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Are Behavioral Measures of Self-Control and the Grasmick Self-Control Scale Measuring the Same Construct? A Meta-Analysis

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Abstract The Grasmick attitudinal scale of self-control (Grasmick, Tittle, Bursik, & Arneklev, *Journal of Research in Crime and Delinquency, 30,* 5–29, 1993) is one of the more commonly used measures in research on Gottfredson and Hirschi's (1990) self-control concept. What has yet to be determined is whether the Grasmick scale correlates as well with crime and delinquency as behavioral measures of self-control and whether the Grasmick scale correlates better with these behavioral measures than it does with crime and delinquency. A meta-analysis was performed on 13 samples obtained from published research where the Grasmick scale, a behavioral or consequences measure of self-control, and an estimate of crime or delinquency were all administered to participants. All analyses were computed with Comprehensive Meta-Analysis, Version 2 (Borenstein, Hedges, Higgins, & Rothstein, 2005) software. The results of the meta-analysis revealed that the Grasmick scale and behavioral/consequences measures of self-control achieved comparable correlations with concurrent measures of crime and delinquency but correlated no higher with each other than they did with crime and delinquency. Four possible interpretations of these results are considered: (1) the self-control concept advanced by Gottfredson and Hirschi is a tautology; (2) the attitudinal and behavioral/consequences measures of self-control are measuring different constructs; (3) self-control is a multidimensional construct; (4) self-report measures of behavioral self-control are inadequate for assessing low self-control.

Keywords Low self-control · Grasmick scale · Construct validity · Meta-analysis

Gottfredson and Hirschi's (1990) general theory of crime has become one of the more popular explanations for criminal behavior in the fields of criminology and criminal justice. A principal reason for its popularity is that its central concept, low self-control,

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correlates well (0.26–0.28) with crime and delinquency (Pratt & Cullen, 2000). Success, however, opens a theory up to increased scrutiny and skepticism, particularly when its authors assert that they have constructed a theory that explains all crime. Gottfredson and Hirschi's (1990) low self-control theory of crime rests on five core postulates (versatility, stability, universality, resiliency, and exclusivity), each of which has attracted attention as well as criticism. The versatility postulate, which holds that offenders rarely specialize in any one type of crime, has received the most consistent support (Chapple & Hope, 2003). There has also been a fair amount of support for the stability postulate, which states that low self-control is stable, at least in a relative sense, once an individual reaches the age of 8 to 10 years (Hay & Forrest, 2006; Turner & Piquero, 2002). There is, however, less support for and greater controversy surrounding the universality (low self-control is the cause of all crime: Benson & Moore, 1992), resiliency (low self-control is impervious to intervention after age 8–10 years: Piquero, Jennings, & Farrington, 2010), and exclusivity (weak parental supervision and control is the sole cause of low self-control: Pratt, Turner, & Piquero, 2004) postulates.

Of even greater concern than the limitations of the universality, resiliency, and exclusivity postulates is how self-control has been operationalized in studies investigating the general theory of crime. Gottfredson and Hirschi (1990) originally proposed that noncriminal behavioral manifestations of low self-control, such as smoking, drinking, reckless driving, and skipping work, be used to measure low self-control. More recently, Hirschi (2004) suggested that a social attachment component be added to the social control construct. He also argued that an effective measure of self-control should include a person's ability to consider the full range of possible consequences for his or her actions. The most popular operationalization of Gottfredson and Hirschi's (1990) low self-control construct, however, has been a 24-item attitudinal measure of low self-control developed by Grasmick, Tittle, Bursik, and Arneklev (1993). In the previously mentioned Pratt and Cullen (2000) meta-analysis, Grasmick et al.'s (1993) scale (hereby referred to as the Grasmick scale) correlated with and predicted criminal behavior at a level commensurate with behavioral measures of low self-control. Even so, there was only one study (Evans, Cullen, Burton, Dunaway, & Benson, 1997) that investigated attitudinal and behavioral measures of self-control in the same sample of participants and the attitudinal measure was not the Grasmick scale.

Although the Grasmick scale may correlate with crime on par with behavioral measures of self-control, there have been several criticisms leveled against attitudinal measures of low self-control, in general, and against the Grasmick scale, in particular. Hirschi and Gottfredson (1993) contend that low self-control, by virtue of its ability to influence responses on an attitudinal measure, will distort responses on a procedure like the Grasmick scale to a much greater extent than it will distort responses on a direct behavioral measure. Hence, the relationship between an attitudinal measure and crime may be weaker than the relationship between a behavioral measure and crime, thereby leading researchers to underestimate the effect of low self-control on criminal behavior. The Grasmick scale has been criticized specifically for poor construct validity in studies that have examined the factor structure and pattern of convergent and discriminant correlations achieved by the scale (Higgins, 2007; Marcus, 2003). Finally, Akers (1991) has characterized the self-control construct, whether measured with an attitudinal or behavioral scale, as tautological in the sense that self-control and crime are one in the same thing.

