

Self-control and Crime/Deviance: Cognitive vs. Behavioral Measures

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Using survey data, various measures of self-control, based respectively on cognitive and behavioral indicators, are compared in their ability to predict eight measures of crime/deviance. The results show that either type of measure produces supportive evidence for the theory, and the behavioral measures provide no better prediction than do the cognitive measures. Unlike cognitive type indicators, and contrary to the implications of the theory, different types of crime-analogous, imprudent behaviors are not highly interrelated, making it difficult to develop reliable behavioral measures. These results suggest that general support for self-control theory would likely not be any greater if all researchers had used behaviorally based measures, as recommended by the authors of the theory. Improving the level of prediction to the point where self-control could claim to be the master variable, as envisioned by its proponents, does not seem to rest on a shift to behaviorally based measures. Instead, improvements in the theory itself, particularly the incorporation of contingencies, appears to offer more promise.

KEY WORDS: self-control, measurement, cognitive, behavioral.

1. INTRODUCTION

One of the leading contemporary theories of criminal/deviant behavior, at least as indicated by research attention (see Pratt and Cullen, 2000; Vazsonyi *et al.*, 2001), is Gottfredson and Hirschi's self-control theory (1990). It contends that variation among individuals in their ability to exercise self-control in the face of temptation accounts for individual differences in criminal/deviant behavior. Those with low self-control, a

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condition natural to all humans who are not taught otherwise, presumably have trouble anticipating the long range negative consequences of their behavior. As a result they are likely to respond to opportunities for misbehavior, which according to the authors of the theory, are ubiquitous. Individuals with strong self-control, which is acquired in early childhood as a result of effective parenting, however, resist temptation because they recognize that in the long run misbehavior is costly.

The net outcome should be a strong negative relationship between self-control and criminal/deviant behavior (low self-control, high misbehavior; high self-control, low misbehavior). This relationship is theorized to be non-deterministic in the sense that low self-control does not always produce crime and many conditions may potentially affect whether it does or not. Nevertheless, the theorists contend that variables popular among sociologists, such as morality, strain, peer influences, social bonds, cultural elements, or social disadvantages actually have little influence. In effect, self-control is said to predate and supercede most other conditions that have traditionally been thought to affect post-childhood misbehavior (Gottfredson and Hirschi, 1990, p. 232).

Much supportive evidence has been compiled (Pratt and Cullen, 2000; Vazsonyi *et al.*, 2001), but reported associations, though consistent, are usually only modest, typically in the range of 0.20 to 0.30.⁵ One reason the associations are not stronger may be that most researchers have employed cognitive type measures rather than behaviorally based ones favored by Hirschi and Gottfredson (1993, p. 48). In this paper we attempt to determine if behaviorally based measures are, in fact, more effective than cognitive ones in producing larger associations between self-control and criminal/deviant behavior.

⁵Favorable results have been reported for established criminals (Longshore, 1998; Longshore and Turner, 1998); general samples of individuals (Grasmick *et al.*, 1993; Evans *et al.*, 1997; college students (Cochran *et al.*, 1998; Gibbs and Giever, 1995; Nagin and Paternoster, 1993; Sellers, 1999); youth (Brownfield and Sorenson, 1993; Junger and Tremblay, 1999; LaGrange and Silverman, 1999; Vazsonyi *et al.*, 2001; Wood *et al.*, 1993); males and females (Burton *et al.*, 1998; Keane *et al.*, 1993; LaGrange and Silverman, 1999); people in different cities (Winfree and Bernat, 1998); and people in different countries (Keane *et al.*, 1993; LaGrange and Silverman, 1999; Moffitt *et al.*, 1995; Nakhaie *et al.*, 2000; Polakowski, 1994; Vazsonyi *et al.*, 2000; Wright *et al.*, 1999). In addition, supportive evidence has been found using cross-sectional (examples; Evans *et al.*, 1997; Grasmick *et al.*, 1993; Nagin and Paternoster, 1993), longitudinal (Avakame, 1998; Junger and Tremblay, 1999; Lynam *et al.*, 2000; Polakowski, 1994; Paternoster and Brame, 1998; White *et al.*, 1994; Wright *et al.*, 1999, and experimental (Finkel and Campbell, 2001; Muraven *et al.*, 1998; see White *et al.*, 1994, for review) subjects.

2. THE MEASUREMENT ISSUE

Researchers have used a wide variety of indicators, combined in various ways, to study self-control. These indicators have included: (1) self-reported, analogous behaviors (Keane *et al.*, 1993); (2) direct behavioral markers, such as length of time one can squeeze a hand grip, being able to refrain from laughing at funny things (Muraven *et al.*, 1998), keeping within the lines while drawing through a maze (see Wilson and Herrnstein, 1985), length of time tracing a circle, various betting behaviors (see White *et al.*, 1994, for a review) and observed use of seat belts (Keane *et al.*, 1993); (3) various scales composed of cognitive responses concerning different dimensions of low self-control identified by Gottfredson and Hirschi (Evans *et al.*, 1997; Finkel and Campbell, 2001; Gibbs *et al.*, 1998; Grasmick *et al.*, 1993; Wright *et al.*, 1999); (4) ratings by teachers or parents (Caspi *et al.*, 1994; Paternoster and Brame, 1998; Tremblay *et al.*, 1995; White *et al.*, 1994; Wright *et al.*, 1999); and (5) even self-reported inability to avoid thinking about white bears when instructed to do so (Muraven *et al.*, 1998). The most commonly used measure is the 23 item cognitive scale developed by Grasmick *et al.* (1993), although its psychometric qualities have been the source of controversy (Arneklev *et al.*, 1999; Arneklev *et al.*, 1993; Grasmick *et al.*, 1993; Longshore *et al.*, 1998; Longshore *et al.*, 1996; Piquero and Rosay, 1998; Piquero *et al.*, 2000).

Gottfredson and Hirschi contend that the best measures are behavioral. In one place they imply, though they do not state directly, that proper measurement involves objectively recording, with a machine or with observation by somebody other than the individual whose self-control is being measured, the actions to be used as indicators of self-control ("behavioral measures of self-control seem preferable to self-reports,"—Hirschi and Gottfredson, 1993, p. 48). Their preference reflects the belief that low self-control can affect response to surveys designed to measure it. However, the contention that "the best indicators of self-control are the acts we use self-control to explain: criminal, delinquent, and reckless acts" (Hirschi and Gottfredson, 1993, p. 49) has drawn charges of tautology (Akers, 1991; Geis, 2000; Reed and Yeager, 1996; Tittle, 1991). The theorists insist they are proposing a logical rather than an empirical tautology, even though they consider criminal behavior to be both a consequence and a *measure* of low self-control (Gottfredson and Hirschi, 1990, pp. 90, 94, 119). Presumably the idea of self-control is so strongly derived from studying the nature of criminal behavior that, in effect, low self-control and crime are the same thing.

The theorists (Hirschi and Gottfredson, 1993) nevertheless maintain that it is possible to develop behavioral measures of crime and self-control that are empirically distinct, and that the use of such measures will provide

much stronger evidence in favor of self-control theory. Moreover, despite their apparent preference for objectively established behavioral indicators, they state that useful behavioral markers can be gathered with surveys:

"We would not suggest that evidence relevant to the adequacy of control theory cannot be produced by survey methods; we would urge, however, that the theory's view of differences among potential respondents be taken into account in research design and measurement. Unless this is done, apparently modest results may in fact be highly supportive of the validity of the theory." (Hirschi and Gottfredson, 1993, p. 48.)

