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Response-Order Effects in Survey Methods: A Randomized Controlled Crossover Study in the Context of Sport Injury Prevention

Full citation: Chan, D. K. C., Ivarsson, A., Stenling, A., Yang, X. S., Chatzisarantis, N. L. D., & Hagger, M. S. (2015). Response-order effects in survey methods: A randomized controlled crossover study in the context of sport injury prevention. *Journal of Sport and Exercise Psychology, 37*, 666-673. doi: 10.1123/jsep.2015-0045

Abstract

Consistency tendency is characterized by the propensity for participants responding to subsequent items in a survey consistent with their responses to previous items. This method effect might contaminate the results of sport psychology surveys using cross-sectional design. We present a randomized controlled crossover study examining the effect of consistency tendency on the motivational pathway (i.e., autonomy support → autonomous motivation → intention) of self-determination theory in the context of sport injury prevention. Athletes from Sweden (N = 341) responded to the survey printed in either low inter-item distance (IID; consistency tendency likely) or high IID (consistency tendency suppressed) on two separate occasions, with a one-week interim period. Participants were randomly allocated into two groups, and they received the survey of different IID at each occasion. Bayesian structural equation modeling showed that low IID condition had stronger parameter estimates than high IID condition, but the differences were not statistically significant.

Keywords: Consistency motif; proximity effect; Socratic effect; common method variance; response bias; general response tendency.

Response-Order Effects in Survey Methods: A Randomized Controlled Crossover Study in the Context of Sport Injury Prevention

Sport and exercise psychology research often uses self-reported survey methods with cross-sectional designs and correlational analyses leading to the possibility that results could be confounded by a method effect known as consistency tendency. Consistency tendency characterizes the propensity where respondents provide consistent answers to consecutive items in a survey, thus inducing artificial covariance between predictor and criterion variable (Salancik, 1984; Salancik & Pfeffer, 1977). It is regarded as one of the main causes of common method bias, producing a systematic measurement error that may lead to an inflation or a deflation of the relationship between study variables (Doty & Glick, 1998; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The most effective means to allay common method variance is to separate measures of different constructs by intentionally placing a time-lag or physical gap between the measurements of different variables (Podsakoff et al., 2003; Podsakoff, MacKenzie, & Podsakoff, 2012). The proposed effects of consistency tendency and item separation led us to speculate that the inter-item distance (IID; i.e., average distance between the items of distinct constructs) might have an effect on factor correlations in a sport psychology survey. Therefore, this study used a randomized controlled crossover design in the context sport injury prevention to examine the effects of response order on the relationships between conceptually-related constructs (i.e., perceived autonomy support, autonomous motivation, intention) from self-determination theory (Deci & Ryan, 1985).

In this study, we aimed to experimentally examine if the factor structure and factor relationships in a cross-sectional survey would be influenced by inter-item distance. The survey used items that measured theoretically-related constructs from the self-determination theory (SDT; Deci & Ryan, 1985; Deci & Ryan, 2000). The theory proposed that perceived autonomy support (i.e., the provision of choice, option, care, and respect) would positively

predicted autonomous motivation (i.e., engaging in a behavior for reasons of interest, personal values, and life goals or aspirations that are perceived to be important and meaningful), which in turn associated with intention or adherence of a target behavior. Relations in the sequence were proposed to be statistically significant and positive according to previous research in the context of sport injury prevention or rehabilitation (Chan & Hagger, 2012a, 2012b, 2012c).

Based on previous literature on consistency tendency and inter-item separation (Podsakoff et al., 2003; Podsakoff et al., 2012), we hypothesized that the proposed relations among the SDT variables and the hypothesized motivational sequence (perceived autonomy support from coaches→ autonomous motivation → intention) would be stronger when inter-item distance between factors was reduced (consistency tendency facilitated).

Method

After we obtained ethical approval from the Research Ethic Committee of University [name masked for blind review], athletes (N = 341, 46.92% male; mean age = 19.84, SD = 3.30) were recruited to participate in the study from sport science educations (university level) and local sports clubs in Sweden (response rate = 90.2%). They engaged in a variety of sports, such as football, floorball, golf, and handball for an average of 9.23 (SD = 4.75) years.