The purpose of this meta-analysis was two-fold. First, studies in which the Grasmick scale and a behavioral (Gottfredson & Hirschi, 1990) or consequences (Hirschi, 2004) measure were administered to the same group of individuals and correlated with a criminal outcome measure were scrutinized. There were no direct comparisons between the Grasmick scale and behavioral self-control measures in the earlier Pratt and Cullen (2000) meta-analysis because no such studies existed at the time. In the fifteen years since the Pratt and Cullen (2000) meta-analysis, several studies were published in which the Grasmick scale was directly compared to either a behavioral or consequences measure of self-control. Second, the correlation between the Grasmick scale and behavioral/consequences measures was compared to correlations between the Grasmick scale and criminal/delinquent outcomes and behavioral/consequences measures and criminal/delinquent outcomes. Before the Grasmick scale and behavioral/consequences measures can be considered construct valid measures of low self-control it must be demonstrated that they correlate significantly better with each other than they do with a measure of a related but separate construct (crime). Otherwise, the Grasmick scale and behavioral/consequences measures are assessing different constructs or low self-control and crime are one in the same construct.

Method

Studies

Thirteen published studies that directly compared the Grasmick scale to a behavioral/consequences measure were identified by entering the term "Grasmick" as a general search term in Criminal Justice Abstracts and PsycInfo search engines. Data required to construct the effect sizes for this meta-analysis were available for six of the 13 studies. Authors of the other seven studies were contacted for additional information and four provided the necessary correlations or data. The other three studies lacked the necessary data to be included in this meta-analysis (Benda, 2005; Cretacci, Rivera, & Ding, 2009; Tittle, Ward, & Grasmick, 2003). Three of the available studies included two independent samples. Hence, the current meta-analysis encompassed ten studies and 13 separate samples.

Measures

The Gramick scale (Grasmick et al., 1993) is a 24-item attitudinal measure of self-control. These 24 items are organized into six subscales (impulsivity, simple tasks, risk seeking, physical activities, self-centered orientation, and volatile temper). Each subscale is composed of four items. Because Gottfredson and Hirschi (1990) originally conceptualized self-control as a unidimensional construct, Grasmick et al. (1993) attempted to construct a unidimensional scale, despite the six subscales. The factor loadings for the individual items in the original Grasmick et al. (1993) study ranged from 0.288 to 0.616, with a median value of 0.419. The scale's internal consistency was also found to be good (Cronbach alpha=0.80) and the eigenvalue of the first factor of a principal components analysis was almost twice that of eigenvalue of the second factor (4.66 vs. 2.34). Scores on this scale have been found to correlate significantly with crimes of fraud and force (Grasmick et al., 1993; Tittle et al., 2003).

The studies included in this meta-analysis used either a behavioral self-control measure based on the original Gottfredson and Hirschi (1990) definition of self-control or a measure of self-control based on the later Hirschi (2004) reformulation. Noncriminal forms of low behavioral self-control found in studies covered by this meta-analysis included frequency of drinking, cigarette smoking, debt, and what has collectively been called imprudent behavior. A modified version of the Retrospective Behavioral Self-Control scale (RBS: Marcus, 2003), sanitized of all crime items, was administered as the behavioral self-control measure in two studies (Boman & Gibson, 2011; Ward, Gibson, Bowman, & Leite, 2010). Four studies included in this meta-analysis (Gunter & Bakken, 2012; Morris, Gerber, & Menard, 2011; Piquero & Bouffard, 2007: Rocque, Posick, & Zimmerman, 2013) adopted Hirschi's (2004) revised definition of self-control as the behavioral alternative to the Grasmick scale. In all four studies, self-control was measured by the prevalence and salience of the actor's consideration of the short- and long-term consequences of imprudent behavior.

The dependent or outcome variable in this study consisted of a measure of crime or delinquency. Gottfredson and Hirschi's (1990) definition of crime/delinquency as an act of force or fraud committed by an individual for personal gain was adopted in many of the studies included in this meta-analysis. Somewhat different definitions, however, were employed in four of the samples. In three samples criminal intentions (Piquero & Bouffard, 2007; Piquero, Schoepfer, & Langton, 2010) served as the outcome measure and in one sample (Gunter & Bakken, 2012) cheating on an exam served as one of the outcome measures. The nine remaining samples used self-reported participation in crime or delinquency in line with Gottfredson and Hirschi's (1990) definition of crime/delinquency as force or fraud performed for personal gain.

Procedure

A meta-analysis is a quantitative statistical analysis performed on studies addressing a single topic, the first step of which is to determine the effect size measure to be used in the analysis. The three most commonly employed effect size measures are the Pearson Product Moment Correlation Coefficient, Cohen's d, and the odds ratio. The next step is to pool the individual effect sizes using either a fixed effect model or random effects model. Whereas the fixed effect model assumes the existence of a single true effect size and bases sampling error on sample size, the random effects model acknowledges that the true effect size may vary across studies and calculates sampling error using both sample size and distance between effect sizes. The third step of a meta-analysis is to conduct a supplemental analysis in which heterogeneity (degree of scatter in the results), publication bias (effect of unpublished studies on the results), sensitivity (consistency of results), and moderator effects (extent to which external variables alter the results) are assessed.