We interpret this admonition to imply (1) extra efforts to include in surveys those whose self-control is predicted by the theory to be low (such as drinkers, smokers, and those who engage in acts of force or fraud) and (2) some leniency in expectations about the magnitude of associations to be found between measures of self-control and crime/deviance. With such precautions, the expectation for stronger results using behavioral rather than cognitive measures would seem to apply to survey data as well as to other types of data.

3. THE EVIDENCE CONCERNING COGNITIVE AND BEHAVIORAL MEASURES

Despite Hirschi and Gottfredson's prescription, few scholars have employed behavioral measures. In their study of night-time drivers in Canada, Keane and his associates (Keane *et al.*, 1993) used observations of seat belt use as one behavioral measure of low self-control. They also employed a self-report indicator of behavior (alcoholic drinks consumed) and several self-report cognitive indicators of low self-control (perceptions of the chances of getting stopped, whether someone tried to discourage them from driving, and belief that their blood alcohol was over the legal limit). Keane and his co-authors found significant effects for all of the indicators (with one conditional exception), with no clear advantage for the behavioral indicators, either objectively observed or cognitively reported. The theorists (Hirschi and Gottfredson, 1993, pp. 48–49) praise the methodology of the study, apparently not concerned that the dependent variable fails to qualify as crime under their definition of force or fraud undertaken for personal gratification or that the behavioral measures performed no better than the cognitive ones.

Polakowski (1994), using six waves of data from the Cambridge Study in Delinquent Development, employed behavioral indicators reported by mother, teachers, peers, and presumably therapists ("psychomotor clumsiness") to explain scores on an objective behavioral measure (convictions) and a self-reported measure of misbehavior. All of the indicators were analyzed as a block, and the results were consistent with the self-control

argument. However, there were no cognitive measures with which to compare results, so it is impossible to conclude from this study whether behavioral measures are superior to cognitive ones.

White *et al.* (1994) studied the relationship of impulsivity, one aspect of low self-control, with self-reported delinquency at age 10 and at ages 12–13. They used 10 different measures of impulsivity, including five based on actual behaviors. For example, the Delay of Gratification test uses a computer game in which the participants choose between a short term payoff at 40% and a long term payoff at 80% while the Circle Tracing Task registers how long it takes a subject to trace a circle on onion skin after being told to go as slowly as possible. The researchers formed separate factor composite scales of the various behavioral and cognitive test scores and used them to predict the delinquency measures. The behavioral scale proved far superior to the cognitive scale (0.03 vs. 0.38 and 0.00 vs. 0.43 for the two delinquency measures).

However, impulsivity alone does not capture the full essence of Gottfredson and Hirschi's concept of low self-control,⁶ and the individual cognitive measures used by White *et al.* to form their composite scale lack the face validity and reliability of cognitive measures typically used (Finkel and Campbell, 2001). For example, the Time Perception Measure, one of five cognitive based measures used by White *et al.*, simply records the subjects' estimates of the time that passes from signaled starts and stops along with their accuracy in judging various specified intervals of time. Another, the Color and Word Association test requires subjects to match lines by reading words printed in different colors. Thus, the White *et al.* study does not seem to offer compelling comparative evidence.

In their study of self-control and accidents in adolescence, Tremblay *et al.* (1995) used teacher ratings of characteristics such as restlessness, short attention span, inattentiveness, and "squirmyness" at age 6 and 10 as well as mother's ratings at age 10 of various dimensions of temperament indicative of self-control, such as persistence at a task until finished, "can't be distracted," and "stays with an activity." They found self-control so measured to be related to adolescent accidents and delinquency but not to account for the association between accidents and delinquency among adolescents. Unfortunately for the issue at hand, they did not use any cognitive measures that would permit comparisons with the behavioral measures.

Using survey data from a mid-western city, Evans *et al.* (1997) examined the predictive power of an 11 item self-reported cognitive scale

⁶The elements of low self-control, according to Gottfredson and Hirschi (1990, pp. 89–90) include impulsivity, preference for simple tasks, attraction to risk taking, orientation toward physical rather than mental activities, self-centeredness, and easy loss of temper.

and an 18 item self-reported behavioral measure of self-control (smoking, having accidents, urinating in public, etc.), using as a dependent variable scores on a 17 item self-reported criminal behavior scale. They found larger coefficients for the behavioral measure than for the cognitive scale, but the cognitive scale appears weak since it does not incorporate all elements of low self-control specified by Gottfredson and Hirschi and it has lower reliability than other cognitive scales of self-control.

Muraven and his associates (Muraven *et al.*, 1998), though not purporting to test Gottfredson and Hirschi's theory, used observable behavioral indicators of self-control, such as length of time a person would squeeze a hand grip in experimental situations. However, few of these experiments concern misbehavior, especially of the type that would fit Gottfredson and Hirschi's definition. And, since different measures were used in different experiments, it is difficult to compare the results of self-reported cognitive indicators with the behavioral ones.

Wright *et al.* (1999) employed 18 different measures of aspects of self-control, including observer reports, parental and teacher reports, self-reports of traits and behaviors, and summary scores for all of the measures before age 15 and between 15 and 18. Each of those measures was then used to predict self-reported variety measures of delinquency at age 15 and crime at age 21. Some of their 16 separate measures of self-control, especially those based on observations or reports by others, appear to be behavioral in nature (10) while others reflect self-reported cognitively based characteristics (6). The average coefficient for the 6 cognitive measures is -0.25 while the corresponding coefficients for the 10 behavioral measures predicting delinquent and criminal behavior is -0.14 . The cognitive and behavioral measures administered before age 15 predict the misbehavior measures about equally (-0.15) while the cognitive measures administered between ages 15 and 18 performed somewhat better than the behavioral measures (-0.29 vs. -0.16). Overall, then, it appears that the cognitively based measures used by Wright *et al.* (1999) predict self-reported misbehavior as well as or better than the behavioral measures preferred by Hirschi and Gottfredson.

Finally, a recent study (Junger *et al.*, 2001) examines the relationship between risky but non-criminal driving behaviors recorded by the police in reports of accidents, which perhaps reflect low self-control, and two measures of officially recorded crime among 1000 drivers in the Netherlands in 1994. Although the authors report a strong association between risky driving and crime they do not include any cognitive measures of low self-control that would permit comparisons with the behavioral measure.

Therefore, it remains an open question whether self-control theory would enjoy stronger support (in the sense of larger effect coefficients for the

main variable) had all researchers followed the prescriptions of Gottfredson and Hirschi to use behavioral measures of self-control. Of the four studies permitting a comparison between cognitive and behavioral measures in predicting criminal/deviant behavior, two show stronger prediction for behavioral measures (Evans *et al.*, 1997; White *et al.*, 1994) and two do not (Keane *et al.*, 1993; Wright *et al.*, 1999). Moreover, the cognitively based measures of self-control in the two studies showing superiority of behavioral measures do not fully incorporate the conceptualization set forth by Gottfredson and Hirschi (1990, pp. 89–90).

Earlier we noted the deficiencies of the White *et al.* composite cognitive measure, which is limited to impulsivity and includes individual measures with questionable face validity. The Evans *et al.* cognitive self-control scale appears to be better but it includes no items reflecting a preference for simple tasks, one of the essential elements of low self-control, and it uses only two items each to reflect three of the other elements (impulsivity, being self-centered, and lacking control of temper). Perhaps as a result, it has relatively low reliability (0.61). In addition, the Evans *et al.* behavioral measure of self-control mainly taps actual illegal behavior (12 of 18 items). This may provide a tautological advantage to the behavioral measure. Hence, given the limited data concerning behavioral, relative to cognitive, measures of self-control, the weakness of cognitive measures used in comparative tests, some possible tautology, and actual mixed results, it is difficult to judge whether the associations between self-control and crime/deviance have been artificially low due to the use of cognitive measures of self-control.

