist to biasing levels in survey methodology and does not need to be ameliorated. Further, while respondents noticed the marker variables, this did not create a meaningful impact on results. While more research is needed, these findings support the argument that procedural remedies to minimize CMV may be unnecessary or ineffective.

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