Pearson Product Moment Coefficients served as the effect size measure in this meta-analysis. All correlations were based on cross-sectional analysis of self-report data. Because the effect sizes in this meta-analysis could have varied as a consequence of certain features of the sample or outcome, it was calculated using the random effects model. Moderator variables considered as part of this meta-analysis included location (US, non-US), sex (male, female), and the nature of the behavioral measure (traditional behavioral, Hirschi revised). Heterogeneity was assessed with the Q-statistic and I^2

(Higgins & Thompson, 2002), publication bias, also known as the file drawer problem, was assessed with funnel plots (Egger, Davey, Schneider, & Minder, 1997) and the Fail-Safe N (Rosenthal, 1979), and sensitivity was evaluated by omitting one study from each pass. The overall meta-analysis, as well as the heterogeneity and publication bias analyses, were computed with Comprehensive Meta-Analysis, Version 2 (CMA-2: Borenstein, Hedges, Higgins, & Rothstein, 2005).

Results

Table 1 summarizes the characteristics of the 13 samples included in this meta-analysis. Effect size data for the Grasmick scale–crime/delinquency outcome relationship (AO), behavioral self-control–crime/delinquency outcome relationship (BO), and Grasmick scale–behavioral self-control relationship (AB) are listed in the last three columns of Table 1. Forest plots of the individual effect sizes for AO, BO, and AB can be found in Figs. 1, 2, and 3, respectively. Meta-analytic results for the full complement of samples and samples broken down by location (US, non-US), sex (male, female), and behavioral measure (traditional behavioral, Hirschi revised) can be found in Table 2. There were no significant differences (non-overlap between the respective 95 % confidence intervals) between the three correlations (AO, BO, AB) in the full complement of studies. Non-overlap between confidence intervals is a meaningful measure of a significant difference between effect sizes when the standard errors of the respective effect sizes are roughly comparable, as they were in the full complement (see Table 2). There was also significant heterogeneity in the effect sizes for each correlation (Q, I^2) and the funnel plot results (see Fig. 4) revealed the presence of heterogeneity but not publication bias (i.e., approximately half the effect sizes fell outside the standard error confidence intervals but the plots were largely symmetrical).

Because the effect sizes in the full complement of studies displayed substantial heterogeneity, separate analyses were carried out on studies grouped according to the three moderator variables (location, sex, behavioral measure). In separate analyses conducted on US, non-US, male, female, traditional behavioral self-control, and Hirschi revised self-control samples, no significant differences surfaced between the three correlations. To give the Grasmick and behavioral scales ample opportunity to correlate significantly better with one another rather than with crime/delinquency, analyses were restricted to studies in which the AB correlation exceeded the AO or BO correlations. The results of an analysis of the nine samples in which AB exceeded AO, BO, or both (final panel of Table 2) revealed extensive overlap in the 95 % confidence intervals between the AO, BO, and AB correlations. Payton, Greenstone, and Schenker (2003) note that when the standard errors of the effect sizes are roughly equivalent, as they were in this comparison, non-overlap between confidence intervals drawn at the 83–84 % level indicates a significant difference between effect sizes at the 0.05 alpha level. Narrowing the confidence intervals for this nine-sample complement to 80 % (the closest confidence interval below 83–84 % available in CMA-2) failed to identify any significant differences between the three correlations (AO=0.162–0.285, BO=0.154–0.352, AB=0.234–0.363).

Table 1 Characteristics of the studies included in this meta-analysis

Study	Sample	Attitude	Behavior	Outcome	AO	BO	AB
Arneklev, Elis, and Medlicott (2006)	391 US adults	Grasmick	imprudent behavior	crime (force, fraud, theft)	0.251	0.223	0.293
Piquero and Bouffard (2007)	109 M US college students	Grasmick	revised Hirschi	likelihood sexual coercion	0.260	0.296	0.259
	102 F US college students	Grasmick	revised Hirschi	likelihood of drink driving	0.153	0.242	0.249
DeLisi, Hochstetler, Higgins, Beaver, and Graeve (2008)	208 M US parolees	Grasmick	disputatiousness	prior arrests	0.208	0.178	0.316
Piquero, Schoepfer, and Langton (2010)	87 US working adults	Grasmick	behavioral problems	intent commit corp crime	0.060	−0.010	0.340
Ward et al. (2010)	309 US college students	Grasmick	modified RBS	self-reported delinquency	0.347	0.615	0.458
Boman and Gibson (2011)	1077 US college students	Grasmick	modified RBS	self-reported deviance	0.434	0.402	0.458
Jennings, Park, Tomsich, Gover, and Akers (2011)	632 M Korean col students	Grasmick	sexual risk taking	physical dating violence	0.025	0.139	0.088
	767 F Korean col students	Grasmick	sexual risk taking	physical dating violence	0.170	0.229	0.034
Morris et al. (2011)	1139 US adults	Grasmick-m	revised Hirschi	crime (assault, fraud, theft)	0.335	0.280	0.090
Gunter and Bakken (2012)	689 US college students	Grasmick	revised Hirschi	DUI in last year	0.192	0.094	0.069
	730 US college students	Grasmick	revised Hirschi	cheating in last year	0.247	0.020	0.103
Rocque et al. (2013)	2360 US 7th to 9th graders	Grasmick	revised Hirschi	crime (violence, property)	0.194	0.166	0.354