4. THE STUDY

4.1. Approach

We offer additional information about cognitively based measures of self-control, relative to behavioral ones, in assessing self-control theory. We use survey data that permits measurement of self-control with a factor based scale of the popular, cognitive items developed by Grasmick *et al.* (1993), a reduced item variation of it, and three self-reported, behaviorally based scales of self-control. The Grasmick *et al.* scale (1993), though the subject of debates about unidimensionality (Arneklev *et al.*, 1999; Arneklev *et al.*, 1993; Grasmick *et al.*, 1993; Longshore *et al.*, 1998; Longshore *et al.*, 1996; Miller and Lynam, 2001; Piquero and Rosay, 1998; Piquero *et al.*, 2000; Vazsonyi *et al.*, 2001), does reflect Gottfredson and Hirschi's description of low self-control, has been shown to have relatively high reliability (0.81), compares favorably with other well constructed cognitive measures of self-

control (Finkel and Campbell, 2001), and has produced much evidence consistent with self-control theory.

To avoid artificially favoring one or the other types of measure, we take several precautionary steps. First, we use an additional cognitively based measure, an attenuated version of the Grasmick *et al.* scale derived from what appear be the poorest items. Second, in constructing the behavioral scales to be used in comparison with the Grasmick *et al.* scale, we minimize possible tautology by using no items directly reporting force or fraud for personal gratification. In addition, the final scales include only one behavior that was actually illegal at the time the survey was conducted (neglect to use a seat belt) and even its illegality was hardly known by the population. Third, we use three different methods to derive a measure of behaviorally based self-control. Finally, we compare the cognitive and behavioral measures in their ability to predict eight different self-reported measures of criminal/deviant behavior.

4.2. The Data

Data are from the 1994 Oklahoma City Survey, conducted by graduate students and faculty of the Department of Sociology at the University of Oklahoma.

4.2.1. Sample

Data were collected in the spring of 1994 from a simple random sample of adults (18+). The 16th Annual Oklahoma City Survey relied on the *R.L. Polk Directory* of names and addresses as a source for sampling. Interviewees were initially contacted by mail and alerted to expect a member of the research team to try to schedule an appointment. Targeted interviewees who could not be scheduled were replaced randomly until a total of 350 face-to-face interviews were conducted. Forty percent of the initially targeted individuals provided a complete interview, with the remainder being random substitutions. Criminal behavior was recorded on a separate sheet of paper unseen by the interviewer.

The sample is slightly more female (56% vs. 53%), a little more white (80% vs. 78%), and perhaps older (median age of 43.5 for the sample, which includes only those 18 plus, vs. 32.4 for the whole population) than the population four years earlier in 1990, as revealed by the U.S. Census. Such differences could be due to changes during the ensuing four years after the census, but it is likely that they also reflect biases inherent to household surveys. If Gottfredson and Hirschi are correct, the net effect of sample biases will be to attenuate the number of low self-control scorers as well as

the number of people who have high probabilities of engaging in criminal behavior. Perhaps these biases differentially affect the measures being considered here, although it is difficult to judge whether such biases could account for our results.

Consistent with warnings that effective survey data should reflect differences among individuals relevant to the theory (Hirschi and Gottfredson, 1993, p. 48), the sample includes drinkers (17% report drinking several alcoholic beverages a week), smokers (28%), those who fail to use seat belts (38% say they do not always use their belts), and people who admit acts of force or fraud (means range from 1.08 to 1.48 on various dichotomous self-reports). Since these behaviors presumably reflect low self-control, there should be sufficient variation in the sample to reveal meaningful associations between self-control and crime/deviance consistent with the theory and with its authors' assumptions about behavioral measures.

It is important to note that the data to be reported here are not the same as those used for previously published, widely cited studies of low self-control and criminal or analogous behaviors using Oklahoma City Survey data (Arneklev *et al.*, 1999; Arneklev *et al.*, 1993; Grasmick *et al.*, 1993). The 1994 survey from which data for this paper are taken uses a sample entirely different from the 1991 survey on which the studies noted are based. The two surveys do ask some of the same questions but they also ask many different questions. Probably the most noteworthy difference is that the 1994 survey does not include a measure of opportunity to commit crime, which was a prominent feature of the 1991 data.

4.2.2. *The Issue of Opportunity*

Although the theorists initially alluded to the import of opportunity in the activation of deviant behavior, they minimized its significance, contending that opportunities for criminal behavior are ubiquitous (see Grasmick *et al.*, 1993, for a discussion). Indeed, Hirschi and Gottfredson (1993, p. 50) later state that self-control and opportunity are actually independent in their effects on crime, though most recently (Hirschi and Gottfredson, 1995, p. 140) they seem to put more stock in the conditional influence of opportunity. However, they never actually define opportunity. Grasmick *et al.* (1993) surmized that, in the context of the theory, opportunity consists of a situation in which a given act of crime/deviance is possible (for example, with respect to auto theft, there are cars to be stolen) and where there are few immediate costs for its commission (such as a strong chance of being caught or punished). We think a more limited notion of opportunity is needed.

Fundamentally, opportunity for crime exists when a given criminal act is physically possible. An opportunity to rob a bank is present where there are banks and nothing to physically prevent robbery, such as armed guards and unbreakable locks. Perceived probabilities of getting caught, fear of the consequences of misbehavior, or other such things should probably not be considered part of the concept of "opportunity." If they were, opportunity would be a catch-all concept, of little value. It makes more sense to differentiate the immediate physical phenomenon of opportunity from aspects of the situation (or the person) that may influence decisions about whether to misbehave (that is, that help explain the behavior).

So conceived, opportunity for misbehavior is indeed ubiquitous, and therefore, probably not of great importance in explaining individual variation in misbehavior. Still, some of our respondents may have encountered more situations where it was physically possible to assault somebody, steal something worth \$20 or less, engage in illegal gambling, cheat on their income tax, and drive while under the influence than do others. Here the particular issue is whether people with high scores on cognitive measures of self-control have as many or more such opportunities for misbehavior as do people who have high scores on the behavioral measures. Perhaps things like using tobacco, drinking, and not wearing a seat belt, which we combine to form behavioral measures of self-control, imply more exposure to criminal opportunities than do cognitive type indicators of things like impulsivity and fondness for risk taking. Other research will have to make that determination. In the meantime, we simply assume that opportunities for misbehavior are so widespread that they are not likely to affect our results.

4.3. Predictors

4.3.1. *Cognitive Self-Control*

The well known Grasmick *et al.* scale of self-control uses 23 items, listed in Table I. There were four response possibilities from strongly agree to strongly disagree, originally scored so that high scores reflected *low* self-control. However, for ease of interpretation and greater facility in comparing results with the behavioral measure of self-control, we reversed the scoring so that a high score on our final scale indicates strong self-control.