Following a randomized controlled crossover design, participants were randomly assigned to one of two groups. Each group was required to complete two separate questionnaires, one per week over two consecutive weeks (see Appendix A) with only the format of the questionnaire differing between the groups. Participants assigned to Group 1 (n = 140) were asked to complete the study questionnaire with low IID in Week 1 and complete the same questionnaire but with high IID in Week 2 (n = 65; 53.57% of dropout). Conversely, Group 2 (n = 201) completed the two formats of the questionnaire in the opposite order (n = 133; 33.83% of dropout in Week 2). The one week gap between the two measurement points followed the methodological recommendations of previous survey-based studies that

attempted to reduce the common method variance of measuring motivational constructs in sport and exercise psychology (e.g., Chan & Hagger, 2012c; Chan, Hagger, & Spray, 2011).

The questionnaire comprised standard measures of the study variables, including perceived autonomy support from coaches (Health Care Climate Questionnaire; Williams, Grow, Freedman, Ryan, & Deci, 1996), autonomous motivation (Treatment Self-Regulation Questionnaire for Sport Injury Prevention; Chan & Hagger, 2012c), and intention (i.e., items developed by Chan and Hagger (2012a) of sport injury preventive behavior. These scales were originally English, so we either adopted the Swedish version of the scale (for perceived autonomy support) in a previous study (Stenling, Lindwall, & Hassmén, 2015) or translated the items (for autonomous motivation and intention) into Swedish using the standard translate-back-translate procedures (Hambleton, 2005). The descriptive statistics, correlation matrix, and internal consistency of the study variables are displayed in Appendix B.

The manipulation of IID in the questionnaire was achieved by inter-mixing the items (Podsakoff et al., 2003). For low IID condition, the items were in the sequence of an alternate item order where one item of autonomy support was followed by one item of autonomous motivation, and then one item of intention, and this rotation continued until all items of were presented in the questionnaire. For high IID condition, the items were in the sequence of ensemble item order where all the items of autonomy support were presented first, that of autonomous motivation second, and that of intention last. The average IID of the questionnaire with low IID (i.e., 5.22 item-units, SD = 5.60) was significantly lower than that with high IID (i.e., 11.25 item-units, SD = 6.09; $t(143) = 4.56$, $p < .01$, Cohen's $d = .76$).

We ran single-group Bayesian structural equation models (BSEM; Muthén & Asparouhov, 2012) to examine model fit for four datasets (i.e., Group 1 Time 1 – low IID, Group 2 Time 1 – high IID, Group 1 Time 2 – high IID, and Group 2 Time 2 – low IID), each representing the data of one group at each time point. Weakly informative priors (zero mean,

small-variance priors = .01) for cross-loadings and correlated residuals were used in the measurement part of the models. Model fit was assessed with the posterior predictive *p* value (PP*p*) and its corresponding 95% credibility interval (CI). A PP*p* larger than .05 with a 95% CI containing zero indicates that the model fits the data (Muthén & Asparouhov, 2012). Convergence was assessed with the potential scale reduction factor (PSRF) and a PSRF < 1.1 was considered as evidence of convergence (Gelman et al., 2014). All models were first run with a convergence criteria of .01 and then replicated with 100000 iterations. The first half of the iterations was used as burn-in phase. Multi-group BSEM then examined approximate invariance of the measurement model between two pairs of datasets (Muthén & Asparouhov, 2013; Van De Schoot et al., 2013). A zero mean, small-variance prior (.01) was used on estimating the difference in factor loadings and intercepts between the groups. In the first step, approximate measurement invariance was estimated for all factor loadings and intercepts; in the second step, the noninvariant parameters were freely estimated and invariant parameters were constrained to exact equality (Muthén & Asparouhov, 2013). Between- and within-group differences in the structural parameters were statistically significant when the range of 95% CI did not contain zero. Missing values (< 7.90%) were treated as random and all available information were included in the analyses (Muthén & Asparouhov, 2010).

Result

Single-group BSEM showed that the proposed model yielded acceptable fit with the four datasets (see Table 1). All the structural parameters were positive and statistically significant (credibility interval did not include zero). Multi-group BSEM for each pair of datasets showed approximate invariance only for the factor loadings but not for the intercepts. Noninvariant intercepts were released and freely estimated in the second step of the invariance test of the measurement model. Full details of the approximate invariance tests of the measurement models can be obtained from the first author. The structural parameters of

low IID datasets were generally higher than that of high IID datasets (Table 2), but the CI for the difference between parameters all included zero. Hence, the results provide little evidence for a statistical between- or within-group difference in the structural parameters.