Sample sample characteristics, *US* United States, *M* male, *F* female, *Attitude* attitudinal self-control measure, *Grasmick* Grasmick et al. (1993) scale, *Grasmick-m* modified Grasmick scale, *Behavior* behavioral self-control measure, *RBS* Retrospective Behavioral Self-Control scale, *Outcome* criminal/delinquent behavior or intention, *AO* correlation between the attitudinal self-control measure and outcome measure, *BO* correlation between the behavioral self-control measure and outcome measure, *AB* correlation between the attitudinal self-control measure and behavioral self-control measure

Discussion

There is both good news and bad news for the Grasmick attitudinal self-control scale in the results of this meta-analysis. The good news is that the Grasmick scale correlates as well with measures of crime and delinquency as do behavioral measures of self-control and Hirschi's (2004) reformulated definition of self-control. This confirms findings from the original Pratt and Cullen (2000) meta-analysis. However, instead of being based on non-direct comparisons of non-independent correlations, the current results are based on results from 13 independent samples in which the Grasmick scale and a behavioral/consequences measure were directly compared. The bad news for the Grasmick scale is that it failed to correlate significantly higher with behavioral/consequences indicators of self-control than it did with the related but putatively distinct construct of crime/delinquency, even after removing the four samples with Grasmick–behavioral correlations lower than the Grasmick-offending and/or behavioral-offending correlations from the analysis. Hence, there was minimal support for the hypothesis that the Grasmick scale and various behavioral indices of low self-control are measuring the same construct.

How might these negative results be explained? One possibility is that the self-control construct is not conceptually distinct from crime and delinquency. In other words, low self-control correlates with and predicts crime and delinquency because low self-control is indistinguishable from crime and delinquency. This is the foundation of Akers' (1991) tautological argument against low self-control as a theory of crime. Hirschi and Gottfredson (1993) attempt to transform the tautology criticism into a complement by suggesting that it demonstrates how well they followed a logical progression in arriving at an internally consistent conceptualization of low self-control. The problem with their argument is that a tautology, by definition, is non-falsifiable and a theory that is non-falsifiable is worthless. The tautology argument, if true, invalidates much of the previous research on low self-control and crime. For if low self-control is