Consistent with previous research, we factor analyzed the items to determine if they reflect a single meaningful underlying concept. The evidence both supported and contradicted the assumption of unidimensionality but we followed general practice and used factor scores from a forced, one factor solution to create a scale with a mean of zero, a standard

Table 1. Items to Measure Cognitive Self-Control

Item	Factor loading	Mean	SD
1. I often do whatever brings me pleasure here and now, even at the cost of some distant goal.	0.583	3.13	0.87
2. I will try to get the things I want even when I know it's causing problems for other people.	0.528	3.50	0.53
3. When things get complicated, I tend to quit or withdraw.	0.506	3.23	0.83
4. Often, when I'm angry at people I feel more like hurting them than talking to them about why I am angry.	0.497	3.47	0.73
5. I often act on the spur of the moment without stopping to think.	0.484	2.67	0.93
6. I sometimes find it exciting to do things for which I might get in trouble.	0.478	3.41	0.82
7. I'm more concerned with what happens to me in the short run than in the long run.	0.474	3.03	0.95
8. When I am really angry, other people better stay away from me.	0.449	2.98	1.04
9. I lose my temper pretty easily.	0.447	3.03	0.53
10. I dislike really hard tasks that stretch my abilities to the limit.	0.445	3.05	0.88
11. I don't devote much thought and effort to preparing for the future.	0.433	3.27	0.83
12. If I had a choice, I would almost always rather do something physical than something mental.	0.404	2.66	0.95
13. The things in life that are easiest to do bring me the most pleasure.	0.402	2.87	0.85
14. I try to look out for myself first, even if it means making things difficult for other people.	0.389	3.23	0.77
15. Excitement and adventure are more important to me than security.	0.387	3.49	0.71
16. If things I do upset people, it's their problem, not mine.	0.382	3.13	0.90
17. I like to get out and do things more than I like to read or contemplate ideas.	0.375	2.34	0.95
18. I frequently try to avoid projects that I know will be difficult.	0.373	2.96	0.91
19. Sometimes I will take a risk just for the fun of it.	0.371	2.88	1.00
20. When I have a serious disagreement with someone, it is usually hard for me to talk calmly about it without getting upset.	0.358	2.69	0.47
21. I'm not very sympathetic to other people when they are having problems.	0.339	3.41	0.81
22. I almost always feel better when I am on the move than when I am sitting and thinking.	0.299	2.20	0.94
23. I like to test myself every now and then by doing something a little risky.	0.236	2.43	0.95

deviation of one, and an alpha reliability of 0.82. The loadings listed in Column 1 of Table I are similar to the ones derived from the 1991 data concerning these same items (see Grasmick *et al.*, 1993), suggesting considerable reliability from sample to sample.

4.3.2. Behavioral Self-Control

4.3.2.1. Factor Scale. We tried to construct a scale of self-control based entirely on self-reports of actual behaviors corresponding to Gottfredson and Hirschi's notions of imprudent actions stemming from weak self-control, but not involving actual "force or fraud for personal gratification" or behaviors prohibited in the criminal code in Oklahoma. That task proved more difficult than we anticipated from Gottfredson and Hirschi's (1990, pp. 91–94) argument that low self-control produces no specialized misbehaviors or analogous acts but instead generates a wide variety of different behavioral manifestations, all presumably associated with each other.

We identified 18 items (covering ten different kinds of imprudent behaviors) from the survey that, based on Gottfredson and Hirschi's discussion, reasonably ought to reflect their notion of self-control. The items concerned marital arrangements, smoking, drinking, taking medicine with minor illnesses, overeating, using seat belts, having accidents, financial planning or lack thereof, and education. However, contrary to expectations, those items were not highly correlated with each other and they did not load well on a single factor. Indeed the eigenvalues and scree plot suggest a number of different factors, most of which are not interpretable in and of themselves. Nevertheless, we tried to follow the implications of Gottfredson and Hirschi's contentions by combining the items that produced the most reliable scale. We began with a one-factor forced solution, combining the 10 best loading items into a factor based scale. Those items are listed in Table II. Seven of the items (2, 4, 5, 6, 8, 9, and 10) used yes/no response formats, which we coded so that higher scores indicate greater self-control. Item #1 (frequency of drinking) used six responses categories from "never" to "nearly every day," with the "never" end of the continuum getting higher scores to reflect greater control. Item #3 (number of drinks in a typical day during the last year) used the actual number reported, which we coded so that fewer drinks (including zero for those who did not drink at all) indicate greater self-control. Item #7, marital status, was coded into "presently married," "single, never married," and "separated or divorced," with being married taken as more indicative of high self-control and being separated or divorced as indicative of the least self-control.

Table II. Items Used in Factor Scale of Behaviorally Based Self-Control

Item	Factor loading	Mean	SD	% with lower self-control response
1. How often during the past year did you drink beer, wine, or hard liquor?	0.785	4.51	1.51	66% (any drinking)
2. Do you usually drink more than two or three alcoholic beverages over a span of a week?	0.721	1.83	0.38	17% (yes)
3. On a typical day when you drank in the past year, how many drinks did you have? That is, how many beers, glasses of wine, mixed drinks and shots of liquor did you have?	0.707	4.53	1.54	63% (any drinking)
4. Have you ever had a blackout while drinking, that is, where you drank enough so that you couldn't remember the next day what you had said or done?	0.638	1.80	0.40	20% (yes)
5. Have you ever had difficulty stopping drinking before you became intoxicated?	0.425	1.80	0.41	21% (yes)
6. Do you smoke tobacco products?	0.369	1.72	0.45	28% (yes)
7. Current marital status.	0.348	2.56	0.74	15% (separated or divorced)
8. When you are in an automobile, do you always use the seat belt?	0.239	1.62	0.49	38% (no)
9. Do you sometimes get so far in debt that it's hard to see how you will get out of it?	0.260	1.78	0.42	22% (yes)
10. When you have a cold or some other minor ailment, do you usually take some kind of medication?	0.217	1.74	0.44	25% (no)
Alpha = 0.62				

In most cases the high self-control response for these behavioral items is obvious, but in three instances it is not. First, married people presumably have more self-control than divorced or separated people, but they may not necessarily have more self-control than do single people. Second, although caring for one's health seems to reflect the theorists' notion of self-control, some might think that "bucking up" and not taking medication for minor illness is more indicative of self-control than is medicating oneself. Third, causing accidents and personal injury may easily indicate weak self-control, but being involved in some accidents may be entirely unavoidable (such as being hit in the rear while stopped at a traffic light), although Gottfredson and Hirschi would probably argue that people with weak self-control are more likely to get themselves in situations where accidents are more likely. For example, people who wait too long to stop at a traffic light because they are not paying attention or because they were trying until the last second to beat the light may inspire more rear end collisions. Nevertheless, our question does not inquire about the circumstances, so it may include some error. For the accident item and all other items we systematically experimented with scales including and excluding them. After the initial ten item scale was formed, we systematically substituted each of the unused items sequentially for the items in the final scale.

We also experimented with scoring of the two items that may not obviously indicate self-control—marital status and taking medicine when sick. We tried the marital item with "never married" and "divorced/separated" being scored alternatively to reflect the least self-control, and we scored the medicine item alternatively so that taking medicine was indicative of high self control in one trial and indicative of low self-control in another. The items and their scoring listed in Table II formed the best and most reliable scale. Divorced or separated is coded in this final scale as the least self-controlled response and taking medicine for minor ailments is scored to reflect high self-control. Consistent with this empirical result, we contend that people who take medicine, even for minor illnesses, probably pay more attention to health issues generally and probably organize their lives to avoid unhealthful activities and to deal with health problems than do those who take no medicine. Therefore, they should have higher self-control.

The final factor scale of behavioral self-control has a mean of zero and a standard deviation of one. Given the lack of a clear factor structure and the relatively low loadings of some of those items, however, it is no surprise that the reliability of this scale is only 0.62.

4.3.2.2. Guttman Scale. Because the factor based scale has relatively low reliability, we developed an alternative, behaviorally based measure of self-control using a method of scale construction that has its own rationale of

cumulativity, not directly dependent on inter-item correlation (McIver and Carmines, 1981). We applied scalogram analysis (commonly called Guttman scaling) to the 18 behavioral items mentioned before. In that scaling technique responses across all respondents are tested to see if they form a stair step pattern (McIver and Carmines, 1981; Menzel, 1953). In a perfect scalogram, individuals with high scores on the most discriminating item also have high scores on all items less discriminating. Similarly all individuals with high scores on the second most discriminating item but not on the most discriminating one, also have high scores on all of the less discriminating items, and so on. Since individuals and researchers can make mistakes in dealing with survey data, and since anomalies exist in life, scalograms may contain departures from perfect patterns and still presumably reflect cumulativity, as long as the departures are within tolerances that can be attributed to chance.