Discussion

This study is the first investigation examining the effects of inter-item distance (IID) on the factor structure and relationships among constructs in a well-evidenced motivational sequence, derived from self-determination theory (Deci & Ryan, 1985, 2000), within a cross-sectional survey in the context of sport injury prevention. Our findings provided little supports to our propositions derived from consistency tendency (Salancik, 1984; Salancik & Pfeffer, 1977), and temporal or proximal separation (Doty & Glick, 1998; Podsakoff et al., 2003; Podsakoff et al., 2012; Weijters, Geuens, & Schillewaert, 2009).

In agreement of tenets of self-determination theory (Deci & Ryan, 1985, 2000), the pathways of perceived autonomy support from coaches→autonomous motivation→intention were positive, and the magnitudes of the parameter estimates in alternate order appeared to be stronger than those in the ensemble order. This pattern of effects seemed to be in favor of our speculation that consistency tendency could lead to an inflation of the relationships between factors to some extent, and method variance associated with consistency tendency could plausibly be manipulated by changing the IID. Nevertheless, non-significant within-group and between-group differences suggested that the effects of IID on parameter estimates were small and that a larger sample size may be required to detect the statistically significant differences.

We hope that the findings of the present study will raise researchers' awareness of the potential confounding effects of consistency tendency in survey-based research. Researchers should consider randomizing and maximizing the temporal or physical (and maybe psychological) separation between the measurements of different factors in order to reduce

the effects of consistency tendency. This is especially true for cross-sectional survey-based studies that simultaneously assess multiple constructs using a highly consistent or homogeneous response format (e.g., Likert-scale). A time gap, a short break, or a section break between the measures of criterion variables and outcome variables should preferably be offered in a survey in order to minimize the possibility that consistency tendency induces artificial covariance in the hypothesized directions (Doty & Glick, 1998; Podsakoff et al., 2003; Podsakoff et al., 2012; Weijters et al., 2009). Also, it is important that researchers should report the way in which the items are arranged in the questionnaire, and discuss if consistency tendency could interfere study findings and how future studies could account for this confounding factor. It is as important as the information such as example items, scale anchors, factorial validity, and prior use of the scale because item order is not only shown to be influential to the factor scoring (Duan, Alegria, Canino, McGuire, & Takeuchi, 2007; McClendon, 1991), but it could also contribute to the extent to which method effects moderate the relationships between factors. This reporting practice is recommended not only for sport and exercise psychology research, but for all studies that include measurements of multiple constructs in a survey or similar forms of assessment.

While the current study has numerous strengths in terms of research design and analytic approach, we should note a number of limitations that may stimulate future research in this field. First, the present study mainly looked at the effects of consistency tendency on the concurrent for theoretically positively related psychological constructs measured by positively worded items, but its impacts on convergent validity, predictive validity and test-retest reliability among theoretically negatively related factors measured by negatively worded items still remain under-researched. Second, previous research has identified a number of method effects could potentially influence factor correlations. For example, acquiescence (yes-saying effects) and naysaying effects, primacy and recency effects, and

social desirability effects (Kline, Sulsky, & Rever-Moriyama, 2000; McClendon, 1991; Podsakoff et al., 2003; Podsakoff et al., 2012) could affect patterns of responses to survey items and confound results. Also, it has been proposed that method effects could be more substantial in certain cases, such as similarity in the format of responses (e.g., Likert-scale), ambiguous items, exhaustion over lengthy questionnaires, and respondents with low education level (Cronbach, 1946, 1950; Krosnick, 1991; Krosnick & Schuman, 1988; McClendon, 1991; Podsakoff et al., 2003). Although our randomized controlled crossover design may somewhat counter-balance the confounding effects, they are difficult to completely resolve unless further research incorporates these factors by using cluster randomized controlled designs. Third, the present investigation is correlational in design and investigated self-reported psychological variables in the context of sport injury prevention. Although this methodological approach is common in sport and exercise psychology research (Andersen, McCullagh, & Wilson, 2007; Biddle, Markland, Gilbourne, Chatzisarantis, & Sparkes, 2001; Hagger & Chatzisarantis, 2009), future research should include more objective assessments (e.g., other-reported measures, implicit association test), and behavioral or clinical outcomes (e.g., sport injury). Finally, culture and background of participants and behavioral contexts being investigated might have impacted on the extent of method effects in survey (Chan, Zhang, Fung, & Hagger, 2014; Hagger et al., 2007; Hui & Triandis, 1989). It is, therefore, important to replicate our study in a variety of sport or health contexts, with preferably larger sampling population for more robust tests of the generalizability of the present findings.