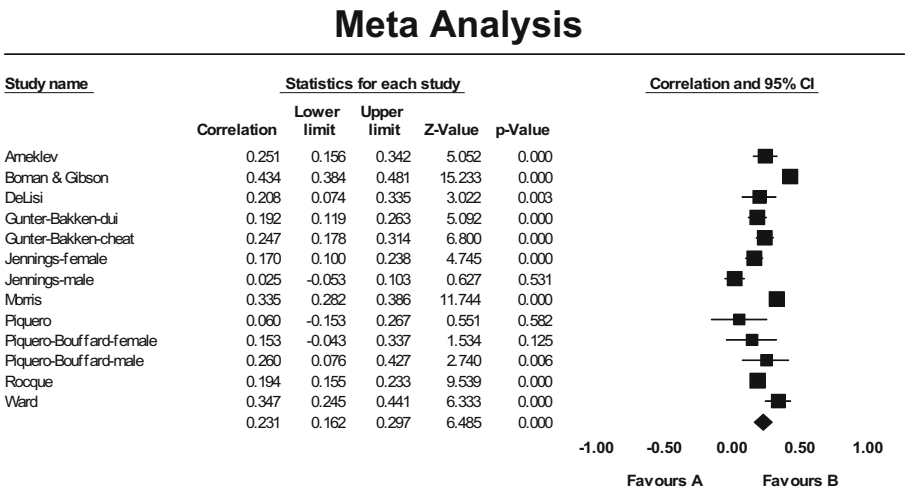

Fig. 1 Results and forest plot for Grasmick-crime effect sizes

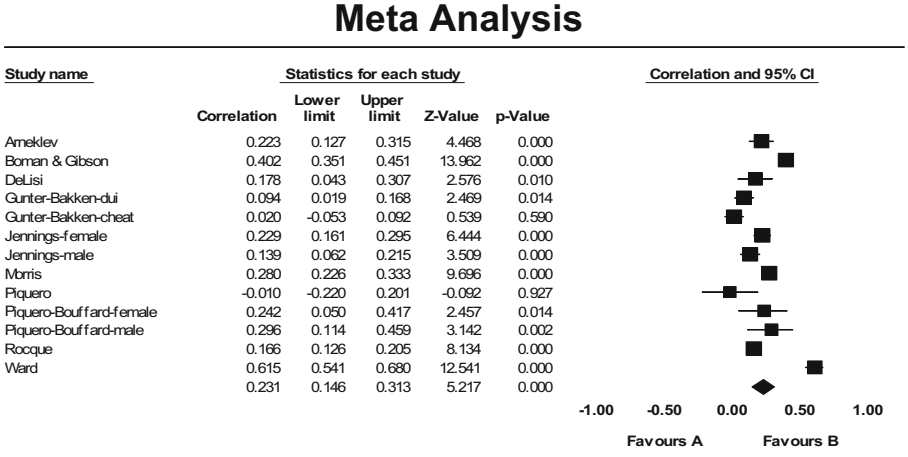

Fig. 2 Results and forest plot for behavioral/consequences-crime effect sizes

conceptually indistinct from crime, prior research on low self-control tells us little more than that crime and delinquency, or behaviors conceptually indistinct from crime and delinquency, correlate with one another and that past crime and delinquency predict future crime and delinquency. In other words, "low self-control causes low self-control" (Akers, 1991, p. 204).

A second plausible explanation for the lack of differentiation between the AB, AO, and BO correlations in the current meta-analysis is that the Grasmick scale and behavioral/consequences measures of self-control are measuring different constructs. It just may be, as Hirschi and Gottfredson (1993) have been quick to point out, that attitudinal measures are inadequate for the purpose of measuring self-control. Before attributing all of the blame for the low convergent validity effect sizes obtained in this study to the Grasmick scale, however, it should be noted that Grasmick et al. (1993)

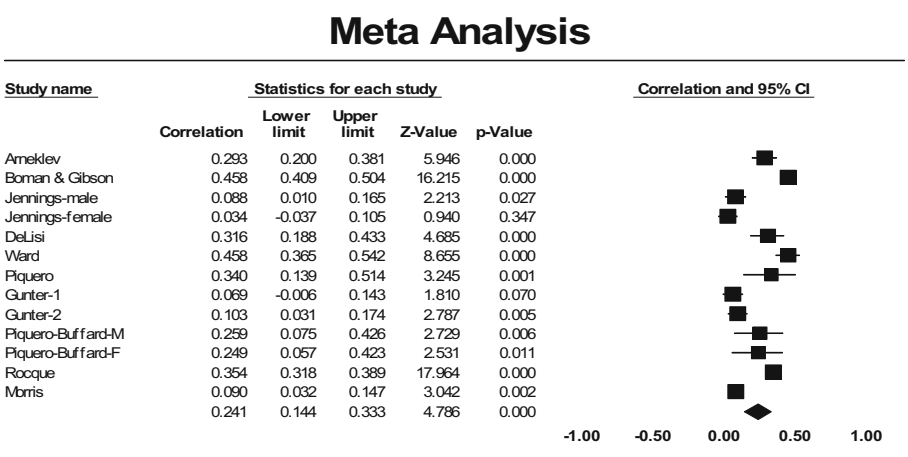

Fig. 3 Results and forest plot for Grasmick-behavioral/consequences effect sizes

Table 2 Results of the meta-analysis

	k	Random effects	SE	Q	df	*p*	I^2	Fail safe N	Sensitivity
All effect sizes									
Attitude-Outcome	13	0.231(0.162–0.297)	0.034	114.07	12	0.000	89.48	1375	0.211–0.251
Behavioral-Outcome	13	0.231(0.146–0.313)	0.043	182.36	12	0.000	93.42	1257	0.194–0.250
Attitude-Behavioral	13	0.241(0.144–0.333)	0.048	238.99	12	0.000	94.98	1366	0.219–0.259
US samples									
Attitude-Outcome	11	0.259(0.192–0.323)	0.033	78.80	10	0.000	82.26	1181	0.240–0.270
Behavioral-Outcome	11	0.240(0.138–0.338)	0.051	177.46	10	0.000	94.36	923	0.195–0.259
Attitude-Behavioral	11	0.275(0.174–0.370)	0.050	177.82	10	0.000	94.38	1251	0.252–0.296
Non-US samples									
Attitude-Outcome	2	0.099(−0.044–0.238)	0.072	7.42	1	0.006	86.52	–	0.025–0.170
Behavioral-Outcome	2	0.186(0.096–0.272)	0.045	3.00	1	0.083	66.65	–	0.139–0.229
Attitude-Behavioral	2	0.058(0.006–0.111)	0.027	1.01	1	0.314	00.00	–	0.034–0.088
Male samples									
Attitude-Outcome	3	0.151(−0.007–0.302)	0.079	8.94	2	0.011	77.64	8	0.109–0.226
Behavioral-Outcome	3	0.174(0.097–0.248)	0.038	2.84	2	0.284	20.58	10	0.149–0.221
Attitude-Behavioral	3	0.213(0.047–0.368)	0.082	10.14	2	0.006	80.28	22	0.153–0.297
Female samples									
Attitude-Outcome	2	0.168(0.103–0.232)	0.033	0.03	1	0.870	00.00	–	0.153–0.170
Behavioral-Outcome	2	0.230(0.166–0.293)	0.032	0.02	1	0.897	00.00	–	0.229–0.242
Attitude-Behavioral	2	0.124(−0.088–0.324)	0.105	4.26	1	0.039	76.50	–	0.034–0.249
Original behavioral SC									
Attitude-Outcome	7	0.223(0.088–0.350)	0.067	92.77	6	0.000	93.53	365	0.183–0.260
Behavioral-Outcome	7	0.274(0.135–0.403)	0.068	102.60	6	0.000	94.15	484	0.211–0.310