Using the criteria of: (1) avoiding too many extremely skewed items, (2) minimizing error in the placement of error cases in the matrix, along with center placement of problematic cases, and (3) successively eliminating items that did not appear to fit into the cumulative matrix, we hand manipulated the data for 115 randomly chosen respondents. Six items, dichotomized, were found to form an acceptable scale, according to conventional criteria (Menzel, 1953). They are reported in Table III in order of discriminating ability, along with the particulars of the scale. The scale has a Coefficient of Reproducibility of 0.912 (0.90 or higher is considered evidence of scalability) and a Minimal Marginal Reproducibility of 0.75, for an improvement of 0.16 (0.15 or higher is the usual standard for acceptable scales). There were no clusters of similar error patterns exceeding 5%, and the Coefficient of Scalability (Menzel, 1953) is 0.65 (0.60 or higher is usually required). Scale scores based on the final six item scalogram (from 7 to 1) reflecting degrees of self-control (*B-G self-control*) were then assigned to respondents in the full sample according to their response patterns.

4.3.2.3. *A Variety Index*. In one place, Hirschi and Gottfredson (1995, p. 134) contend that the best measures of a propensity to offend (presumably meaning low self-control) are indexes of the number of different kinds of problem behaviors in which a person engages. To accommodate that point of view and to provide the best comparative test of cognitive and behavioral measures, we created a behavioral measure of self-control using self-reports of the ten forms of non-criminal, problem behavior available in the data. As noted before, they include getting separated or divorced, smoking, drinking, not taking medicine when sick, overeating, not using seat belts, having accidents, getting in debt, failure to save for retirement, and failure to get educated (only high school or less).

Table III. Items Used in Guttman Scale of Behaviorally Based Self-Control

Item	Dichotomous response	% with lower self-control response
1. What is the highest level or grade of education you ever completed in school? Completed Advanced Degree:	Yes/No	95%
2. In the past year, did you invest in a retirement savings plan—such as an IRA, Keogh, SEP, or 401 K plan—that allows you to defer payment on income taxes until retirement, or not?	Did/Did Not	61%
3. When you are in an automobile, do you always use the seat belt?	Yes/No	38%
4. When you have a cold or some other minor ailment, do you usually take some kind of medication?	Yes/No	25%
5. Have you ever had a blackout while drinking, that is, where you drank enough so that you couldn't remember the next day what you had said or done?	No/Yes	20%
6. During the past year, have you been in an accident or injured yourself so severely that you had to see a doctor?	No/Yes	12%
Distribution: 7 (<i>N</i> = 10); 6 (<i>N</i> = 92); 5 (<i>N</i> = 115); 4 (<i>N</i> = 73); 3 (<i>N</i> = 31); 2 (<i>N</i> = 16); 1 (<i>N</i> = 6)		

Each was dichotomized into yes (0) and no (1) and then the ten were summed to create an index in which higher scores reflect greater self-control. The index has a mean of 6.73 and a standard deviation of 1.48.

4.4. Dependent Variables

4.4.1. General Crime Index

To develop a general index of illegal behavior with maximum reliability, we used 12 items; seven concern self-reports of past misbehavior and five concern self projections of future misbehavior. These items are oriented around five different violations—assault (four items), stealing goods worth less than \$20 (two items), income tax cheating (two items), illegal gambling (two items), and driving while under the influence (two items). Responses to each were “yes” or “no.” The upper panel of Table IV describes the items and reports means, standard deviations, and factor loadings. Based on the theorists’ contentions that various kinds of misbehavior should all stem from low self-control, we performed a forced one factor analytic solution on the 12 items. A composite scale was then generated from factor scores by the standard regression technique. It has a mean of zero, a standard deviation of one, and an alpha reliability of 0.76.

4.4.2. A Gottfredson/Hirschi Based Crime Scale

The authors of self-control theory contend that it explains acts of force or fraud undertaken for personal gratification. The *general crime index* described above contains self-reports of driving under the influence and illegal gambling, neither of which qualifies as crime according to Gottfredson and Hirschi’s definition. Therefore, we derived a crime measure based specifically on their definition. It uses 8 of the 12 items included in the *general crime index*. Those items, along with descriptive statistics, are reported in the bottom part of Table IV. As before, we used a forced, single factor solution to generate factor loadings and from them we constructed a *G-H Crime Scale*, with a mean of zero, a standard deviation of one, and a reliability of 0.70.

4.4.3. Variety Indexes

Because Hirschi and Gottfredson favor variety measures of misbehavior (1995, p. 134) to reflect self-control, we assume they also favor variety measures of crime. Therefore, we constructed separate variety indexes of future and past crime. We summed indicators of having engaged in or

Table IV. Crime/Deviance Items

Item	Factor loading	Mean	SD
General Crime Index Items			
1. As an adult, how often have you threatened someone with physical violence?	0.412	1.48	0.74
2. In the future will you ever gamble illegally on a sporting event or other situation?	0.670	1.23	0.45
3. In the future will you ever drive an automobile while under the influence of a moderate amount of alcohol?	0.557	1.23	0.41
4. In the past 5 years have you ever driven an automobile while under the influence of a moderate amount of alcohol?	0.510	1.31	0.46
5. As an adult, that is, since you were 18, how often have you beaten or punched another adult?	0.360	1.08	0.27
6. In the future will you ever take something from someplace worth <i>less than \$20</i> that does not belong to you?	0.465	1.05	0.23
7. In the future will you ever fail to report a certain income or claim an undeserved deduction on your income tax return?	0.611	1.17	0.38
8. In the past 5 years have you ever taken something worth <i>less than \$20</i> that did not belong to you?	0.528	1.13	0.33
9. In the future will you ever physically hurt another person on purpose?	0.500	1.10	0.27
10. In the past 5 years have you ever physically hurt another person on purpose?	0.486	1.11	0.31
11. In the past 5 years have you ever failed to report a certain income or claimed an undeserved deduction on your income tax return?	0.641	1.18	0.39
12. In the past 5 years have you ever gambled illegally on a sporting event or other situation?	0.722	1.29	0.45
Gottfredson/Hirschi Crime Index Items			
1. As an adult, that is, since you were 18, how often have you beaten or punched another adult?	0.413	1.08	0.27
2. In the future will you ever take something worth <i>less than \$20</i> that does not belong to you?	0.674	1.05	0.23
3. In the past 5 years have you ever failed to report certain income or claimed an undeserved deduction on your income tax return?	0.663	1.18	0.39

Table IV. Continued.

Item	Factor loading	Mean	SD
4. In the past 5 years have you ever taken something from someplace worth <i>less than</i> \$20 that did not belong to you?	0.673	1.13	0.33
5. In the past 5 years have you ever physically hurt another person on purpose?	0.480	1.11	0.31
6. In the future will you ever physically hurt another person on purpose?	0.623	1.10	0.27
7. In the future will you ever fail to report a certain income or claim an undeserved deduction on your income tax return?	0.674	1.17	0.38
8. As an adult, how often have you threatened someone with physical violence?	0.410	1.48	0.74

having projected a future probability of assault, theft, tax cheating, illegal gambling, and DWI. The *future variety* index has a mean of 0.80 and a standard deviation of 1.09 while the *past variety* index has a mean of 1.01 and a standard deviation of 1.23.

4.4.4. Specific Offenses

To compare more precisely the predictive power of the cognitive self-control measures relative to the behavioral self-control measures, we also use indicators of four of the six specific offenses included in the *general crime scale*. Each specific crime index is formed from factor scores with two of the items listed in the upper portion of Table IV.⁷ Items 1 and 5 make up the assault index; items 6 and 8 make up a theft index; illegal gambling is indexed by items 2 and 12; and items 3 and 7 go into the tax cheating index.