Conclusion

This study is the first investigation on the effects of consistency tendency, as one of the major sources of common method bias, on the relationships between autonomy support, autonomous motivation, and intention in the context of sport injury prevention. Results

provide some evidence that consistency tendency could be manipulated by modifying the temporal or proximal separation between the items, but its effects on factor correlation were small. Researchers in sport and exercise psychology should be aware of the potential method effects of consistency tendency when designing and reporting research methods, particularly when cross-sectional survey designs with correlational analysis are adopted.

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Table 1

Model fit of the Single- and Multi-Group BSEM Models

Dataset(s)	PP*p*	2.5% PP limit	97.5 % PP limit
Single-Group Analyses			
Group 1 Time 1	.61	-52.76	38.58
Group 2 Time 1	.58	-51.08	41.38
Group 1 Time 2	.74	-63.20	31.54
Group 2 Time 2	.62	-53.01	39.29
Full Low IID	.56	-49.28	41.99
Full High IID	.57	-49.79	41.95
Multi-Group Analyses (Between-Group)			
Group 1 Time 1 vs Group 2 Time 1			
Approximate invariance step 1[a]	.18	-36.08	98.44
Approximate invariance step 2	.39	-55.99	72.30
Structural model	.33	-49.50	79.32
Group 1 Time 2 vs Group 2 Time 2			
Approximate invariance step 1[b]	.61	-75.68	57.60
Approximate invariance step 2	.41	-58.87	73.54
Structural model	.36	-54.70	76.45
Full Low IID vs Full High IID			
Approximate invariance step 1[c]	.20	-39.01	94.62
Approximate invariance step 2	.46	-61.23	68.01
Structural model	.39	-56.67	72.72
Multi-Group Analyses (Within-Group)			
Group 1 Time 1 vs Group 1 Time 2			
Approximate invariance step 1[d]	.77	-91.08	41.37
Approximate invariance step 2	.62	-76.99	53.72
Structural model	.55	-71.97	60.57
Group 2 Time 1 vs Group 2 Time 2			
Approximate invariance step 1[e]	.17	-33.86	99.73
Approximate invariance step 2	.13	-28.64	102.95
Structural model	.13	-28.48	102.58

Note. PP*p* = posterior predictive *p* value.

[a]Non-invariant intercepts: autonomous motivation items 3, 4, 5, and 6, and intention items 1 and 3.

[b]Non-invariant intercepts: autonomy support item 3.

[c]Non-invariant intercepts: autonomous motivation items 3, 4, 5, and 6, and intention items 1, 2, and 3.

[d]Full approximate invariance.

[e]Non-invariant intercepts: autonomous motivation items 3, 4, and 6, and intention item 1.