Table 2 (continued)

	k	Random effects	SE	Q	df	*p*	I^2	Fail safe N	Sensitivity
Attitude-Behavioral	7	0.288(0.130–0.432)	0.077	134.08	6	0.000	95.52	450	0.254–0.330
Hirschi-revised SC									
Attitude-Outcome	6	0.238(0.175–0.298)	0.031	20.15	5	0.001	75.18	360	0.204–0.251
Behavioral-Outcome	6	0.171(0.084–0.256)	0.044	38.53	5	0.000	87.02	176	0.137–0.203
Attitude-Behavioral	6	0.185(0.050–0.314)	0.067	97.87	5	0.000	94.89	242	0.109–0.210
AB > AO or BO									
Attitude-Outcome	9	0.225(0.129–0.316)	0.048	96.09	8	0.000	91.67	609	0.193–0.270
Behavioral-Outcome	9	0.235(0.110–0.352)	0.062	95.16	8	0.000	95.16	594	0.179–0.262
Attitude-Behavioral	9	0.300(0.198–0.395)	0.050	93.12	8	0.000	93.12	1066	0.283–0.345

k number of effect sizes, *Random Effects* mean random effects effect size with 95 % confidence interval (in parentheses), *SE* standard error, *Q* Q statistic, *df* degrees of freedom, *p* significance level of Q statistic, I^2 I squared dispersion statistic, *Sensitivity* range of effect sizes when one study omitted from each pass, *SC* self-control, *AB > AO or BO* samples in which the correlation between the attitudinal and behavior self-control measures was greater than the correlation between the attitudinal self-control and outcome measures or the correlation between the behavioral self-control and outcome measures.