4.5. Control Variables

Six controls are used in each main equation: sex, race, age, education, childhood family intactness, and size of place of residence while growing up. Sex (females = 1, males = 2) and race (nonwhite = 1, whites = 2) are dichotomized, and age ranges from 18 to 88. Childhood home intactness comes from the item: "Think back to when you were growing up: *in general*, which of the following describes your family situation? Most of the time, you were living with (1) your mother or mother-figure (like a stepmother); (2) only your father or father-figure (like a stepfather); (3) both your mother (or mother-figure) and father (or father-figure); (4) other. Responses were coded "1" for "only father" and "other"; "2" for "only mother..."; and "3" for both parents, whether biological or surrogate. Education is reported in eight categories from 0 for less than high school to 8 for a graduate degree.

4.6. Analysis

Using multiple regression with seven predictors (the particular self-control measure and the six control variables) and each of the eight measures of crime/deviance (the general crime index, the G-H crime index, the future variety index, the past variety index, and four indicators of specific offenses), we first calculate the predictive power of the three behavioral measures (the factor based scale, the Guttman scale, and the

⁷We also conducted the analysis separately for the reports of specific past offense and for specific future projections. The pattern of results is exactly the same for each.

misbehavior variety index). After comparing the coefficients for behavioral relative to the cognitive measure using each of the eight crime measures and the three different measures of behavioral self-control, we turn to comparisons of the relative predictive power of the two types of measures for subgroups of sex, age, race, education, intactness of the childhood home, and size of place while growing up. In these latter comparisons we estimate and compare the effects of the two types of self-control measures separately for each subgroup to ascertain if there are subgroups in which one or the other type of self-control measure consistently produces superior prediction of the crime measures. In comparing the measures within each subgroup, the equations exclude the respective control variable for the specific subgroup being examined.

In estimating the significance of the difference in coefficients for the behavioral and cognitive measures we use the z test recommended by Paternoster *et al.* (1998). We also estimate the significance of the addition of each measure to R^2 with an F test.

5. RESULTS

The comparative tests involve three alternative measures of behaviorally based self-control (a 10 item, factor based scale, a 6 item Guttman scale, and a 10 item variety index). The pattern of results is the same for the three, with the Guttman measure and the variety index showing somewhat lower predictive coefficients than the factor scale in almost all instances.⁸ Therefore, we report results only for the factor scale. We conclude from those comparisons of the predictive power of the three behavioral self-control measures that in trying to increase support for self-control theory researchers are likely to gain nothing from undertaking the arduous task of constructing Guttman scales or of following the preferences of Hirschi and Gottfredson for variety indexes.

Table V shows the coefficients for the factor based *behavioral self-control* scale and the 23 item *cognitive self-control* scale predicting eight measures of crime/deviance. Column 5 shows the differences between the predictive coefficients for the two scales; a positive sign indicates a higher negative coefficient for the behavioral measure.

In accordance with the substantive thrust of the theory, all of the coefficients in Columns 1 and 3 are negative, showing that higher self-control, as reflected by both the cognitive and behaviorally based measures, is associated with lower probabilities of criminal behavior. And, in all but

⁸Note that the prediction equations using the Guttman scale and the variety index include only five control variables, excluding education which overlaps the items in the measures. Numbers are available upon request.

Table V. Standardized Regression Coefficients Representing the Effects of Two Alternative Measures of Self-Control on Eight Measures of Crime/Deviance, Controlling Socio-Demographic Background Variables^a

Crime/deviance measure	Self-control measures				Diff ^{ab}	z ^c	R ² change	
	Behavioral beta	se	Cognitive beta	se			Behavioral	Cognitive
General deviance	−0.394*	(0.050)	−0.296*	(0.050)	0.098	1.39	0.097*	0.049*
G-H crime index	−0.250*	(0.055)	−0.303*	(0.051)	−0.053	0.71	0.032*	0.063*
Fut variety	−0.336*	(0.059)	−0.229*	(0.058)	0.107	1.29	0.073*	0.027*
Past variety	−0.368*	(0.062)	−0.263*	(0.062)	0.105	1.21	0.087*	0.037*
Assault	−0.150*	(0.055)	−0.291*	(0.051)	−0.141	1.88	0.008	0.065*
Theft	−0.058	(0.058)	−0.171*	(0.055)	−0.113	1.41	0.001	0.024*
Tax cheating	−0.136*	(0.058)	−0.155*	(0.056)	−0.019	0.23	0.010*	0.016*
Illegal gambling	−0.325*	(0.054)	−0.181*	(0.053)	0.144	1.89	0.072*	0.015*
Mean	−0.252		−0.236		0.016		0.048	0.037

^aAll equations include controls for sex, race, age, education, size of childhood place of residence, and intactness of the family while growing up.

^bA positive number indicates that the behavioral measure has a larger coefficient.

^cUsing formula described by Paternoster *et al.* (1998).

* $p < 0.05$.

one instance the coefficients are statistically significant (the behavioral measure of self-control is not significantly related to the measure of theft). These results add to the body of supportive findings for self-control theory. Consistent with the arguments of the theorists and with other research, they also show that support for the theory can be produced by either cognitively based or behaviorally based measures of self-control.

However, the issue at hand is whether behavioral measures of self-control produce more favorable outcomes than do cognitive measures. We interpret the theorists' arguments to imply that coefficients for the behavioral measure should be significantly larger than for the cognitive measure **more than half the time**, that is, more often than simple chance would dictate. By that standard, the results shown in Table V contradict Gottfredson and Hirschi's contentions. In no instance does the behavioral scale have a significantly higher negative coefficient than does the cognitively based scale, according to the z test. Comparing additions to R^2 , the cognitive measure actually produces significantly better prediction of assault and theft than does the behavioral measure (the cognitive measure adds significantly to R^2 with the behavioral measure already in the equation, but the behavioral measure does not add to an equation with the cognitive measure already in). Therefore, from these results it does not appear likely that support for self-control theory would be any greater had all researchers used behavioral measures instead of the cognitive ones that many have employed.

Perhaps of more importance, the figures concerning increments to R^2 (Columns 7 and 8 of Table V) suggest that in general the behavioral and cognitive measures cover somewhat different domains of self-control. In every instance, adding the cognitive measure to the prediction equation that contains the behavioral measure and the control variables increases the R^2 significantly. And, in all but the two instances noted before, adding the behavioral measure to the prediction equation that contains the cognitive measure and the control variables also increases the R^2 significantly. The possibility that the two scales are measuring somewhat different aspects of self-control is confirmed by a correlation of only 0.20 between them. Thus, the issue may not be whether behavioral measures of self-control *per se* produce better prediction of criminal behavior but rather whether the domain of self-control tapped by behavioral measures is more strongly associated with misbehavior than is the domain tapped by cognitive measures. These data suggest that it is not.

That conclusion, however, might be because the behavioral scales contain many fewer items than the Grasmick *et al.* cognitively based scale. More items generally lead to scales with greater variation, thereby making higher coefficients more likely. Therefore, to give the fairest test to

Gottfredson and Hirschi's notion that behavioral measures would provide more support for self-control theory than do cognitive measures, we derived an alternative version of the Grasmick *et al.* scale using only ten of the items rather than all 23. Further, to be absolutely sure we give the behavioral approach its due, we constructed the alternative scale using the ten cognitive items with the lowest factor loadings (14–23 as listed in Table I).