Table 2

Parameter Estimates and Credibility Intervals in the Structural Models

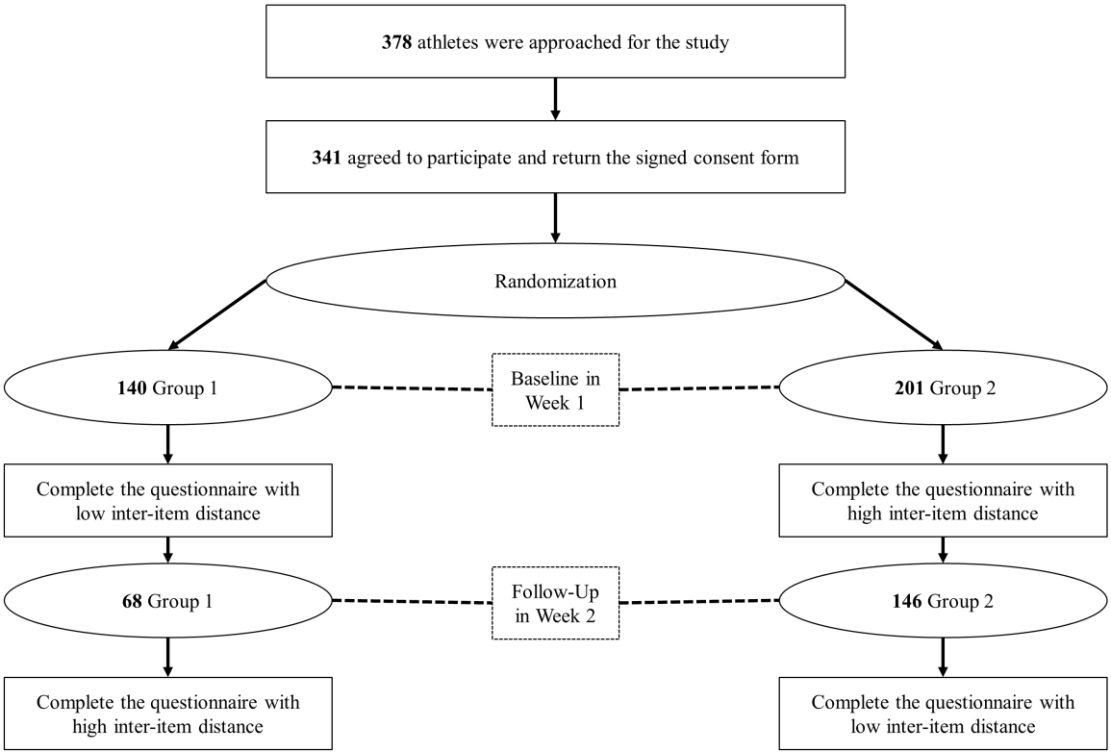
Dataset(s)	Autonomy Support → Autonomous Motivation	Autonomous Motivation → Intention
	Standardized Beta [Credibility Interval]	
1. Group 1 Time 1 (Low IID)	.39 [.17, .56]	.57 [.38, .71]
2. Group 2 Time 1 (High IID)	.26 [.05, .45]	.43 [.18, .63]
3. Group 2 Time 1 (High IID)	.23 [.01, .42]	.45 [.17, .65]
4. Group 2 Time 2 (Low IID)	.46 [.22, .63]	.48 [.26, .64]
5. Full Low IID	.40 [.21, .55]	.57 [.40, 70]
6. Full High IID	.24 [.06, .41]	.45 [.22, .62]
	Difference of Parameter Estimates [Credibility Interval]	
Between-Group Time 1 (Dataset 1 vs Dataset 2)	-.15 [-.47, .18]	-.18 [-.53, .18]
Between-Group Time 2 (Dataset 3 vs Dataset 4)	.09 [-.28, .46]	.17 [-.23, .57]
Within-Group Group 1 (Dataset 1 vs Dataset 3)	-.10 [-.54, .33]	.27 [-.21, .75]
Within-Group Group 2 (Dataset 2 vs Dataset 4)	-.27 [-.64, .08]	.01 [-.38, .40]
Between-Condition (Dataset 5 vs Dataset 6)	-.18 [-.47, .10]	-.14 [-.48, .18]

Note. IID = inter-item distance. All the parameter estimates had non-zero credibility intervals, thus were positive and statistically significant.

Appendix A

(Supplementary online material)

Experimental Procedures



Appendix B

(Supplementary online material)

Descriptive Statistics and Correlations Between Latent Factors

Correlations			1	2	3	4	5	6
					Group 1			
Time 1	1. Autonomy Support		1	.39*	.43*	.90*	.36*	.60*
	2. Autonomous Motivation		.26*	1	.67*	.09	.77*	.49*
	3. Intention	Group 2	.10	.33*	1	.36*	.49*	.83*
Time 2	4. Autonomy Support		.77*	.34*	.16	1	.28	.47*
	5. Autonomous Motivation		.13	.69*	.48*	.35*	1	.44*
	6. Intention		.14	.47*	.66*	.34*	.62*	1
Group 1	Mean		4.97	5.49	4.79	5.19	5.59	4.06
	SD		1.34	1.01	1.45	1.40	1.15	1.59
	Cronbach's Alpha		.91	.79	.87	.95	.91	.96
	Mean Factor Loading		.83	.68	.85	.90	.84	.93
	Mean Standard Error		.06	.13	.09	.05	.07	.05
Group 2	Mean		4.98	6.03	4.02	4.73	5.21	4.55
	SD		1.30	0.88	1.55	1.15	1.11	1.36
	Cronbach's Alpha		.92	.85	.96	.90	.87	.86
	Mean Factor Loading		.83	.75	.92	.80	.77	.85
	Mean Standard Error		.05	.08	.04	.07	.10	.07

Note. The correlation matrix of Group 1 is presented at the upper diagonal, and that of Group 2 is displayed at the lower diagonal. *Credibility interval did not include zero.