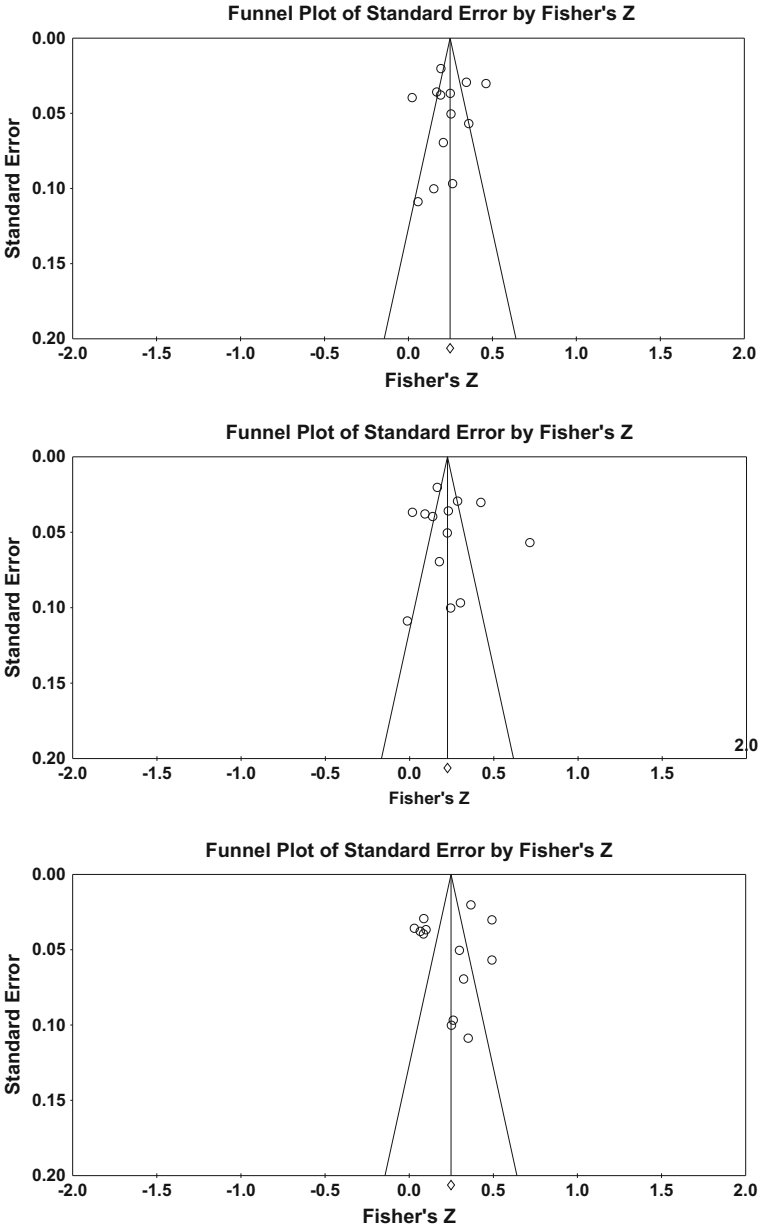

Fig. 4 Funnel plots for Attitudinal–Outcome effect sizes (*top panel*), Behavioral–Outcome effect sizes (*middle panel*), and Attitudinal–Behavioral effect sizes (*bottom panel*)

apparently did their best to faithfully replicate Gottfreson and Hirschi's (1990) conceptualization of low self-control when they constructed their attitudinal measure of low self-control. Moreover, in a study where two behavioral measures of self-control (number of drinks, percentage of class hours cut) were correlated with an attitudinal

measure of self-control similar to the Grasmick scale, the behavioral measures correlated twice as high with the attitudinal scale as they did with each other (0.36–0.40 vs. 0.20: Gibbs & Giever, 1995). Similarly, Kort-Butler, Tyler, and Melander (2011) discovered that two behavioral measures of low self-control (running away, substance use) correlated two to three times higher with crime than they did with each other (0.33–0.52 vs. 0.18).

If the Grasmick scale and behavioral/consequences indices of low self-control are measuring different constructs then what might these constructs be? One possibility is that behavioral/consequences measures assess the low self-control construct in much the same manner as Gottfredson and Hirschi (1990) proposed in their original formulation, whereas attitudinal measures like the Grasmick scale are measuring a separate but related construct known as reactive criminal thinking. Reactive criminal thinking denotes the impulsive, irrational, and emotional features of criminal thought process that have been found to mediate and predict a number of different crime-related relationships including those evolving from behavioral self-control (Walters, 2015b). It could be argued that attitudinal measures are better at assessing cognition than they are at assessing behavior and so may therefore do a better job of predicting behavior than behavior does of predicting cognition (Walters, 2015a). Meta-analytic research, in fact, indicates that attitudinal measures are generally good predictors of behavior (Glasman & Albarracin, 2006; Kraus, 1995). Additional research is required to determine whether, in fact, attitudinal measures are assessing reactive criminal thinking rather than low self-control.

A third conceivable explanation for the lack of construct validity in the current meta-analysis is that the Grasmick and behavioral/consequences measures are assessing two different dimensions of the same construct. Gottfredson and Hirschi (1990) have characterized low self-control as a unidimensional construct and Grasmick et al. (1993) sought to create and verify a unidimensional scale even though they broke it down into six subscales. The evidence Grasmick et al. (1993) amass in support of the unidimensionality of their scale, however, is less than impressive. First, they performed an exploratory principal components analysis rather than comparing a one-factor model with several alternative multi-factor models in a confirmatory factor analysis. Second, the eigenvalue of the one-factor model in their principal components analysis (4.66) was only twice that of the eigenvalue of the two factor model (2.34). Ordinarily, researchers like to see at least a three-fold difference between the eigenvalues of the first two factors before assuming unidimensionality (Cooke & Michie, 1997). In fact, IRT analysis based on the Rasch model (Higgins, 2007) and exploratory and confirmatory factor analyses and structural equation analysis (Delisi, Hochstetler, & Murphy, 2003) have failed to find evidence of unidimensionality in the original Grasmick scale. A recent component analysis, moreover, revealed that the total Grasmick score was inferior to individual subscale and subcomponent scores in predicting crime and deviance (DeCamp, 2015).

A fourth possibility is that behavioral self-control cannot adequately be assessed using a self-report measure. All of the behavioral/consequences measures employed in this meta-analysis were based on self-report. For some of the same reasons that Gottfredson and Hirschi (1990) find fault with attitudinal measures of self-control, they would also argue that behavioral self-report measures are limited as indicators of self-control. In particular, low self-control may influence a person's response to a self-report

inventory, whether it assesses attitudes or behaviors (Hirschi & Gottfredson, 1993). Unfortunately, there have been very few attempts to study low self-control using non-self-report behavioral measures. One exception is a study by Turner and Piquero (2002) in which data from the National Longitudinal Survey of Youth-Child were used to track the stability of self-control assessed with a self-report attitudinal scale and a behavioral rating scale completed by the child's mother. Although Turner and Piquero (2002) did not correlate the attitudinal and behavioral measures, which were administered during different waves of the longitudinal study, with a measure of crime, a reanalysis of data used in the Turner and Piquero (2002) study in conjunction with measures of crime and delinquency revealed that the attitudinal and behavioral measures correlated 0.15 whereas the behavioral measure and crime correlated 0.14 over an average of 6 years (Walters, 2015c). These results, though confined to a single study, suggest that the current findings may not have been significantly different had observations of self-control behavior been available instead of the self-report measures of behavioral self-control used in the current meta-analysis.