As shown in Table VI, the results are similar. Although six of the eight coefficients for the behavioral measure are now larger than the corresponding cognitive measure (only four of eight were larger when the 23 item cognitive scale was used), none of those six are statistically significant, according to the Paternoster *et al.* modified z test. In addition comparing additions to R^2 suggests only one significant difference in favor of the behavioral measure. One significant difference out of eight trials is well below the standard of “over half” that we apply. Hence, if these data can be taken as a guide, general support for self-control theory would most probably not be any less had researchers all used cognitively based measures of self-control composed of ten low loading items rather than behaviorally based scales.

Despite the conclusion that, in the general case, behaviorally based measures of self-control provide no stronger support for predictions from self-control theory than do cognitively based measures, it is still possible that behavioral measures may produce better prediction for some subcategories of research subjects. To test that possibility, analyses were repeated within 15 subgroups: two sex subgroups, four age subgroups (18–24, 25–44, 45–64, 65+), two racial subgroups, three educational subgroups (high school or less, post high school education or training but not college graduates, and those with college degrees or higher), two subgroups who came from families that differed in the degree of their intactness, and two categories of people who grew up in different size places (places and towns 10,000 or less and cities).

The results reported in Table VII confirm our general conclusion. It shows the magnitude of differences in the predictive coefficients for the behavioral and cognitive scales for each of the eight measures of crime, within each of 15 subgroups. In only one subgroup does the coefficient for the behavioral scale significantly exceed the coefficient for the cognitive scale for even one measure of crime, according to the z test. Using the 10 item cognitive measure instead of the 23 item scale,⁹ only two subgroups show a significantly larger coefficient for the behavioral measure for any of the eight measures of crime (one measure in each case). It does not appear, then, that the behavioral measure produces any better prediction than the cognitive

⁹Numbers available on request.

Table VI. Standardized Regression Coefficients Representing the Effects of Two Alternative Measures of Self-Control on Eight Measures of Crime/Deviance, Controlling Socio-Demographic Background Variables,^a and Using a Ten Item, Cognitively Based Self-Control Scale

Crime/deviance measure	Self-control measures				Diff ^b	z ^c	R ² change	
	Behavioral beta	se	Cognitive 10 beta	se			Behavioral	Cognitive
General deviance	−0.394*	(0.050)	−0.260*	(0.050)	0.134	1.90	0.102*	0.036*
G-H crime index	−0.250*	(0.055)	−0.238*	(0.052)	0.012	0.16	0.036*	0.036*
Fut variety	−0.336*	(0.059)	−0.211*	(0.058)	0.125	1.50	0.076*	0.023*
Past variety	−0.368*	(0.062)	−0.215*	(0.062)	0.153	1.76	0.092*	0.022*
Assault	−0.150*	(0.055)	−0.232*	(0.052)	−0.082	1.08	0.010*	0.040*
Theft	−0.058	(0.058)	−0.100*	(0.055)	−0.042	0.52	0.001	0.008
Tax cheating	−0.136*	(0.058)	−0.114*	(0.056)	0.022	0.27	0.011*	0.008
Illegal gambling	−0.325*	(0.054)	−0.189*	(0.053)	0.136	1.79	0.072*	0.017*
Mean	−0.252		−0.194		0.058		0.050	0.023

^aAll equations include controls for sex, race, age, education, size of childhood place of residence, and intactness of the family while growing up.

^bA positive number indicates that the behavioral measure has a larger coefficient.

^cUsing formula described by Paternoster *et al.* (1998).

* $p < 0.05$.

Table VII. Differences^b in Standardized Regression Coefficients^c Representing the Effects of Two Alternative Measures of Self-Control on Eight Alternative Measures of Crime/Deviance

Measure of crime/dev	Subgroups															Mean
	Male diff	Female diff	18-24 diff	25-44 diff	45-64 diff	65+ diff	Non-White diff	White diff	Low Ed diff	Med Ed diff	High Ed diff	Low Int diff	High Int diff	Sm Pl diff	Lg Pl diff	
Gen Dev	0.07	0.10	-0.02	0.03	0.22	0.25	0.25	0.06	0.08	0.16	0.09	0.15	0.10	0.06	0.12	0.09
G-H index	0.06	-0.08	-0.06	-0.11	-0.08	0.16	0.19	-0.11	-0.11	0.08	-0.12	-0.08	-0.04	-0.12	-0.01	-0.04
Fut Var	0.17	0.04	-0.11	0.07	0.23	0.12	0.28	0.07	0.14	0.12	0.13	0.36	0.09	0.10	0.11	0.12
Past Var	0.18	0.01	-0.00	0.03	0.29	0.23	0.12	0.10	0.04	0.20	0.11	0.14	0.12	0.11	0.09	0.12
Assault	-0.23	-0.08	-0.03	-0.18	-0.14	-0.02	-0.05	-0.16 ^a	-0.12	-0.06	-0.27 ^a	-0.15	-0.13	-0.09	-0.23 ^a	-0.13
Theft	-0.11	-0.10	-0.15	-0.09	-0.09	0.09	0.03	-0.14	-0.18	-0.10	-0.04	-0.02	-0.12	-0.09	-0.15	-0.08
Tax cheat	-0.00	-0.09	-0.24	-0.12	0.06	-0.03	0.18	-0.07	-0.19	0.12	-0.15	-0.11	0.00	-0.14	0.07	-0.05
Ill Gamble	0.11	0.17	-0.05	0.06	0.36 ^a	0.22	0.20	0.14	0.23	0.13	0.08	0.35	0.11	0.14	0.15	0.16
Mean	0.02	-0.00	-0.08	-0.05	0.11	0.13	0.15	-0.01	-0.01	0.08	-0.02	0.08	0.02	0.00	0.02	
N	198	152	35	143	105	66	69	281	121	121	108	60	290	174	176	

^a $p < 0.05$, using the z test described by Paternoster *et al.* (1998).

^bA positive number indicates that the behavioral measure has a larger negative coefficient.

^cAll equations include controls for sex, race, age, education, size of childhood place of residence, and intactness of the home while growing up, except when the subcategories of the control variable are being examined.

scale in any of the 15 subgroups we examined here. This is not to deny that there may be specific situations representing combinations of kinds of misbehavior and kinds of samples, such as illegal gambling among those aged 45–64 (where the significant difference in Table VII is shown) in which behavioral measures would produce more support for self-control theory. It is also possible that in investigating specific issues, such as whether self-control interprets an association between sex or age and criminal behavior, a behaviorally based scale might produce more favorable evidence toward self-control theory.

6. DISCUSSION

Cognitive based scales of self-control, even when constructed from the lowest loading items, seem to perform as well as the behavioral measures. Considered in the context of previous research bearing on the relative strength of cognitive and behavioral measures, which also generally fails to show that behavioral measures produce larger predictive coefficients, the contention of Gottfredson and Hirschi that behaviorally based measures should provide stronger support for self-control theory than cognitive based measures would seem to be questionable. The extant body of evidence, based mainly on cognitively rooted measures of self-control, therefore, may be as strong in its support of the theory as evidence is likely to get with the present, limited theoretical formulation.

One problem is the difficulty we had in deriving a behavioral scale of self-control with high inter-item correlations, a problem also apparently experienced by Evans and his associates (Evans *et al.*, 1997), whose scale also showed low reliability. Assuming that it is not due to differential accuracy in reporting of various behaviors, this raises questions about certain aspects of self-control theory. Gottfredson and Hirschi (1990) imply that many pursuits of immediate pleasure such as smoking, drinking, using drugs, gambling, and engaging in illicit sex (p. 88) reflect low self-control, as do other things such as unstable marriages and job profiles (p. 89), skipping school and having accidents (p. 92), and failing to maintain contact with relatives or to attend church (p. 94). They also imply that any subset of such behaviors or indicators of self-gratifying behaviors are as good as any other subset. However, if various behaviors that seemingly ought to indicate low self-control are not highly associated with each other, then it would appear that some behaviors may be much better indicators than others. The theory provides no guidance as to which of the various possibilities are the “true” indicators. If one can ascertain which behavioral indicators reflect low self-control only after seeing how well they predict criminal behavior, then critic’s charges of tautology are indeed valid.

The failure to find significantly stronger associations between behavioral measures and crime/deviance than between cognitive measures and crime/deviance, as has been the case in the few studies permitting such comparisons, may not be due to misdirected measurement. Perhaps "vulnerability to temptations of the moment" (p. 87) influences some "crime analogous" behaviors more than others. Not everyone has the opportunity for an advanced degree, older people have usually had more opportunity to get divorced than younger people, and opportunity to drink probably varies substantially at the lower ages. Moreover, self-control may have hardly any influence on some behaviors that might appear to be "crime analogous." In addition, rather than contending that all manner of undesirable behavior reflects low self-control, the theorists might specify, along with a logical rationale, which particular behaviors are more "crime analogous" and more reflective of low self-control. Moreover, our data suggest the possibility that self-control is a more complex concept than the theorists presently acknowledge. If the domain tapped by behavioral measures is truly different from the domain tapped by cognitive measures, then both kinds of measures may be doing as good a job as possible. In that case, it is a theoretical issue as to the conditions under which one or the other should perform better.

Of course, the conclusion that behavioral based measures of self-control are probably no better than cognitively based ones, and the suggestion that overall support for the theory is probably at its maximum, must be tempered. For one thing, although our results are in line with the few other studies permitting comparison of the two types of measures, there are not many such comparisons and this study was undertaken in one place and time, and with specific cognitive and behavioral indicators. Other research with different subjects and using different indicators might contradict our findings. In addition, the cognitive and behavioral scales we used to measure self-control may not be the best possible, certainly they may not be unidimensional. Conceivably, better measurement and scaling techniques might yet show that behavioral scales provide relatively more support, and they might reveal the overall predictive capability of measures of self-control to be far greater than what has been shown so far.

Second, survey respondents may find it easier to report honestly such things as liking to take risks, losing their tempers sometimes, or often acting on the spur of the moment than to fully disclose things like drinking too much, too often, getting deeply in debt, or engaging in risky sexual conduct. Cognitive indicators of low self-control, which are actually expressions of preferences and of general styles of behavior, are probably more socially acceptable than are direct admissions of misbehavior. And if people are more willing to report socially acceptable behaviors in a survey, then the absence of greater predictive ability for the behavioral scale could be a mere

function of differential accuracy of the data. This would suggest that the only behavioral measures that would prove superior to cognitive measures would be those involving objective recording (perhaps by a machine, camera, or document) or observation by a third party (such as a parent, a researcher, or supervisor). Although Hirschi and Gottfredson apparently meant for their admonitions about behavioral and cognitive measures to apply to survey data (1993, p. 48), it is still probably true that they think direct or objective measures are superior to indirect, self-reported ones. The few instances reported in the literature where objective measures have been used, and in which comparisons with cognitive type measures have been possible, have not established their greater predictive power. Nevertheless, it still may be that such measures, where practical, will provide more support for self-control theory.

Despite the possibility that the results are idiosyncratic, due to inaccurate data, or that they are limited because of indirect, subjective types of indicators, there are good reasons to imagine they can be generalized. First, there is no necessary reason to expect all forms of imprudent behavior to be alike, equally reflective of weak self-control. Many behaviors that ostensibly stem from weak self-control may not actually do so. For example, careful speeding on the highway, investing in risky but profitable businesses, pursuing a gratifying extramarital affair in the face of potential serious consequences, and resisting the consumption of medicine when sick, may actually depend on one's having substantial self-control. It takes much "nerve," or self restraint, to stay alert enough to drive an automobile at high speeds, to commit to possible loss of investments and to sustain that commitment through market ups and downs, to keep a course of love despite potential costs, and to "buck up" without resort to medications when ill. Moreover, wearing seat belts, which after a time becomes habitual, may not be similar to succumbing to a sales pitch, and the use of addictive substances may not reflect weak self-control in the same way as speeding or failure to attend church. Thus, without specific theoretical guidance, any selected set of behavioral indicators is likely to be unreliable, as we and other researchers have found.

It should be no surprise, then, to find that cognitively based measures are more reliable and predict criminal behavior as effectively as do behaviorally based measures of self-control. It is far easier to invent a meaningful set of cognitive indicators of the various dimensions of low self-control than it is to identify appropriate behavioral indicators that reflect those same dimensions. Our findings that the two types of scales seem to tap different aspects of self-control suggests a need for more theorizing. Perhaps the theorists will at some point provide a rationale for the selection of specific "imprudent" behaviors that can be used to measure self-control reliably. And perhaps they, or somebody else, will address the possibility

that self-control has several different aspects, all with their own integrity and predictive zones. Until that is done, cognitive measures would seem to be just as sensible and probably a lot more practical.

The theorists seem to be interested in behaviorally based measures because they believe such measures will produce stronger predictive coefficients, thereby more solidly validating the theory. It is likely, however, that the theory, as currently formulated, enjoys as much support as it can. As critics have noted, the theory logically could benefit from several modifications (Akers, 1991; Barlow, 1991; Benson and Moore, 1992; Geis, 2000; Grasmick *et al.*, 1993; Reed and Yeager, 1996; Tittle, 1991, 1995). Among the most important would be consideration of the contingencies under which self-control is likely to play a larger or smaller part. The theory seems to assume that, given opportunity, low self-control always has more or less the same effect. However, research has already shown that the effects of self-control are somewhat contingent on emotions (Giner-Sorolla, 2001), neighborhood context (Lynam *et al.*, 2000), family, school, and peer relations (Nakhaie *et al.*, 2000), perceived risks and rewards (Nagin and Paternoster, 1993), gender (Burton *et al.*, 1998; Keane *et al.*, 1993; LaGrange and Silverman, 1999); age (Burton *et al.*, 1998), and sequences of temptations (Baumeister and Exline, 1999, 2000; Muraven *et al.*, 1998).

Motivation for, or desire to do, a criminal act may be an important additional contingency. If the predictive power of self-control were assessed separately for those with strong motivation to offend, the predictive coefficients might turn out to be much greater than has been recorded so far. In addition, people may differ with respect to their desire to exercise self-control. Some with strong self-control may nevertheless choose to offend while some with weak self-control may so badly want to exercise the small degree of self-control they possess that they refrain from offending. If potential differences in desire to exercise self-control were taken into account, self-control might produce much stronger predictive coefficients. Other important contingencies not yet investigated might be the person's moral commitments to particular norms, peer influences, the amount of strain the person is experiencing, and others (Baumeister *et al.*, 1994). With such specifications the predictive power of the theory might be improved far more than if the focus is strictly on the type of measurement.

7. CONCLUSION

Our results show that both cognitively based and behaviorally based measures of self-control produce evidence favorable to self-control theory, a finding consistent with previous research. However, behaviorally based scales of self-control produce no advantage over cognitively based ones in

the prediction of criminal/deviant behavior. This latter finding contradicts the contentions of the authors of the theory that behaviorally based measures should show much larger associations with criminal behavior than cognitive type measures. And it challenges the notion that if behaviorally based measures were used, predictive coefficients for self-control would be large enough to establish low self-control as the key, almost exclusive cause of offending. Our data, though far from perfect, nevertheless suggest that the general failure of self-control measures to predict criminal behavior to the degree envisioned by its proponents is probably not mainly because of the use of cognitive type measures. Instead, it may stem from the neglect of theoretical specifications of the contingencies under which self-control is likely to have more or less effect.

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