This study's strengths are its use of a single attitudinal scale, its ability to directly compare attitudinal and behavioral/consequences measures of self-control, and its use of independent samples. The current study also took a somewhat different approach to self-report versus behavioral assessment of low self-control compared to previous research. First, the attitudinal measurement of low self-control was restricted to the Grasmick scale. Incidentally, non-Grasmick studies enlist even less support for a strong attitude-behavioral/consequences correlation (Evans et al., 1997; Kort-Butler et al., 2011; O'Gorman & Baxter, 2002). Second, unlike the Pratt and Cullen (2000) meta-analysis, the current meta-analysis included only studies in which both the Grasmick scale and a behavioral/consequences measure were administered to the same group of individuals. Third, also unlike the Pratt and Cullen (2000) meta-analysis, only one effect size statistic per sample was included in the analysis. The two primary weaknesses of this study were its size and the heterogeneity of results. Information could only be gathered on 13 independent samples of participants who had been administered both the Grasmick scale and a behavioral/consequences measure of self-control, thus limiting the power of the analyses. In addition, the results were heterogeneous, although in none of the moderator variable analyses did the behavioral/consequences measure significantly outperform the Grasmick scale. Also, neither the Grasmick scale nor the behavioral/consequences measures correlated significantly higher with each other than they did with crime and delinquency.

Whether or not Gottfredson and Hirschi's (1990) low self-control model remains a viable explanation of criminal behavior depends on the ability of researchers to translate Gottfredson and Hirschi's preliminary conceptualization into one or more operationally defined measures that correlate better with each other than they do with crime and delinquency. A nomological net of countervailing convergent and discriminant correlations is required to both establish the validity of the low self-control concept and its operational measures. The Grasmick scale may not be capable of serving such a purpose, but neither, would it seem, are self-report measures of behavioral self-control. A similar situation appears to exist with the psychological constructs of psychopathy and antisocial personality disorder, where definitions are

so dependent on crime and criminality that criterion contamination may occur when these constructs are used to assess and predict criminal behavior (Ullrich & Coid, 2010; Walters, 2012). Additional measures need to be found or the Grasmick and behavioral/consequences measures expanded before a well-operationalized definition of low self-control can become a reality.

There was no support in the current study for Hirschi and Gottfredson's (1993) contention that the general theory of crime would fare better if behavioral measures of self-control were employed in place of the attitudinal measures that are commonly used to test the general theory. Attitudinal and behavioral measures correlated equally well with measures of crime and delinquency in the present meta-analysis. The problem was that they failed to correlate even higher with each other. Hence, there is no evidence that the Grasmick scale and behavioral/consequences measures of low self-control are measuring the same construct. In a manner of speaking, self-control theory may be a victim of its own success. It correlates so well with crime and delinquency that it may be difficult for its measures to correlate even higher with each other. Yet, to remain a viable theory, the central construct of low self-control needs to be better operationalized and construct valid indicators must be identified. Perhaps non-self-report behavioral indicators are the way to answer the question of whether behavioral estimates of low self-control are required to properly evaluate the general theory of crime and also a way to determine whether self-control theory is anything more than an exercise in tautology.

It could be argued that self-report and non-self-report behavioral indicators of low self-control are measuring different constructs. In fact, Hirschi's consequences measure had an effect size half that of traditional behavioral measures in the current meta-analysis and the correlation between the Grasmick scale and the consequences measure was 36 % lower than the correlation between the Grasmick scale and traditional behavioral measures. Hence, while there was no evidence that the Grasmick scale was a more effective predictor of offending in some contexts and traditional behavioral measures were more effective predictors of offending in other contexts, there was some suggestion that measures based on Hirschi's reformulated definition of self-control performed worse than both the Grasmick scale and traditional behavioral measures. One possible solution to these ambiguous findings is to conceptualize self-report and traditional behavioral indices of low self-control as measures of different constructs (reactive criminal thinking in the case of the Grasmick scale and low self-control in the case of traditional behavioral measures) and work on developing reliable and valid non-self-report behavioral measures of low self-control. The Behavior Problems Index (BPI: Peterson & Zill, 1986) employed in the previously mentioned Turner and Piquero (2002) study and a three-element (risk-seeking, impulsivity, and temper) behavioral index of self-control created by Meldrum, Young, Hay, and Flexon (2012) may serve such a function. Further development of non-self-report behavioral rating scales for parents, teachers, and outside observers may be just what is required to advance research and theory on low self-control.

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